SAS® 9.4 Graph Template Language: Reference, Fifth Edition

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SAS® 9.4 Graph Template Language: Reference, Fifth Edition

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Syntax Conventions Used in this Document

Syntax Conventions for the SAS Language

Overview of Syntax Conventions for the SAS Language

SAS uses standard conventions in the documentation of syntax for SAS language elements. These conventions enable you to easily identify the components of SAS syntax. The conventions can be divided into these parts:

- syntax components
- style conventions
- special characters
- references to SAS libraries and external files

Syntax Components

The components of the syntax for most language elements include a keyword and arguments. For some language elements, only a keyword is necessary. For other language elements, the keyword is followed by an equal sign (=). The syntax for arguments has multiple forms in order to demonstrate the syntax of multiple arguments, with and without punctuation.

keyword
specifies the name of the SAS language element that you use when you write your program. Keyword is a literal that is usually the first word in the syntax. In a CALL routine, the first two words are keywords.

In these examples of SAS syntax, the keywords are bold:

CHAR (*string, position*)

CALL RANBIN (*seed, n, p, x*);

ALTER (*alter-password*)

BEST *w*.

REMOVE <*data-set-name*>

In this example, the first two words of the CALL routine are the keywords:

CALL RANBIN(*seed*, *n*, *p*, *x*)

The syntax of some SAS statements consists of a single keyword without arguments:

DO;
... *SAS code* ...
END;

Some system options require that one of two keyword values be specified:

DUPLEX | **NODUPLEX**

Some procedure statements have multiple keywords throughout the statement syntax:

CREATE <UNIQUE> **INDEX** *index-name* **ON** *table-name* (*column-1* <, *column-2*, ...>)

argument
specifies a numeric or character constant, variable, or expression. Arguments follow the keyword or an equal sign after the keyword. The arguments are used by SAS to process the language element. Arguments can be required or optional. In the syntax, optional arguments are enclosed in angle brackets (< >).

In this example, *string* and *position* follow the keyword CHAR. These arguments are required arguments for the CHAR function:

CHAR (*string, position*)

Each argument has a value. In this example of SAS code, the argument *string* has a value of 'summer', and the argument *position* has a value of 4:

```
x=char('summer', 4);
```

In this example, *string* and *substring* are required arguments, whereas *modifiers* and *startpos* are optional.

FIND(*string, substring* <, *modifiers*> <, *startpos*>

argument(s)
specifies that one argument is required and that multiple arguments are allowed. Separate arguments with a space. Punctuation, such as a comma (,) is not required between arguments.

The MISSING statement is an example of this form of multiple arguments:

MISSING *character(s)*;

<LITERAL_ARGUMENT> *argument-1* <<LITERAL_ARGUMENT> *argument-2* ... >
specifies that one argument is required and that a literal argument can be associated with the argument. You can specify multiple literals and argument pairs. No punctuation is required between the literal and argument pairs. The ellipsis (...) indicates that additional literals and arguments are allowed.

The BY statement is an example of this argument:

BY <DESCENDING> *variable-1* <<DESCENDING> *variable-2* ...>;

argument-1 <*options*> <*argument-2* <*options*> ...>
specifies that one argument is required and that one or more options can be associated with the argument. You can specify multiple arguments and associated options. No punctuation is required between the argument and the option. The ellipsis (...) indicates that additional arguments with an associated option are allowed.

The FORMAT procedure PICTURE statement is an example of this form of multiple arguments:

PICTURE name <(*format-options*)>
<*value-range-set-1* <(*picture-1-options*)>
<*value-range-set-2* <(*picture-2-options*)> ...>>;

argument-1=value-1 <*argument-2=value-2* ...>
specifies that the argument must be assigned a value and that you can specify multiple arguments. The ellipsis (...) indicates that additional arguments are allowed. No punctuation is required between arguments.

The LABEL statement is an example of this form of multiple arguments:

LABEL *variable-1=label-1* <*variable-2=label-2* ...>;

argument-1 <, *argument-2*, ...>
specifies that one argument is required and that you can specify multiple arguments that are separated by a comma or other punctuation. The ellipsis (...) indicates a continuation of the arguments, separated by a comma. Both forms are used in the SAS documentation.

Here are examples of this form of multiple arguments:

AUTHPROVIDERDOMAIN (*provider-1:domain-1* <, *provider-2:domain-2*, ...>

INTO :*macro-variable-specification-1* <, :*macro-variable-specification-2*, ...>

Note: In most cases, example code in SAS documentation is written in lowercase with a monospace font. You can use uppercase, lowercase, or mixed case in the code that you write.

Style Conventions

The style conventions that are used in documenting SAS syntax include uppercase bold, uppercase, and italic:

UPPERCASE BOLD
identifies SAS keywords such as the names of functions or statements. In this example, the keyword ERROR is written in uppercase bold:

ERROR <*message*>;

UPPERCASE
identifies arguments that are literals.

In this example of the CMPMODEL= system option, the literals include BOTH, CATALOG, and XML:

CMPMODEL=BOTH | CATALOG | XML |

italic
identifies arguments or values that you supply. Items in italic represent user-supplied values that are either one of the following:

- nonliteral arguments. In this example of the LINK statement, the argument *label* is a user-supplied value and therefore appears in italic:

  LINK *label*;

- nonliteral values that are assigned to an argument.

  In this example of the FORMAT statement, the argument DEFAULT is assigned the variable *default-format*:

  FORMAT *variable(s)* <*format* > <DEFAULT = *default-format*>;

Special Characters

The syntax of SAS language elements can contain the following special characters:

=
an equal sign identifies a value for a literal in some language elements such as system options.

In this example of the MAPS system option, the equal sign sets the value of MAPS:

MAPS=*location-of-maps*

< >
angle brackets identify optional arguments. A required argument is not enclosed in angle brackets.

In this example of the CAT function, at least one item is required:

CAT (*item-1* <, *item-2*, ...>)

|

a vertical bar indicates that you can choose one value from a group of values. Values that are separated by the vertical bar are mutually exclusive.

In this example of the CMPMODEL= system option, you can choose only one of the arguments:

CMPMODEL=BOTH | CATALOG | XML

...

an ellipsis indicates that the argument can be repeated. If an argument and the ellipsis are enclosed in angle brackets, then the argument is optional. The repeated argument must contain punctuation if it appears before or after the argument.

In this example of the CAT function, multiple *item* arguments are allowed, and they must be separated by a comma:

CAT (*item-1* <, *item-2*, ...>)

'*value*' or "*value*"

indicates that an argument that is enclosed in single or double quotation marks must have a value that is also enclosed in single or double quotation marks.

In this example of the FOOTNOTE statement, the argument *text* is enclosed in quotation marks:

FOOTNOTE <*n*> <*ods-format-options* '*text*' | "*text*">;

;

a semicolon indicates the end of a statement or CALL routine.

In this example, each statement ends with a semicolon:

```
data namegame;
   length color name $8;
   color = 'black';
   name = 'jack';
   game = trim(color) || name;
run;
```

References to SAS Libraries and External Files

Many SAS statements and other language elements refer to SAS libraries and external files. You can choose whether to make the reference through a logical name (a libref or fileref) or use the physical filename enclosed in quotation marks.

If you use a logical name, you typically have a choice of using a SAS statement (LIBNAME or FILENAME) or the operating environment's control language to make the reference. Several methods of referring to SAS libraries and external files are available, and some of these methods depend on your operating environment.

In the examples that use external files, SAS documentation uses the italicized phrase *file-specification*. In the examples that use SAS libraries, SAS documentation uses the italicized phrase *SAS-library* enclosed in quotation marks:

```
infile file-specification obs = 100;
libname libref 'SAS-library';
```

Value Type Notation Used for GTL Statement Options

The value type notation that is used in the syntax descriptions and in some examples in this document are as follows:

boolean
specifies a literal value that resolves to true or false. The following table lists literal values that resolve to true or false.

Boolean Values

Values That Resolve To True	Values That Resolve To False
ON	OFF
_ON_	_OFF_
TRUE	FALSE
YES	NO
YES	_NO_
1	0

color
specifies a string that identifies a color. A color can be one of the following:

- any of the color names that are supported by SAS. See "Color-Naming Schemes" on page 1609.
- one of the colors that exists in the SAS session when the style template is used, such as DMSBLACK or DMSCYAN. (Use these color specifications only if you are running SAS in the windowing environment.)
- an English description of an Hue/Light/Saturation (HLS) value. Such descriptions use a combination of words to describe the lightness, the

saturation, and the hue (in that order). You can use the Color Naming System to form a color by doing one of the following:

- combining a chromatic hue with a lightness, a saturation, or both
- combining the achromatic hue gray with a lightness
- combining the achromatic hue black or white without qualifiers.
- combining words to form a wide variety of colors, such as light vivid green, dark vivid orange, or light yellow.

- specify hues that are intermediate between two neighboring colors. To do so, combine one of the following adjectives with one of its neighboring colors: brownish, greenish, purplish, or yellowish (for example, bluish purple or reddish orange).

column
specifies a column variable that contains either double-precision values or string values, or a dynamic variable that refers to such a column.

See also: *integer-column*, *numeric-column*, and *string-column*.

dimension
specifies a nonnegative number. The number can be followed by one of the following optional units of measure:

Units for Dimension

Unit	Description
CM	centimeters
IN	inches
MM	millimeters
PCT or %	percentage
PT	point size (72 points = 1 inch)
PX	pixels

expression
specifies a selective, relational, or logical program structure that calculates values when those values are not stored in the data. The expression must be specified as an EVAL() argument. The following shows the structure of an EVAL() argument:

```
x = EVAL(expression)
```

The expression returns a number and can be formed with consonants, data columns, dynamic variables, functions, or other expressions. The following example uses the data column Time and the SGE functions MEAN and ACF:

```
EVAL(MEAN(Time) + ACF(Time, NLags=10))
```

For more information about expressions, see Chapter 21, “Expressions,” on page 1539.

fill-pattern
specifies a fill pattern as a two-character code that consists of a line-direction prefix (R for right, L for left, or X for cross hatch) and a line identification number, 1–5. For more information about fill patterns, see “Fill Pattern Options” on page 1601.

format
specifies a SAS format or a user-defined format.

integer, integer-column
specifies a member of the set of positive whole numbers, negative whole numbers, and zero.

An integer column specifies a column that contains integer values, or a dynamic variable that refers to such a column.

line-pattern-name, line-pattern-number
specifies a string value of a line pattern, a numeric value of a line pattern, a dynamic variable that contains such a string or number, or a style reference to a line pattern. Line patterns are chosen for discriminability. Because of different densities, equal weighting is impossible for lines of the same thickness. Instead, line patterns are ordered to provide a continuum of weights, which is useful when displaying confidence bands.

For details about line attributes, see “Line Options” on page 1602.

marker-name
specifies a string value of a maker symbol, a dynamic variable that contains a marker symbol, or a style reference to a marker symbol.

For details about marker attributes, see “Marker Options” on page 1604.

number, numeric-column
specifies a value, a dynamic variable that contains a double-precision value, an expression that resolves to a double-precision value, or a style reference to a double-precision value.

A *numeric-column* specifies a column that contains double-precision values, or a dynamic variable that refers to such a column.

string, string-column
specifies a quoted character string.

A *string-column* specifies a column that contains string values, or a dynamic variable that refers to such a column.

Note: For quoted character string options in GTL, a space enclosed in quotation marks (" " or ' ') and empty quotation marks ("" or '') are not equivalent. A space enclosed in quotation marks specifies a blank space or a missing string value. Empty quotation marks have the same effect as not setting the option. To

specify a blank space or missing value in a quoted string option, use a space enclosed in quotation marks (" " or ' ').

style-reference
specifies a reference to an attribute that is defined in a style element.

In the ODS Graphics templates that SAS provides, options for plot features are specified with a style reference in the form *style-element-name:attribute-name*, rather than a specific value. For example, the symbol, color, and size of markers for a basic scatter plot is specified in a SCATTERPLOT statement as follows:

```
scatterplot x=X y=Y /
  markersymbol=GraphDataDefault:markersymbol
  markercolor=GraphDataDefault:contrastcolor
  markersize=GraphDataDefault:markersize
```

The above style references guarantee a common appearance for markers used in all basic scatter plots. For non-grouped data, the marker appearance is controlled by the GraphDataDefault style element in the style template that you specify.

In order to create your own style template, or to modify a style template to use with ODS Graphics, you need to understand the relationship between style elements and graph features. For more information, see the usage guide.

What's New in SAS 9.4 Graph Template Language

Overview

New and enhanced statements for the Graph Template Language (GTL) extend the versatility of the language and introduce new plot types. The following changes are included in this release:

- new plot statements
- new features for general use
- enhancements to SAS 9.3 statements

Possible Changes Required for Your Existing SAS GTL Programs

There are changes in GTL for SAS 9.4 and subsequent maintenance releases that might require you to modify your existing SAS GTL programs. Review this section carefully to determine whether you need to modify your existing SAS GTL programs for SAS 9.4.

Programs That Use the BARCHART or BARCHARTPARM Statement

In SAS 9.4, the BARCHART statement STAT=PCT option now displays percentages in the range 0–100 in order to be consistent with other GTL statements. In prior

releases, STAT=PCT displays proportional values in the range 0–1. To restore the proportional values in SAS 9.4 and later releases, change STAT=PCT to STAT=PROPORTION.

SAS 9.4M3 adds option COLORSTAT= to the BARCHART statement. It is enabled by the COLORRESPONSE= option. The COLORSTAT= option specifies the statistic to be calculated for the data range of the bar-color gradient. The default is SUM. For existing SAS programs that use the BARCHART statement, if STAT= is used with COLORRESPONSE= in the BARCHART statement and STAT= specifies a statistic other than SUM, then the bar-chart colors and color statistic might change from those of previous releases. In that case, to restore the original colors and color statistic, set COLORSTAT= in the BARCHART statement to the same statistic that is specified in STAT=.

SAS 9.4M5 changes the behavior of the BARCHART and BARCHARTPARM statement option FILLTYPE=GRADIENT. In earlier releases, GRADIENT fills each bar with a color and a transparency gradient that starts at the bar top with the initial transparency that is assigned to that bar, and ends with full transparency at the bar baseline. In SAS 9.4M5, GRADIENT is replaced by ALPHAGRADIENT, which has the same behavior as GRADIENT in earlier releases. GRADIENT is changed to an alias of COLORGRADIENT, which fills each bar with an opaque color gradient that starts with the fill color that is assigned to that bar and ends with the color that is specified in a new option, FILLENDCOLOR=. For existing SAS programs that use the BARCHART or BARCHARTPARM statement FILLTYPE=GRADIENT option, the bar gradients will change. To restore the original bar gradients in that case, specify FILLTYPE=ALPHAGRADIENT.

See BARCHART in "Plot Statement Enhancements" on page xxvii.

Programs That Use the DENSITYPLOT Statement

In SAS 9.4, the WEIGHT= option of the KERNEL( ) distribution option in the DENSITYPLOT statement is changed to WEIGHTFUNCTION=. This change enables the addition of the WEIGHT= option in the DENSITYPLOT statement. In SAS 9.4, the WEIGHT= option is not valid in the KERNEL() distribution option and results in a syntax error. If your existing SAS programs specify the WEIGHT= option in the KERNEL( ) distribution option, then you must change it to WEIGHTFUNCTION=.
See DENSITYPLOT in "Plot Statement Enhancements" on page xxvii.

Programs That Use the HEATMAPPARM Statement

SAS 9.4M3 adds options DISCRETEX= and DISCRETEY= to the HEATMAPPARM statement. These options specify whether the X or Y axis is discrete. The default is FALSE. For existing SAS programs that use the HEATMAPPARM statement, if the X axis is discrete, the DISCRETEX=TRUE option must be specified in the HEATMAPPARM statement. Likewise, if the Y axis is discrete, the

DISCRETEY=TRUE option must be specified in the HEATMAPPARM statement. Otherwise, the heat map might not be drawn.

Programs That Use the HISTOGRAM or HISTOGRAMPARM Statement

SAS 9.4M5 changes the behavior of the FILLTYPE=GRADIENT option. In earlier releases, GRADIENT fills each bar with a color and a transparency gradient that starts at the bar top with the initial transparency that is assigned to that bar, and ends with full transparency at the bar baseline. SAS 9.4M5 replaces option GRADIENT with option ALPHAGRADIENT, which has the same behavior as GRADIENT in earlier releases. GRADIENT is changed to an alias of COLORGRADIENT, which fills each bar with an opaque color gradient that starts with the fill color that is assigned to that bar and ends with the color that is specified in a new option, FILLENDCOLOR=. For existing SAS programs that use the HISTOGRAM or HISTOGRAMPARM statement FILLTYPE=GRADIENT option, the bar gradients will change. To restore the original bar gradients in that case, specify FILLTYPE=ALPHAGRADIENT.

Programs That Use the SERIESPLOT Statement

SAS 9.4M4 changes the behavior of the BREAK=TRUE option to break the series line at missing values of only the Y variable. In earlier SAS releases, the BREAK=TRUE option breaks the series line at missing values of the X or Y variable. If you want your existing SAS programs that specify BREAK=TRUE in a SERIESPLOT statement to break the series line at missing X or Y variable values in SAS 9.4M4 and later releases, do one of the following:

- In your data, set the Y variable value to missing when the X variable value is missing.
- In the SERIESPLOT statement in your template, use the IFN or IFC function to set the Y variable value to missing when the X variable value is missing, as shown in the following examples.

```
seriesplot x=x-var-name y=eval(ifn(x-var-name ne ., y-var-name, .));
seriesplot x=x-var-name y=eval(ifc(x-var-name, y-var-name, ''));
```

Programs That Use the WATERFALLCHART Statement

SAS 9.4M3 adds option COLORSTAT= to the WATERFALLCHART statement. It is enabled by the COLORRESPONSE= option. The COLORSTAT= option specifies the statistic to be calculated for the data range of the color gradient. The default is SUM. For existing SAS programs that use the WATERFALLCHART statement, if STAT= is used with COLORRESPONSE= in the WATERFALLCHART statement and STAT= specifies a statistic other than SUM, then the chart colors and color statistic might change from those of previous releases. In that case, to restore the original colors and color statistic, set COLORSTAT= in the WATERFALLCHART statement to the same statistic that is specified in STAT=. See WATERFALLCHART in "Plot Statement Enhancements" on page xxvii.

Programs That Use the DISPLAY=ALL Option in Plot Statements

SAS 9.4M5 adds support for fill patterns to band plots, box plots, bubble plots, high-low plots, ellipse plots, and polygon plots. SAS 9.4M5 also adds fill patterns to the ODS styles. If your SAS program uses the DISPLAY=ALL option in any of these plot statements, your graph might now display fill patterns in addition to fill color, outline, and so on. If you do not want to use fill patterns in your graph, use the DISPLAY= option in your plot statement to display only the features that you want.

New Plot Statements

The following plot statements are new:

- ANNOTATE draws annotations from annotation instructions that are stored in a SAS data set. It can draw all of the annotations in the data set or a subset only.
- AXISTABLE draws textual values (character or numeric) on the graph at locations that are aligned with the X or Y axis.
- LINECHART creates a summarized line chart that is computed from input data.

SAS 9.4M1 adds the following statement:

- POLYGONPLOT draws one or more polygons from data that is stored in a SAS data set.

SAS 9.4M2 adds the following statement:

- TEXTPLOT displays text values at specific X and Y locations in the graph. For information about subsequent enhancements to this statement, see "Plot Statement Enhancements" on page xxvii.

SAS 9.4M3 adds the following statement:

- HEATMAP creates a plot of color-coded rectangles for the response variable of a pair of X and Y variables after it bins the data in two dimensions.

New Legend Statement

SAS 9.4M3 adds the LEGENDTEXTITEMS statement. This statement creates the definition for data-driven text items that can be included in a discrete legend. The items and optional labels are stored in the plot data set.

New Marker Definition Statements

SAS 9.4M1 adds the following statements:

- SYMBOLCHAR defines a marker symbol from a Unicode character value.
- SYMBOLIMAGE defines a marker symbol from a GIF, JPG, or PNG image that is stored in a file.

You can use these statements to define custom marker symbols for your graphs. For information about subsequent enhancements to these statements, see "Marker Definition Statement Enhancements" on page lvi.

New Function

SAS 9.4M1 adds the TYPEOF function. This function returns the type (numeric or character) of a specified column at run time. You can use the TYPEOF function to take specific actions in your template at run time based on the input data type.

New Features for General Use

Color-Priority Graph Data Attribute Rotation

GTL now supports a color-priority rotation pattern for cycling graph data attributes. In the default rotation pattern, graph data attributes rotate as they are defined in the GraphData1–GraphDataN style elements. The new color-priority rotation pattern first cycles through all of the colors while holding the marker symbol, line pattern, or fill pattern constant. When all of the colors have been used, it increments to the next marker symbol, line pattern, or fill pattern, and then repeats the colors.

Color-priority rotation is enabled in one of the following ways:

- the currently active style sets the Graph:attrPriority attribute to COLOR
- the ATTRPRIORITY=COLOR option is specified in the ODS GRAPHICS statement, which overrides the Graph:attrPriority style attribute
- the ATTRPRIORITY=COLOR option is specified in the BEGINGRAPH statement of the template, which overrides the ODS GRAPHICS ATTRPRIORITY= option for all plots in that template

When none of these conditions are true, the default rotation pattern is used. For more information, see "BEGINGRAPH Statement Enhancements" on page xxiv.

Template-Level Graph Data Attribute Overrides

GTL provides new options that enable you to override GraphData1–GraphDataN style attributes for all of the plots within a template. They provide an easy way to modify group attributes without having to create a custom ODS style. These options are used in the BEGINGRAPH statement of a template. By using these options, you can override attributes in the GraphData1–GraphDataN style elements by specifying one or more of the following lists for all of the plots within a template:

- a list of colors that replace the graph data colors (fill) in the current style
- a list of contrast colors that replace the graph data contrast colors in the current style
- a list of marker symbols that replace the graph data marker symbols in the current style

- a list of line patterns that replace the graph data line patterns in the current style

In addition, you can specify a priority for the group value attribute cycling. For more information, see "BEGINGRAPH Statement Enhancements" on page xxiv.

Outer Padding

GTL provides a new OUTERPAD= option that enables you to control the padding around the outside of layouts, legends, titles, footnotes, and text entries. You can use this option to modify the outer padding when the default padding is not sufficient. You can specify a single padding value for all four sides, or you can specify different values for each side.

Unicode Values in User-Defined Formats

SAS 9.4M3 adds support for Unicode values in user-defined formats to ODS Graphics. The Unicode value must be escaped with the (*ESC*) escape sequence, as shown in the following example.

```
"(*ESC*){unicode beta}"
```

ODS Graphics does not support the use of a user-defined ODS escape character to escape Unicode values in user-defined formats.

General Enhancements Supported by Many of the Plots

The following new features that are supported by many of the plot statements are worth highlighting. The individual plot statements that support these features are identified in "Plot Statement Enhancements" on page xxvii.

- The algorithm that is used to place data labels has been improved to more effectively position the data labels in the vicinity of their data markers while avoiding label collisions.
- In certain cases, you can rotate or split data labels, curve labels, and discrete-axis tick values in order to fit them in the available space.
- Subpixel rendering is now supported, which produces smoother curves and more precise bar spacing in plots.
- You can now suppress tips and URLs from individual plots.

Enhancements to SAS 9.4 Statements

BEGINGRAPH Statement Enhancements

- ATTRPRIORITY= specifies a priority for cycling of the attributes for group attributes.
- DATACOLORS= specifies the list of fill colors that replaces the graph data colors from the GraphData1–GraphDataN style elements.
- DATACONTRASTCOLORS= specifies the list of contrast colors that replaces the graph data contrast colors from the GraphData1–GraphDataN style elements.
- DATALINEPATTERNS= specifies the list of line patterns that replaces the graph data line patterns from the GraphData1–GraphDataN style elements.
- DATASKIN= enhances the visual appearance of all plots in the template that support data skins.
- DATASYMBOLS= specifies the list of marker symbols that replaces the graph data marker symbols from the marker symbols that are defined in the GraphData1–GraphDataN style elements.
- SUBPIXEL= specifies whether subpixel rendering is used for drawing smooth curved lines or for spacing bars more precisely.
- SAS 9.4M3 has the following enhancements:
  - AXISBREAKSYMBOL= specifies a symbol to use on the axis lines to indicate a break in the axis.
  - AXISBREAKTYPE= specifies whether the axis break is indicated in the full display or only on the axis line.
  - AXISLINEEXTENT= specifies the extent of the axis line for all axes.
  - DISCRETEAXISOFFSETPAD= specifies whether additional padding is added to the minimum and maximum axis offsets for discrete axes.
  - OPAQUE= specifies whether the graph background is opaque or transparent.
- SAS 9.4M5 adds option DATAFILLPATTERNS=, which specifies a list of fill patterns to replace the graph data fill patterns that are provided by the GraphData1–GraphDataN style elements, if any.

Layout Statement Enhancements

LAYOUT DATALATTICE and LAYOUT DATAPANEL:

- For cell insets, match-merging is now supported for merging the inset and analysis data. The DATASCHEME= suboption of the INSETOPTS= option specifies whether one-to-one merging or match merging was used to merge the data.
- HEADERLABELDISPLAY= now supports NONE, which suppresses the row and column headings, or the cell headings.
- SORTORDER= specifies the order of the cells along the columns and rows.
- LAYOUT DATALATTICE only:
  - COLUMNDATARANGE=, ROWDATARANGE=, COLUMN2DATARANGE=, and ROW2DATARANGE= now support AUTO, which selects the range automatically, based on the column weight or row weight, and the axis type.
  - COLUMNWEIGHT= specifies how to assign weights to the columns widths.
  - ROWWEIGHT= specifies how to assign weights to the row heights.
- SAS 9.4M1 has the following enhancements:
  - HEADERPACK= specifies whether the values listed in the cell headers are displayed as a delimited list in a single header cell in order to save space.
  - HEADERSEPARATOR= specifies a separator to place between each value in the cell header.
  - HEADERSPLITCOUNT= specifies the number of class variables in the cell header after which the cell header wraps to a separate line.
- SAS 9.4M2 has the following enhancements:
  - For the INSETOPTS= option:
    - CONTENTDISPLAY= specifies whether the variable information displayed in the inset includes the column label and value, or the column value only.
    - SEPARATOR= specifies a new separator for the column label and value.
- SAS 9.4M3 adds option HEADERBORDER=, specifies whether a border is drawn around the header cells.

LAYOUT GLOBALLEGEND:

- SAS 9.4M1 changes the default padding between the global legend and the plot area (including the axes) to 10 pixels. Use the OUTERPAD= option to adjust the padding, if necessary.

LAYOUT OVERLAY:

- INNERMARGIN statement:
  - ALIGN= now supports LEFT and RIGHT in addition to TOP and BOTTOM.

- BACKGROUNDCOLOR= specifies the color of the inner margin background.
- OPAQUE= specifies whether the inner margin's background is opaque.
- SAS 9.4M1 has the following enhancements:
  - SEPARATOR= specifies whether a separating line is drawn between the inner margin and the rest of the layout content.
  - SEPARATORATTRS= specifies the attributes of the inner margin separating line.
- SAS 9.4M2 has the following enhancements:
  - GUTTER= specifies the gap between stacked items in the inner margin.
  - PAD= specifies the amount of extra space that is added inside the inner margin border.

LAYOUT OVERLAYEQUATED:

- The HEATMAPPARM statement is now supported.
- EQUATETYPE= now supports SQUAREDATA, which specifies that both the X and Y axes have the same range, but can have different tick values.

LAYOUT PROTOTYPE:

- The HEATMAPPARM statement is now supported.
- SAS 9.4M1 enables the INNERMARGIN statement to be used in a LAYOUT PROTOTYPE block.

Legend Statement Enhancements

AXISLEGEND:

- SAS 9.4M2 changes the BORDER= option default to style reference GraphLegendBackground:FrameBorder.

DISCRETELEGEND:

- SAS 9.4M1 has the following enhancements:
  - The default padding between the legend and the plot area (including the axes) is 10 pixels, depending on the context. You can use the OUTERPAD= option to adjust the padding if necessary.
  - ITEMSIZE= specifies the size of specific types of items in a discrete legend.
- SAS 9.4M2 changes the BORDER= option default to style reference GraphLegendBackground:FrameBorder.
- SAS 9.4M3 has the following enhancements:
  - FILLITEMOUTLINE= specifies whether the fill swatches are outlined only when enabled by the contributing statements or are always outlined.
  - The ITEMSIZE= option now supports the following suboptions:

        - FILLASPECTRATIO= specifies the aspect ratio for the fill swatches.
        - FILLHEIGHT= specifies the height of the fill swatches.
        - HEIGHTSCALE= specifies a scaling factor that is to be applied to the fill swatch height.
    - SORTBY= specifies whether text legend items are sorted by label or by text.
    - SAS 9.4M5 adds REVERSEAUTO to option SORTORDER=. REVERSEAUTO presents groups of legend entries in the reverse order in which they are listed in the legend statement.

CONTINUOUSLEGEND:

- EXTRACTSCALE= specifies whether to extract a scale factor from the tick values and use it to reduce the tick value width.
- EXTRACTSCALETYPE= specifies whether to extract a named scale or a scientific-notation scale.
- SAS 9.4M2 changes the BORDER= option default to style reference GraphLegendBackground:FrameBorder.
- SAS 9.4M3 adds option INTEGER=, which specifies whether only integer tick values are used in the continuous legend.

LEGENDITEM:

- FILLEDOUTLINEDMARKERS= specifies whether markers are drawn with both fills and outlines.
- SAS 9.4M3 adds option FILLDISPLAY=, which specifies whether the fill swatch for this legend item displays fill only or displays fill and outline.

MERGEDLEGEND:

- SAS 9.4M1 has the following enhancements:
    - ADDITIONALNAMES= specifies the name of one or more sources for legend items that are to be added to the merged legend after merging takes place.
    - ITEMSIZE= specifies the size of specific types of items in a merged legend.
- SAS 9.4M2 changes the BORDER= option default to style reference GraphLegendBackground:FrameBorder.
- SAS 9.4M5 adds REVERSEAUTO to option SORTORDER=. REVERSEAUTO presents groups of legend entries in the reverse order in which they are listed in the legend statement.

Plot Statement Enhancements

AXISTABLE:

- SAS 9.4M2 has the following enhancements:
    - CLASSDISPLAY= specifies how the class values are displayed.

- CLASSORDER= specifies the order in which the class values are displayed.
- CLUSTERWIDTH= specifies the width of the group clusters as a fraction of the midpoint spacing.
- DISPLAY= now supports VALUES, which displays the table values.
- DROPONMISSING= specifies whether the entire axis table is dropped when all of the VALUE= column values are missing.
- GUTTER= specifies the gap between rows when a class variable is used.
- INCLUDEMISSINGCLASS= specifies whether missing class values are represented in the table.
- LABEL= specifies the text for the table label.
- LABELHALIGN= specifies the horizontal alignment of the column labels relative to the column width in a Y-axis table.
- LABELJUSTIFY= specifies the justification of the column label, when displayed.
- PAD= specifies the amount of extra space that is added inside the table border.
- SHOWMISSING= specifies whether missing values are represented in the table.
- TITLE= specifies the text for the table title.
- TITLEATTRS=specifies the color and font attributes of the table title.
- TITLEHALIGN= specifies the horizontal alignment of the axis table header label relative to the table width for a Y-axis table.
- TITLEJUSTIFY= specifies the justification of the title string.
- VALUEFORMAT= specifies a SAS format or a user-defined format for the table values.
- VALUEHALIGN= specifies the horizontal alignment of the column values relative to the column width in a Y-axis table.
- VALUEJUSTIFY= specifies the justification of the values in the axis table.
- The following options are replaced and considered deprecated:
  - HEADERLABEL= is replaced with TITLE=.
  - HEADERLABELATTRS= is replaced with TITLEATTRS=.

  The deprecated options are still honored, but the new options are the preferred options.

- SAS 9.4M3 adds option TITLEHALIGN=, which specifies the horizontal alignment of the axis table header label relative to the table width for Y-axis tables and X-axis tables.

BANDPLOT:

- TIP= now supports NONE, which suppressed data tips from the plot.
- SAS 9.4M2 adds option ANTIALIAS=, which specifies whether anti-aliasing is turned off for a band plot.

- SAS 9.4M5 has the following enhancements:
  - FILLPATTERNATTRS= specifies the appearance of the pattern-filled areas.
  - DISPLAY= now supports FILLPATTERN, which displays the band fill pattern.

BARCHART:

- X= is changed to CATEGORY= in order to be consistent with the other GTL plot statements. The X= option is still valid for backward compatibility. However, you should change the X= option to CATEGORY= in your BARCHART statements.

  Note: If you specify X as a data tip role when you change X= to CATEGORY=, then you must also change X to CATEGORY in your data tip options.

- Y= is changed to RESPONSE= in order to be consistent with the other GTL plot statements. The Y= option is still valid for backward compatibility. However, you should change the Y= option to RESPONSE= in your BARCHART statements.

  Note: If you specify Y as a data tip role when you change Y= to RESPONSE=, then you must also change Y to RESPONSE in your data tip options.

- BARLABELFITPOLICY= specifies a policy for avoiding collisions among the bar labels when bar labels are displayed.
- BASELINEATTRS= specifies the appearance of the baseline.
- The baseline is now drawn by default. To suppress the baseline, use the BASELINEATTRS= option to set the line thickness to 0.
- DATALABELFITPOLICY= specifies a policy for avoiding collisions among the bar labels when bar labels are displayed.
- STAT= now supports PROPORTION, which displays proportions in the range 0–1.
- STAT=PCT now displays percentages in the range 0–100 in order to be consistent with other GTL statements.

  Note: In prior SAS releases, the BARCHART statement STAT=PCT option displays proportional values in the range 0–1. To restore the original STAT=PCT results in SAS 9.4 and later releases, specify STAT=PROPORTION in your BARCHART statements instead.

- TIP= now supports NONE, which suppressed data tips and URLs from the plot.
- SAS 9.4M2 has the following enhancements:
  - GROUPORDER= supports REVERSEDATA, which orders the groups within a category in the reverse group-column data order.
  - FILLTYPE= specifies whether the fill color is solid or is a gradient that transitions from fully opaque to fully transparent.

- SEGMENTLABEL= specifies whether a label is displayed inside each bar segment.
- SEGMENTLABELATTRS= specifies the text properties of the bar segment label text.
- SEGMENTLABELFITPOLICY= specifies a policy for fitting the bar segment labels within the bar segments.
- SEGMENTLABELFORMAT= specifies the text format used to display the bar segment labels.

- SAS 9.4M3 has the following enhancements:
  - The BARCHART statement now supports a linear category axis or a time category axis.
  - COLORBYFREQ= specifies whether the bar colors are based on the frequency of the category variable.
  - COLORMODEL= specifies a color ramp that is to be used with the COLORRESPONSE= option or the COLORBYFREQ= option.
  - COLORRESPONSE= specifies the column or range attribute variable that is used to map the bar colors.
  - COLORSTAT= specifies the statistic to use for computing the response colors.
  - DISPLAYZEROLENGTHBAR= specifies whether zero-length bars are drawn.
  - GROUP100= displays the computed response values (FREQ, SUM, or MEAN), normalized to 100%.
  - INTERVALBARWIDTH= specifies the width of the bars in an interval bar chart as a ratio of the interval width.
- SAS 9.4M5 has the following enhancements:
  - BARLABELFITPOLICY=INSIDEPREFERRED attempts to place the bar labels in a horizontal bar chart inside the bars.
  - DISPLAYBASELINE= specifies whether the baseline is displayed.
  - FILLENDCOLOR=*color* specifies the end color of the bar fill color gradient.
  - FILLTYPE=ALPHAGRADIENT replaces FILLTYPE=GRADIENT from the previous releases. This option fills each bar with a color and a transparency gradient that starts at the bar top with the initial transparency that is assigned to that bar, and ends with full transparency at the bar baseline.
  - FILLTYPE=COLORGRADIENT fills each bar with a color gradient that starts with the fill color that is assigned to that bar and ends with the color that is specified in the FILLENDCOLOR= option.
  - FILLTYPE=GRADIENT is changed to an alias of FILLTYPE=COLORGRADIENT.
  - CONNECTBREAK= specifies whether the connect line is broken for values that have no observations.

BARCHARTPARM:

- X= is changed to CATEGORY= in order to be consistent with the other GTL plot statements. The X= option is still valid for backward compatibility. However, you should change the X= option to CATEGORY= in your BARCHARTPARM statements.
- Y= is changed to RESPONSE= in order to be consistent with the other GTL plot statements. The Y= option is still valid for backward compatibility. However, you should change the Y= option to RESPONSE= in your BARCHARTPARM statements.
- BASELINEATTRS= specifies the appearance of the baseline.
- The baseline is now drawn by default. To suppress the baseline, use the BASELINEATTRS= option to set the line thickness to 0.
- DATALABELFITPOLICY= specifies a policy for avoiding collisions among the bar labels when bar labels are displayed.
- DATALABELSPLITCHAR= specifies one or more characters on which the data labels can be split if needed.
- DATALABELSPLITCHARDROP= specifies whether the split characters are included in the data labels.
- ERRORBARCAPSHAPE= specifies whether the error bars have a serif cap.
- TIP= now supports NONE, which suppressed data tips and URLs from the plot.
- SAS 9.4M2 has the following enhancements:
  - ERRORBARCAPSHAPE= defaults to style reference GraphError:CapStyle.
  - DATALABELTYPE= specifies whether the data labels display the RESPONSE values or the values of the column specified by the DATALABEL= option.
  - FILLTYPE= specifies whether the fill color is solid or is a gradient that transitions from fully opaque to fully transparent.
  - GROUPORDER= supports REVERSEDATA, which orders the groups within a category in the reverse group-column data order.
  - SEGMENTLABELATTRS= specifies the text properties of the bar segment label text.
  - SEGMENTLABELFITPOLICY= specifies a policy for fitting the bar segment labels within the bar segments.
  - SEGMENTLABELFORMAT= specifies the text format used to display the bar segment labels.
  - SEGMENTLABELTYPE= specifies whether a label is displayed inside each bar segment.
- SAS 9.4M3 has the following enhancements:
  - The BARCHARTPARM statement now supports a linear category axis or a time category axis.
  - COLORMODEL= specifies a color ramp that is to be used with the COLORRESPONSE= option.
  - COLORRESPONSE= specifies the column or range attribute variable that is used to map the bar colors.

  - DISPLAYZEROLENGTHBAR= specifies whether zero-length bars are drawn.
  - GROUP100= displays the computed values normalized to 100%.
  - INTERVALBARWIDTH= specifies the width of the bars as a ratio of the interval width.
- SAS 9.4M5 has the following enhancements:
  - DATALABELFITPOLICY=INSIDEPREFERRED attempts to place the data labels in a horizontal bar chart inside the bars.
  - DISPLAYBASELINE= specifies whether the baseline is displayed.
  - FILLENDCOLOR=*color* specifies the end color of the bar fill color gradient.
  - FILLTYPE=ALPHAGRADIENT replaces FILLTYPE=GRADIENT from the previous releases. This option fills each bar with a color and a transparency gradient that starts at the bar top with the initial transparency that is assigned to that bar, and ends with full transparency at the bar baseline.
  - FILLTYPE=COLORGRADIENT fills each bar with a color gradient that starts with the fill color that is assigned to that bar and ends with the color that is specified in the FILLENDCOLOR= option.
  - FILLTYPE=GRADIENT is changed to an alias of FILLTYPE=COLORGRADIENT.
  - CONNECTBREAK= specifies whether the connect line is broken for values that have no observations.
  - ERRORBARCAPSCALE= specifies a positive number to use as a multiplier for determining the default width of the error-bar caps.

BLOCKPLOT:

- BLOCKLABEL= specifies alternative text to display for the internal block text values.
- VALUEFITPOLICY= now supports the SPLIT, SPLITALWAYS, and NONE policies.
- VALUESPLITCHAR= specifies one or more characters on which the values can be split if needed.
- VALUESPLITCHARDROP= specifies whether the split characters are included in the displayed values.

BOXPLOT:

- CAPSHAPE= now supports NONE, which specifies that no shape is displayed at the ends of the box whiskers.
- DATALABELSPLIT= specifies whether to split the data labels at specified split characters.
- DATALABELSPLITCHAR= specifies one or more characters on which the data labels can be split if needed.
- DATALABELSPLITCHARDROP= specifies whether the split characters are included in the data labels.

- DATALABELSPLITJUSTIFY= specifies the justification of the strings that are inside the data label blocks.
- DATASKIN= enhances the visual appearance of the filled boxes.
- DISPLAYSTATS= specifies the statistics that are displayed for each box.
- TIP= now supports NONE, which suppressed data tips from the plot.
- WEIGHT= specifies a column that contains a statistics calculation *a priori* weight for each observation of the input data object.
- SAS 9.4M1 has the following enhancements:
  - WHISKERPERCENTILE= specifies the whisker length in percentile units.
  - DISPLAYSTATS= now displays the DATAMAX, DATAMIN, and SUMWGT statistics.
  - LEGENDLABEL= now defaults to the Y= column label or name.
- SAS 9.4M2 adds option GROUPORDER=REVERSEDATA, which orders the groups within a category in the reverse group-column data order.
- SAS 9.4M3 modifies the BOXPLOT statement to contribute its mean markers to a discrete legend when the BOXPLOT DISPLAY= option includes MEAN, and TYPE=MARKER is specified in the DISCRETELEGEND statement.
- SAS 9.4M5 has the following enhancements:
  - DISPLAYSTATS= can be used with both vertical and horizontal box plots.
  - CONNECTBREAK= specifies whether the connect line is broken for values that have no observations.
  - CAPSCALE= specifies a positive number to use as a multiplier for determining the default width of the whisker caps.
  - FILLPATTERNATTRS= specifies the appearance of the pattern-filled areas.
  - DISPLAY= now supports FILLPATTERN, which displays the box fill pattern.

BOXPLOTPARM:

- CAPSHAPE= now supports NONE, which specifies that no shape is displayed at the ends of the box whiskers.
- DATALABELSPLIT= specifies whether to split the data labels at specified split characters.
- DATALABELSPLITCHAR= specifies one or more characters on which the data labels can be split if needed.
- DATALABELSPLITCHARDROP= specifies whether the split characters are included in the data labels.
- DATALABELSPLITJUSTIFY= specifies the justification of the strings that are inside the data label blocks.
- DATASKIN= enhances the visual appearance of the filled boxes.
- TIP= now supports NONE, which suppresses data tips from the plot.
- SAS 9.4M1 has the following enhancements:

  - DISPLAYSTATS= now displays the DATAMAX, DATAMIN, and SUMWGT statistics.
  - LEGENDLABEL= now defaults to the Y= column label or name.
  - URL= specifies an HTML page that is displayed when a box or an outlier marker is selected.
- SAS 9.4M2 adds option GROUPORDER=REVERSEDATA, which orders the groups within a category in the reverse group-column data order.
- SAS 9.4M3 modifies the BOXPLOTPARM statement to contribute its mean markers to a discrete legend when the BOXPLOTPARM DISPLAY= option includes MEAN, and TYPE=MARKER is specified in the DISCRETELEGEND statement.
- SAS 9.4M5 has the following enhancements:
  - DISPLAYSTATS= can be used with both vertical and horizontal box plots.
  - CONNECTBREAK= specifies whether the connect line is broken for values that have no observations.
  - CAPSCALE= specifies a positive number to use as a multiplier for determining the default width of the whisker caps.
  - FILLPATTERNATTRS= specifies the appearance of the pattern-filled areas.
  - DISPLAY= now supports FILLPATTERN, which displays the box fill pattern.

BUBBLEPLOT:

- DATALABELSPLIT= specifies whether to split the data labels at specified split characters.
- DATALABELSPLITCHAR= specifies one or more characters on which the data labels can be split if needed.
- DATALABELSPLITCHARDROP= specifies whether the split characters are included in the data labels.
- DATALABELSPLITJUSTIFY= specifies the justification of the strings that are inside the data label blocks.
- TIP= now supports NONE, which suppresses data tips and URLs from the plot.
- SAS 9.4M3 adds option DRAWORDER=, which specifies whether the bubbles are drawn according to bubble size or according to data order.
- SAS 9.4M5 has the following enhancements:
  - FILLPATTERNATTRS= specifies the appearance of the pattern-filled areas.
  - DISPLAY= now supports FILLPATTERN, which displays the bubble fill pattern.

CONTOURPLOTPARM:

- LEVELS= specifies a list of contour level values.

DENDROGRAM:

- TIP= now supports NONE, which suppresses data tips and URLs from the plot.

DENSITYPLOT:

- CURVELABELSPLIT= specifies whether to split the curve label at the specified split characters.
- CURVELABELSPLITCHAR= specifies one or more characters on which the curve label can be split if needed.
- CURVELABELSPLITCHARDROP= specifies whether the split characters are included in the curve label text.
- CURVELABELSPLITJUSTIFY= specifies the justification of the strings that are inside the curve label block.
- WEIGHT= specifies a column that contains a density-curve calculation *a priori* weight for each observation of the input data object.
- The KERNEL() distribution option WEIGHT= is changed to WEIGHTFUNCTION=. This change enables the addition of the WEIGHT= option in the DENSITYPLOT statement.

  Note: The WEIGHT= option is not valid in the KERNEL() distribution option in SAS 9.4. If you used the WEIGHT= option in the KERNEL() distribution option in prior SAS releases, then you must change it to WEIGHTFUNCTION= in SAS 9.4 and later releases.

- SAS 9.4M2 has the following enhancements:
  - GROUP= creates a separate density curve for each unique group value of the specified column.
  - INCLUDEMISSINGGROUP= specifies whether missing values of the group variable are included in the plot.

DROPLINE:

- DATASKIN= enhances the appearance of the drop line.
- SAS 9.4M1 adds option DROPTO=BOTH, which draws one or more drop lines to both the X and Y axes.

ELLIPSE:

- SAS 9.4M2 has the following enhancements:
  - GROUP= creates a separate ellipse for each unique group value of the specified column.
  - INCLUDEMISSINGGROUP= specifies whether missing values of the group variable are included in the plot.
- SAS 9.4M5 has the following enhancements:
  - FILLPATTERNATTRS= specifies the appearance of the pattern-filled areas.
  - DISPLAY= now supports FILLPATTERN, which displays the band fill pattern.

ELLIPSEPARM:

SAS 9.4M5 has the following enhancements:

- FILLPATTERNATTRS= specifies the appearance of the pattern-filled areas.

- DISPLAY= now supports FILLPATTERN, which displays the ellipse fill pattern.

FRINGEPLOT:

- GROUP= creates a distinct set of lines for each unique group value in the specified column.
- INCLUDEMISSINGGROUP= specifies whether missing values in the group column are included in the plot.
- INDEX= specifies indices for mapping line attributes (color and line pattern) to one of the GraphData1–GraphDataN style elements.
- TIP= now supports NONE, which suppresses data tips from the plot.

HEATMAPPARM:

- URL= specifies an HTML page to display when a rectangle is selected.
- TIP= now supports NONE, which suppresses data tips and URLs from the plot.
- SAS 9.4M2 adds option INCLUDEMISSINGCOLOR=, which specifies whether missing values of the color-group variable or the color-response variable are included in the plot.
- SAS 9.4M3 has the following enhancements:
  - DISCRETEX= specifies whether the X axis is discrete when X= specifies a numeric column.
  - DISCRETEY= specifies whether the Y axis is discrete when Y= specifies a numeric column.

HIGHLOWPLOT:

- CLIPCAP= specifies whether a special clip cap is displayed to indicate where clipping occurred.
- CLIPCAPSHAPE= specifies the shape of the arrowhead on the clipped end of a line.
- DATASKIN= enhances the visual appearance of the high-low chart filled bars or lines.
- ENDCAPDISPLAYPOLICY= specifies the policy for displaying end caps when end caps are present.
- TIP= now supports NONE, which suppresses data tips from the plot.
- SAS 9.4M2 adds option GROUPORDER=REVERSEDATA, which orders the groups within a category in the reverse group-column data order.
- SAS 9.4M3 has the following enhancements:
  - COLORMODEL= specifies a color ramp that is used with the COLORRESPONSE= option.
  - COLORRESPONSE= specifies the column or range attribute variable that is used to map the bar or line colors.

HISTOGRAM:

- DATALABELTYPE= specifies the statistic to display at the end of each bar.

- DATASKIN= enhances the visual appearance of the filled bars.
- WEIGHT= specifies a column that contains a bin-width calculation *a priori* weight for each observation of the input data object.
- SAS 9.4M1 has the following enhancements:
  - The number of bins is limited to approximately 10,000. When the limit is exceeded, SAS automatically adjusts the NBINS= or BINWIDTH= value to set the number of bins to about 10,000.
  - DISPLAY= now supports FILLPATTERN.
  - FILLPATTERNATTRS= specifies the appearance of the pattern-filled bar area.
- SAS 9.4M2 has the following enhancements:
  - FILLTYPE= specifies whether the fill color is solid or is a gradient that transitions from fully opaque to fully transparent.
  - GROUP= creates a separate bar segment or bar for each unique group value of the specified column.
  - INCLUDEMISSINGGROUP= specifies whether missing values of the group variable are included in the plot.
  - The OUTLINEATTRS= option defaults are now consistent with that of BARCHART.
- SAS 9.4M5 has the following enhancements:
  - DATALABELATTRS= specifies the color and font attributes of the bar labels.
  - FILLENDCOLOR=*color* specifies the end color of the bar fill color gradient.
  - FILLTYPE=ALPHAGRADIENT replaces FILLTYPE=GRADIENT from the previous releases. This option fills each bar with a color and a transparency gradient that starts at the bar top with the initial transparency that is assigned to that bar, and ends with full transparency at the bar baseline.
  - FILLTYPE=COLORGRADIENT fills each bar with a color gradient that starts with the fill color that is assigned to that bar and ends with the color that is specified in the FILLENDCOLOR= option.
  - FILLTYPE=GRADIENT is changed to an alias of FILLTYPE=COLORGRADIENT.

HISTOGRAMPARM:

- DATALABELFITPOLICY= specifies a policy for avoiding collisions among the bin labels when bin labels are displayed.
- DATALABELSPLITCHAR= specifies one or more characters on which the data labels can be split if needed.
- DATALABELSPLITCHARDROP= specifies whether the split characters are included in the data labels.
- DATASKIN= enhances the visual appearance of the filled bars.
- TIP= now supports NONE, which suppresses data tips from the plot.
- SAS 9.4M1 has the following enhancements:

  - DISPLAY= now supports FILLPATTERN.
  - FILLPATTERNATTRS= specifies the appearance of the pattern-filled bar area.
- SAS 9.4M2 adds option FILLTYPE=, which specifies whether the fill color is solid or is a gradient that transitions from fully opaque to fully transparent.
- SAS 9.4M5 has the following enhancements:
  - FILLENDCOLOR=*color* specifies the end color of the bar fill color gradient.
  - FILLTYPE=ALPHAGRADIENT replaces FILLTYPE=GRADIENT from the previous releases. This option fills each bar with a color and a transparency gradient that starts at the bar top with the initial transparency that is assigned to that bar, and ends with full transparency at the bar baseline.
  - FILLTYPE=COLORGRADIENT fills each bar with a color gradient that starts with the fill color that is assigned to that bar and ends with the color that is specified in the FILLENDCOLOR= option.
  - FILLTYPE=GRADIENT is changed to an alias of FILLTYPE=COLORGRADIENT.

LINECHART:

- SAS 9.4M2 adds option GROUPORDER=REVERSEDATA, which orders the groups within a category in the reverse group-column data order.
- SAS 9.4M3 has the following enhancements:
  - COLORMODEL= specifies a color ramp that is used with the COLORRESPONSE= option.
  - COLORRESPONSE= specifies the column or range attribute variable that is used to map the line, marker, and fill colors.

LINEPARM:

- CURVELABELSPLIT= specifies whether to split the line label at the specified split characters.
- CURVELABELSPLITCHAR= specifies one or more characters on which the line label can be split if needed.
- CURVELABELSPLITCHARDROP= specifies whether the split characters are included in the line label text.
- CURVELABELSPLITJUSTIFY= specifies the justification of the strings that are inside the line label block.

LOESSPLOT:

- CURVELABELSPLIT= specifies whether to split the curve label at the specified split characters.
- CURVELABELSPLITCHAR= specifies one or more characters on which the curve label can be split if needed.
- CURVELABELSPLITCHARDROP= specifies whether the split characters are included in the curve label text.

- CURVELABELSPLITJUSTIFY= specifies the justification of the strings that are inside the curve label block.

MODELBAND:

- SAS 9.4M2 has the following enhancements:
  - ANTIALIAS= specifies whether anti-aliasing is turned off for a model band plot.
  - A confidence band that depicts confidence limits for individual predicted values (CLI) for a weighted spline plot or regression plot is now displayed as a high-low chart instead of a band.

NEEDLEPLOT:

- BASELINEATTRS= specifies the appearance of the baseline. This option enables you to suppress the baseline by setting the line thickness to 0.
- DATALABELSPLIT= specifies whether to split the data labels at specified split characters.
- DATALABELSPLITCHAR= specifies one or more characters on which the data labels can be split if needed.
- DATALABELSPLITCHARDROP= specifies whether the split characters are included in the data labels.
- DATALABELSPLITJUSTIFY= specifies the justification of the strings that are inside the data label blocks.
- DATASKIN= enhances the appearance of the needle plot lines.
- MARKERATTRS= now supports transparency.
- TIP= now supports NONE, which suppresses data tips and URLs from the plot.
- SAS 9.4M2 adds option GROUPORDER=REVERSEDATA, which orders the groups within a category in the reverse group-column data order.
- SAS 9.4M5 adds option DISPLAYBASELINE=, which specifies whether the baseline is displayed.

PBSPLINEPLOT:

- CURVELABELSPLIT= specifies whether to split the curve label at the specified split characters.
- CURVELABELSPLITCHAR= specifies one or more characters on which the curve label can be split if needed.
- CURVELABELSPLITCHARDROP= specifies whether the split characters are included in the curve label text.
- CURVELABELSPLITJUSTIFY= specifies the justification of the strings that are inside the curve label block.
- SAS 9.4M2 changes the range of the PBSPLINEPLOT DEGREE= option from 0–174 to 0–10 .

PIECHART:

- TIP= now supports NONE, which suppresses data tips and URLs from the plot.

- SAS 9.4M1 adds option CENTERFIRSTSLICE=, which specifies whether the first pie slice is centered on the starting angle or starts on it.
- SAS 9.4M3 adds sub option TRANSPARENCY= to the PIECHART statement FILLATTRS= option. The new TRANSPARENCY= sub option sets the transparency of the other slice unless transparency is specified in the OTHERSLICEOPTS= option.

POLYGONPLOT:

- SAS 9.4M2 has the following enhancements:
  - ANTIALIAS= specifies whether anti-aliasing is turned off for a polygon plot.
  - BACKLIGHT= specifies a back-light effect for the polygon label text.
- SAS 9.4M5 has the following enhancements:
  - FILLPATTERNATTRS= specifies the appearance of the pattern-filled areas.
  - DISPLAY= now supports FILLPATTERN, which displays the band fill pattern.

REFERENCELINE:

- CURVELABELSPLIT= specifies whether to split the reference line label at the specified split characters.
- CURVELABELSPLITCHAR= specifies one or more characters on which the reference line label can be split if needed.
- CURVELABELSPLITCHARDROP= specifies whether the split characters are included in the reference line label text.
- CURVELABELSPLITJUSTIFY= specifies the justification of the strings that are inside the reference line label block.
- DATASKIN= enhances the visual appearance of the reference line.
- SAS 9.4M5 has the following enhancements:
  - DISCRETELINETHICKNESS= specifies the line thickness as a fraction of the midpoint spacing.
  - USEDISCRETETHICKNESS= specifies that the line thickness is based on a fraction of the midpoint spacing that is set by the DISCRETELINETHICKNESS= option.

REGRESSIONPLOT:

- CURVELABELSPLIT= specifies whether to split the regression line label at the specified split characters.
- CURVELABELSPLITCHAR= specifies one or more characters on which the regression line label can be split if needed.
- CURVELABELSPLITCHARDROP= specifies whether the split characters are included in the regression line label text.
- CURVELABELSPLITJUSTIFY= specifies the justification of the strings that are inside the regression line label block.
- SAS 9.4M2 changes the range of the DEGREE= regression option from 0–174 to 1–10.

SCATTERPLOT:

- CLUSTERAXIS= specifies the axis to use for clustering groups when GROUPDISPLAY=CLUSTER.
- DATALABELSPLIT= specifies whether to split the data labels at specified split characters.
- DATALABELSPLITCHAR= specifies one or more characters on which the data labels can be split if needed.
- DATALABELSPLITCHARDROP= specifies whether the split characters are included in the data labels.
- DATALABELSPLITJUSTIFY= specifies the justification of the strings that are inside the data label blocks.
- ERRORBARCAPSHAPE= specifies whether the error bars have a serif cap. SAS 9.4M2 changes the default of this option to style reference GraphError:CapStyle.
- FILLEDOUTLINEDMARKERS= specifies whether markers are drawn with both fills and outlines.
- JITTER= specifies whether to jitter data markers.
- JITTEROPTS= specifies options for managing jittering.
- LABELSTRIP= specifies whether leading and trailing blanks are stripped from marker characters or fixed-position data labels before they are displayed in the plot.
- MARKERATTRS= now supports transparency.
- MARKERCHARACTERPOSITION= specifies the justification of the marker characters.
- MARKERFILLATTRS= specifies the appearance of the filled markers.
- MARKEROUTLINEATTRS= specifies the appearance of the marker outlines.
- TIP= now supports NONE, which suppresses data tips and URLs from the plot.
- SAS 9.4M1 adds option OUTLINEDMARKERCHARACTERS=, which specifies whether backlighting or a drop shadow is applied to the characters that are used as marker symbols in order to enhance their appearance in the graph.
- SAS 9.4M2 has the following enhancements:
  - CONTRIBUTEOFFSETS= specifies whether the plot's space requirements contribute to the calculation of the axis offsets.
  - The GROUPORDER= option supports REVERSEDATA, which orders the groups within a category in the reverse group-column data order.
  - The following options are replaced and considered deprecated:
    - MARKERCOLORGRADIENT= is replaced with COLORRESPONSE=.
    - MARKERSIZERESPONSE= is replaced with SIZERESPONSE=.
    - MARKERSIZEMAX= is replaced with SIZEMAX=.
    - MARKERSIZEMIN= is replaced with SIZEMIN=.

The new options are functionally the same as the deprecated options and are more consistent with the other plot statements. The deprecated options are still honored, but the new options are the preferred options.

- The OUTLINEDMARKERCHARACTERS= option is deprecated. It is still honored, but the TEXTPLOT statement is now the preferred method for creating scatter plots using text markers.

- SAS 9.4M3 adds option SUBPIXEL=, which specifies whether subpixel rendering is used for image output when the scatter plot is rendered.
- SAS 9.4M5 adds option ERRORBARCAPSCALE=, which specifies a positive number to use as a multiplier for determining the default width of the error-bar caps.

SCATTERPLOTMATRIX:

- DATALABELSPLIT= specifies whether to split the data labels at specified split characters.
- DATALABELSPLITCHAR= specifies one or more characters on which the data labels can be split if needed.
- DATALABELSPLITCHARDROP= specifies whether the split characters are included in the data labels.
- DATALABELSPLITJUSTIFY= specifies the justification of the strings that are inside the data label blocks.
- DATASKIN= enhances the visual appearance of the plot markers.
- ELLIPSE= now supports the CLIP= option, which specifies whether clipped confidence ellipses are included in the plot.
- LABELSTRIP= specifies whether leading and trailing blanks are stripped from marker characters or fixed-position data labels before they are displayed in the plot.
- MARKERATTRS= now supports transparency.
- MARKERCHARACTERPOSITION= specifies the justification of the marker characters.
- MATRIXTYPE= specifies whether to display the full matrix, or just the upper or lower triangle of the matrix.
- TIP= now supports NONE, which suppresses data tips from the plot.
- SAS 9.4M2 replaces option MARKERCOLORGRADIENT= with the COLORRESPONSE= option. Option MARKERCOLORGRADIENT= is considered deprecated. The COLORRESPONSE= option is more consistent with the other plot statements. The MARKERCOLORGRADIENT= option is still honored, but the COLORRESPONSE= option is the preferred option.
- SAS 9.4M3 adds option SUBPIXEL=, which specifies whether subpixel rendering is used for image output when the scatter plots are rendered.

SERIESPLOT:

- CLUSTERAXIS= specifies the axis to use for clustering groups when GROUPDISPLAY=CLUSTER.

- DATALABELSPLIT= specifies whether to split the data labels at specified split characters.
- DATALABELSPLITCHAR= specifies one or more characters on which the data labels can be split if needed.
- DATALABELSPLITCHARDROP= specifies whether the split characters are included in the data labels.
- DATALABELSPLITJUSTIFY= specifies the justification of the strings that are inside the data label blocks.
- CURVELABELSPLIT= specifies whether to split the series line label at the specified split characters.
- CURVELABELSPLITCHAR= specifies one or more characters on which the series line label can be split if needed.
- CURVELABELSPLITCHARDROP= specifies whether the split characters are included in the series line label text.
- CURVELABELSPLITJUSTIFY= specifies the justification of the strings that are inside the series line label block.
- DATASKIN= enhances the visual appearance of the series plot lines.
- FILLEDOUTLINEDMARKERS= specifies whether markers are drawn with both fills and outlines.
- MARKERATTRS= now supports transparency.
- MARKERFILLATTRS= specifies the appearance of the filled markers.
- MARKEROUTLINEATTRS= specifies the appearance of the marker outlines.
- TIP= now supports NONE, which suppresses data tips and URLs from the plot.
- SAS 9.4M2 has the following enhancements:
  - The GROUPORDER= option supports REVERSEDATA, which orders the groups within a category in the reverse group-column data order.
  - LINECOLORGROUP= specifies a column that determines the line colors for a grouped plot independently of the GROUP= column.
  - LINEPATTERNGROUP= specifies a column that determines the line patterns for a grouped plot independently of the GROUP= column.
  - MARKERCOLORGROUP= specifies a column that determines the marker colors for a grouped plot independently of the GROUP= column.
  - MARKERSYMBOLGROUP= specifies a column that determines the marker symbols for a grouped plot independently of the GROUP= column.
- SAS 9.4M3 has the following enhancements:
  - ARROWHEADPOSITION= specifies a position for arrowheads.
  - ARROWHEADSCALE= specifies an arrowhead scale factor based on the thickness of the arrow line.
  - ARROWHEADSHAPE= specifies a shape for arrowheads.

- COLORMODEL= specifies a color ramp that is to be used with the COLORRESPONSE= option.
- COLORRESPONSE= specifies the column or range attribute variable that is used to map the line and marker colors.
- LINETHICKNESSMAX= specifies the maximum line thickness when a response variable is used to determine the line thickness.
- LINETHICKNESSMAXRESPONSE= specifies the response value that corresponds to the maximum line thickness.
- LINETHICKNESSMIN= specifies the minimum line thickness when a response variable is used to determine the line thickness.
- LINETHICKNESSRESPONSE= specifies a response column or range attribute variable that is used to map a line thickness to each group value.
- SPLINEPOINTS= specifies a multiplier to apply to the time interval that is in effect for the INTERVAL= axis option.
- SPLINETYPE= specifies the type of spline interpolation that is used to draw the series line.
- The LINECOLORGROUP=, LINEPATTERNGROUP=, MARKERCOLORGROUP=, and MARKERSYMBOLGROUP= options now support a discrete attribute map variable.

SAS 9.4M4 has the following enhancement and change:

- LINEJOIN= specifies how to treat the vertices of the series line.
- BREAK= breaks the series line at missing values of the Y variable only. In earlier SAS releases, the BREAK= option breaks the series line at missing values of the X or Y variable.

Note: If you want to break the series line at missing X or Y variable values in SAS 9.4M4 and later releases, set the Y variable value to missing when the X variable value is missing. See "Programs That Use the SERIESPLOT Statement" on page xix.

SAS 9.4M5 has the following enhancements:

- ERRORBARATTRS= specifies the attributes of the error bars that are associated with the data points.
- ERRORBARCAPSHAPE= specifies whether the error bars have a serif cap.
- XERRORLOWER= specifies values for the lower endpoints on the X error bars.
- XERRORUPPER= specifies values for the upper endpoints on the X error bars.
- YERRORLOWER= specifies values for the lower endpoints on the Y error bars.
- YERRORUPPER= specifies values for the upper endpoints on the Y error bars.

  - ERRORBARCAPSCALE= specifies a positive number to use as a multiplier for determining the default width of the error-bar caps.

STEPPLOT:

- CLUSTERAXIS= specifies the axis to use for clustering groups when GROUPDISPLAY=CLUSTER.
- DATALABELSPLIT= specifies whether to split the data labels at specified split characters.
- DATALABELSPLITCHAR= specifies one or more characters on which the data labels can be split if needed.
- DATALABELSPLITCHARDROP= specifies whether the split characters are included in the data labels.
- DATALABELSPLITJUSTIFY= specifies the justification of the strings that are inside the data label blocks.
- DATASKIN= enhances the appearance of the step plot lines.
- ERRORBARCAPSHAPE= specifies whether the error bars have a serif cap.
- CURVELABELSPLIT= specifies whether to split the step line label at the specified split characters.
- CURVELABELSPLITCHAR= specifies one or more characters on which the step line label can be split if needed.
- CURVELABELSPLITCHARDROP= specifies whether the split characters are included in the step line label text.
- CURVELABELSPLITJUSTIFY= specifies the justification of the strings that are inside the step line label block.
- FILLEDOUTLINEDMARKERS= specifies whether markers are drawn with both fills and outlines.
- MARKERATTRS= now supports transparency.
- MARKERFILLATTRS= specifies the appearance of the filled markers.
- MARKEROUTLINEATTRS= specifies the appearance of the marker outlines.
- TIP= now supports NONE, which suppresses data tips and URLs from the plot.
- SAS 9.4M2 has the following enhancements:
  - ERRORBARCAPSHAPE= defaults to style reference GraphError:CapStyle.
  - The GROUPORDER= option supports REVERSEDATA, which orders the groups within a category in the reverse group-column data order.
- SAS 9.4M3 has the following enhancements:
  - ARROWHEADPOSITION= specifies a position for arrowheads.
  - ARROWHEADSCALE= specifies an arrowhead scale factor based on the thickness of the arrow line.
  - ARROWHEADSHAPE= specifies a shape for arrowheads.
  - LINETHICKNESSMAX= specifies the maximum line thickness when a response variable is used to determine the line thickness.

  - LINETHICKNESSMAXRESPONSE= specifies the response value that corresponds to the maximum line thickness.
  - LINETHICKNESSMIN= specifies the minimum line thickness when a response variable is used to determine the line thickness.
  - LINETHICKNESSRESPONSE= specifies a response column or range attribute variable that is used to map a line thickness to each group value.
- SAS 9.4M5 adds option ERRORBARCAPSCALE=, which specifies a positive number to use as a multiplier for determining the default width of the error-bar caps.

SURFACEPLOTPARM:

- SAS 9.4M2 replaces option SURFACECOLORGRADIENT= with the COLORRESPONSE= option. The SURFACECOLORGRADIENT= option is considered deprecated. The COLORRESPONSE= option is more consistent with the other plot statements. The SURFACECOLORGRADIENT= option is still honored, but the COLORRESPONSE= option is the preferred option.

TEXTPLOT:

- SAS 9.4M3 has the following experimental options:
  - OUTFILE= specifies a file for storing information about the text bounding-box for each text value in the column specified in the OUTID= option.
  - OUTID= specifies a column that contains text values to write to the file specified in the OUTFILE= option.
- SAS 9.4M5 has the following enhancements:
  - POSITION= now accepts the name of a keyword column.
  - POSITIONOFFSETX= specifies the positive or negative X offset for an individual text item.
  - POSITIONOFFSETY= specifies the positive or negative Y offset for an individual text item.

VECTORPLOT:

- DATALABELSPLIT= specifies whether to split the data labels at specified split characters.
- DATALABELSPLITCHAR= specifies one or more characters on which the data labels can be split if needed.
- DATALABELSPLITCHARDROP= specifies whether the split characters are included in the data labels.
- DATALABELSPLITJUSTIFY= specifies the justification of the strings that are inside the data label blocks.
- DATASKIN= enhances the appearance of the vector plot lines.
- TIP= now supports NONE, which suppresses data tips from the plot.
- SAS 9.4M3 has the following enhancements:
  - COLORMODEL= specifies a color ramp that is used with the COLORRESPONSE= option.

- COLORRESPONSE= specifies the column or range attribute variable that is used to map the line colors.
- LINETHICKNESSMAX= specifies the maximum line thickness when a response variable is used to determine the line thickness.
- LINETHICKNESSMAXRESPONSE= specifies the response value that corresponds to the maximum line thickness.
- LINETHICKNESSMIN= specifies the minimum line thickness when a response variable is used to determine the line thickness.
- LINETHICKNESSRESPONSE= specifies a response column or range attribute variable that is used to map a line thickness to each group value.

WATERFALLCHART:

- BARLABELFITPOLICY= specifies a policy for avoiding collisions among the bar labels when bar labels are displayed.
- BASELINEATTRS= specifies the appearance of the baseline. This option enables you to suppress the baseline by setting the line thickness to 0.
- TIP= now supports NONE, which suppresses data tips and URLs from the plot.
- SAS 9.4M3 adds option COLORSTAT=, which specifies the statistic to use for computing the response colors.
- SAS 9.4M5 adds option CONNECTBREAK=, which specifies whether the connect line is broken for values that have no observations.

Text Statement Enhancements

ENTRY:

- SAS 9.4M1 removes the 512-character limit on the length of the entry text.

ENTRYFOOTNOTE:

- HALIGNCENTER= specifies whether the footnote is centered automatically by the system or is always centered in the graph area.
- SAS 9.4M1 removes the 512-character limit on the length of the footnote text.

ENTRYTITLE:

- HALIGNCENTER= specifies whether the title is centered automatically by the system or is always centered in the graph area.
- SAS 9.4M1 removes the 512-character limit on the length of the title text.

Draw Statement Enhancements

SAS 9.4M1 adds option URL= to the BEGINPOLYGON, BEGINPOLYLINE, DRAWTEXT, DRAWLINE, DRAWARROW, DRAWRECTANGLE, DRAWIMAGE, and DRAWOVAL statements. The new URL= option specifies an HTML page that is displayed when the output of the draw statement is selected.

Axis Statement Enhancements

LAYOUT OVERLAY:

- LABELFITPOLICY= specifies a policy for fitting axis labels in the available space.
- LABELPOSITION= specifies the position of the axis label.
- LABELSPLITCHAR= specifies one or more characters on which the axis labels can be split if needed.
- LABELSPLITCHARDROP= specifies whether the split characters are included in the axis labels.
- LABELSPLITJUSTIFY= specifies the justification of the strings that are inside the axis label blocks.
- TICKVALUEHALIGN= specifies the horizontal alignment for all of the tick values that are displayed on the Y and Y2 axes.
- TICKVALUEVALIGN= specifies the vertical alignment for all of the tick values that are displayed on the X and X2 axes.
- SAS 9.4M3 adds option LINEEXTENT=, which specifies the extent of the axis line.
- SAS 9.4M5 adds option LABELFITPOLICY=STACKED, which displays the Y or Y2 axis label vertically as stacked letters.
- DISCRETEOPTS= supports the following new features for discrete axes:
  - TICKDISPLAYLIST= specifies the text that is displayed for the tick values that are defined in the TICKVALUELIST= option.
  - TICKVALUEFITPOLICY= supports new fit policies: ROTATE, ROTATEALWAYS, ROTATELAWAYSDROP, SPLIT, SPLITALWAYS, SPLITALWAYSTHIN, SPLITTHIN, and SPLITROTATE.
  - TICKVALUELIST= specifies the list of tick values that are displayed on the axis.
  - TICKVALUEROTATION= specifies how the tick values are rotated on the X and X2 axes.

- TICKVALUESPLITCHAR= specifies a list of characters on which the tick values can be split if needed.
- TICKVALUESPLITJUSTIFY= specifies justification of the strings that are inside the tick value block.
- TICKVALUESPLITCHARDROP= specifies whether the split characters are included in the displayed tick values.
- SAS 9.4M3 adds option TICKVALUEFORMAT=, which specifies how to format the values for major tick marks.
- SAS 9.4M5 has the following enhancements:
  - TICKVALUEROTATION=DIAGONAL2 rotates the tick values to a –45-degree diagonal position.
  - TICKVALUEFITPOLICY=STACKEDALWAYS always displays the tick values vertically as stacked letters.
  - TICKVALUEFITPOLICY=STACKEDALWAYSTHIN is the same as STACKEDALWAYS, except that thinning is performed when the tick values do not fit the available space.

- LINEAROPTS= supports the following new features for linear axes:
  - MINORGRID= specifies whether grid lines are displayed at the minor tick values.
  - MINORGRIDATTRS= specifies the attributes of the minor grid lines.
  - MINORTICKCOUNT= specifies the number of minor ticks that are displayed on the axis.
  - MINORTICKS= specifies whether the minor tick marks are displayed on the axis.
  - TICKDISPLAYLIST= specifies the text that is displayed for the tick values that are defined in the TICKVALUELIST= option.
  - TICKVALUEFITPOLICY= now supports policies NONE and ROTATEALWAYS.
  - TICKVALUEFORMAT= now supports EXTRACTSCALETYPE=, which enables you to specify the type of scale that you want to extract.
  - TICKVALUEROTATION= specifies how the tick values are rotated on the X and X2 axes.
  - SAS 9.4M1 adds option INCLUDERANGES=, which specifies the ranges for a broken axis.
  - SAS 9.4M2 has the following enhancements:
    - The MINORGRID= option defaults to style reference GraphMinorGridLines:DisplayOpts.
    - The MINORGRIDATTRS= option defaults to style element GraphMinorGridLines in order to visually contrast the major and minor grid lines.
    - The MINORTICKCOUNT= option for linear axes defaults to one minor tick and two intervals.

- SAS 9.4M5 adds option TICKVALUEROTATION=DIAGONAL2, which rotates the tick values to a –45-degree diagonal position.

- LOGOPTS= supports the following new features for log axes:
  - MINORGRID= specifies whether grid lines are displayed at the minor tick values.
  - MINORGRIDATTRS= specifies the attributes of the minor grid lines.
  - MINORTICKCOUNT= specifies the number of minor ticks that are displayed on the axis.
  - TICKVALUELIST= specifies the tick values for a log axis as a space-separated list.
  - TICKVALUEPRIORITY= specifies whether the TICKVALUELIST= specification can extend the axis data range.
  - VALUETYPES= specifies how the VIEWMIN=, VIEWMAX=, and TICKVALUELIST= option values are interpreted.
  - SAS 9.4M2 has the following enhancements:
    - The MINORGRID= option defaults to style reference GraphMinorGridLines:DisplayOpts.
    - The MINORGRIDATTRS= option defaults to style element GraphMinorGridLines in order to visually contrast the major and minor grid lines.
  - SAS 9.4M3 adds option TICKVALUEFORMAT=, which specifies how to format the values for major tick marks.
- TIMEOPTS= supports the following new features for time axes:
  - MINORGRID= specifies whether grid lines are displayed at the minor tick values.
  - MINORGRIDATTRS= specifies the attributes of the minor grid lines.
  - MINORTICKINTERVAL= specifies the time interval between minor ticks.
  - TICKVALUEFITPOLICY= now supports policies NONE and ROTATEALWAYS.
  - TICKVALUEROTATION= specifies how the tick values are rotated on the X and X2 axes.
  - SAS 9.4M1 adds option INCLUDERANGES=, which specifies the ranges for a broken axis.
  - SAS 9.4M2 has the following enhancements:
    - The MINORGRID= option defaults to style reference GraphMinorGridLines:DisplayOpts.
    - The MINORGRIDATTRS= option defaults to style element GraphMinorGridLines in order to visually contrast the major and minor grid lines.
  - SAS 9.4M3 adds option INTERVALMULTIPLIER=, which specifies a multiplier to apply to the time interval that is in effect for the axis.

  - SAS 9.4M5 adds option TICKVALUEROTATION=DIAGONAL2, which rotates the tick values to a –45-degree diagonal position.

LAYOUT OVERLAY3D:

- LINEAROPTS= supports the following new features for linear axes:
  - MINORGRID= specifies whether grid lines are displayed at the minor tick values.
  - MINORGRIDATTRS= specifies the attributes of the minor grid lines.
  - MINORTICKCOUNT= specifies the number of minor ticks that are displayed on the axis.
  - MINORTICKS= specifies whether the minor tick marks are displayed on the axis.
  - TICKDISPLAYLIST= specifies the text that is displayed for the tick values that are defined in the TICKVALUELIST= option.
  - TICKVALUEFORMAT= now supports EXTRACTSCALETYPE=, which enables you to specify the type of scale that you want to extract.
  - TICKVALUEPRIORITY= specifies whether the TICKVALUELIST= specification can extend the axis data range.
  - SAS 9.4M2 changes the MINORGRIDATTRS= option default to style element GraphMinorGridLines in order to visually contrast the major and minor grid lines.
- TIMEOPTS= supports the following new features for time axes:
  - MINORGRID= specifies whether grid lines are displayed at the minor tick values.
  - MINORGRIDATTRS= specifies the attributes of the minor grid lines.
  - MINORTICKINTERVAL= specifies the time interval between minor ticks.
  - SAS 9.4M2 changes the MINORGRIDATTRS= option default to style element GraphMinorGridLines in order to visually contrast the major and minor grid lines.
  - SAS 9.4M3 adds option INTERVALMULTIPLIER=, which specifies a multiplier to apply to the time interval that is in effect for the axis.

LAYOUT OVERLAYEQUATED:

- MINORGRID= specifies whether grid lines are displayed at the minor tick values.
- MINORGRIDATTRS= specifies the attributes of the minor grid lines.
- MINORTICKCOUNT= specifies the number of minor ticks that are displayed on the axis.
- MINORTICKS= specifies whether the minor tick marks are displayed on the axis.
- TICKVALUEFITPOLICY= now supports policies NONE and ROTATEALWAYS.
- TICKVALUEFORMAT= now supports EXTRACTSCALETYPE=, which enables you to specify the type of scale that you want to extract.

- VIEWMAX= specifies the maximum data value to include in the display (the value might be adjusted by the threshold calculation).
- VIEWMIN= specifies the minimum data value to include in the display (the value might be adjusted by the threshold calculation).
- SAS 9.4M3 adds option LINEEXTENT=, which specifies the extent of the axis lines.

LAYOUT LATTICE:

- LABELFITPOLICY= specifies a policy for fitting axis labels in the available space.
- LABELPOSITION= specifies the position of the axis label.
- LABELSPLITCHAR= specifies one or more characters on which the axis labels can be split if needed.
- LABELSPLITCHARDROP= specifies whether the split characters are included in the axis labels.
- LABELSPLITJUSTIFY= specifies the justification of the strings that are inside the axis label blocks.
- TICKVALUEHALIGN= specifies the horizontal alignment for all of the tick values that are displayed on the Y and Y2 axes.
- TICKVALUEVALIGN= specifies the vertical alignment for all of the tick values that are displayed on the X and X2 axes.
- SAS 9.4M5 adds option LABELFITPOLICY=STACKED, which displays the Y or Y2 axis label vertically as stacked letters.
- DISCRETEOPTS= supports the following new features for discrete axes:
  - TICKDISPLAYLIST= specifies the text that is displayed for the tick values that are defined in the TICKVALUELIST= option.
  - TICKVALUEFITPOLICY= supports new fit policies: ROTATE, ROTATEALWAYS, ROTATEALWAYSDROP, SPLIT, SPLITALWAYS, SPLITALWAYSTHIN, and SPLITTHIN.
  - TICKVALUELIST= specifies the list of tick values that are displayed on the axis.
  - TICKVALUEROTATION= specifies how the tick values are rotated on the X and X2 axes.
  - TICKVALUESPLITCHAR= specifies a list of characters on which the tick values can be split if needed.
  - TICKVALUESPLITJUSTIFY= specifies justification of the strings that are inside the tick value block.
  - TICKVALUESPLITCHARDROP= specifies whether the split characters are included in the displayed tick values.
  - SAS 9.4M3 adds option TICKVALUEFORMAT=, which specifies how to format the values for major tick marks.
  - SAS 9.4M5 has the following enhancements:

        - TICKVALUEROTATION=DIAGONAL2 rotates the tick values to a –45-degree diagonal position.
        - TICKVALUEFITPOLICY=STACKEDALWAYS always displays the tick values vertically as stacked letters.
        - TICKVALUEFITPOLICY=STACKEDALWAYSTHIN is the same as STACKEDALWAYS, except that thinning is performed when the tick values do not fit the available space.
- LINEAROPTS= supports the following new features for linear axes:
    - MINORGRID= specifies whether grid lines are displayed at the minor tick values.
    - MINORGRIDATTRS= specifies the attributes of the minor grid lines.
    - MINORTICKCOUNT= specifies the number of minor ticks that are displayed on the axis.
    - MINORTICKS= specifies whether the minor tick marks are displayed on the axis.
    - TICKDISPLAYLIST= specifies the text that is displayed for the tick values that are defined in the TICKVALUELIST= option.
    - TICKVALUEFITPOLICY= now supports policies NONE and ROTATEALWAYS.
    - TICKVALUEFORMAT= now supports EXTRACTSCALETYPE=, which enables you to specify the type of scale that you want to extract.
    - TICKVALUEROTATION= specifies how the tick values are rotated on the X and X2 axes.
    - SAS 9.4M3 adds option TICKVALUEFORMAT=, which specifies how to format the values for major tick marks.
    - SAS 9.4M5 adds option TICKVALUEROTATION=DIAGONAL2, which rotates the tick values to a –45-degree diagonal position.
- LOGOPTS= supports the following new features for log axes:
    - MINORGRID= specifies whether grid lines are displayed at the minor tick values.
    - MINORGRIDATTRS= specifies the attributes of the minor grid lines.
    - MINORTICKCOUNT= specifies the number of minor ticks that are displayed on the axis.
    - TICKVALUELIST= specifies the tick values for a log axis as a space-separated list.
    - TICKVALUEPRIORITY= specifies whether the TICKVALUELIST= specification can extend the axis data range.
    - VALUETYPES= specifies how the VIEWMIN=, VIEWMAX=, and TICKVALUELIST= option values are interpreted.
    - SAS 9.4M3 adds option TICKVALUEFORMAT=, which specifies how to format the values for major tick marks.

- TIMEOPTS= supports the following new features for time axes:
  - MINORGRID= specifies whether grid lines are displayed at the minor tick values.
  - MINORGRIDATTRS= specifies the attributes of the minor grid lines.
  - MINORTICKINTERVAL= specifies the time interval between minor ticks.
  - TICKVALUEFITPOLICY= now supports policies NONE and ROTATEALWAYS.
  - TICKVALUEROTATION= specifies how the tick values are rotated on the X and X2 axes.
  - SAS 9.4M3 has the following enhancements:
    - TICKVALUEFORMAT= specifies how to format the values for major tick marks.
    - INTERVALMULTIPLIER= specifies a multiplier to apply to the time interval that is in effect for the axis.
  - SAS 9.4M5 adds option TICKVALUEROTATION=DIAGONAL2, which rotates the tick values to a –45-degree diagonal position.

LAYOUT DATALATTICE and LAYOUT DATAPANEL:

- LABELFITPOLICY= specifies a policy for fitting axis labels in the available space.
- LABELPOSITION= specifies the position of the axis label.
- LABELSPLITCHAR= specifies one or more characters on which the axis labels can be split if needed.
- LABELSPLITCHARDROP= specifies whether the split characters are included in the displayed axis labels.
- LABELSPLITJUSTIFY= specifies the justification of the strings that are inside the axis label blocks.
- TICKVALUEHALIGN= specifies the horizontal alignment for all of the tick values that are displayed on the Y and Y2 axes.
- TICKVALUEVALIGN= specifies the vertical alignment for all of the tick values that are displayed on the X and X2 axes.
- SAS 9.4M5 adds option LABELFITPOLICY=STACKED, which displays the Y or Y2 axis label vertically as stacked letters.
- DISCRETEOPTS= supports the following new features for discrete axes:
  - TICKDISPLAYLIST= specifies the text that is displayed for the tick values that are defined in the TICKVALUELIST= option.
  - TICKVALUEFITPOLICY= supports new fit policies: ROTATE, ROTATEALWAYS, ROTATEALWAYSDROP, SPLIT, SPLITALWAYS, SPLITALWAYSTHIN, and SPLITTHIN.
  - TICKVALUELIST= specifies the list of tick values that are displayed on the axis.

- TICKVALUEROTATION= specifies how the tick values are rotated on the X and X2 axes.
- TICKVALUESPLITCHAR= specifies a list of characters on which the tick values can be split if needed.
- TICKVALUESPLITJUSTIFY= specifies justification of the strings that are inside the tick value block.
- TICKVALUESPLITCHARDROP= specifies whether the split characters are included in the displayed tick values.
- SAS 9.4M3 adds option TICKVALUEFORMAT=, which specifies how to format the values for major tick marks.
- SAS 9.4M5 has the following enhancements:
  - TICKVALUEROTATION=DIAGONAL2 rotates the tick values to a –45-degree diagonal position.
  - TICKVALUEFITPOLICY=STACKEDALWAYS always displays the tick values vertically as stacked letters.
  - TICKVALUEFITPOLICY=STACKEDALWAYSTHIN is the same as STACKEDALWAYS, except that thinning is performed when the tick values do not fit the available space.

- LINEAROPTS= supports the following new features for linear axes:
  - MINORGRID= specifies whether grid lines are displayed at the minor tick values.
  - MINORGRIDATTRS= specifies the attributes of the minor grid lines.
  - MINORTICKCOUNT= specifies the number of minor ticks that are displayed on the axis.
  - MINORTICKS= specifies whether the minor tick marks are displayed on the axis.
  - TICKDISPLAYLIST= specifies the text that is displayed for the tick values that are defined in the TICKVALUELIST= option.
  - TICKVALUEFITPOLICY= now supports policies NONE and ROTATEALWAYS.
  - TICKVALUEFORMAT= now supports EXTRACTSCALETYPE=, which enables you to specify the type of scale that you want to extract.
  - TICKVALUEROTATION= specifies how the tick values are rotated on the X and X2 axes.
  - SAS 9.4M2 changes the MINORGRIDATTRS= option default to style element GraphMinorGridLines in order to visually contrast the major and minor grid lines.
  - SAS 9.4M5 adds option TICKVALUEROTATION=DIAGONAL2, which rotates the tick values to a –45-degree diagonal position.
- LOGOPTS= supports the following new features for log axes:
  - MINORGRID= specifies whether grid lines are displayed at the minor tick values.

  - MINORGRIDATTRS= specifies the attributes of the minor grid lines.
  - MINORTICKCOUNT= specifies the number of minor ticks that are displayed on the axis.
  - TICKVALUELIST= specifies the tick values for a log axis as a space-separated list.
  - TICKVALUEPRIORITY= specifies whether the TICKVALUELIST= specification can extend the axis data range.
  - VALUETYPES= specifies how the VIEWMIN=, VIEWMAX=, and TICKVALUELIST= option values are interpreted.
  - SAS 9.4M2 changes the MINORGRIDATTRS= option default to style element GraphMinorGridLines in order to visually contrast the major and minor grid lines.
  - SAS 9.4M3 adds option TICKVALUEFORMAT=, which specifies how to format the values for major tick marks.
- TIMEOPTS= supports the following new features for time axes:
  - MINORGRID= specifies whether grid lines are displayed at the minor tick values.
  - MINORGRIDATTRS= specifies the attributes of the minor grid lines.
  - MINORTICKINTERVAL= specifies the time interval between minor ticks.
  - TICKVALUEFITPOLICY= now supports policies NONE and ROTATEALWAYS.
  - TICKVALUEROTATION= specifies how the tick values are rotated on the X and X2 axes.
  - SAS 9.4M2 changes the MINORGRIDATTRS= option default to style element GraphMinorGridLines in order to visually contrast the major and minor grid lines.
  - SAS 9.4M3 adds option INTERVALMULTIPLIER=, specifies a multiplier to apply to the time interval that is in effect for the axis.
  - SAS 9.4M5 adds option TICKVALUEROTATION=DIAGONAL2, which rotates the tick values to a –45-degree diagonal position.

Marker Definition Statement Enhancements

SYMBOLCHAR:

SAS 9.4M3 has the following enhancements:

- HOFFSET= and VOFFSET= now move the marker character within the marker character bounding box. The bounding box position remains centered on the data point.
- Offsets applied to the marker character with HOFFSET= and VOFFSET= are also applied to the marker character that is displayed in the legend.

Discrete Attribute Map Enhancements

The following enhancements have been made to discrete attribute maps:

VALUE statement:

- TEXTATTRS= specifies the text attributes to use when an attribute map is applied to text in a plot.

SAS 9.4M1 has the following enhancements:

- You can now specify the attribute mapping information for a discrete attribute map in a SAS data set. You now have an alternative to coding your mapping information in a DISCRETEATTRMAP block in your template. For more information, see *SAS ODS Graphics: Procedures Guide*.
- DISCRETEATTRMAP statement:
  - DISCRETELEGENDENTRYPOLICY= specifies whether the items that the associated plot contributes to a discrete legend are items that appear only in the data or items that are defined only in the attribute map.
- DISCRETEATTRVAR statement:
  - ATTRMAP= now accepts a name that is specified in the ID column in a discrete attribute map data set. This feature enables you to create a discrete attribute map variable for a discrete attribute map that is defined in a SAS data set. To resolve the attribute map name in that case, you must specify the name of the attribute map data set in the DATTRMAP= option in the SGRENDER statement that renders the graph. For information about discrete attribute map data sets and the SGRENDER statement DATTRMAP= option, see *SAS ODS Graphics: Procedures Guide*.
- VALUE statement:
  - FILLATTRS= now supports the TRANSPARENCY= fill option.
  - LINEATTRS= now supports the THICKNESS= line option.
  - MARKERATTRS= now supports the SIZE=, TRANSPARENCY=, and WEIGHT= marker options.

Documentation Enhancements

In SAS 9.4M2, *SAS Graph Template Language: User's Guide* is reorganized to make it easier to find information about how to use the Graph Template Language.

PART 1

Fundamentals

Chapter 1
Overview 3

1

Overview

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Graph Template Language (GTL)

GTL and the Output Delivery System (ODS)

The SAS *Graph Template Language* (GTL) is an extension to the Output Delivery System (ODS) that enables you to create sophisticated graphics. For example,

using GTL, you can generate Model-Fit plots, Distribution Plots, Comparative plots, Prediction Plots, and more.

The graphics produced by GTL are generated by template definitions that control the graph format and appearance and specify the variable roles to represent in the graph display. The graph can then be rendered by associating the templates with a data source.

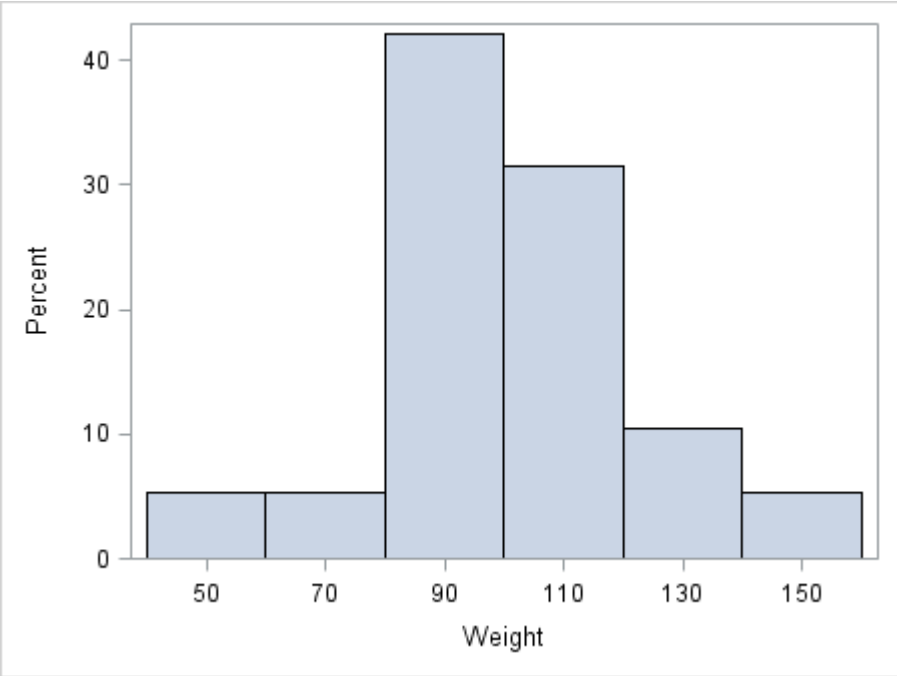
- The GTL templates are defined with PROC TEMPLATE. GTL includes conditional statements that can be used to determine what graph features are rendered. It also includes layout statements that specify the arrangement of graph features, plot statements that request specific plot types (such as histograms and scatter plots), and text and legend statements that specify titles, footnotes, legends, and other text-based graph elements.
- The GTL templates are rendered using the SGRENDER procedure, which specifies a data source that contains appropriate data values and the template to use for rendering the graph.
- You can also modify predefined GTL templates that SAS delivers for use on the SAS statistical procedures. For information about modifying existing templates, refer to ODS Graphics Template Modification in *SAS/STAT User's Guide*.

This manual provides a complete reference to the Graph Template Language. For detailed usage information, consult the *SAS Graph Template Language: User's Guide*.

Note: If you are also a SAS/GRAPH user, then you might want to consult the *SAS Graph Template Language: User's Guide* to learn about some of the distinctions between ODS Graphics and SAS/GRAPH.

A Quick Example

The data set Sashelp.Class is delivered with SAS. It includes data columns named Height and Weight, which store height and weight measures for a small sample of subjects. The Graph Template Language can be used to generate a histogram that shows the distribution of weight recorded in that data set:



The following SAS program produces the graph:

```
proc template;
  define statgraph histogram;
    begingraph;
      layout overlay;
        histogram weight;
      endlayout;
    endgraph;
  end;
run;

ods graphics / width=450px;
proc sgrender data=sashelp.class
  template=histogram;
run;
```

- The DEFINE STATGRAPH statement on PROC TEMPLATE opens a definition block for defining a graphics template named HISTOGRAM. The HISTOGRAM template is stored in the template folder (also called the “template store,” by default located in Sasuser.Templat).
- The template definition for HISTOGRAM specifies two GTL statements within a BEGINGRAPH/ENDGRAPH block: LAYOUT OVERLAY and HISTOGRAM.
- The LAYOUT OVERLAY statement is one of the most fundamental layout statements. It can overlay the results of one or more plot statements, each of which shares the same plot area, axes, and legends. The layout in this example specifies only a single element: a HISTOGRAM with bars showing the distribution of observations of the data column named Weight.
- The ENDLAYOUT statement ends the layout block, the ENDGRAPH statement ends the graph definition, and the END statement ends the template definition.

- The ODS GRAPHICS statement uses the WIDTH= option to set a width for the output graph. Because the HEIGHT= option is not specified, GTL manages the graph's aspect ratio and sets an appropriate height.
- The DATA= option on PROC SGRENDER specifies Sashelp.Class as the data source for the graph. TEMPLATE= specifies HISTOGRAM as the template definition to use for rendering the graph.

Template Compilation

A GTL template describes the structure and appearance of a graph to be produced, similar to how a TABLE template describes the organization and content of a table.

All templates are stored, compiled programs. The following source program produces a simple GTL template named SCATTER:

```
proc template;
  define statgraph scatter;
    begingraph;
      layout overlay;
        scatterplot x=height y=weight;
      endlayout;
    endgraph;
 end;
run;
```

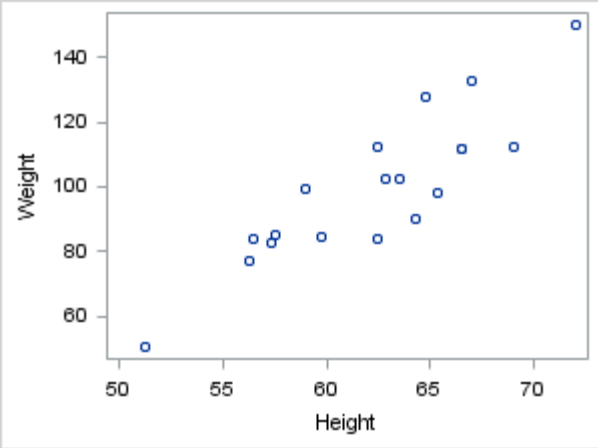
When this code is submitted, the statement keywords and options are parsed, just as with any other procedure. If no syntax error is detected, then an output template named SCATTER is created and stored in the default template folder Sasuser.Templat. No graph is produced. Note the following:

- Any required arguments in the template must be specified. In this example, X= and Y= in the SCATTERPLOT statement must specify variables for the analysis, but no checking for the existence of these variables is done at compile time. (Unlike other SAS procedures, PROC TEMPLATE does not perform a compile and then run sequence, which includes variable validation.)
- No reference to an input data set appears in the template.

Run-Time Actions

To produce a graph, a GTL template must be bound to a data source using the SGRENDER procedure. The following example uses SGRENDER to bind the SCATTER template to the SAS data set Sashelp.Class, which is delivered with SAS:

```
proc sgrender data=sashelp.class
              template=scatter;
run;
```



Generally, an ODS data object is constructed by comparing the template references to column names with columns that exist in the current data set. In the current example, Sashelp.Class contains columns named Height and Weight. Because these column names match the columns that are named in template SCATTER, columns Height and Weight are added to the data object. The other columns in Sashelp.Class are ignored. (It is possible for a template to define new computed columns based on existing columns.)

After all the observations have been read, the data object and template definition are passed to a graph renderer, which produces the graph image. The image is then automatically integrated into the ODS destination. The visual properties of the graph are determined by the ODS style that is in effect.

Note: Template SCATTER is a restrictive definition: it can create a plot only with columns named Height and Weight. A GTL template can be made more flexible by introducing dynamic variables or macro variables that supply variables and other information at run time. For more information, see "Flexible Templates" on page 14.

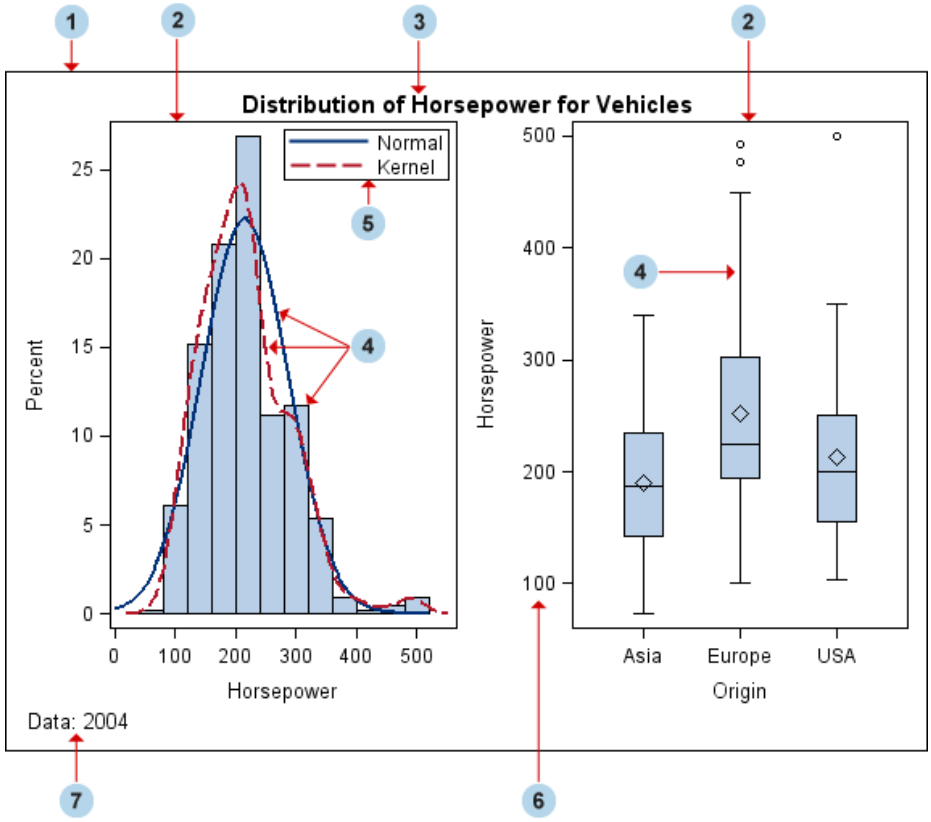
Components of a Graph

In general, a graph is made of up of the following parts:

- titles and footnotes
- one or more cells that contain a composite of one or more plots
- legends, which can reside inside or outside a cell

The following figure shows the different parts of a graph:

Figure 1.1 Components of a Graph



1 Graph

a visual representation of data. The graph can contain titles, footnotes, legends, and one or more cells that have one or more plots.

2 Cell

a distinct rectangular subregion of a graph that can contain plots, text, and legends.

3 Title

descriptive text that is displayed above any cell or plot areas in the graph.

4 Plot

a visual representation of data such as a scatter plot, a series line, a bar chart, or a histogram. Multiple plots can be overlaid in a cell.

5 Legend

refers collectively to the legend border, one or more legend entries (where each entry has a symbol and a corresponding label) and an optional legend title.

6 Axis

refers collectively to the axis line, the major and minor tick marks, the major tick mark values, and the axis label. Each cell has a set of axes that are shared by all the plots in the cell. In multi-cell graphs, the columns and rows of cells can share common axes if the cells have the same data type.

7 Footnote

descriptive text that is displayed below any cell or plot areas in the graph.

Graphical Layouts

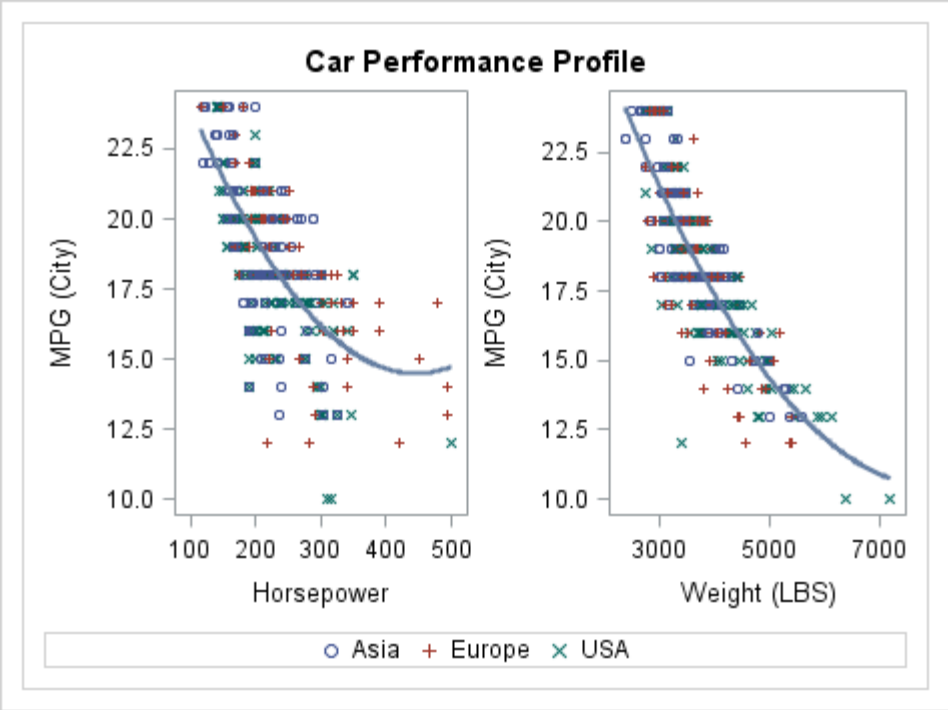
One of most powerful features of GTL is the syntax built around hierarchical statement blocks called “layouts.” The outermost layout block determines

- The overall organization of the graph—whether it uses a single-cell or a multi-cell display.
- What statements are allowed in the block. Generally, layout blocks can contain plots, lines of text, a legend, or even another layout.
- How the contained statements interact.

Table 1.1 *Outermost Layouts in GTL*

Layout	Description
OVERLAY	General purpose layout for displaying 2-D plots in a single-cell.
OVERLAY3D	Layout for displaying 3-D plots in a single-cell.
OVERLAYEQUATED	Specialized OVERLAY with equated axes.
REGION	General purpose layout for displaying single-cell graphs that does not use axes.
GRIDDED	Basic grid of plots. All cells are independent.
LATTICE	Advanced multi-cell layout. Axes can be shared across columns or rows and be external to grid. Many grid labeling and alignment features.
DATALATTICE	Generates a classification panel from the values of 1 or 2 classifiers.
DATAPANEL	Generates a classification panel from the values of n classifiers.
GLOBALLEGEND	Specialized layout for creating a compound legend that contains multiple discrete legends.

For example, the following graph is a two-cell graph produced using the LAYOUT LATTICE statement as the outermost template in the layout.



The LAYOUT LATTICE statement is typically used to create a multi-cell layout of plots that are aligned across columns and rows. In the following template, which produced the graph, plot statements are specified within nested LAYOUT OVERLAY statements. Thus, the LATTICE automatically aligns the plot areas and tick display areas in the plots. The LATTICE layout is a good layout to choose when you want to compare the results of related plots.

```
proc template;
  define statgraph lattice;
  begingraph;
    entrytitle "Car Performance Profile";
    layout lattice / border=true pad=10 opaque=true
                     rows=1 columns=2 columngutter=3;
      layout overlay;
        scatterplot x=horsepower y=mpg_city /
          group=origin name="cars";
        regressionPlot x=horsepower y=mpg_city / degree=2;
      endlayout;

      layout overlay;
        scatterplot x=weight y=mpg_city / group=origin;
        regressionPlot x=weight y=mpg_city / degree=2;
      endlayout;

      sidebar;
        discretelegend "cars";
      endsidebar;
    endlayout;
  endgraph;
  end;
run;
```

For detailed information about each layout, see the chapter for that layout type.

Plots

The plots in GTL are classified in different ways, depending on the context of the discussion.

Within layout blocks, plots are often classified according to graphical dimension: whether they are projected in two or three visual dimensions. Thus, plots in GTL are often referred to as 2-D or 3-D plots, based on their graphical dimensions, not their data dimensions.

Relative to their input data, plots are classified according to the statements that calculate summary statistics from raw input data, and those that use calculated statistics as input parameters on the plot statement. Thus, many GTL plot statements have two versions: BARCHART and BARCHARTPARM, HISTOGRAM and HISTOGRAMPARM, and so on. The main distinction between such plots is the nature of the input data that they accept:

- The “non-parm” version (for example, BARCHART) computes its values from raw, unsummarized data. For example, a BARCHART computes the summary values it needs for the bars in the chart. Such plots are often referred to as “computed plots.”
- The “parm” version (for example, BARCHARTPARM) does not summarize or compute values from the input data but instead simply renders the input data it is given. Thus, the input data must be pre-summarized, perhaps by a SAS procedure. The “parm” version of plots, often referred to as “parameterized plots,” produce the same result as the non-parm version. However, they do not perform the calculations or data summarizations needed to achieve the result.

Chapter 5, “Key Concepts for Using Plots,” on page 201 discusses general concepts that apply across plot types. For detailed information about a particular plot, see the chapter for that plot.

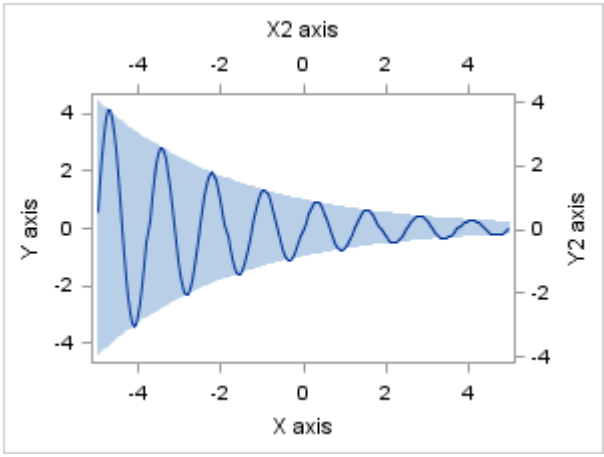
Axes

GTL uses various criteria to determine the displayed axis features for a graph. Generally, axis features are based on the following criteria:

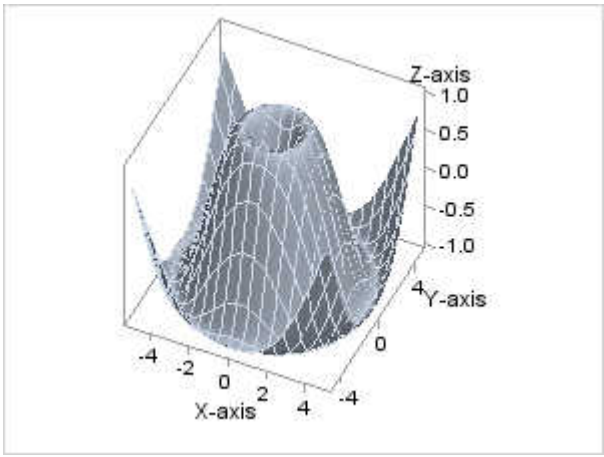
- the layout type
- the order of plot statements in the layout and the options specified on those statements
- the use of “primary” and “secondary” axes on the plots (when secondary axes are supported)

- the plot type
- the column(s) of data that contribute to defining the axis range
- the data formats for the contributing data columns

Depending on the layout type, 2-D plots can have up to four independent axes that can be displayed: X, Y, X2, and Y2. The X and Y axes are considered the primary axes, and the X2 and Y2 axes are considered the secondary axes. By default, the X2 and Y2 axes are not displayed. When requested, the secondary axes can be displayed as copies of the primary axes, or data can be mapped separately to them. The following figure identifies the X, Y, X2, and Y2 axes.



All 3-D plots display the standard X, Y, and Z axes.



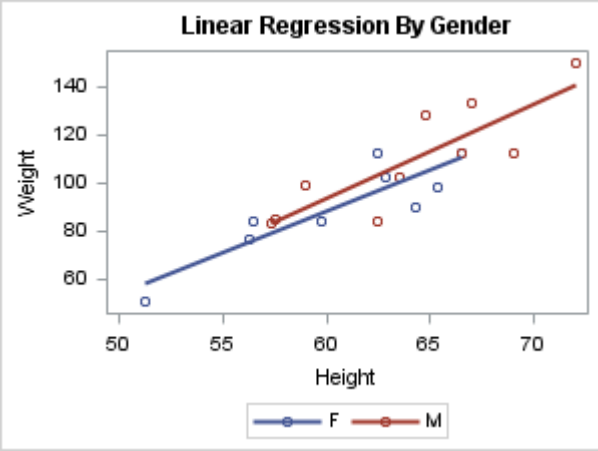
For more information about axis features in GTL, see Chapter 7, “Axis Features in Layouts,” on page 1039.

Legends

Many plot statements support a GROUP= option that partitions the data into unique values, performs separate analysis, if necessary, and automatically assigns distinct visual properties to each group value. The visual properties of group values are defined by the style in effect.

Legends are not automatically displayed for plots with group values. Rather, an appropriate legend statement must be added to the template to generate the desired legend. In the following example, a legend is added to display markers and line patterns that show the association between the group values from a scatter plot and corresponding linear regression lines. The example shows the mechanism that GTL uses to associate a legend with its corresponding plot(s): a name is assigned to each plot that must be represented in the legend, and these names are then used as arguments for the legend statement (in this case, MERGEDLEGEND).

```
proc template;
 define statgraph scatterfit;
  begingraph;
  entrytitle "Linear Regression By Gender";
   layout overlay;
     scatterplot x=height y=weight / group=sex name="scat";
     regressionplot x=height y=weight/ group=sex name="reg";
     mergedlegend "scat" "reg" / border=true;
   endlayout;
  endgraph;
 end;
run;
```



For more information about managing legends in GTL, see *SAS Graph Template Language: User's Guide*.

Flexible Templates

Several features in GTL can make template definitions less restrictive on input data and more general in nature. These features enable a single compiled template to produce many output variations.

Expressions and Functions

In GTL, expressions can be used to compute constants and data columns. The expressions must be enclosed in an EVAL construct. Within the expression, you can use DATA step functions, arithmetic operators, and other special functions supported by GTL.

Expressions are also useful in text statements like ENTRY and ENTRYTITLE. Both of these statements support rich text and have special text commands such as {SUP}, {SUB}, and {UNICODE}, which enable subscripting, superscripting, and Unicode characters.

The following template shows how the ± symbol is included in the title line using its hexadecimal Unicode value. Also, new data columns are computed for the upper and lower error bars of the scatter plot, based on the input columns MeanWeight and STDERR.

```
proc template;
 define statgraph expression;
  begingraph;
  entrytitle "Errorbars show " {unicode "00B1"x} "2 SE";
   layout overlay;
    scatterplot x=age y=meanweight /
       yerrorlower=eval(meanweight - 2*stderr)
       yerrorupper=eval(meanweight + 2*stderr);
    seriesplot x=age y=meanweight;
   endlayout;
  endgraph;
 end;
run;
```

For more information about using expressions, see Chapter 21, “Expressions,” on page 1539. For more information about using functions, see Chapter 22, “Functions,” on page 1543.

Dynamic Variables and Macro Variables

An extremely useful technique for generalizing templates is to define dynamic variables, macro variables, or both. The dynamic variables and macro variables

resolve when the template is executed. The following PROC TEMPLATE statements can be used in a DEFINE STATGRAPH block:

Template Statement	Purpose	Value supplied by...
DYNAMIC	defines one or more dynamic variables	either of the following: ■ DYNAMIC= suboption of ODS= option of FILE PRINT ■ DYNAMIC statement of PROC SGRENDER
MVAR	defines one or more macro variables	%LET or CALL SYMPUT( )
NMVAR	defines one or more macro variables that resolve to a number or numbers	%LET or CALL SYMPUT( )
NOTES	provides information about the graph definition	user-supplied text

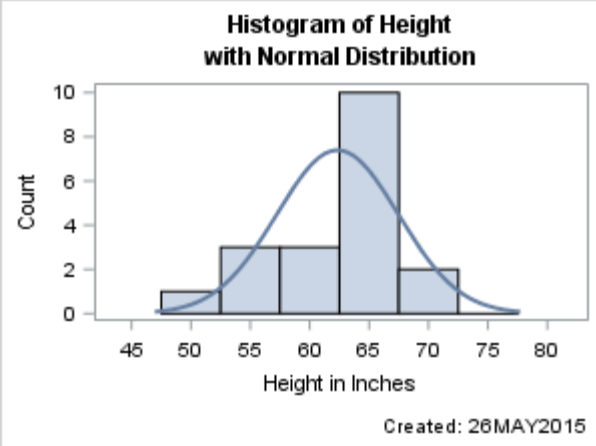
The following example defines a template named DYNAMICS that can create a histogram and density plot for any variable. It defines both macro variables and dynamic variables for run-time substitution. No data-dependent information is hard coded in the template.

Note: You can initialize macro variables with %LET statements and dynamic variables with SGRENDER's DYNAMIC statement.

```
proc template;
 define statgraph dynamics;
   mvar SYSDATE9 SCALE;
   nmvar BINS;
   dynamic VAR VARLABEL;
   begingraph;
     entrytitle "Histogram of " VAR;
     entrytitle "with Normal Distribution";
     layout overlay / xaxisopts=(label=VARLABEL);
       histogram VAR /  scale=SCALE  nbins=BINS;
       densityplot VAR / normal();
     endlayout;
     entryfootnote halign=right "Created: " SYSDATE9 /
       textattrs=GraphValueText;
   endgraph;
 end;
run;

%let bins=6;
%let scale=count;
proc sgrender data=sashelp.class
```

```
                template=dynamics;
  dynamic var="Height" varlabel="Height in Inches";
run;
```



For more information about using dynamic variables and macro variables, see Chapter 20, “Dynamic Variables and Macro Variables,” on page 1535.

Conditional Logic

Using conditional logic, you can create templates that have multiple visual results or output representations, depending on existing conditions. The evaluation of a logical expression must generate one or more complete statements (not portions of statements). All conditional logic uses one of the following constructs:

IF Block	IF/ELSE Block

`if (condition)`
`  statement(s);`
`endif;`
	`if (condition)`
	`  statement(s);`
	`else`
	`  statement(s);`
	`endif;`

In the IF statement, *condition* must be enclosed in parentheses. The condition can be any standard SAS expression involving arithmetic, logical operators, comparison operators, Boolean operators, or concatenation operators. The expression can also use SAS DATA step functions. The expression resolves to a single numeric value, which is *true* or *false*.

In the following example, a histogram is conditionally overlaid with a normal distribution curve, a Kernel Density Estimate distribution curve, both, or neither:

```
proc template;
  define statgraph conditional;
   dynamic VAR VARLABEL BINS CURVE;
   begingraph;
    entrytitle "Histogram of " VAR;
    layout overlay / xaxisopts=(label=VARLABEL);
```

```
      histogram VAR /  nbins=BINS;

      if (upcase(CURVE) in ("ALL"  "KERNEL"))
         densityplot VAR / kernel() name="k"
                           legendlabel="Kernel"
                           lineattrs=(pattern=dash);
      endif;

      if (upcase(CURVE) in ("ALL" "NORMAL"))
         densityplot VAR / normal() name="n"
                           legendlabel="Normal";
      endif;

      discretelegend "n" "k";
    endlayout;
  endgraph;
 end;
run;
```

Note that the legend syntax does not have to be made conditional. At run time, each plot name in the legend is checked. If the plot does not exist, then its name is removed from the legend name list. If no names appear in the DISCRETELEGEND statement, then the legend “drops out” and the histogram size is adjusted to fill the remaining space.

For more information about using conditional logic, see Chapter 23, “Conditional Logic,” on page 1555.

Output

When using GTL, you focus primarily on defining template definitions that produce specific graphs and generate a particular output layout. Ultimately, you must also customize the graphical environment to get the exact output that you desire. The ODS GRAPHICS statement is available for customizing the graphical environment, and ODS styles enable you to manage the output appearance.

ODS GRAPHICS Statement

The ODS GRAPHICS statement is used to modify the environment in which graphics templates are executed. The ODS GRAPHICS statement is used to control

- whether ODS Graphics is enabled
- the type and name of the image created
- the size of the image
- whether features such as scaling and anti-aliasing are used.

The following ODS GRAPHICS statement uses the HEIGHT= and WIDTH= options to set an aspect ratio for the output image.

```
ods graphics on / height=175px width=200px;
 proc sgrender data=sashelp.class
              template=scatter;
 run;
ods graphics off;
```

For more information about using the ODS GRAPHICS statement in GTL, see *SAS Graph Template Language: User's Guide*. For a more complete discussion of the ODS GRAPHICS statement, see "ODS GRAPHICS Statement" on page 1561.

ODS Styles

When any graphics template is executed, there is always an ODS style in effect that governs the appearance of the output. The following ODS statement sends graphics output to the RTF output destination using the LISTING style:

```
ods rtf style=listing;

ods graphics on / height=175px width=200px border=off;
 proc sgrender data=sashelp.class
              template=scatter;
   run;
ods graphics off;

ods rtf close;
```

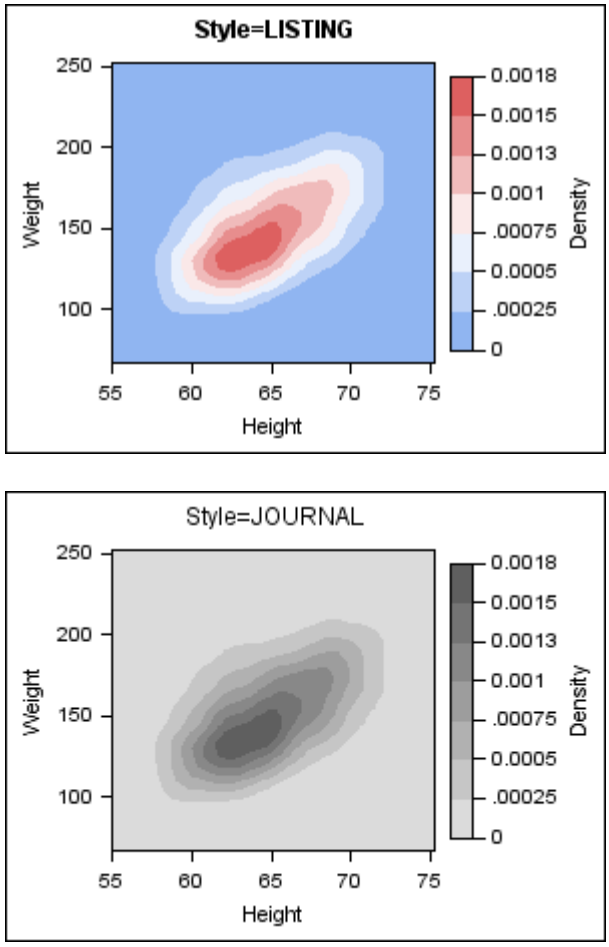
Support for ODS styles is highly integrated into GTL syntax. By default, the graphical appearance features of most plot and text statements are mapped to corresponding style elements and associated attributes. Because of this, your output tables and graphs always have a reasonable overall appearance. Moreover, output for a given ODS destination has a consistent look (for example, table colors and graph colors do not clash).

The following figures show how a graph's appearance can be changed by using references to style elements to set the graph's appearance options. This technique permits changes in graph appearance by style modification instead of graphical template modification. The graphs in the figures are generated with the following GTL statement:

```
contourplotparm x=x y=y z=density /
  contourtype=fill nhint=9
  colormodel=ThreeColorRamp ;
```

The following style template shows the definition for the ThreeColorRamp style element:

```
style ThreeColorRamp /
  endcolor     = GraphColors("gramp3cend")
  neutralcolor = GraphColors("gramp3cneutral")
  startcolor   = GraphColors("gramp3cstart");
```



For more information about the use of ODS styles in GTL, see *SAS Graph Template Language: User's Guide*. For a more complete discussion of ODS styles, see *SAS Output Delivery System: User's Guide*.

About the Examples in This Documentation

The example programs that are shown in this document often provide all of the code that you need to generate the graphs that are shown in the figures. We encourage you to copy and paste the example code into your SAS session and generate the graphs for yourself. The examples are written to be runnable in the SAS windowing environment and in SAS Studio. Unless otherwise noted, the examples use the default ODS destination. In the SAS windowing environment, the default ODS destination is ODS HTML. For information about results in SAS Studio, see *SAS Studio: User's Guide* for your version of SAS Studio. You can find the documentation for all versions of SAS Studio on the SAS Studio documentation page on support.sas.com.

If you generate the example graphs using an HTML destination, they are typically rendered as 640 pixel by 480 pixel images using the HTMLBlue style. Because of size limitations, the graphs in this document are not shown in their default size. They are scaled down to meet the size requirements of our documentation production system. When graphs that are produced with ODS graphics are reduced in size, several automatic processes take place to optimize the appearance of the output. Among the differences between default size graphs and smaller graphs are that the smaller graphs have scaled down font sizes. Also, their numeric axes might display a reduced number of ticks and tick values. Thus, the graphs that you generate from the example programs will not always look identical to the graphs that are shown in the figures. However, both graphs will accurately represent the data.

When you produce your own graphical output, you can change the graph size and attributes, if needed. The *SAS Graph Template Language: User's Guide* explains how to set fonts, DPI, anti-aliasing, and other features that contribute to producing professional-looking graphics of any size in any output format.

Examples and Resources on the Web

The SAS website contains a large number of examples that can help you visualize and code your graphs. The examples cover a range of SAS technologies including the ODS Graphics procedures.

- Graphically Speaking is a blog focused on using ODS Graphics for data visualization in SAS. The blog covers topics related to the ODS Graphics procedures, the SAS Graph Template Language, and the SAS ODS Graphics Designer.

  https://blogs.sas.com/content/graphicallyspeaking/

- The SAS Training Post is a blog that provides tutorials, tips, and practical information about SAS. Dr. Robert Allison contributed a great deal of SAS/GRAPH and ODS Graphics data visualization examples to this blog during his tenure at SAS. His blog is no longer active, but it provides an extensive set of very useful examples.

  https://blogs.sas.com/content/sastraining/author/robertallison/

- The SAS Knowledge Base contains an abundance of searchable samples and SAS Notes. You can browse by topic, search for a particular note or a particular technology such as the name of a procedure, and conduct other searches.

  https://support.sas.com/en/knowledge-base.html

  Note: The SAS Knowledge Base content is currently available only in English.

- The Graphics Samples Output Gallery in the SAS Knowledge Base is a collection of graphs organized by SAS procedure. The graphs link to the source code. The gallery is maintained by SAS Technical Support.

https://support.sas.com/en/knowledge-base/graph-samples-gallery.html

- The Focus Area Graphics site provides a simple interface to business and analytical graphs. The site is maintained by the SAS Data Visualization team.

  https://support.sas.com/rnd/datavisualization/index.htm

- You can share your questions, suggestions, and experiences related to graphics on the Graphics Programming community site.

  https://communities.sas.com/t5/Graphics-Programming/bd-p/sas_graph.

In addition, SAS offers instructor-led training and self-paced e-learning courses to help you get started with platform graphics software. The SAS Training site provides information about the courses that are available.

sas.com/training.

PART 2

Graph Block

Chapter 2
BEGINGRAPH Statement **25**

2

BEGINGRAPH Statement

Dictionary 25
BEGINGRAPH Statement 25

Dictionary

BEGINGRAPH Statement

Defines the outermost container for a graph template that is defined with *GTL-statements*.

Requirements: All STATGRAPH template definitions must start with a BEGINGRAPH statement and end with an ENDGRAPH statement.

The BEGINGRAPH block must contain one and only one layout block.

The layout block and its nested layouts, if any, must contain at least one plot.

Syntax

BEGINGRAPH </*options*>;
    <GTL-global-statements>
    GTL-layout-block
    <GTL-global-statements>
ENDGRAPH;

Summary of Optional Arguments

Appearance options

ATTRPRIORITY=AUTO | COLOR | NONE
: specifies a priority for cycling the group attributes.

BACKGROUNDCOLOR=*style-reference* | *color*
: specifies the color of the graph background.

BORDER=TRUE | FALSE
: specifies whether a border is drawn around the graph.

BORDERATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
: specifies the attributes of the border line around the graph.

DATACOLORS=(*color-list*)
: specifies the list of fill colors that will replace the graph data colors from the GraphData1–GraphDataN style elements.

DATACONTRASTCOLORS=(*color-list*)
: specifies the list of contrast colors that will replace the graph data contrast colors from the GraphData1–GraphDataN style elements.

DATAFILLPATTERNS=(*fill-pattern-list*)
: specifies the list of fill patterns that will replace the graph data fill patterns from the GraphData1–GraphDataN style elements, if specified.

DATALINEPATTERNS=(*line-pattern-list*)
: specifies the list of line patterns that will replace the graph data line patterns from the GraphData1–GraphDataN style elements.

DATASKIN=NONE | CRISP | GLOSS | MATTE | PRESSED | SHEEN
: enhances the visual appearance of all plots in the template that support data skins.

DATASYMBOLS=(*marker-symbol-list*)
: specifies the list of marker symbols that will replace the graph data marker symbols from the marker symbols that are defined in the GraphData1–GraphDataN style elements.

DESIGNHEIGHT=DEFAULTDESIGNHEIGHT | *dimension*
: specifies the design height of the graph.

DESIGNWIDTH=DEFAULTDESIGNWIDTH | *dimension*
: specifies the design width of the graph.

DRAWSPACE= GRAPHPERCENT | GRAPHPIXEL | LAYOUTPERCENT | LAYOUTPIXEL | WALLPERCENT | WALLPIXEL | DATAPERCENT | DATAPIXEL | DATAVALUE
: specifies a global drawing space and drawing units for all of the draw statements within this BEGINGRAPH block.

OPAQUE=TRUE | FALSE
: specifies whether the graph background is opaque or transparent.

PAD=*dimension* | (*pad-options*)
: specifies the amount of extra space that is added inside the graph border.

SUBPIXEL=AUTO | OFF | ON
: specifies whether subpixel rendering is used for drawing smooth curved lines or for spacing bars more precisely.

Axis options

AXISBREAKSYMBOL=BRACKET | NOTCH | SLANTEDLEFT | SLANTEDRIGHT | SQUIGGLE | SPARK | Z
: specifies a symbol to use on the axis lines to indicate a break in the axis.

AXISBREAKTYPE=FULL | AXIS
: specifies whether the axis break is indicated in the full display or only on the axis line.

AXISLINEEXTENT=FULL | DATA | *number*
: specifies the extent of the axis line for all axes.

DISCRETEAXISOFFSETPAD=TRUE | FALSE
: specifies whether additional padding is added to the minimum and maximum axis offsets for discrete axes.

Label options

LABELPLACEMENT=AUTO | GREEDY | SA
: specifies the label-placement algorithm to use for positioning labels in the graphs.

SAPLACEMENTOPTS=(*placement-options*)
: specifies the options for the label-placement algorithm when LABELPLACEMENT=SA.

Midpoint options

INCLUDEMISSINGDISCRETE=TRUE | FALSE
: specifies whether missing values are displayed on a discrete axis.

Optional Arguments

ATTRPRIORITY=AUTO | COLOR | NONE
specifies a priority for cycling the group attributes.

AUTO
: honors the current state of the attribute priority rotation pattern as specified in the active style or in the ODS GRAPHICS statement.

COLOR
: changes the current setting of attribute priority rotation pattern to the color-priority pattern by cycling through the list of colors while holding the marker symbol, line pattern, or fill pattern constant. When all of the colors are exhausted, the MarkerSymbol, LineStyle, or FillPattern attribute increments to the next element, and then the colors in the list are repeated. This pattern repeats as needed.

NONE
: changes the current setting of attribute priority rotation pattern to the default pattern, which cycles progressively through the attribute lists.

Tip Use NONE if you want groups to be distinguished by color, marker, and line changes for all ODS styles that use color.

Default The attribute priority pattern that is specified in the active style or in the ODS GRAPHICS statement.

Interactions This option overrides the attribute priority rotation pattern that is specified in the current style and the ATTRPRIORITY= option in the ODS GRAPHICS statement.

The default lists of data colors, contrast colors, marker symbols, and line patterns are set in the active style's GraphData1–GraphDataN elements.

The individual attributes in these lists can be overridden with the BEGINGRAPH options DATACOLORS=, DATACONTRASTCOLORS=, DATALINEPATTERNS=, and DATASYMBOLS=.

The ATTRPRIORITY= option affects the cycling of the style attributes for GROUP=, CYCLEATTRS=TRUE, and explicit style references such as MARKERATTRS=GraphData2.

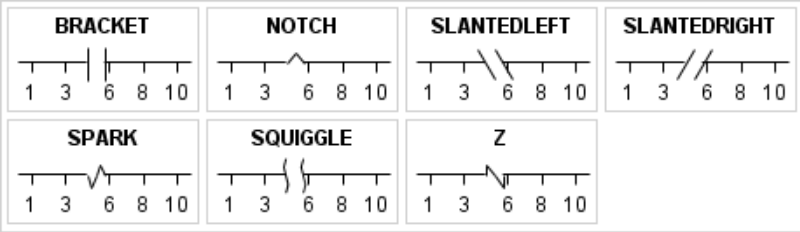
See "Attribute Rotation Patterns" in *SAS Graph Template Language: User's Guide*

AXISBREAKSYMBOL=BRACKET | NOTCH | SLANTEDLEFT | SLANTEDRIGHT | SQUIGGLE | SPARK | Z

specifies a symbol to use on the axis lines to indicate a break in the axis.

Note: This feature applies to SAS 9.4M3 and to later releases.

The following figure shows an example of each symbol on a horizontal linear axis for ranges 1–4 and 6–10.



Default SQUIGGLE

Restriction This option applies to linear and time axes only.

Requirements The AXISBREAKTYPE= option must be set to AXIS for this option to have any effect.

You must use the INCLUDERANGES= option to specify ranges for the axis for this option to have any effect.

The DISPLAY= option for the axis must include the axis line for this option to have any effect.

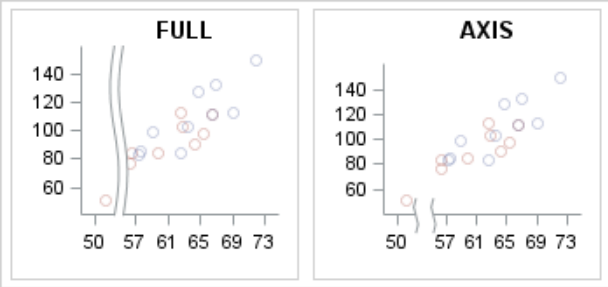
AXISBREAKTYPE=FULL | AXIS

specifies whether the axis break is indicated in the full display or only on the axis line.

Note: This feature applies to SAS 9.4M3 and to later releases.

The following figure shows an example of each type for ranges 50–52 and 56–73 on a linear horizontal axis.

Figure 2.1 *Axis Break Types FULL and AXIS*



Default FULL

Requirements You must use the INCLUDERANGES= axis option to specify ranges for the axis for this option to have any effect.

The axis line or the plot wall outline must be displayed for AXIS to have any effect. Otherwise, FULL is used.

Interaction When AXIS is specified, if the secondary axis line or the plot wall outline is displayed, then the axis break symbol is displayed on both the primary and the secondary axis. Otherwise, the break symbol is displayed only on the primary axis, as shown in Figure 2.2 on page 29.

Notes The axis break indicators pass through inner margin areas.

No attempt is made to avoid collisions between the axis break indicators and other graphical elements.

Tip When you use AXIS, use the AXISBREAKSYMBOL= option to change the break symbol.

AXISLINEEXTENT=FULL | DATA | ***number***
specifies the extent of the axis line for all axes.

Note: This feature applies to SAS 9.4M3 and to later releases.

FULL
specifies axis lines that extend along the entire length of the axis.

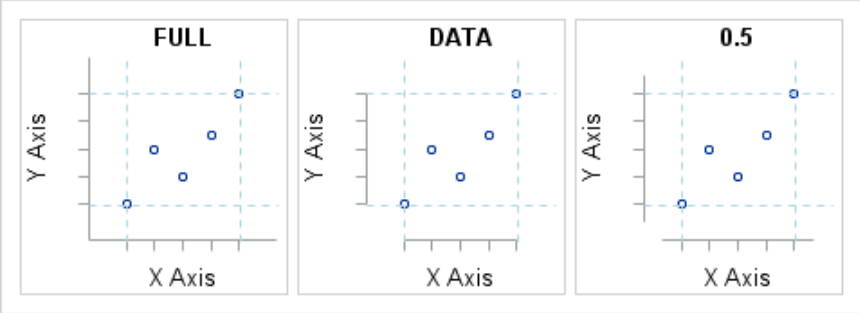
DATA
specifies axis lines that extend through the data range from the minimum offset to the maximum offset.

number
specifies, as a decimal proportion, how much the axis line extends from DATA toward FULL. A value of 0 is equivalent to DATA, and a value of 1 is equivalent to FULL.

Range 0–1

Tip A numeric value is useful for bar charts when DATA terminates the axis line at the midpoint positions of the minimum and maximum bars. In that case, you can specify a numeric value to lengthen the axis line so that it extends to the full width of both bars.

The following figure shows a simple example of each value for the X axis and Y-axis lines. The light-blue dashed lines depict the minimum and maximum offsets that are set on the axes.



Default FULL

Restriction This option is valid only in OVERLAY and OVERLAYEQUATED layouts.

Tips The graph wall outline might appear to be an axis line. In that case, use the WALLDISPLAY=NONE or WALLDISPLAY=(FILL) option in the layout statement to suppress the wall outline.

Use the LINEEXTENT= axis option to control the axis line extent on a per-axis basis.

BACKGROUNDCOLOR=*style-reference* | *color*
specifies the color of the graph background.

style-reference
specifies a style reference in the form *style-element:style-attribute*. Only the style attribute named Color or ContrastColor is used.

Default The GraphBackground:Color style reference.

Interaction This option has no effect when OPAQUE=FALSE.

BORDER=TRUE | FALSE
specifies whether a border is drawn around the graph.

Default The ODS GRAPHICS statement BORDER= option setting, which is TRUE by default.

Interaction If this option is set to FALSE, then the BORDERATTRS= option is ignored.

See "boolean " on page xii for other Boolean values that you can use.

BORDERATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the attributes of the border line around the graph.

Default The GraphBorderLines style element.

Interaction BORDER= TRUE must be set for this option to have any effect.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element* .

"Line Options" on page 1602 for available *line-options*.

DATACOLORS=(*color-list*)
specifies the list of fill colors that will replace the graph data colors from the GraphData1–GraphDataN style elements.

(*color-list*)
a space-separated list of colors, enclosed in parentheses. You can use a style attribute reference such as GraphData3:color, a color name, or an RGB, CMYK, HLS, or HSV (HSB) color code to specify a color. The list can contain a mix of style attribute references, color names, and color codes.

Requirement The list of colors must be enclosed in parentheses.

Example
```
datacolors=(CXFF0000 green blue)
```

When this option is specified, the fill colors rotate through this color list rather than through the colors that are defined in the GraphData1–GraphDataN style elements. For information about the attribute rotation patterns, see "Attribute Rotation Patterns" in *SAS Graph Template Language: User's Guide*.

Default The colors that are defined in the GraphData1–GraphDataN style elements.

Interaction Where applicable, the COLOR= suboption of the FILLATTRS= option overrides the DATACOLORS= option.

Tip When specifying data attributes for multiple plots, the attributes might not be assigned consistently in some cases. To ensure consistent attribute assignments, specify option CYCLEATTRS=FALSE in the layout statement.

DATACONTRASTCOLORS=(*color-list*)
specifies the list of contrast colors that will replace the graph data contrast colors from the GraphData1–GraphDataN style elements.

(*color-list*)
a space-separated list of contrast colors, enclosed in parentheses. You can use a style attribute reference such as GraphData3:color, a color name, or an

RGB, CMYK, HLS, or HSV (HSB) color code to specify a color. The list can contain a mix of style attribute references, color names, and color codes.

Requirement The list of colors must be enclosed in parentheses.

Example `datacontrastcolors=(red graphdata3:contrastcolor CXFF0000)`

When this option is specified, the contrast colors cycle through this color list rather than through the contrast colors that are defined in the GraphData1–GraphDataN style elements. For information about the attribute rotation patterns, see "Attribute Rotation Patterns" in *SAS Graph Template Language: User's Guide*.

Default The contrast colors that are defined in the GraphData1–GraphDataN style elements.

Interaction Where applicable, the COLOR= suboption of the MARKERATTRS= option or the LINEATTRS= option overrides the DATACONTRASTCOLORS= option.

Tip When specifying data attributes for multiple plots, the attributes might not be assigned consistently in some cases. To ensure consistent attribute assignments, specify option CYCLEATTRS=FALSE in the layout statement.

DATAFILLPATTERNS=(*fill-pattern-list*)
specifies the list of fill patterns that will replace the graph data fill patterns from the GraphData1–GraphDataN style elements, if specified.

Note: This feature applies to SAS 9.4M5 and to later releases.

(*fill-pattern-list*)
a space-separated list of fill patterns, enclosed in parentheses. You can use a style attribute reference such as GraphData3:fillpattern or a two-character fill-pattern name such as L1, X5, and so on, to specify a fill pattern. The list can contain a mix of style attribute references and pattern names.

Requirement The list of fill patterns must be enclosed in parentheses.

Example `datafillpatterns=(graphdata4:fillpattern L5 X2)`

When this option is specified, the fill patterns rotate through this fill-pattern list rather than through the fill patterns that are defined in the GraphData1–GraphDataN style elements, if any. For information about the attribute rotation patterns, see "Attribute Rotation Patterns" in *SAS Graph Template Language: User's Guide*.

Default The fill patterns that are defined in the GraphData1–GraphDataN style elements, if any.

Interaction Where applicable, the PATTERN= suboption of the FILLPATTERNATTRS= option overrides the DATAFILLPATTERNS= option.

Tip When specifying data attributes for multiple plots, the attributes might not be assigned consistently in some cases. To ensure consistent attribute assignments, specify option CYCLEATTRS=FALSE in the layout statement.

DATALINEPATTERNS=(*line-pattern-list*)
specifies the list of line patterns that will replace the graph data line patterns from the GraphData1–GraphDataN style elements.

(*line-pattern-list*)
a space-separated list of line patterns, enclosed in parentheses. You can use a style attribute reference such as GraphData3:LineStyle, a line pattern number, or a line pattern name (where applicable) to specify a pattern. The list can contain a mix of style attribute references, line pattern numbers, and line pattern names.

Requirement The list of line patterns must be enclosed in parentheses.

When this option is specified, the line patterns cycle through this line-pattern list rather than through the line patterns that are defined in the GraphData1–GraphDataN style elements. When the patterns in *line-pattern-list* are exhausted, the patterns repeat.

Default The line patterns that are defined in the GraphData1–GraphDataN style elements.

Interaction Where applicable, the PATTERN= suboption of the LINEATTRS= option overrides the DATALINEPATTERNS= option.

Tip When specifying data attributes for multiple plots, the attributes might not be assigned consistently in some cases. To ensure consistent attribute assignments, specify option CYCLEATTRS=FALSE in the layout statement.

Example
```
datalinepatterns=(solid dash 16 26)
```

DATASKIN=NONE | CRISP | GLOSS | MATTE | PRESSED | SHEEN
enhances the visual appearance of all plots in the template that support data skins. The following plot statements support data skins:

BARCHART	HISTOGRAM	SCATTERPLOT
BARCHARTPARM	HISTOGRAMPARM	SCATTERPLOTMATRIX
BOXPLOT	LINECHART	SERIESPLOT
BOXPLOTPARM	NEEDLEPLOT	STEPPLOT
BUBBLEPLOT	PIECHART	VECTORPLOT
DROPLINE	POLYGONPLOT	WATERFALLCHART
HIGHLOWPLOT	REFERENCELINE	

Default The GraphSkins:DataSkin style attribute, if it is specified in the current style. If the current style does not specify the GraphSkins:DataSkin style attribute, then the default is NONE.

Restriction Starting with SAS 9.4M1, the maximum number of skinned graphical elements is limited to 200 per plot in an OVERLAY or PROTOTYPE layout. When this limit is exceeded for a plot, the specified data skin is not applied to that plot. In that case, use the DATASKINMAX= option in your ODS GRAPHICS statement to increase the maximum limit.

Interaction This option is overridden by the DATASKIN= option in the individual plot statements.

Note Applying data skins to a graph that has a very large number of markers can negatively impact performance.

DATASYMBOLS=(*marker-symbol-list*)
specifies the list of marker symbols that will replace the graph data marker symbols from the marker symbols that are defined in the GraphData1–GraphDataN style elements.

(*marker-symbol-list*)
a space-separated list of marker symbols, enclosed in parentheses. You can use a style attribute reference such as GraphData5:markerSymbol or a marker symbol name to specify a marker. The list can contain a mix of style attribute references and marker symbol names.

Requirement The list of marker symbols must be enclosed in parentheses.

When this option is specified, the marker symbols cycle through this marker symbol list rather than through the line patterns that are defined in the GraphData1–GraphDataN style elements. When the symbols in *marker-symbol-list* are exhausted, the symbols repeat.

Default The marker symbols that are defined in the GraphData1–GraphDataN style elements.

Interaction Where applicable, the SYMBOL= suboption of the MARKERATTRS= option overrides the DATASYMBOLS= option.

Example
```
datasymbols=(circle square triangle star)
```

DESIGNHEIGHT=DEFAULTDESIGNHEIGHT | *dimension*
specifies the design height of the graph.

Default DEFAULTDESIGNHEIGHT. This value is obtained from the SAS Registry key **ODS** ⇨ **ODS Graphics** ⇨ **Design Height** when the graph is rendered. The initial value of this registry key is 480px.

Restriction The minimum *dimension* value that you can set is 2 pixels. If a smaller setting is specified, then the default design height is used.

Interactions The design height can be overridden at run time with a render height that is specified with the HEIGHT= option in the ODS GRAPHICS statement (external to the template). Also, the ODS destination statement's IMAGE_DPI= option can affect the height.

You can change the value of the Design Height registry key in the SAS registry. However, doing so affects the design height of all templates that do not include an explicit dimension for the design height. You can also change the height setting in the graph style, but doing so affects the height of all templates that use that style.

See "dimension" on page xiii

DESIGNWIDTH=DEFAULTDESIGNWIDTH | *dimension*
specifies the design width of the graph.

Default DEFAULTDESIGNWIDTH. This value is obtained from the SAS Registry key **ODS** ⇨ **ODS Graphics** ⇨ **Design Width** when the graph is rendered. The initial value of this registry key is 640px.

Restriction The minimum *dimension* value that you can set is 2 pixels. If a smaller setting is specified, then the default design width is used.

Interactions The design width can be overridden at run time with a render width that is specified with the WIDTH= option in the ODS GRAPHICS statement (external to the template). Also, the ODS destination statement's IMAGE_DPI= option can affect the width.

You can change the value of the Design Width registry key in the SAS registry. However, doing so affects the design width of all templates that do not include an explicit dimension for the design width. You can also change the width setting in the graph style, but doing so affects the width of all templates that use that style.

See "dimension" on page xiii

DISCRETEAXISOFFSETPAD=TRUE | FALSE
specifies whether additional padding is added to the minimum and maximum axis offsets for discrete axes. When set to TRUE, an additional 5 pixels of padding are added to the minimum and maximum axis offsets.

Note: This feature applies to SAS 9.4M3 and to later releases.

Default TRUE

Restriction This option applies only to discrete axes.

Tip This option is useful for heat maps when you want the heat map to occupy the entire plot area. In that case, in addition to setting this option to FALSE, set OFFSETMIN= and OFFSETMAX= to 0 for the discrete axes.

DRAWSPACE= GRAPHPERCENT | GRAPHPIXEL | LAYOUTPERCENT | LAYOUTPIXEL | WALLPERCENT | WALLPIXEL | DATAPERCENT | DATAPIXEL | DATAVALUE
specifies a global drawing space and drawing units for all of the draw statements within this BEGINGRAPH block.

Default LAYOUTPERCENT

Tip Individual draw statements within this BEGINGRAPH block can override this global setting.

See "About the Drawing Space and Drawing Units" on page 1398

INCLUDEMISSINGDISCRETE=TRUE | FALSE
specifies whether missing values are displayed on a discrete axis.

Default FALSE

Interaction This option affects all charts and plots within the template.

See "boolean " on page xii for other Boolean values that you can use.

LABELPLACEMENT=AUTO | GREEDY | SA
specifies the label-placement algorithm to use for positioning labels in the graphs. The following labels are affected:

- data labels for needle plots, scatter plots, series plots, step plots, and vector plots
- vertex labels for line charts
- curve labels when the curve label is positioned at the start or end of the curve

AUTO
always selects GREEDY.

GREEDY
specifies the Greedy method for managing label collision. The Greedy method tries different placement combinations in order to find an optimal approximation that avoids collisions. Label placement using this method is often less optimal than label placement using the Simulated Annealing (SA) method. However, depending on the number of data points and the potential for label collisions, the Greedy process can be significantly faster.

SA
specifies the Simulated Annealing method for managing label collision. The SA method attempts to determine the global minimization-of-cost function, which is based on a simulated annealing algorithm. The resulting label placement is usually better than placement using the Greedy method. However, depending on the number of data points and the potential for label collisions, the SA method can be significantly slower.

Restriction For BANDPLOT and LINECHART, the SA method has no effect on the curve labels when the CURVELABELPOSITION= option specifies START or END.

Default The value specified by the ODS GRAPHICS statement LABELPLACEMENT= option, which is AUTO by default.

Restriction The data label placement algorithm is not aware of bar labels, curve labels, box plot outlier labels, and marker characters.

Collisions between these elements and data labels might occur regardless of the LABELPLACEMENT= setting.

Interactions This option overrides the ODS GRAPHICS statement LABELPLACEMENT= option.

This option affects a plot's labels only when DATALABELPOSITION=AUTO is in effect for that plot.

The data label font size might be reduced in order to avoid overlapping labels and markers. Starting with SAS 9.4M3, when a broken axis is used, the data-label font size is not scaled during label placement.

OPAQUE=TRUE | FALSE

specifies whether the graph background is opaque or transparent.

Note: This feature applies to SAS 9.4M3 and to later releases.

When this option is set to FALSE, the graph background is transparent.

Default TRUE

Restriction A transparent background is supported only by the PNG, EMF, PDF, and SVG output formats. The PS output format supports a transparent background when the graph is rendered as a PNG image. It does not support a transparent background when the graph is rendered as vector-graphics output.

Interaction When this option is set to FALSE, the BACKGROUNDCOLOR= option has no effect.

PAD=*dimension* | (*pad-options*)

specifies the amount of extra space that is added inside the graph border.

dimension

specifies a dimension to use for the extra space at the left, right, top, and bottom of the layout border.

(*pad-options*)

a space-separated list of one or more of the following name-value-pair options enclosed in parentheses:

LEFT=*dimension*	specifies the amount of extra space added to the left side.
RIGHT=*dimension*	specifies the amount of extra space added to the right side.
TOP=*dimension*	specifies the amount of extra space added to the top.
BOTTOM=*dimension*	specifies the amount of extra space added to the bottom.

Note Sides that are not assigned padding are padded with the default amount.

Tip Use *pad-options* to create non-uniform padding.

Default Padding for all sides is 10 pixels.

Note The default units for *dimension* are pixels.

See "dimension" on page xiii

SAPLACEMENTOPTS=(*placement-options*)
specifies the options for the label-placement algorithm when LABELPLACEMENT=SA. Placement options can be any of the following:

MAXITERATIONS=*positive-integer*
specifies the maximum number of iterations for the SA label-placement algorithm.

Default 100

WEIGHTS=(*keyword-number-list*)
specifies the relative weight to give to a particular cost when determining the best label position. The keyword number list is a space-separated list of *keyword = number* pairs.

The following keywords can be used:

LABEL	assigns a weight to the overlapping of labels
MARKER	assigns a weight to the overlapping of markers and labels
OUTOFBOUND	assigns a weight to labels that are out-of-bounds or clipped
PRIORITY	assigns a weight to the priority of each potential label position
OBSTACLE	assigns a weight to the overlapping of labels with drop lines, needles, reference lines, series lines, step lines, and vector lines

The higher the number, the more weight is assigned to the specified cost. For example, if MARKER is given more weight than OBSTACLE, avoiding marker collisions is given a higher priority than avoiding line collisions.

Default A weight of 1.0 is assigned to each keyword

Restriction A dynamic variable reference or a run-time macro variable reference cannot be used to specify a keyword value.

Example
```
saplacementopts=(maxiterations=100
   weights=(LABEL=2.0 OBSTACLE=10.0))
```

SEED=*positive-integer*
specifies a random number seed for the Simulated Annealing algorithm.

Default 1234567

Range 0–2147483647 (2^{31}–1), where 0 specifies the current Java time as the seed value

Restriction This option applies only when LABELPLACEMENT=SA.

SUBPIXEL=AUTO | OFF | ON

specifies whether subpixel rendering is used for drawing smooth curved lines or for spacing bars more precisely.

Note: Starting with SAS 9.4M3, this option controls subpixel rendering only for image output. For vector-graphics output, subpixel rendering is always enabled.

AUTO

the system determines whether to use subpixel rendering. In SAS 9.4M2 and in earlier releases, the system uses the default rendering for the rendering technology. Starting with SAS 9.4M3, for image output, if the SUBPIXEL= option is explicitly set in an ODS GRAPHICS statement, the system honors its setting. Otherwise, the system determines whether to use subpixel rendering based on the following criteria:

- If a SCATTERPLOT or SCATTERPLOTMATRIX statement is used, subpixel rendering is OFF for the graph.
- If neither a SCATTERPLOT nor a SCATTERPLOTMATRIX statement is used, subpixel rendering is turned ON for the graph if one or more of the following statements is also used:

BANDPLOT	DENSITYPLOT	LOESSPLOT
BARCHART	HEATMAP	PBSPLINEPLOT
BARCHARTPARM	HEATMAPPARM	POLYGONPLOT
BOXPLOT	HIGHLOWPLOT	REGRESSIONPLOT
BOXPLOTPARM	HISTOGRAM	SERIESPLOT
BUBBLEPLOT	HISTOGRAMPARM	WATERFALLCHART
CONTOURPLOTPARM	LINECHART	

- For all other cases, subpixel rendering is turned OFF.

OFF

never uses subpixel rendering.

Note OFF is valid starting with SAS 9.4M3.

ON

always uses subpixel rendering, when applicable, for image output when rendering graphs.

Default AUTO

Restrictions In SAS 9.4M2 and in earlier releases, subpixel rendering can be used only for the following statements: BANDPLOT, BARCHART, BARCHARTPARM, DENSITYPLOT, LINECHART, LOESSPLOT,

PBSPLINEPLOT, REGRESSIONPLOT, and SERIESPLOT. Starting with SAS 9.4M3, subpixel rendering can be used for all plots and charts.

Starting with SAS 9.4M3, this option is ignored for vector-graphics output.

Requirement: Anti-aliasing must be enabled for this option to have any effect.

Interaction: Starting with SAS 9.4M3, this option overrides the SUBPIXEL= option in the ODS GRAPHICS statement.

Tips: If anti-aliasing is disabled, use the ANTIALIAS=ON option in the ODS GRAPHICS statement to enable it.

Anti-aliasing is disabled automatically when the resources required for anti-aliasing exceed a preset threshold. When anti-aliasing is disabled for all or part of a graph, subpixel rendering is disabled for the entire graph. A note is written to the SAS log that provides information about how to use the ANTIALIASMAX= option in an ODS GRAPHICS statement to re-enable anti-aliasing.

See: "Using Subpixel Rendering" in *SAS Graph Template Language: User's Guide*

"ODS GRAPHICS Statement" on page 1561 for information about the ANTIALIAS= and ANTIALIASMAX= options.

Details

About the BEGINGRAPH Statement

All template definitions in the Graphics Template Language must start with a BEGINGRAPH statement and end with an ENDGRAPH statement. Within a BEGINGRAPH block, one and only one GTL layout block is required. It can be a LATTICE, GRIDDED, OVERLAY, OVERLAYEQUATED, OVERLAY3D, REGION, DATALATTICE, or DATAPANEL layout block. This layout block and its nested layouts, if any, must contain at least one plot statement. It can contain other nested layout blocks.

The GTL global statements apply to the entire template and can include ENTRYTITLE and ENTRYFOOTNOTE statements, attribute maps, draw statements, conditional statements, and so on. Any of these global statements can precede or follow the GTL layout block.

Changing the Size of Your Graph

By default, graphs are rendered at 640px by 480px (4:3 aspect ratio). To change the output size for a single graph, use the DESIGNWIDTH= and DESIGNHEIGHT= options in the BEGINGRAPH statement for that graph. For example, the template in the "Example Program" on page 42 uses DESIGNHEIGHT= to change the graph

height to 320px. To prevent the graph width from automatically scaling to preserve the 4:3 aspect ratio, it uses DESIGNWIDTH= to maintain the 640px width. In this instance, the setting renders each graph cell as a 320px by 320px square. (The cells are square in this case, but the resulting cell size depends on the graph definition and would not be the same for all graphs.)

Note: To change the graph sizes for all templates in the current SAS session, you can use the WIDTH= and HEIGHT= options in the ODS GRAPHICS statement. Size settings in the ODS GRAPHICS statement override size settings in the BEGINGRAPH statement and remain in effect unless they are changed in another ODS GRAPHICS statement. You can also use WIDTH= and HEIGHT= settings in the graph style to modify the graphs sizes across template definitions. Be aware, however, that if you explicitly manage the graph output size, then the graph elements might be scaled so that the size specification is honored.

The following template defines a square graph (equal height and width, 1:1 aspect ratio) by setting the design width equal to the internal default height (480px). The setting is made with DESIGNWIDTH=DEFAULTDESIGNHEIGHT:

Note: A “square graph” means that the output graph’s width and height are equal. That does not imply that the X axis and Y-axis lengths are equal if the graph contains only one cell.

```
proc template;
  define statgraph squareplot;
    dynamic title xvar yvar;
    begingraph / designwidth=defaultDesignHeight;
      entrytitle title;
      layout overlayequated / equatetype=square;
        scatterplot x=xvar y=yvar;
        regressionplot x=xvar y=yvar;
      endlayout;
    endgraph;
  end;
run;
```

If this template is executed with the following SGRENDER procedure statement, then a 480px by 480px graph is created:

```
proc sgrender data=mydata template="squareplot" ;
dynamic title="Square Plot" xvar="time1" yvar="time2";
run;
```

If the ODS GRAPHICS statement’s WIDTH= or HEIGHT= options change the render width or render height, then the *squareplot* template’s 1:1 aspect ratio would still be honored. Thus, both of the following GRENDER procedure statements would create a 550px by 550px graph:

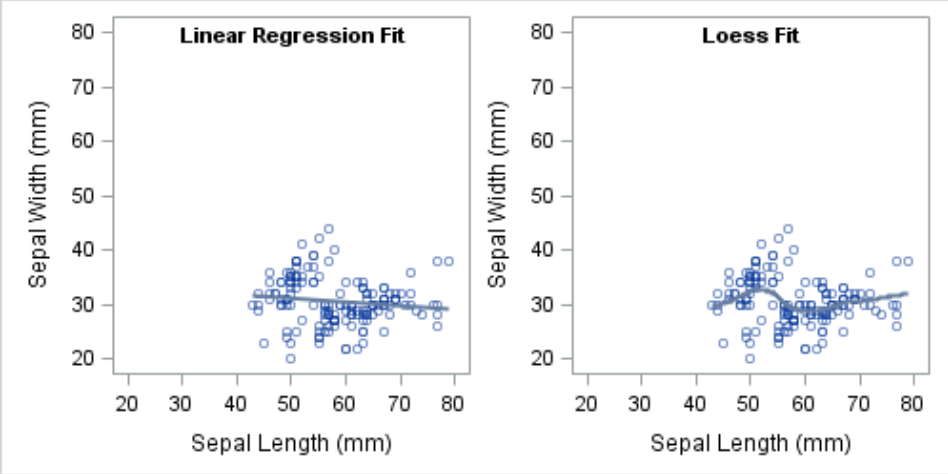
```
ods graphics / width=550px;
proc sgrender data=mydata template="squareplot" ;
dynamic title="Square Plot" xvar="time1" yvar="time2";
run;

ods graphics / height=550px;
```

```
proc sgrender data=mydata template="squareplot" ;
dynamic title="Square Plot" xvar="time1" yvar="time2";
run;
```

Example: BEGINGRAPH Statement

The following graph was generated by the "Example Program" on page 42:



Example Program

The BEGINGRAPH statement block is a required outermost container for any graph template. One of its purposes is to support options that apply to the entire graph. For example, the default graph size that a template produces is typically 640x480 pixels. If you need a different size, then you can declare the alternative size on this statement. To do so, use the DESIGNWIDTH= option, or the DESIGNHEIGHT= option, or both. This program shows one way to set the width and height of two graph cells to be equal.

```
proc template;
  define statgraph begingraph;
    dynamic XVAR YVAR;
    begingraph / designwidth=640px designheight=320px;
    layout lattice / columns=2;
      layout overlayequated / equatetype=square;
        entry "Linear Regression Fit" /
          valign=top textattrs=(weight=bold);
        scatterplot x=XVAR y=YVAR / datatransparency=0.5;
        regressionplot x=XVAR y=YVAR;
      endlayout;
      layout overlayequated / equatetype=square;
        entry "Loess Fit" /
          valign=top textattrs=(weight=bold);
        scatterplot x=XVAR y=YVAR / datatransparency=0.5;
        loessplot x=XVAR y=YVAR;
```

```
      endlayout;
    endlayout;
    endgraph;
  end;
run;

proc sgrender data=sashelp.iris template=begingraph;
  dynamic title="Square Plot"
    xvar="SepalLength" yvar="SepalWidth";
run;
```

PART 3

Layout Statements

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Layout Statements **51**

3

Summary of Layout Statements

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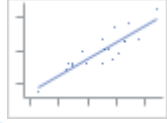
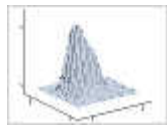
Overview

Layout blocks always begin with the LAYOUT keyword followed by a keyword indicating the purpose of the layout. All layout blocks end with an ENDLAYOUT statement.

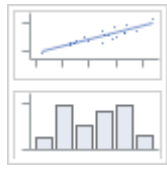
The following sections summarize the available layouts. To learn more about a layout, see the chapter devoted to that layout.

Single-cell Layouts

Layout (Description)	Graphics Allowed and Cells Produced	Comments	Example
OVERLAY (Single Cell)	2-D (1 cell)	General purpose layout for superimposing 2-D plots	

Layout (Description)	Graphics Allowed and Cells Produced	Comments	Example
OVERLAYEQUATED (Single Cell)	2-D (1 cell)	Specialized OVERLAY with equated axes	
PROTOTYPE (Single Cell)	2-D (1 cell)	Specialized LAYOUT used only as child layout of DATAPANEL or DATALATTICE	
REGION (Single Cell)	2-D (1 cell)	General purpose layout for displaying a single-cell plot that does not use axes	
OVERLAY3D (Single Cell)	3-D (1 cell)	General purpose 3-D layout for superimposing 3-D plots.	

Multi-cell Layouts

Layout (Description)	Graphics Allowed and Cells Produced	Comments	Example
LATTICE (Advanced Multi-cell)	2-D (1 or more cells)	All cells must be predefined. Axes can be shared across columns or rows and be external to grid. Many grid labeling and alignment features.	
GRIDDED (Simple Multi-cell)	2-D (1 or more cells)	All cells must be predefined. Axes independent for each cell. Very simple multi-cell container.	

Data-driven Layouts

Layout (Description)	Graphics Allowed and Cells Produced	Comments	Example
DATAPANEL (Classification Panel)	2-D (1 or more cells)	Displays a panel of similar graphs based on data subsets by classification variable(s). Number of cells is based on crossings of *n* classification variable(s).	
DATALATTICE (Classification Panel)	2-D (1 or more cells)	Displays a panel of similar graphs based on data subsets by classification variable(s). Number of cells is based on crossings of 1 or 2 classification variables.	

Legend Layout

Layout	Cells Produced	Comments
GLOBALLEGEND	1 cell for a legend	Specialized layout for creating a compound legend that contains multiple discrete legends.

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Layout Statements

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Dictionary

LAYOUT DATALATTICE Statement

Creates a grid of graphs based on one or two classification variables and a graphical prototype. By default, a separate instance of the prototype (a data cell) is created for each possible combination of the classification variables.

Restriction: You can specify only one LAYOUT PROTOTYPE block in the LAYOUT DATALATTICE block. If you specify more than one, then only the last prototype block specified is honored. The remaining prototype blocks are ignored.

Requirement: You must specify at least one ROWVAR= option or one COLUMNVAR= option. You can specify both.

Syntax

LAYOUT DATALATTICE ROWVAR=*class-variable*
COLUMNVAR=*class-variable* < */options* >;

LAYOUT PROTOTYPE <*/options*>;

GTL-statements;

ENDLAYOUT;

<**SIDEBAR** <*/options*>;

GTL-statements;

ENDSIDEBAR;>
ENDLAYOUT;

LAYOUT DATALATTICE COLUMNVAR=*class-variable* < */options* >;

layout-prototype-block ;

<*sidebar-block(s)*> ;
ENDLAYOUT;

LAYOUT DATALATTICE ROWVAR=*class-variable* < */options* >;

layout-prototype-block ;

<*sidebar-block(s)*> ;
ENDLAYOUT;

Summary of Optional Arguments

Appearance options

BACKGROUNDCOLOR=*style-reference* | *color*
: specifies the color of the layout background.

BORDER=TRUE | FALSE
: specifies whether a border is drawn around the layout.

BORDERATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
: specifies the attributes of the border line around the layout.

CELLHEIGHTMIN=*dimension*
: specifies the minimum height of a cell in the grid.

CELLWIDTHMIN=*dimension*
: specifies the minimum width of a cell in the grid.

COLUMNGUTTER=*dimension*
: specifies the amount of empty space that is between the columns.

COLUMNHEADERS=TOP | BOTTOM | BOTH
: specifies where to position the outside column heading.

HEADERBACKGROUNDCOLOR=*style-reference* | *color*
: specifies the background color of the cell headers.

HEADERBORDER=TRUE | FALSE
: specifies whether a border is drawn around the header cells.

HEADERLABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)

specifies the color and font attributes of the data labels.

HEADERLABELLOCATION=OUTSIDE | INSIDE
indicates whether the cell header is placed within each cell (INSIDE) or as row and column headers external to the lattice (OUTSIDE).

HEADEROPAQUE=TRUE | FALSE
specifies whether the background for cell headers is opaque (TRUE) or transparent (FALSE).

HEADERPACK=TRUE | FALSE
specifies whether the header cells are consolidated into a comma-separated list in order to save space.

HEADERSEPARATOR="*string*"
specifies one or more characters to place between each value in the cell header when HEADERPACK=TRUE.

HEADERSPLITCOUNT=*positive-integer*
specifies the number of headers to consolidate on a header line before splitting the text to the next line.

OPAQUE=TRUE | FALSE
specifies whether the layout background is opaque (TRUE) or transparent (FALSE).

OUTERPAD=AUTO | *dimension* | (*pad-options*)
specifies the amount of extra space to add outside the layout border.

PAD=*dimension* | *(pad-options)*
specifies the amount of extra space that is added inside the layout border.

SHRINKFONTS=TRUE | FALSE
specifies whether fonts in the layout are scaled down.

SORTORDER=(COLUMNVAR=*sort-order-keyword* | ROWVAR=*sort-order-keyword*)
specifies the order of the cells along the columns and rows.

Axis options

COLUMN2AXISOPTS=(*axis-options*)
specifies X2-axis options for all columns.

COLUMN2DATARANGE=AUTO | UNIONALL | UNION
specifies how the X2-axes of instances of the *graph-prototype* are scaled.

COLUMNAXISOPTS=(*axis-options*)
specifies X-axis options for all columns.

COLUMNDATARANGE=AUTO | UNIONALL | UNION
specifies how the X-axes of instances of the *graph-prototype* are scaled.

ROW2AXISOPTS=(*axis-options*)
specifies Y2-axis options for all rows.

ROW2DATARANGE=AUTO | UNIONALL | UNION
specifies how the Y2-axes of instances of the *graph-prototype* are scaled.

ROWAXISOPTS=(*axis-options*)
specifies Y-axis options for all rows.

ROWDATARANGE=AUTO | UNIONALL | UNION
specifies how the Y-axes of instances of the *graph-prototype* are scaled.

Inset options

INSET=(*variable-list*)
specifies what information is displayed in an inset.

INSETOPTS=(*appearance-options*)
specifies location and appearance options for the inset information.

Layout options

COLUMNS=*integer*
specifies the number of columns in the layout.

COLUMNWEIGHT=EQUAL | PROPORTIONAL
specifies how weights are assigned to the columns widths.

HEADERLABELDISPLAY=NAMEVALUE | VALUE | NONE
specifies the content of the cell headers.

INCLUDEMISSINGCLASS=TRUE | FALSE
specifies whether to include grid cells for crossings of the ROWVAR and COLUMNVAR variables that contain a missing value.

PANELNUMBER=*positive-integer*
specifies the number of the panel to produce.

ROWGUTTER=*dimension*
specifies the amount of empty space between the rows.

ROWHEADERS=RIGHT | LEFT | BOTH
specifies where to position the outside row heading.

ROWS=*integer*
specifies the number of rows in the layout.

ROWWEIGHT=EQUAL | PROPORTIONAL
specifies how weights are assigned to the row heights.

SKIPEMPTYCELLS=TRUE | FALSE
specifies whether the external axes skip the empty cells in a partially filled grid.

START=TOPLEFT | BOTTOMLEFT
indicates whether to start populating the grid from the top left or bottom left corner.

Required Arguments

You must specify at least one of the following arguments. You can specify both.

ROWVAR=*class-variable*
specifies the classification variable for the rows. One row of cells is created for each unique value of the row class variable.

See ROWS= option and “Managing Rows and Columns” on page 75

COLUMNVAR=*class-variable*
specifies the classification variable for the columns. One column is created of each unique value of the column class variable.

See COLUMNS= option and “Managing Rows and Columns” on page 75

Optional Arguments

BACKGROUNDCOLOR=*style-reference* | *color*
specifies the color of the layout background.

style-reference
specifies a style reference in the form *style-element:style-attribute*.

Only the style attribute named COLOR or CONTRASTCOLOR is used.

color
specifies a color by name.

See color on page xii

Default The GraphBackground:Color style reference.

Interaction OPAQUE=TRUE must be in effect in order for the color to be seen. By default, OPAQUE=FALSE.

BORDER=TRUE | FALSE
specifies whether a border is drawn around the layout.

Default FALSE

Interaction If this option is set to FALSE, then the BORDERATTRS= option is ignored.

See "boolean " on page xii for other Boolean values that you can use.

BORDERATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the attributes of the border line around the layout.

Default The GraphBorderLines style element.

Interaction BORDER= TRUE must be set for this option to have any effect.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

CELLHEIGHTMIN=*dimension*
specifies the minimum height of a cell in the grid. Use this option in conjunction with the CELLWIDTHMIN= option to set the minimum cell size.

The overall size of the panel is constrained by the HEIGHT= and WIDTH= options in the ODS GRAPHICS statement. As the number of cells in the grid increases, the size of each cell decreases. At some point the cell becomes so small that a meaningful graph cannot be rendered. This option sets the minimum height threshold for all cells. If the actual cell height becomes smaller, then no panel is drawn.

Default 100px

See "dimension" on page xiii

CELLWIDTHMIN=*dimension*
specifies the minimum width of a cell in the grid. Use this option in conjunction with the CELLHEIGHTMIN= option to set the minimum cell size.

The overall size of the panel is constrained by the HEIGHT= and WIDTH= options in the ODS GRAPHICS statement. As the number of cells in the grid increases, the size of each cell decreases. At some point the cell becomes so small that a meaningful graph cannot be rendered. This option sets the minimum width threshold for all cells. If the actual cell width becomes smaller, then no panel is drawn.

Default 100px

See "dimension" on page xiii

COLUMNAXISOPTS=(*axis-options*)
specifies X-axis options for all columns.

Restriction Axis options must be enclosed in parentheses and separated by spaces.

See "Axis Options for LAYOUT DATALATTICE and LAYOUT DATAPANEL" for a list of options..

COLUMN2AXISOPTS=(*axis-options*)
specifies X2-axis options for all columns.

Restriction This option is needed only if you use a plot statement that supports a secondary X2 axis. If you do not use that statement's XAXIS= option to map data to the X2 axis, then this option is ignored. For more information about how data are mapped to the axes, see "Plot Data Are Mapped to a Designated Axis" on page 1040

Requirement Axis options must be enclosed in parentheses and separated by spaces.

See "Axis Options for LAYOUT DATALATTICE and LAYOUT DATAPANEL" for a list of options.

COLUMNDATARANGE=AUTO | UNIONALL | UNION
specifies how the X-axes of instances of the *graph-prototype* are scaled.

AUTO
selects the X-axis scale based on the COLUMNWEIGHT= option.

The X-axis scale is determined, as follows:

- When COLUMNWEIGHT=EQUAL (default), UNIONALL is selected.
- When COLUMNWEIGHT=PROPORTIONAL and the column axis is discrete, UNION is selected. Otherwise, UNIONALL is selected.

UNIONALL
scales the X-axis data ranges across all layout columns and panels (when PANELNUMBER= is in effect).

UNION
scales the X-axis data ranges separately for each column on a per-panel basis.

The scaling does not span multiple panels.

Default AUTO

Tip Use the COLUMNAXISOPTS= option to control shared axis features.

See The COLUMNWEIGHT= option.

The PANELNUMBER= option for information about how to create multiple panels.

COLUMN2DATARANGE=AUTO | UNIONALL | UNION
specifies how the X2-axes of instances of the *graph-prototype* are scaled.

AUTO
automatically selects the X2-axis scale based on the COLUMNWEIGHT= option and the column axis type.

The X2-axis scale is selected as follows:

- When COLUMNWEIGHT=EQUAL (default), UNIONALL is selected.
- When COLUMNWEIGHT=PROPORTIONAL and the column axis is discrete, UNION is selected. Otherwise, UNIONALL is selected.

UNIONALL
scales the X2-axis data ranges across all layout columns and panels (when PANELNUMBER= is in effect).

UNION
scales the X2-axis data ranges separately for each column on a per-panel basis.

The scaling does not span multiple panels.

Default AUTO

Interaction This option is needed only if you use a plot statement that supports a secondary X2 axis. If you do not use that statement's XAXIS= option to map data to the X2 axis, then this option is ignored. For more information about how data are mapped to the axes, see "Plot Data Are Mapped to a Designated Axis" on page 1040

Tip Use the COLUMN2AXISOPTS= option to control shared axis features.

See The COLUMNWEIGHT= option.

The PANELNUMBER= option for information about how to create multiple panels.

COLUMNGUTTER=*dimension*
specifies the amount of empty space that is between the columns.

Default 0

Note If there are *n* columns, then there are *n*-1 gutters.

See “dimension” on page xiii

COLUMNHEADERS=TOP | BOTTOM | BOTH
specifies where to position the outside column heading.

TOP
specifies that column heading text appears at the top of the layout.

BOTTOM
specifies that column heading text appears at the bottom of the layout.

BOTH
specifies that column heading text alternates between the top and bottom of the layout column by column.

Default TOP

Interaction HEADERLABELLOCATION= OUTSIDE must be set for this option to have any effect.

COLUMNS=*integer*
specifies the number of columns in the layout.

Defaults If this option is not specified, then the number of columns is dynamically adjusted to equal the number of classifier values for the COLUMVAR= variable.

If this option is specified, that many columns are created. If the number of COLUMNVAR classifier values is greater than the specified number of columns, then no graph is created for some classifier values. If the number of classifier values is smaller than the specified number of columns, then extra empty columns are created.

Interactions The overall grid size is constrained by the HEIGHT= and WIDTH= options in the ODS GRAPHICS statement. As the grid size grows, the cell size shrinks. To control the minimum size of a cell use the CELLHEIGHTMIN= and CELLWIDTHMIN= options.

The START= option affects how the columns are populated.

The PANELNUMBER= option enables you to create multiple smaller grids that completely partition the classifier values.

COLUMNWEIGHT=EQUAL | PROPORTIONAL
specifies how weights are assigned to the columns widths.

EQUAL
all columns have equal width.

PROPORTIONAL
each column has a width that is proportional to the number of discrete midpoint values that it contains.

Restriction At least one column axis must be discrete in order for PROPORTIONAL to have any effect. Otherwise, EQUAL is used.

Interactions When COLUMNDATARANGE=UNIONALL, PROPORTIONAL is ignored and EQUAL is used.

When PROPORTIONAL is in effect, COLUMNDATARANGE=AUTO is interpreted as UNION.

If all of the following conditions are true, then the discrete axis is used to proportion the columns: PROPORTIONAL is in effect, both the X and X2 axes are used, and only one of the two axes is discrete. If both axes are discrete, then the X axis is used to proportion the columns.

When PROPORTIONAL is in effect, the OFFSETMIN= and OFFSETMAX= axis options are ignored in COLUMNAXISOPTS= and COLUMN2AXISOPTS=. The axis offsets are always set to one-half of the midpoint spacing regardless of plot type.

Default EQUAL

HEADERBACKGROUNDCOLOR=*style-reference* | *color*
specifies the background color of the cell headers.

style-reference
specifies a style reference in the form *style-element:style-attribute*.

Only the style attribute named COLOR or CONTRASTCOLOR is used.

Default The GraphHeaderBackground:Color style reference.

Interaction HEADEROPAQUE= TRUE must be in effect in order for the color to be seen.

HEADERBORDER=TRUE | FALSE
specifies whether a border is drawn around the header cells.

Note: This feature applies to SAS 9.4M3 and to later releases.

Default TRUE

Tip The border attributes are controlled by the GraphBorderLines style element.

See "boolean " for other Boolean values that you can use.

HEADERLABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font attributes of the data labels.

Default The GraphValueText style element.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Text Options" on page 1606 for available *text-options*.

HEADERLABELDISPLAY=NAMEVALUE | VALUE | NONE
specifies the content of the cell headers.

NAMEVALUE
displays the classification variable name and value as a *name=value* pair in each cell header.

Example If the classification variables are Country and Product, then HEADERLABEL=NAMEVALUE produces cell headers such as the following:

```
Country=CANADA
Product=TABLE
```

VALUE
displays the classification variable value only in each cell header.

Example If the classification variables are Country and Product, then HEADERLABEL=VALUE produces cell headers such as the following:

```
CANADA
TABLE
```

NONE
suppresses the cell headers.

Default NAMEVALUE

HEADERLABELLOCATION=OUTSIDE | INSIDE
indicates whether the cell header is placed within each cell (INSIDE) or as row and column headers external to the lattice (OUTSIDE).

Default OUTSIDE

HEADEROPAQUE=TRUE | FALSE
specifies whether the background for cell headers is opaque (TRUE) or transparent (FALSE).

Default TRUE

Interaction When this option is set to FALSE, the background color for cell headers is not used.

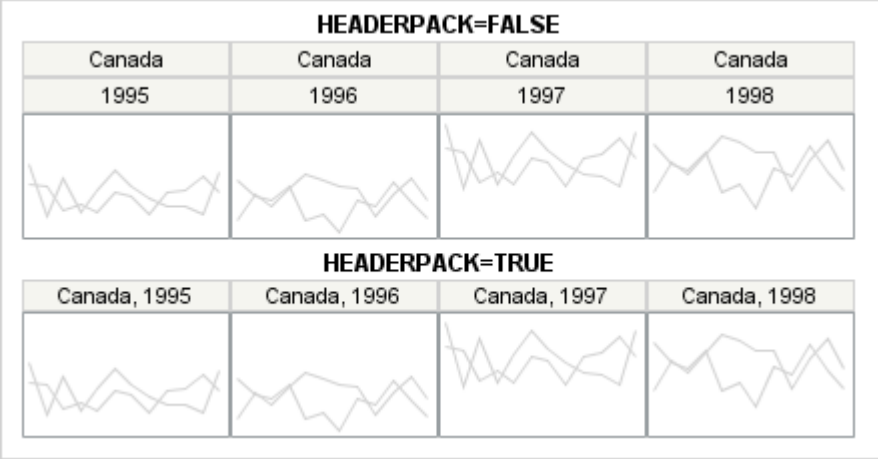
See "boolean " on page xii for other Boolean values that you can use.

HEADERPACK=TRUE | FALSE

specifies whether the header cells are consolidated into a comma-separated list in order to save space.

Note: This option is valid starting in SAS 9.4M1.

The following figure shows the effect of HEADERPACK= on the cell headers in one row of a data lattice. The data lattice contains classification variables Country and Year.



The following figure shows the effect of HEADERPACK= on the cell headers in one row of a data lattice. The data lattice contains classification variables Country, Year, and Product.

Default FALSE

Note If the length of the cell header text exceeds the available width, then the text is truncated.

Tip If truncation occurs, then use the HEADERSPLITCOUNT= option to split the cell header text into multiple lines.

See “boolean ” on page xii for other Boolean values that you can use.

HEADERSEPARATOR="*string*"

specifies one or more characters to place between each value in the cell header when HEADERPACK=TRUE.

Note: This option is valid starting in SAS 9.4M1.

Default A comma followed by a space

Interaction This option is ignored when HEADERPACK=FALSE.

HEADERSPLITCOUNT=*positive-integer*

specifies the number of headers to consolidate on a header line before splitting the text to the next line.

Note: This option is valid starting in SAS 9.4M1.

The following figure shows how HEADERSPLITCOUNT=2 splits the cell header value in a data panel of classification variables Country, Year, and Product.

Default The cell header text is not split

Interaction This option is ignored when HEADERPACK=FALSE.

Note If the length of the cell header text exceeds the available width, then the text is truncated.

Tip Use the HEADERSEPARATOR= option to specify a different separator.

INCLUDEMISSINGCLASS=TRUE | FALSE
specifies whether to include grid cells for crossings of the ROWVAR and COLUMNVAR variables that contain a missing value.

TRUE
any crossing of the class variables that includes a missing value produces a row or column of cells in the grid.

FALSE
any crossing of the class variables that includes a missing value does not produce a row or columns of cells in the grid.

By default, missing class values are included in the classification. When the data contains missing classification values, cells are created for the missing classes. The classification headers for the missing values are blank for missing string values or a dot for missing numeric values. You can use the INCLUDEMISSINGCLASS=FALSE option to exclude the missing values. If you want to keep the missing values, then you can create a format that specifies more meaningful headings for the missing classes. For an example, see "Missing Class Values" in *SAS Graph Template Language: User's Guide*.

Note: ODS Graphics does not support Unicode values in user-defined formats in SAS 9.4M2 and in earlier releases. Starting with SAS 9.4M3, ODS Graphics supports Unicode values in user-defined formats only if they are preceded by the (*ESC*) escape sequence. Example: `"(*ESC*){unicode beta}"`. ODS Graphics does not support an escape character that is defined in an ODS ESCAPECHAR statement in user-defined formats.

Default TRUE

See "boolean " on page xii for other Boolean values that you can use.

INSET=(*variable-list*)
specifies what information is displayed in an inset. The *variable-list* defines one or more variables whose names and values appear as a small table in the data cells. The variables can be either numeric or character. Variable names are separated by spaces.

Requirement No predefined information is available for the inset. You must create the desired inset information as part of your input data. See "Creating Your Inset Data" on page 76.

Note The variable values are associated with the data cells by data order. That is, the first observation from all the variables in *variable-list* are used in the first data cell, the second observation from all variables in *variable-list* are used in the second data cell, and so on. If a value is missing for an observation, then the corresponding *name-value* pair is skipped in the affected data cell.

Tip The location and appearance of the inset is controlled by the INSETOPTS= option.

See "Adding Insets to Your Graph" in *SAS Graph Template Language: User's Guide*

INSETOPTS=(*appearance-options*)
specifies location and appearance options for the inset information. The appearance options can be any one or more of the following values:

AUTOALIGN=NONE | AUTO | (*location-list*)
specifies whether the inset is automatically aligned within the layout.

NONE
does not automatically align the inset.

This inset's position is set by the HALIGN= and VALIGN=*appearance-options*.

AUTO
attempts to center the inset in the area that is farthest from any surrounding markers.

Data cells might have different inset placements.

(*location-list*)
restricts the inset's possible locations to those locations in the specified *location-list*, and uses the *location-list* position that least collides with the data cell's other graphics features.

The *location-list* is a space-separated list that can contain any of these locations: TOPLEFT, TOP, TOPRIGHT, LEFT, CENTER, RIGHT, BOTTOMLEFT, BOTTOM, and BOTTOMRIGHT.

Example
```
AUTOALIGN=(TOPRIGHT TOPLEFT)
```

Default NONE

Interaction When AUTOALIGN=AUTO or (*location-list*), the HALIGN= and VALIGN= options are ignored.

BACKGROUNDCOLOR=*style-reference* | *color*
specifies the color of the inset background.

style-reference
specifies a style reference in the form *style-element : style-attribute*.

Only the COLOR and CONTRASTCOLOR style attributes are valid.

Default The background is transparent. No color is assigned.

BORDER=TRUE | FALSE
specifies whether a border is displayed around the inset.

Default FALSE

See "boolean " on page xii for other Boolean values that you can use.

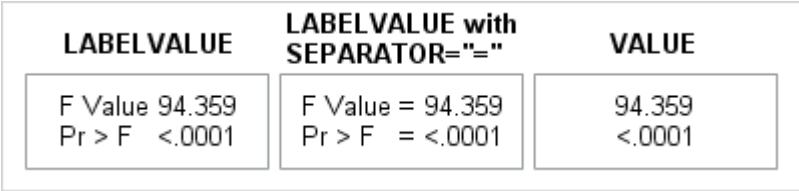
CONTENTDISPLAY=LABELVALUE | VALUE
specifies whether the variable information that is displayed in the inset includes the column label and value, or only the column value.

Note: This feature applies to SAS 9.4M2 and to later releases.

If a label is not assigned to a column, then the column name is used as the label for that column. Consider the following inset data:

```
                      F
Obs     _TYPE_      Value     Pr > F
 1       SS1       94.359     <.0001
```

The following figure shows the effect that the CONTENTDISPLAY= option has on the content of an inset that displays this data.



Default LABELVALUE

Tip Use the SEPARATOR= option to specify a separator other than the default blank space.

DATASCHEME=LIST | MATCHED
specifies the scheme that was used to merge the inset information into the analysis data.

LIST
one-to-one merging (no BY statement) was used to merge the inset and analysis data.

The variable values are associated with the cells of the data lattice by using data order. That is, the inset variable values in the first observation are used in the inset for the first cell, the inset variable values in the second observation are used in the inset for the second cell, and so on.

MATCHED
match-merging (using a BY statement) was used to merge the inset and analysis data.

Defaults LIST if the data is a SAS data set

MATCHED if the data is a CAS in-memory table

Tip MATCHED is the preferred data scheme for merging the inset and analysis data.

See "Adding Insets to Classification Panels" in *SAS Graph Template Language: User's Guide*

HALIGN=LEFT | CENTER | RIGHT
specifies the horizontal alignment of the inset.

Default LEFT

Interaction This option has an effect only when this layout is nested within a REGION layout or when this layout is nested in an overlay-type layout and AUTOALIGN=NONE.

OPAQUE=TRUE | FALSE
specifies whether the inset background is opaque (TRUE) or transparent (FALSE).

Default FALSE

Interaction When OPAQUE=FALSE, the background color is not used.

See "boolean " on page xii for other Boolean values that you can use.

SEPARATOR="*string*"
specifies a new separator for the column label and value.

Note: This feature applies to SAS 9.4M2 and to later releases.

Default A blank space

Interaction This option is ignored when CONTENTDISPLAY=VALUE.

TEXTATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the text properties of the entire inset, excluding the title.

Default The GraphDataText style element.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Text Options" on page 1606 for available *text-options*.

TITLE="*string*"
specifies a title for the inset.

The title is added at the top of the inset and spans the full inset width.

Note Space is not reserved for the title when this value is not specified.

Tip Text properties for the title string can be specified with TITLEATTRS=.

TITLEATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the text properties of the inset's title string.

Default The GraphValueText style element.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Text Options" on page 1606 for available *text-options*.

VALIGN=TOP | CENTER | BOTTOM
specifies the vertical alignment of the inset.

Default TOP

Interaction This option has effect only when this layout is nested within a REGION layout or when this layout is nested in an overlay-type layout and AUTOALIGN=NONE.

Requirements The options must be enclosed in parentheses.

Each option must be specified as a *name = value* pair, and each pair must be separated by a space.

OPAQUE=TRUE | FALSE
specifies whether the layout background is opaque (TRUE) or transparent (FALSE).

Default FALSE

Interaction When this option is set to FALSE, the background color is not used.

See "boolean " on page xii for other Boolean values that you can use.

OUTERPAD=AUTO | *dimension* | (*pad-options*)
specifies the amount of extra space to add outside the layout border.

AUTO
specifies that the default outside padding for this component is used.

dimension
specifies a dimension to use for the extra space at the left, right, top, and bottom of the layout border.

(*pad-options*)
a space-separated list of one or more name-value pair pad options, enclosed in parentheses.

The list can contain one or more of the following pad options:

LEFT=*dimension*
specifies the amount of extra space to add to the left side.

RIGHT=*dimension*
specifies the amount of extra space to add to the right side.

TOP=*dimension*
specifies the amount of extra space to add to the top.

BOTTOM=*dimension*
specifies the amount of extra space to add to the bottom.

Note Sides that are not assigned padding are padded with the default amount.

Tip Use *pad-options* to create non-uniform padding.

Default AUTO

Note The default units for *dimension* are pixels.

See "dimension" on page xiii

PAD=*dimension* | *(pad-options)*
specifies the amount of extra space that is added inside the layout border.

dimension
specifies a dimension to use for the extra space at the left, right, top, and bottom of the border.

(*pad-options*)
a space-separated list of one or more name-value-pair pad options enclosed in parentheses.

The list can include one or more of the following pad options:

LEFT=*dimension*
specifies the amount of extra space added to the left side.

Default 0

RIGHT=*dimension*
specifies the amount of extra space added to the right side.

Default 0

TOP=*dimension*
specifies the amount of extra space added to the top.

Default 0

BOTTOM=*dimension*
specifies the amount of extra space added to the bottom.

Default 0

Note Sides that are not assigned padding are padded with the default amount.

Tip Use *pad-options* to create non-uniform padding.

Note The default units for *dimension* are pixels.

See "dimension" on page xiii

PANELNUMBER=*positive-integer*
specifies the number of the panel to produce. This option enables you to partition a large grid into a number of smaller grids under these conditions:

- You set a grid size explicitly (ROWS= and COLUMNS= when ROWVAR and COLUMNVAR variables are specified; ROWS= when only a ROWVAR variable is specified; COLUMNS= when only a COLUMNVAR variable is specified)
- The grid size is smaller in one or both of the dimensions of the default dynamically generated grid.
- You execute the template N times and increment the panel number each time. N is determined by CEIL(all rows * all columns / grid rows * grid columns).

Default 1

Example Suppose ROWVAR=R (R has 10 unique values) and COLUMNVAR=C (C has 11 unique values). The dynamic grid has 10 rows and 11 columns and you would have to make the HEIGHT=and WIDTH= quite large to enable 110 plots to be displayed. By setting some smaller grid size, say ROWS=3 and COLUMNS=4, and by making the value of PANELNUMBER= a dynamic or macro variable, you can create 10 panels (9 with 12 data cells and 1 with 2 data cells) that collectively display all 110 possible crossings. You simply invoke PROC SGRENDER or a DATA step 10 times, incrementing the dynamic value for PANELNUMBER each time.

ROWAXISOPTS=(*axis-options*)
specifies Y-axis options for all rows.

Requirement Axis options must be enclosed in parentheses and separated by spaces.

See "Axis Options for LAYOUT DATALATTICE and LAYOUT DATAPANEL" on page 1218 for a list of options..

ROW2AXISOPTS=(*axis-options*)
specifies Y2-axis options for all rows.

Requirement Axis options must be enclosed in parentheses and separated by spaces.

Interaction This option is needed only if you use a plot statement that supports a secondary Y2 axis. If you do not use that statement's YAXIS= option to map data to the Y2 axis, then this option is ignored. For more information about how data are mapped to the axes, see "Plot Data Are Mapped to a Designated Axis" on page 1040

See "Axis Options for LAYOUT DATALATTICE and LAYOUT DATAPANEL" on page 1218 for a list of options..

ROWDATARANGE=AUTO | UNIONALL | UNION
specifies how the Y-axes of instances of the *graph-prototype* are scaled.

AUTO
automatically selects the Y-axis scale based on the ROWWEIGHT= option and the column axis type.

The Y-axis scale is selected as follows:

- When ROWWEIGHT=EQUAL (default), UNIONALL is selected.
- When ROWWEIGHT=PROPORTIONAL and the row axis is discrete, UNION is selected. Otherwise, UNIONALL is selected.

UNIONALL
scales the Y-axis data ranges across all layout rows and panels (when PANELNUMBER= is in effect).

UNION
scales the Y-axis data ranges separately for each row in the layout on a per-panel basis.

The scaling does not span multiple panels.

Default AUTO

Tip Use the ROWAXISOPTS= option to control shared axis features.

See The ROWWEIGHT= option.

The PANELNUMBER= option for information about how to create multiple panels.

ROW2DATARANGE=AUTO | UNIONALL | UNION
specifies how the Y2-axes of instances of the *graph-prototype* are scaled.

AUTO
automatically selects the Y2-axis scale based on the ROWWEIGHT= option and the column axis type.

The Y2-axis scale is selected as follows:

- When ROWWEIGHT=EQUAL (default), UNIONALL is selected.
- When ROWWEIGHT=PROPORTIONAL and the row axis is discrete, UNION is selected. Otherwise, UNIONALL is selected.

UNIONALL
scales the Y2-axis data ranges across all layout rows and panels (when PANELNUMBER= is in effect).

UNION
scales the Y2-axis data ranges separately for each row in the layout on a per-panel basis.

The scaling does not span multiple panels.

Default AUTO

Interaction This option is needed only if you use a plot statement that supports a secondary Y2 axis. If you do not use that statement's YAXIS= option to map data to the Y2 axis, then this option is ignored. For more information about how data are mapped to the axes, see "Plot Data Are Mapped to a Designated Axis" on page 1040

Tip Use the ROW2AXISOPTS= option to control shared axis features.

See The ROWWEIGHT= option.

The PANELNUMBER= option for information about how to create multiple panels.

ROWGUTTER=*dimension*
specifies the amount of empty space between the rows.

Default 0

Note If there are *n* rows, then there are *n*-1 gutters.

See "dimension" on page xiii

ROWHEADERS=RIGHT | LEFT | BOTH
specifies where to position the outside row heading.

RIGHT
specifies that row heading appears at the right of the layout.

LEFT
specifies that row heading appears at the left of the layout.

BOTH
specifies that row heading alternates between the right and left of the layout row by row.

Default RIGHT

Requirement HEADERLABELLOCATION= OUTSIDE must be set for this option to have any effect.

ROWS=*integer*
specifies the number of rows in the layout.

Defaults If this option is not specified, then the number of rows is dynamically adjusted to equal the number of classifier values for the ROWVAR= variable.

If this option is specified, then the specified number of rows is created. If the number of ROWVAR classifier values is greater than the specified number of rows, then no graph is created for some classifier values. If the number of classifier values is smaller than the specified number of rows, then extra empty rows are created.

Interactions The overall grid size is constrained by the HEIGHT= and WIDTH= options in the ODS GRAPHICS statement. As the grid size grows, the cell size shrinks. To control the minimum size of a cell use the CELLHEIGHTMIN= and CELLWIDTHMIN= options.

The START= option affects how the rows are populated.

Tip The PANELNUMBER= option enables you to create multiple smaller grids that completely partition the classifier values.

ROWWEIGHT=EQUAL | PROPORTIONAL
specifies how weights are assigned to the row heights.

EQUAL
all rows have equal height.

PROPORTIONAL
each row has a height that is proportional to the number of discrete midpoint values that it contains.

Restriction At least one row axis must be discrete in order for PROPORTIONAL to have any effect. Otherwise, EQUAL is used.

Interactions When ROWDATARANGE=UNIONALL, PROPORTIONAL is ignored and EQUAL is used.

When PROPORTIONAL is in effect, ROWDATARANGE=AUTO is interpreted as UNION.

If all of the following conditions are true, then the discrete axis is used to proportion the rows: PROPORTIONAL is in effect, both the Y and Y2 axes are used, and only one of the two axes is discrete. When both axes are discrete, the Y axis is used to proportion the rows.

When PROPORTIONAL is in effect, the OFFSETMIN= and OFFSETMAX= axis options are ignored in ROWAXISOPTS= and ROW2AXISOPTS=. The axis offsets are always set to one-half of the midpoint spacing regardless of plot type.

Default EQUAL

SHRINKFONTS=TRUE | FALSE
specifies whether fonts in the layout are scaled down.

Default FALSE

Note If SHRINKFONTS=TRUE, the font scaling applies to all child layouts within the parent layout. If a child layout also specifies SHRINKFONTS=TRUE, the fonts for the children of that child layout are further scaled down.

See “boolean ” on page xii for other Boolean values that you can use.

SKIPEMPTYCELLS=TRUE | FALSE

specifies whether the external axes skip the empty cells in a partially filled grid.

TRUE

skips empty cells and "snaps" the external axes to the nearest data cell, both vertically and horizontally.

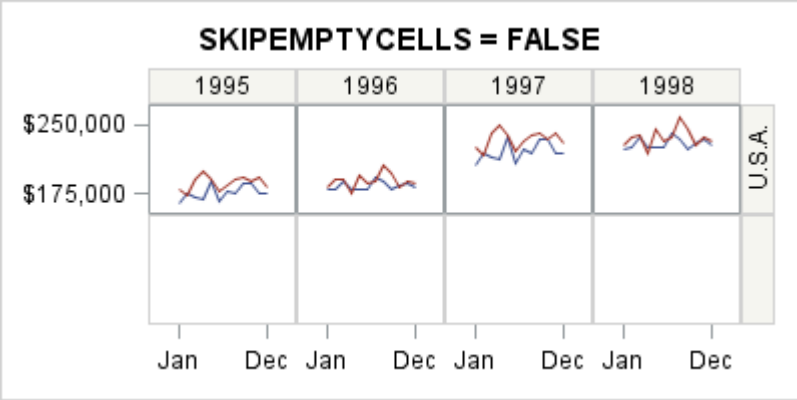
Though the empty cells are not displayed, the data cells in the grid are not enlarged to fill the area.

FALSE

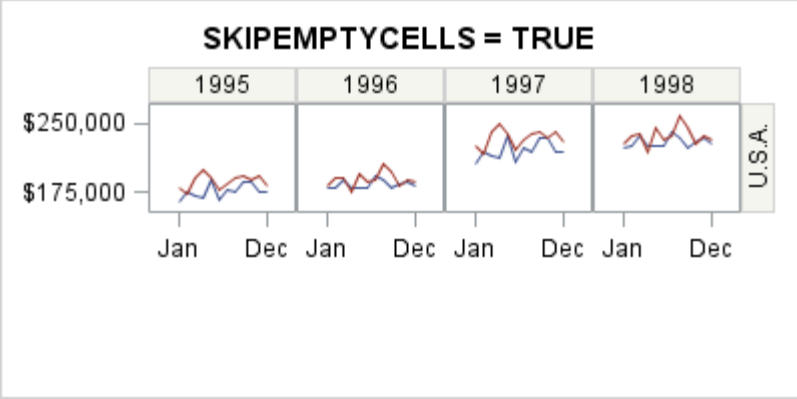
displays external axes at their normal locations, even if there are empty cells at one or more of the locations.

Whenever the number of unique COLUMNVAR= classifier values (data cells) is not evenly divisible by the COLUMNS= value, or the number of unique ROWVAR= classifier values (data cells) is not evenly divisible by the ROWS= value, then one or more panels is partially filled with data cells and padded with empty cells to complete the grid.

Here is an example of a data lattice that consists of 4 column-data cells and 3 row-data cells arranged in a 4-column, 2-row grid. The following figure shows the default appearance of the last panel:



When SKIPEMPTYCELLS=TRUE, the empty padding cells of all panels are removed and external axis ticks and tick values snap to the data cells:



Default FALSE

See "boolean " on page xii for other Boolean values that you can use.

SORTORDER=(COLUMNVAR=*sort-order-keyword* | ROWVAR=*sort-order-keyword*)

specifies the order of the cells along the columns and rows.

COLUMNVAR
the column role.

ROWVAR
the row variable role.

sort-order-keyword
a sort-order keyword.

The keyword can be one of the following:

AUTO
sorts using DATA for character data and ascending unformatted for numeric data.

DATA
retains the data order.

Note In SAS 9.4M6 and SAS 9.4M5, when data stored in a CAS in-memory table is used and DATA is specified, unpredictable results might occur. To generate consistent graphs in that case, specify ASCENDINGFORMATTED or DESCENDINGFORMATTED. Starting with SAS Viya 3.5 and SAS Studio 5.2, when data stored in a CAS in-memory table is used and DATA is specified, DATA is ignored, and AUTO is used instead.

ASCENDINGFORMATTED
sorts in ascending order, using the formatted values.

DESCENDINGFORMATTED
sorts in descending order, using the formatted values.

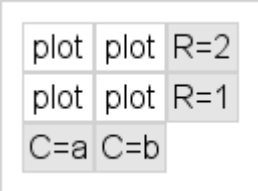
Defaults AUTO for all roles if the data is a SAS data set

ASCENDINGFORMATTED for all roles if the data is a CAS in-memory table

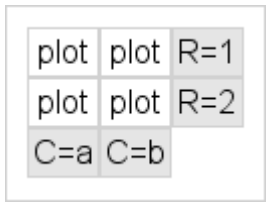
Tip The placement of the cells within the layout also depends on the starting location, which is controlled by the START= option.

START=TOPLEFT | BOTTOMLEFT

indicates whether to start populating the grid from the top left or bottom left corner. If ROWVAR=R has values in the sort order 1 and 2 and COLUMNVAR=C has values in the sort order *a* and *b*, then START=BOTTOMLEFT is populated as follows:



START=TOPLEFT is populated as follows:



Default TOPLEFT

SIDEBAR Statement Options

ALIGN=BOTTOM | TOP | LEFT | RIGHT
specifies the sidebar's location within the layout. You can specify up to four SIDEBAR blocks in a LAYOUT DATALATTICE, one for each of the bottom, top, left, and right sidebar positions.

- The LAYOUT DATALATTICE automatically aligns a sidebar with the layout columns or rows.
- Only one statement (such as ENTRY or DISCRETELEGEND) or one layout block (such as LAYOUT GRIDDED) is allowed in a SIDEBAR block. To create multi-line text in a sidebar, nest ENTRY statements within a LAYOUT GRIDDED block.

Default BOTTOM

SPACEFILL=TRUE | FALSE
specifies whether to fill all the area of the sidebar with its contents.

Default TRUE

Tip To prevent a layout block within the sidebar from expanding to the sidebar boundaries, set this option to FALSE.

See "boolean " on page xii for other Boolean values that you can use.

Details

Statement Description

The LAYOUT DATALATTICE statement makes it easy to create a grid of graphs, based on the values of one or two classifications variables. To create a grid that is based on more than two classification variables, or to have more control over the grid layout, use LAYOUT DATAPANEL instead.

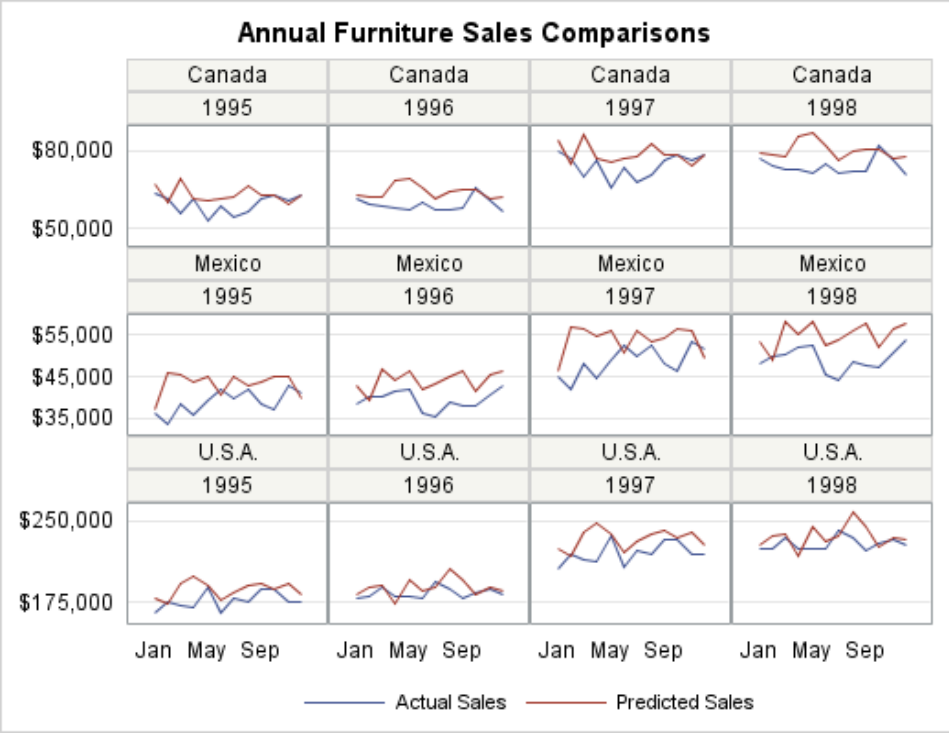
By default, the number of cells in the layout is determined by the number of value pairings that are possible for the classification values plus any empty cells needed to complete the last row or column of the grid. The contents of each data cell are based on a graph prototype that you specify in the *graph-prototype-block*. You can enhance the display using one or more *sidebar-statement-blocks*. For classification

variables that have many values, you can use the COLUMNS= and or ROWS= options and the PANELNUMBER= option to generate multiple panel displays.

Classification variables for the layout are specified on the ROWVAR= argument (to specify a row variable), or the COLUMNVAR= argument (to specify a column), or both arguments to specify both a column and a row variable. The graph prototype for each data cell's contents is specified within a "LAYOUT PROTOTYPE Block" on page 77 block, and sidebars are specified within SIDEBAR blocks. The LAYOUT PROTOTYPE and SIDEBAR blocks are nested within the LAYOUT DATALATTICE block.

By default, the first data cell to be filled is in the layout's top left corner. Use the START= option to change the starting data cell to the bottom left corner.

Rather than display the header labels outside the grid, you can set HEADERLABELLOCATION= INSIDE to display them inside the grid, as shown in the following figure:



Note: The DATALATTICE layout is designed to be the outermost layout in the template.

Managing Rows and Columns

If you do not explicitly manage columns and rows using the COLUMNS= and ROWS= options, then the default layout behavior is as follows:

- If both ROWVAR= and COLUMNVAR= are specified, then a data cell is created for each of the value pairings that are possible for the classification values of the specified variables. If the ROWVAR variable has R distinct values and the COLUMNVAR variable has C distinct values, then the dimension of grid produced is R x C.

- If only the ROWVAR variable is used, then an R x 1 grid is produced.
- If only the COLUMNVAR variable is used, then a 1 x C grid is produced.

If the class variable is of type character, then its values are returned in data order. To control the ordering of the values, you can sort the input data by the classification variables. If the class variable is of type numeric, then the values are displayed in ordinal order.

Formats can be assigned to class variables to create classification levels (for example, an AGEGROUPFMT. format for numeric AGE). In this case, the classification is performed after the format is applied. For numeric data, the order is ordinal, based on the first value in each class.

Use the INCLUDEMISSINGCLASS option to control whether cells are displayed when any value crossing contains a missing value.

The output size does not grow automatically as the number of cells increases. To set a panel size for the current template, use the DESIGNHEIGHT= and DESIGNWIDTH= options in the BEGINGRAPH statement. To set a panel size for all templates in the current SAS session, use the HEIGHT= and WIDTH= options in the ODS GRAPHICS statement. Size settings in the ODS GRAPHICS statement override size settings in the BEGINGRAPH statement. The default output width is 640px, and the default output height is 480px.

As the number of cells in the grid increases, the size of each cell decreases. At some point the cells might become so small that a meaningful graph cannot be rendered. The CELLHEIGHTMIN= and CELLWIDTHMIN= options set a threshold for the smallest cell. If the actual cell height or width becomes smaller, then no panel is drawn. The default minimum cell size is CELLHEIGHTMIN=100px and CELLWIDTHMIN=100px.

Using the default panel size and cell size, the DATALATTICE layout accommodates a grid of about 24 cells (6 columns by 4 rows). If you know that the number of cells is larger, then you should increase the overall panel size, or decrease the minimum cell size, or both. You can also use ROWS= , COLUMNS= , and PANELNUMBER= options to partition your data so that a number of smaller grids are produced that cumulatively show all of the value crossings.

Creating Your Inset Data

When you use the INSET= option to insert an inset, no predefined information is available for the inset. You must create the desired inset information as part of your input data. This is most typically done as follows:

- Create a separate data set for the inset columns making sure that the column names are different from the other columns used in graph. The number observations of inset data should match the number of cells in the classification panel. The ordering of the inset observations should be the same as the population order of the classification panel's cells, taking into account the ROWVAR= and COLUMNVAR= arguments and the START= option. Typically, the number of observations for the inset data is smaller than the other input data for the graph.
- Merge the inset data set with the data set for the graph using a DATA or PROC SQL step. Do not match-merge the observations of the two data sets (no BY

processing). The resulting data set typically has the inset columns padded with missing values.

- Use the merged data set to produce the graph, specifying the inset column names in this option's *variable-list*.

LAYOUT PROTOTYPE Block

You must specify a single LAYOUT PROTOTYPE block within the LAYOUT DATALATTICE block, using the following syntax:

LAYOUT PROTOTYPE </*options*>;

GTL-statement(s);

ENDLAYOUT;

The LAYOUT PROTOTYPE block determines the graphical content of each data cell and is repeated within each data cell, based on the subsets of the classification variables.

For more information about the LAYOUT PROTOTYPE block and the list of available options, see "LAYOUT PROTOTYPE Statement" on page 186.

SIDEBAR Blocks

A LAYOUT DATALATTICE enables you to display one or more *sidebars* outside of the axes. A sidebar spans across columns or rows and is useful for displaying information that applies to all of the columns or all of the rows. For example, sidebars are useful for displaying a legend.

A SIDEBAR statement has the following syntax:

SIDEBAR </ *options*>;

GTL-statement(s);

ENDSIDEBAR;

The following example shows a SIDEBAR block that displays a legend at the top of the layout grid.

```
sidebar / align=top;
   discretelegend 'p' 'a' / across=2;
endsidebar;
```

Example: LAYOUT DATALATTICE

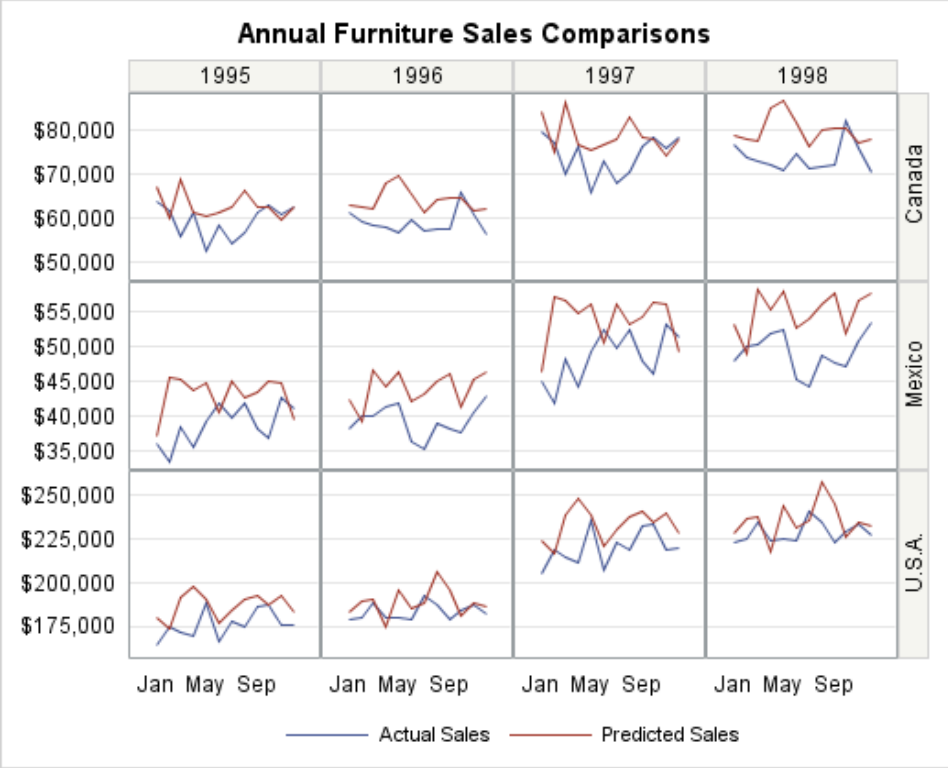
This example shows the result of using row and column classification variables. In this case, a four-column, three-row data lattice is created:

- The classification values are placed as row or column labels by default.
- The ROWDATARANGE=UNION option assures that an axis range is computed separately for each row using the data ranges of all Y= columns in that row. This facilitates the visual comparison of the data cells.

- A SIDEBAR block is used to place the legend at the bottom of the lattice.

Example Graph

The following graph was generated by the "Example Program" on page 78:



Example Program

```
proc template;
 define statgraph layoutdatalattice;
  begingraph;
    entrytitle "Annual Furniture Sales Comparisons";
    layout datalattice rowvar=country columnvar=year /
      rowdatarange=union
      headerlabeldisplay=value
      headerbackgroundcolor=GraphAltBlock:color
      rowaxisopts=(display=(tickvalues) griddisplay=on
        linearopts=(tickvalueformat=dollar12.))
      columnaxisopts=(display=(tickvalues)
        timeopts=(tickvalueformat=monname3.));
      layout prototype / cycleattrs=true;
        seriesplot x=month y=TotalActual / name="Actual";
        seriesplot x=month y=TotalPredict / name="Predict";
      endlayout;
```

```
      sidebar / align=bottom;
        discretelegend "Actual" "Predict" / border=false;
      endsidebar;
    endlayout;
  endgraph;
 end;
run;

proc summary data=sashelp.prdsal2 nway;
  class country year month;
  var actual predict;
  output out=prdsal2 sum=TotalActual TotalPredict;
run;

proc sgrender data=prdsal2 template=layoutdatalattice;
run;
```

LAYOUT DATAPANEL Statement

Creates a grid of graphs based on one or more classification variables and a graphical prototype. By default, a separate instance of the prototype (a data cell) is created for each actual combination of the classification variables.

Restriction: You can specify only one LAYOUT PROTOTYPE block in the LAYOUT DATAPANEL block. If you specify more than one, then only the last prototype block specified is honored. The remaining prototype blocks are ignored.

Tip: The DATAPANEL layout should be the outermost layout in the template.

Syntax

LAYOUT DATAPANEL CLASSVARS=(*class-var1...class-varN*) < */options* > ;
  LAYOUT PROTOTYPE < */options* >;
    GTL-statements;
  ENDLAYOUT;
  <**SIDEBAR** < */ options* >;
    GTL-statement(s);
  ENDSIDEBAR;
  <... *more-sidebar-statement-blocks* ...> >
ENDLAYOUT;

Summary of Optional Arguments

Appearance options

BACKGROUNDCOLOR=*style-reference* | *color*

specifies the color of the layout background.

BORDER=TRUE | FALSE
specifies whether a border is drawn around the layout.

BORDERATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the attributes of the border line around the layout.

CELLHEIGHTMIN=*dimension*
specifies the minimum height of a cell in the grid.

CELLWIDTHMIN=*dimension*
specifies the minimum width of a cell in the grid.

COLUMNGUTTER=*dimension*
specifies the amount of empty space that is between the columns.

HEADERBACKGROUNDCOLOR=*style-reference* | *color*
specifies the background color of the cell headers.

HEADERBORDER=TRUE | FALSE
specifies whether a border is drawn around the header cells.

HEADERLABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font attributes of the data labels.

HEADEROPAQUE=TRUE | FALSE
specifies whether the background for cell headers is opaque (TRUE) or transparent (FALSE).

HEADERPACK=TRUE | FALSE
specifies whether the header cells are consolidated into a comma-separated list in order to save space.

HEADERSEPARATOR="*string*"
specifies one or more characters to place between each value in the cell header when HEADERPACK=TRUE.

HEADERSPLITCOUNT=*positive-integer*
specifies the number of headers to consolidate on a header line before splitting the text to the next line.

OPAQUE=TRUE | FALSE
specifies whether the layout background is opaque (TRUE) or transparent (FALSE).

OUTERPAD=AUTO | *dimension* | (*pad-options*)
specifies the amount of extra space to add outside the layout border.

PAD=*dimension* | *(pad-options)*
specifies the amount of extra space that is added inside the layout border.

SHRINKFONTS=TRUE | FALSE
specifies whether fonts in the layout are scaled down.

SORTORDER=(COLUMNVAR=*sort-order-keyword* | ROWVAR=*sort-order-keyword*)
specifies the order of the cells along the columns and rows.

Axis options

COLUMN2AXISOPTS=(*axis-options*)
specifies X2-axis options for all columns.

COLUMN2DATARANGE=AUTO | UNIONALL | UNION

specifies how the X2-axes of instances of the *graph-prototype* are scaled.

COLUMNAXISOPTS=(*axis-options*)
specifies X-axis options for all columns.

COLUMNDATARANGE=AUTO | UNIONALL | UNION
specifies how the X-axes of instances of the *graph-prototype* are scaled.

ROW2AXISOPTS=(*axis-options*)
specifies Y2-axis options for all rows.

ROW2DATARANGE=AUTO | UNIONALL | UNION
specifies how the Y2-axes of instances of the *graph-prototype* are scaled.

ROWAXISOPTS=(*axis-options*)
specifies Y-axis options for all rows.

ROWDATARANGE=AUTO | UNIONALL | UNION
specifies how the Y-axes of instances of the *graph-prototype* are scaled.

Inset options

INSET=(*variable-list*)
specifies what information is displayed in an inset.

INSETOPTS=(*appearance-options*)
specifies location and appearance options for the inset information.

Layout options

COLUMNS=*integer*
specifies the number of columns in the layout.

COLUMNWEIGHT=EQUAL | PROPORTIONAL
specifies how weights are assigned to the columns widths.

HEADERLABELDISPLAY=NAMEVALUE | VALUE | NONE
specifies the content of the cell headers.

INCLUDEMISSINGCLASS=TRUE | FALSE
specifies whether to include grid cells for crossings of the CLASSVARS variables that contain a missing value.

ROWGUTTER=*dimension*
specifies the amount of empty space between the rows.

ROWS=*integer*
specifies the number of rows in the layout.

ROWWEIGHT=EQUAL | PROPORTIONAL
specifies how weights are assigned to the row heights.

Panel options

ORDER=ROWMAJOR | COLUMNMAJOR
specifies whether data cells are populated by column priority or by row priority.

PANELNUMBER=*positive-integer*
specifies the number of the panel to produce.

SKIPEMPTYCELLS=TRUE | FALSE
specifies whether the external axes skip the empty cells in a partially filled grid.

SPARSE=TRUE | FALSE

specifies whether crossings of the class variables include only the crossings in the data or all possible crossings.

START=TOPLEFT | BOTTOMLEFT
indicates whether to start populating the grid cells from the top left or bottom left corner.

Role options

ROLENAME=(*role-name-list*)
specifies user-defined roles for information contained in data columns.

Required Argument

CLASSVARS=(*column-list*)
specifies a list of classification variables. By default, a data cell is created for each crossing of these variables in the input data. The total number of grid cells created is the result of a crosstabulation table of all the classification variables plus any empty cells needed to complete the last row or column of the grid. You can request that data cells be generated for all possible crossings, even when the class variables have no values at those crossings. For more information, see the SPARSE= option.

If the class variable is of type character, then its values are returned in data order. To control the ordering of the values, you can sort the input data by the classification variables. If the class variable is of type numeric, then the values are displayed in ordinal order.

Formats can be assigned to class variables to create classification levels (for example, an AGEGROUPFMT. format for numeric AGE). In this case, the classification is performed after the format is applied. For numeric data, the order is ordinal, based on the first value in each class.

Use the INCLUDEMISSINGCLASS option to control whether cells are displayed when any value crossing contains a missing value.

The output size does not grow automatically as the number of cells increases. To set a panel size for the current template, use the DESIGNHEIGHT= and DESIGNWIDTH= options in the BEGINGRAPH statement. To set a panel size for all templates in the current SAS session, use the HEIGHT= and WIDTH= options in the ODS GRAPHICS statement. Size settings in the ODS GRAPHICS statement override size settings in the BEGINGRAPH statement. The default output width is 640px, and the default output height is 480px.

As the number of cells in the grid increases, the size of each cell decreases. At some point the cells might become so small that a meaningful graph cannot be rendered. The CELLHEIGHTMIN= and CELLWIDTHMIN= options set a threshold for the smallest cell. If the actual cell height or width becomes smaller, then no panel is drawn. The default minimum cell size is CELLHEIGHTMIN=100px and CELLWIDTHMIN=100px.

Using the default panel size and cell size, the DATAPANEL layout accommodates a grid of about 24 cells (6 columns by 4 rows). If you know that the number of cells is larger, then you should increase the overall panel size, or decrease the minimum cell size, or both. You can also use ROWS= , COLUMNS= , and PANELNUMBER= options to partition your data so that a

number of smaller grids are produced that cumulatively show all of the value crossings.

Optional Arguments

BACKGROUNDCOLOR=*style-reference* | *color*
specifies the color of the layout background.

style-reference
specifies a style reference in the form *style-element:style-attribute*.

Only the style attribute named COLOR or CONTRASTCOLOR is used.

color
specifies a color by name.

See color on page xii

Default The GraphBackground:Color style reference.

Interaction OPAQUE=TRUE must be in effect in order for the color to be seen. By default, OPAQUE=FALSE.

BORDER=TRUE | FALSE
specifies whether a border is drawn around the layout.

Default FALSE

Interaction If this option is set to FALSE, then the BORDERATTRS= option is ignored.

See "boolean " on page xii for other Boolean values that you can use.

BORDERATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the attributes of the border line around the layout.

Default The GraphBorderLines style element.

Interaction BORDER= TRUE must be set for this option to have any effect.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

HEADERBORDER=TRUE | FALSE
specifies whether a border is drawn around the header cells.

Note: This feature applies to SAS 9.4M3 and to later releases.

Default TRUE

Tips The border attributes are controlled by the GraphBorderLines style element.

HEADERBORDER=FALSE does not remove the border around empty cells. If your panel has empty cells and you want to remove the cell borders, you can specify SKIPEMPTYCELLS=TRUE with HEADERBORDER=FALSE to remove the empty cells and the cell borders.

See "boolean " for other Boolean values that you can use.

CELLHEIGHTMIN=*dimension*
specifies the minimum height of a cell in the grid. Use this option in conjunction with the CELLWIDTHMIN= option to set the minimum cell size.

The overall size of the panel is constrained by the HEIGHT= and WIDTH= options in the ODS GRAPHICS statement. As the number of cells in the grid increases, the size of each cell decreases. At some point the cell becomes so small that a meaningful graph cannot be rendered. This option sets the minimum height threshold for all cells. If the actual cell height becomes smaller, then no panel is drawn.

Default 100px

See "dimension" on page xiii

CELLWIDTHMIN=*dimension*
specifies the minimum width of a cell in the grid. Use this option in conjunction with the CELLHEIGHTMIN= option to set the minimum cell size.

The overall size of the panel is constrained by the HEIGHT= and WIDTH= options in the ODS GRAPHICS statement. As the number of cells in the grid increases, the size of each cell decreases. At some point the cell becomes so small that a meaningful graph cannot be rendered. This option sets the minimum width threshold for all cells. If the actual cell width becomes smaller, then no panel is drawn.

Default 100px

See "dimension" on page xiii

COLUMNAXISOPTS=(*axis-options*)
specifies X-axis options for all columns.

Restriction Axis options must be enclosed in parentheses and separated by spaces.

See "Axis Options for LAYOUT DATALATTICE and LAYOUT DATAPANEL" for a list of options..

COLUMN2AXISOPTS=(*axis-options*)
specifies X2-axis options for all columns.

Restriction This option is needed only if you use a plot statement that supports a secondary X2 axis. If you do not use that statement's XAXIS= option to map data to the X2 axis, then this option is ignored. For more information about how data are mapped to the

axes, see "Plot Data Are Mapped to a Designated Axis" on page 1040

Requirement Axis options must be enclosed in parentheses and separated by spaces.

See "Axis Options for LAYOUT DATALATTICE and LAYOUT DATAPANEL" for a list of options.

COLUMNDATARANGE=AUTO | UNIONALL | UNION
specifies how the X-axes of instances of the *graph-prototype* are scaled.

AUTO
selects the X-axis scale based on the COLUMNWEIGHT= option.

The X-axis scale is determined, as follows:

- When COLUMNWEIGHT=EQUAL (default), UNIONALL is selected.
- When COLUMNWEIGHT=PROPORTIONAL and the column axis is discrete, UNION is selected. Otherwise, UNIONALL is selected.

UNIONALL
scales the X-axis data ranges across all layout columns and panels (when PANELNUMBER= is in effect).

UNION
scales the X-axis data ranges separately for each column on a per-panel basis.

The scaling does not span multiple panels.

Default AUTO

Tip Use the COLUMNAXISOPTS= option to control shared axis features.

See The COLUMNWEIGHT= option.

The PANELNUMBER= option for information about how to create multiple panels.

COLUMN2DATARANGE=AUTO | UNIONALL | UNION
specifies how the X2-axes of instances of the *graph-prototype* are scaled.

AUTO
automatically selects the X2-axis scale based on the COLUMNWEIGHT= option and the column axis type.

The X2-axis scale is selected as follows:

- When COLUMNWEIGHT=EQUAL (default), UNIONALL is selected.
- When COLUMNWEIGHT=PROPORTIONAL and the column axis is discrete, UNION is selected. Otherwise, UNIONALL is selected.

UNIONALL
scales the X2-axis data ranges across all layout columns and panels (when PANELNUMBER= is in effect).

UNION
scales the X2-axis data ranges separately for each column on a per-panel basis.

The scaling does not span multiple panels.

Default AUTO

Interaction This option is needed only if you use a plot statement that supports a secondary X2 axis. If you do not use that statement's XAXIS= option to map data to the X2 axis, then this option is ignored. For more information about how data are mapped to the axes, see "Plot Data Are Mapped to a Designated Axis" on page 1040

Tip Use the COLUMN2AXISOPTS= option to control shared axis features.

See The COLUMNWEIGHT= option.

The PANELNUMBER= option for information about how to create multiple panels.

COLUMNGUTTER=*dimension*
specifies the amount of empty space that is between the columns.

Default 0

Note If there are *n* columns, then there are *n*-1 gutters.

See "dimension" on page xiii

COLUMNS=*integer*
specifies the number of columns in the layout.

Defaults If this option is not specified and ROWS= is specified, then the number of data cells (and columns) increases dynamically to allow all classifier values to be presented.

If both this option and ROWS= are specified, then a grid of that size is created, regardless of the number of classifier values. If the number of classifier values is greater than the grid size, then no graphs are created for some classifier values. If the number of classifier values is small and the grid size large, then there might be empty cells created.

Interactions The overall grid size is constrained by the HEIGHT= and WIDTH= options in the ODS GRAPHICS statement. As the grid size grows, the cell size shrinks. To control the minimum size of a cell use the CELLHEIGHTMIN= and CELLWIDTHMIN= options.

The START= and ORDER= options affect how the rows are populated.

The PANELNUMBER= option enables you to create multiple smaller grids that completely partition the classifier values.

COLUMNWEIGHT=EQUAL | PROPORTIONAL
specifies how weights are assigned to the columns widths.

EQUAL
all columns have equal width.

PROPORTIONAL
each column has a width that is proportional to the number of discrete midpoint values that it contains.

Restriction At least one column axis must be discrete in order for PROPORTIONAL to have any effect. Otherwise, EQUAL is used.

Interactions When COLUMNDATARANGE=UNIONALL, PROPORTIONAL is ignored and EQUAL is used.

When PROPORTIONAL is in effect, COLUMNDATARANGE=AUTO is interpreted as UNION.

If all of the following conditions are true, then the discrete axis is used to proportion the columns: PROPORTIONAL is in effect, both the X and X2 axes are used, and only one of the two axes is discrete. If both axes are discrete, then the X axis is used to proportion the columns.

When PROPORTIONAL is in effect, the OFFSETMIN= and OFFSETMAX= axis options are ignored in COLUMNAXISOPTS= and COLUMN2AXISOPTS=. The axis offsets are always set to one-half of the midpoint spacing regardless of plot type.

Default EQUAL

HEADERBACKGROUNDCOLOR=*style-reference* | *color*
specifies the background color of the cell headers.

style-reference
specifies a style reference in the form *style-element:style-attribute*.

Only the style attribute named COLOR or CONTRASTCOLOR is used.

Default The GraphHeaderBackground:Color style reference.

Interaction HEADEROPAQUE= TRUE must be in effect in order for the color to be seen.

HEADERLABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font attributes of the data labels.

Default The GraphValueText style element.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Text Options" on page 1606 for available *text-options*.

HEADERLABELDISPLAY=NAMEVALUE | VALUE | NONE
specifies the content of the cell headers.

NAMEVALUE
displays the classification variable name and value as a *name=value* pair in each cell header.

Example If the classification variables are Country and Product, then HEADERLABEL=NAMEVALUE produces cell headers such as the following:

```
Country=CANADA
Product=TABLE
```

VALUE
displays the classification variable value only in each cell header.

Example If the classification variables are Country and Product, then HEADERLABEL=VALUE produces cell headers such as the following:

```
CANADA
TABLE
```

NONE
suppresses the cell headers.

Default NAMEVALUE

HEADEROPAQUE=TRUE | FALSE
specifies whether the background for cell headers is opaque (TRUE) or transparent (FALSE).

Default TRUE

Interaction When this option is set to FALSE, the background color for cell headers is not used.

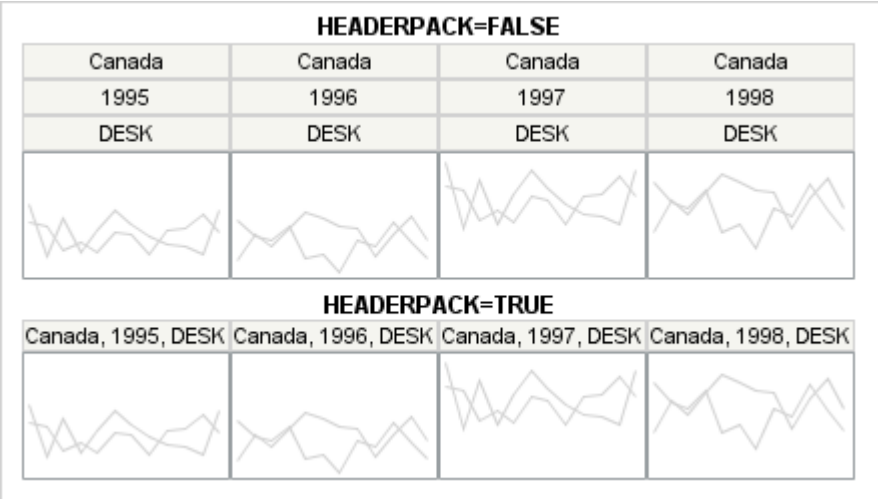
See "boolean " on page xii for other Boolean values that you can use.

HEADERPACK=TRUE | FALSE
specifies whether the header cells are consolidated into a comma-separated list in order to save space.

Note: This option is valid starting in SAS 9.4M1.

The following figure shows the effect of HEADERPACK= on the cell headers in one row of a data lattice. The data lattice contains classification variables Country and Year.

The following figure shows the effect of HEADERPACK= on the cell headers in one row of a data lattice. The data lattice contains classification variables Country, Year, and Product.



Default FALSE

Note If the length of the cell header text exceeds the available width, then the text is truncated.

Tip If truncation occurs, then use the HEADERSPLITCOUNT= option to split the cell header text into multiple lines.

See “boolean ” on page xii for other Boolean values that you can use.

HEADERSEPARATOR="*string*"
specifies one or more characters to place between each value in the cell header when HEADERPACK=TRUE.

Note: This option is valid starting in SAS 9.4M1.

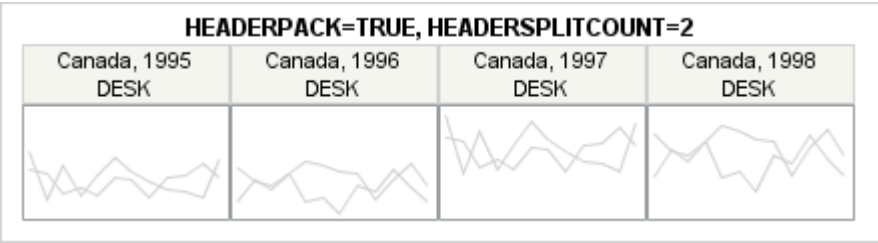
Default A comma followed by a space

Interaction This option is ignored when HEADERPACK=FALSE.

HEADERSPLITCOUNT=*positive-integer*
specifies the number of headers to consolidate on a header line before splitting the text to the next line.

Note: This option is valid starting in SAS 9.4M1.

The following figure shows how HEADERSPLITCOUNT=2 splits the cell header value in a data panel of classification variables Country, Year, and Product.



Default The cell header text is not split

Interaction This option is ignored when HEADERPACK=FALSE.

Note If the length of the cell header text exceeds the available width, then the text is truncated.

Tip Use the HEADERSEPARATOR= option to specify a different separator.

INCLUDEMISSINGCLASS=TRUE | FALSE
specifies whether to include grid cells for crossings of the CLASSVARS variables that contain a missing value.

TRUE
any crossing of the class variables that includes a missing value produces a row or column of cells in the grid.

FALSE
any crossing of the class variables that includes a missing value does not produce a row or columns of cells in the grid.

By default, missing class values are included in the classification. When the data contains missing classification values, cells are created for the missing classes. The classification headers for the missing values are blank for missing string values or a dot for missing numeric values. You can use the INCLUDEMISSINGCLASS=FALSE option to exclude the missing values. If you want to keep the missing values, then you can create a format that specifies more meaningful headings for the missing classes. For an example, see "Missing Class Values" in *SAS Graph Template Language: User's Guide*.

Note: ODS Graphics does not support Unicode values in user-defined formats in SAS 9.4M2 and in earlier releases. Starting with SAS 9.4M3, ODS Graphics supports Unicode values in user-defined formats only if they are preceded by the (*ESC*) escape sequence. Example: `"(*ESC*){unicode beta}"`. ODS Graphics does not support an escape character that is defined in an ODS ESCAPECHAR statement in user-defined formats.

Default TRUE

See "boolean " on page xii for other Boolean values that you can use.

INSET=(*variable-list*)
specifies what information is displayed in an inset. The *variable-list* defines one or more variables whose names and values appear as a small table in the data cells. The variables can be either numeric or character. Variable names are separated by spaces.

Requirement No predefined information is available for the inset. You must create the desired inset information as part of your input data. See "Creating Your Inset Data" on page 76.

Note The variable values are associated with the data cells by data order. That is, the first observation from all the variables in

variable-list are used in the first data cell, the second observation from all variables in *variable-list* are used in the second data cell, and so on. If a value is missing for an observation, then the corresponding *name-value* pair is skipped in the affected data cell.

Tip The location and appearance of the inset is controlled by the INSETOPTS= option.

See "Adding Insets to Your Graph" in *SAS Graph Template Language: User's Guide*

INSETOPTS=(*appearance-options*)
specifies location and appearance options for the inset information. The appearance options can be any one or more of the following values:

AUTOALIGN=NONE | AUTO | (*location-list*)
specifies whether the inset is automatically aligned within the layout.

NONE
does not automatically align the inset.

This inset's position is set by the HALIGN= and VALIGN=*appearance-options*.

AUTO
attempts to center the inset in the area that is farthest from any surrounding markers.

Data cells might have different inset placements.

(*location-list*)
restricts the inset's possible locations to those locations in the specified *location-list*, and uses the *location-list* position that least collides with the data cell's other graphics features.

The *location-list* is a space-separated list that can contain any of these locations: TOPLEFT, TOP, TOPRIGHT, LEFT, CENTER, RIGHT, BOTTOMLEFT, BOTTOM, and BOTTOMRIGHT.

Example `AUTOALIGN=(TOPRIGHT TOPLEFT)`

Default NONE

Interaction When AUTOALIGN=AUTO or (*location-list*), the HALIGN= and VALIGN= options are ignored.

BACKGROUNDCOLOR=*style-reference* | *color*
specifies the color of the inset background.

style-reference
specifies a style reference in the form *style-element : style-attribute*.

Only the COLOR and CONTRASTCOLOR style attributes are valid.

Default The background is transparent. No color is assigned.

BORDER=TRUE | FALSE
specifies whether a border is displayed around the inset.

Default FALSE

See "boolean " on page xii for other Boolean values that you can use.

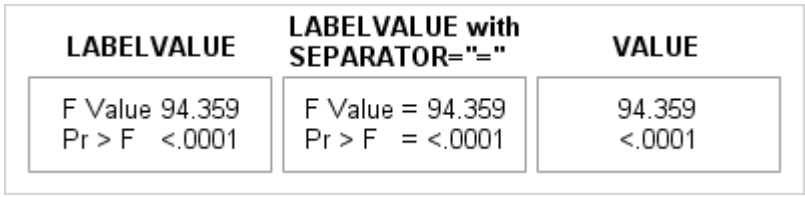
CONTENTDISPLAY=LABELVALUE | VALUE
specifies whether the variable information that is displayed in the inset includes the column label and value, or only the column value.

Note: This feature applies to SAS 9.4M2 and to later releases.

If a label is not assigned to a column, then the column name is used as the label for that column. Consider the following inset data:

Obs	_TYPE_	F Value	Pr > F
1	SS1	94.359	<.0001

The following figure shows the effect that the CONTENTDISPLAY= option has on the content of an inset that displays this data.



Default LABELVALUE

Tip Use the SEPARATOR= option to specify a separator other than the default blank space.

DATASCHEME=LIST | MATCHED
specifies the scheme that was used to merge the inset information into the analysis data.

LIST
one-to-one merging (no BY statement) was used to merge the inset and analysis data.

The variable values are associated with the cells of the data lattice by using data order. That is, the inset variable values in the first observation are used in the inset for the first cell, the inset variable values in the second observation are used in the inset for the second cell, and so on.

MATCHED
match-merging (using a BY statement) was used to merge the inset and analysis data.

Defaults LIST if the data is a SAS data set

MATCHED if the data is a CAS in-memory table

Tip MATCHED is the preferred data scheme for merging the inset and analysis data.

See "Adding Insets to Classification Panels" in *SAS Graph Template Language: User's Guide*

HALIGN=LEFT | CENTER | RIGHT
specifies the horizontal alignment of the inset.

Default LEFT

Interaction This option has an effect only when this layout is nested within a REGION layout or when this layout is nested in an overlay-type layout and AUTOALIGN=NONE.

OPAQUE=TRUE | FALSE
specifies whether the inset background is opaque (TRUE) or transparent (FALSE).

Default FALSE

Interaction When OPAQUE=FALSE, the background color is not used.

See "boolean " on page xii for other Boolean values that you can use.

SEPARATOR="*string*"
specifies a new separator for the column label and value.

Note: This feature applies to SAS 9.4M2 and to later releases.

Default A blank space

Interaction This option is ignored when CONTENTDISPLAY=VALUE.

TEXTATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the text properties of the entire inset, excluding the title.

Default The GraphDataText style element.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Text Options" on page 1606 for available *text-options*.

TITLE="*string*"
specifies a title for the inset.

The title is added at the top of the inset and spans the full inset width.

Note Space is not reserved for the title when this value is not specified.

Tip Text properties for the title string can be specified with TITLEATTRS=.

TITLEATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the text properties of the inset's title string.

Default The GraphValueText style element.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Text Options" on page 1606 for available *text-options*.

VALIGN=TOP | CENTER | BOTTOM
specifies the vertical alignment of the inset.

Default TOP

Interaction This option has effect only when this layout is nested within a REGION layout or when this layout is nested in an overlay-type layout and AUTOALIGN=NONE.

Requirements The options must be enclosed in parentheses.

Each option must be specified as a *name = value* pair, and each pair must be separated by a space.

OPAQUE=TRUE | FALSE
specifies whether the layout background is opaque (TRUE) or transparent (FALSE).

Default FALSE

Interaction When this option is set to FALSE, the background color is not used.

See "boolean " on page xii for other Boolean values that you can use.

ORDER=ROWMAJOR | COLUMNMAJOR
specifies whether data cells are populated by column priority or by row priority.

ROWMAJOR
fills the data cells by rows, from the starting position.

COLUMNMAJOR
fills the data cells by columns, from the starting position.

Default ROWMAJOR

Interaction The starting point for rendering data cells is controlled by the START= option. See the START= option for examples.

OUTERPAD=AUTO | *dimension* | (*pad-options*)
specifies the amount of extra space to add outside the layout border.

AUTO
specifies that the default outside padding for this component is used.

dimension
specifies a dimension to use for the extra space at the left, right, top, and bottom of the layout border.

(*pad-options*)
a space-separated list of one or more name-value pair pad options, enclosed in parentheses.

The list can contain one or more of the following pad options:

LEFT=*dimension*
specifies the amount of extra space to add to the left side.

RIGHT=*dimension*
specifies the amount of extra space to add to the right side.

TOP=*dimension*
specifies the amount of extra space to add to the top.

BOTTOM=*dimension*
specifies the amount of extra space to add to the bottom.

Note Sides that are not assigned padding are padded with the default amount.

Tip Use *pad-options* to create non-uniform padding.

Default AUTO

Note The default units for *dimension* are pixels.

See "dimension" on page xiii

PAD=*dimension* | *(pad-options)*
specifies the amount of extra space that is added inside the layout border.

dimension
specifies a dimension to use for the extra space at the left, right, top, and bottom of the border.

(*pad-options*)
a space-separated list of one or more name-value-pair pad options enclosed in parentheses.

The list can include one or more of the following pad options:

LEFT=*dimension*
specifies the amount of extra space added to the left side.

Default 0

RIGHT=*dimension*
specifies the amount of extra space added to the right side.

Default 0

TOP=*dimension*
specifies the amount of extra space added to the top.

Default 0

BOTTOM=*dimension*
specifies the amount of extra space added to the bottom.

Default 0

Note Sides that are not assigned padding are padded with the default amount.

Tip Use *pad-options* to create non-uniform padding.

Note The default units for *dimension* are pixels.

See "dimension" on page xiii

PANELNUMBER=*positive-integer*
specifies the number of the panel to produce. This option enables you to partition a large grid into a number of smaller sized grids under these conditions:

- You set a grid size explicitly (ROWS= and COLUMNS= options).
- The grid size (`gridrows x gridcolumns`) is smaller than the total number of classifier levels.
- You execute the template N times and increment the panel number each time. N is determined by CEIL(`total-classification-levels / gridrows x gridcolumns`).

Default 1

Example Suppose there are two classifiers (CLASS1 has 10 unique values and CLASS2 has 11 unique values). By setting some smaller grid size, say ROWS=3 and COLUMNS=4, and making the value of PANELNUMBER= a dynamic or macro variable, you can create 10 panels (9 panels with 12 data cells and 1 panel with 2 data cells) that collectively display all 110 possible crossings. You simply invoke PROC SGRENDER or a DATA step 10 times, incrementing the dynamic value for PANELNUMBER each time.

ROLENAME=(*role-name-list*)
specifies user-defined roles for information contained in data columns. The role name list is a space-separated list *role-name=column* pairs.

Default no user-defined roles

Requirement The role names that you choose must be unique and different from the predefined roles.

Example The following example assigns the column Obs to the user-defined role TIP1.

```
ROLENAME=(TIP1=OBS)
```

ROWAXISOPTS=(*axis-options*)
specifies Y-axis options for all rows.

Requirement Axis options must be enclosed in parentheses and separated by spaces.

See "Axis Options for LAYOUT DATALATTICE and LAYOUT DATAPANEL" on page 1218 for a list of options..

ROW2AXISOPTS=(*axis-options*)
specifies Y2-axis options for all rows.

Requirement Axis options must be enclosed in parentheses and separated by spaces.

Interaction This option is needed only if you use a plot statement that supports a secondary Y2 axis. If you do not use that statement's YAXIS= option to map data to the Y2 axis, then this option is ignored. For more information about how data are mapped to the axes, see "Plot Data Are Mapped to a Designated Axis" on page 1040

See "Axis Options for LAYOUT DATALATTICE and LAYOUT DATAPANEL" on page 1218 for a list of options..

ROWDATARANGE=AUTO | UNIONALL | UNION
specifies how the Y-axes of instances of the *graph-prototype* are scaled.

AUTO
automatically selects the Y-axis scale based on the ROWWEIGHT= option and the column axis type.

The Y-axis scale is selected as follows:

- When ROWWEIGHT=EQUAL (default), UNIONALL is selected.
- When ROWWEIGHT=PROPORTIONAL and the row axis is discrete, UNION is selected. Otherwise, UNIONALL is selected.

UNIONALL
scales the Y-axis data ranges across all layout rows and panels (when PANELNUMBER= is in effect).

UNION
scales the Y-axis data ranges separately for each row in the layout on a per-panel basis.

The scaling does not span multiple panels.

Default AUTO

Tip Use the ROWAXISOPTS= option to control shared axis features.

See The ROWWEIGHT= option.

The PANELNUMBER= option for information about how to create multiple panels.

ROW2DATARANGE=AUTO | UNIONALL | UNION
specifies how the Y2-axes of instances of the *graph-prototype* are scaled.

AUTO
automatically selects the Y2-axis scale based on the ROWWEIGHT= option and the column axis type.

The Y2-axis scale is selected as follows:

- When ROWWEIGHT=EQUAL (default), UNIONALL is selected.
- When ROWWEIGHT=PROPORTIONAL and the row axis is discrete, UNION is selected. Otherwise, UNIONALL is selected.

UNIONALL
scales the Y2-axis data ranges across all layout rows and panels (when PANELNUMBER= is in effect).

UNION
scales the Y2-axis data ranges separately for each row in the layout on a per-panel basis.

The scaling does not span multiple panels.

Default AUTO

Interaction This option is needed only if you use a plot statement that supports a secondary Y2 axis. If you do not use that statement's YAXIS= option to map data to the Y2 axis, then this option is ignored. For more information about how data are mapped to the axes, see "Plot Data Are Mapped to a Designated Axis" on page 1040

Tip Use the ROW2AXISOPTS= option to control shared axis features.

See The ROWWEIGHT= option.

The PANELNUMBER= option for information about how to create multiple panels.

ROWGUTTER=*dimension*
specifies the amount of empty space between the rows.

Default 0

Note If there are *n* rows, then there are *n*-1 gutters.

See "dimension" on page xiii

ROWS=*integer*
specifies the number of rows in the layout.

Defaults If this option is not specified and COLUMNS= is specified, then the number of data cells (and rows) increases dynamically to allow all classifier values to be presented.

If both this option and COLUMNS= are specified, then a grid of that size is created, regardless of the number of classifier values. If the number of classifier values is greater than the grid size, then no graphs are created for some classifier values. If the number of

classifier values is small and the grid size large, then there might be empty cells created.

Interactions The overall grid size is constrained by the HEIGHT= and WIDTH= options in the ODS GRAPHICS statement. As the grid size grows, the cell size shrinks. To control the minimum size of a cell use the CELLHEIGHTMIN= and CELLWIDTHMIN= options.

The START= and ORDER= options affect how the rows are populated.

Tip The PANELNUMBER= option enables you to create multiple smaller grids that completely partition the classifier values.

ROWWEIGHT=EQUAL | PROPORTIONAL
specifies how weights are assigned to the row heights.

EQUAL
all rows have equal height.

PROPORTIONAL
each row has a height that is proportional to the number of discrete midpoint values that it contains.

Restriction At least one row axis must be discrete in order for PROPORTIONAL to have any effect. Otherwise, EQUAL is used.

Interactions When ROWDATARANGE=UNIONALL, PROPORTIONAL is ignored and EQUAL is used.

When PROPORTIONAL is in effect, ROWDATARANGE=AUTO is interpreted as UNION.

If all of the following conditions are true, then the discrete axis is used to proportion the rows: PROPORTIONAL is in effect, both the Y and Y2 axes are used, and only one of the two axes is discrete. When both axes are discrete, the Y axis is used to proportion the rows.

When PROPORTIONAL is in effect, the OFFSETMIN= and OFFSETMAX= axis options are ignored in ROWAXISOPTS= and ROW2AXISOPTS=. The axis offsets are always set to one-half of the midpoint spacing regardless of plot type.

Default EQUAL

SHRINKFONTS=TRUE | FALSE
specifies whether fonts in the layout are scaled down.

Default FALSE

Note If SHRINKFONTS=TRUE, the font scaling applies to all child layouts within the parent layout. If a child layout also specifies SHRINKFONTS=TRUE, the fonts for the children of that child layout are further scaled down.

See “boolean ” on page xii for other Boolean values that you can use.

SKIPEMPTYCELLS=TRUE | FALSE

specifies whether the external axes skip the empty cells in a partially filled grid.

TRUE

skips empty cells and "snaps" the external axes to the nearest data cell, both vertically and horizontally.

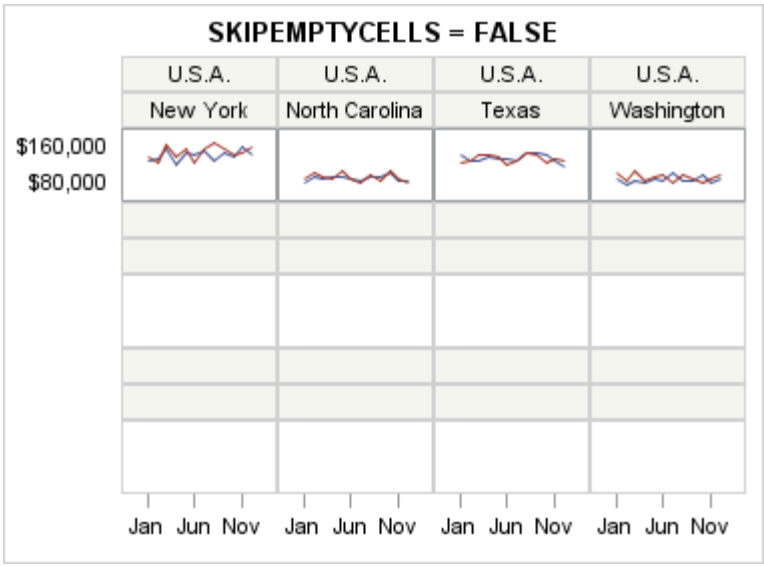
Though the empty cells are not displayed, the data cells in the grid are not enlarged to fill the area.

FALSE

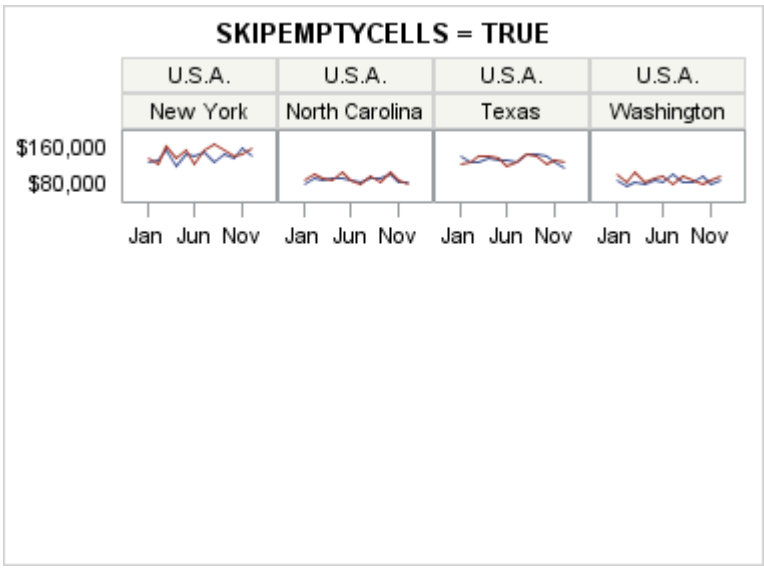
displays external axes at their normal locations, even if there are empty cells at one or more of the locations.

Whenever the total number of classifier crossings (data cells) is not evenly divisible by the panel size (columns * rows), the last panel is partially filled with data cells and padded with empty cells to complete the grid.

Here is an example of a data panel that consists of 16 data cells arranged in a 4-column, 3-row grid. The following figure shows the default appearance of the last panel:



When SKIPEMPTYCELLS=TRUE, the empty padding cells of the last panel are removed and external axis ticks and tick values snap to the data cells:



Note that SKIPEMPTYCELLS=TRUE removes only the empty padding cells on the last panel. It does not remove any data cells that have no crossing values and therefore no graph (these data cells are displayed when SPARSE=TRUE).

Default FALSE

See "boolean " on page xii for other Boolean values that you can use.

SORTORDER=(COLUMNVAR=*sort-order-keyword* | ROWVAR=*sort-order-keyword*)

specifies the order of the cells along the columns and rows.

COLUMNVAR

the column role.

ROWVAR

the row variable role.

sort-order-keyword

a sort-order keyword.

The keyword can be one of the following:

AUTO

sorts using DATA for character data and ascending unformatted for numeric data.

DATA

retains the data order.

Note In SAS 9.4M6 and SAS 9.4M5, when data stored in a CAS in-memory table is used and DATA is specified, unpredictable results might occur. To generate consistent graphs in that case, specify ASCENDINGFORMATTED or DESCENDINGFORMATTED. Starting with SAS Viya 3.5 and SAS Studio 5.2, when data stored in a CAS in-memory table is used and DATA is specified, DATA is ignored, and AUTO is used instead.

ASCENDINGFORMATTED
sorts in ascending order, using the formatted values.

DESCENDINGFORMATTED
sorts in descending order, using the formatted values.

Defaults AUTO for all roles if the data is a SAS data set

ASCENDINGFORMATTED for all roles if the data is a CAS in-memory table

Tip The placement of the cells within the layout also depends on the starting location, which is controlled by the START= option.

SPARSE=TRUE | FALSE
specifies whether crossings of the class variables include only the crossings in the data or all possible crossings.

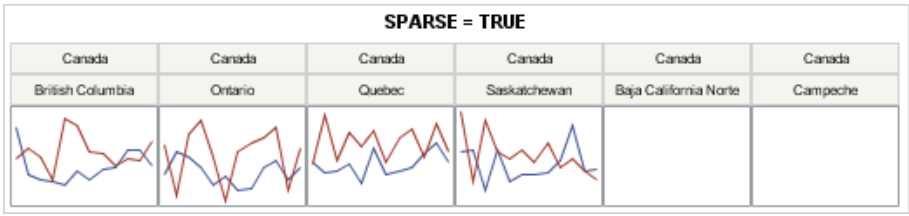
FALSE
specifies that data cells are created only for crossings of the class variables that are in the data.

TRUE
specifies that the number of data cells is the product of the unique values for each classification variable.

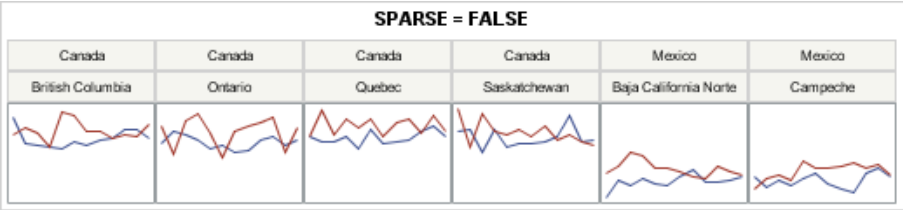
By default, if a crossing of the class variables has a missing value as part of the data, then a data cell is created for it.

Here is an example of a classification panel where the classification variables are COUNTRY and STATE. There are 3 distinct values of COUNTRY (Canada, Mexico, and U.S.A.) Within Canada and Mexico there are 4 states, and within U.S.A. there are 8 states. All state names are unique to each country. Therefore, there are 16 unique STATE values and 48 unique crossings of COUNTRY and STATE, but there are data for only 16 of the crossings.

Assume that a data panel layout is created with COLUMNS=6 and SPARSE=TRUE, meaning to display all possible crossings. This is what the first row would look like. Blank data cells are added whenever there are no data values for a crossing:



When SPARSE=FALSE the crossings of the classifiers with no data are automatically removed. This compacts the display:



Default FALSE

See "boolean " on page xii for other Boolean values that you can use.

START=TOPLEFT | BOTTOMLEFT

indicates whether to start populating the grid cells from the top left or bottom left corner. If ORDER=ROWMAJOR (the default) and START=TOPLEFT (the default), then a 2 row 2 column grid is populated as shown in the following figure.

Cell 1 Header	Cell 2 Header
Cell 1	Cell 2
Cell 3 Header	Cell 4 Header
Cell 3	Cell 4

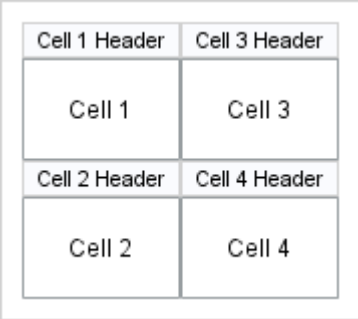
If ORDER=ROWMAJOR (the default) and START=BOTTOMLEFT, then a 2 row 2 column grid is populated as shown in the following figure.

Cell 3 Header	Cell 4 Header
Cell 3	Cell 4
Cell 1 Header	Cell 2 Header
Cell 1	Cell 2

If ORDER=COLUMNMAJOR and START=BOTTOMLEFT, then a 2 row 2 column grid is populated as shown in the following figure.

Cell 2 Header	Cell 4 Header
Cell 2	Cell 4
Cell 1 Header	Cell 3 Header
Cell 1	Cell 3

If ORDER=COLUMNMAJOR and START=TOPLEFT, then a 2 row 2 column grid is populated as shown in the following figure.



Default TOPLEFT

SIDEBAR Optional Argument

ALIGN=BOTTOM | TOP | LEFT | RIGHT
specifies the sidebar's location within the layout. You can specify up to four SIDEBAR blocks in a LAYOUT DATAPANEL, one for each of the bottom, top, left, and right sidebar positions.

- The LAYOUT DATAPANEL automatically aligns a sidebar with the layout columns or rows.
- Only one statement (such as ENTRY or DISCRETELEGEND) or one layout block (such as LAYOUT GRIDDED) is allowed in a SIDEBAR block. To create multi-line text in a sidebar, nest ENTRY statements within a LAYOUT GRIDDED block.

Default BOTTOM

SPACEFILL=TRUE | FALSE
specifies whether to fill all the area of the sidebar with its contents.

Default TRUE

Tip To prevent a layout block within the sidebar from expanding to the sidebar boundaries, set this option to FALSE.

See "boolean " on page xii for other Boolean values that you can use.

Details

Statement Description

The LAYOUT DATAPANEL statement creates a grid of graphs, based on the values of one or more classifications variables. The main differences between this layout and the DATALATTICE layout are that this layout supports more than two classification variables, and it provides more control over the grid layout.

By default, the number of cells in the layout is determined by a crosstabulation table of all the classification variables plus any empty cells needed to complete the last row or column of the grid. The contents of each data cell are based on a graph prototype that you specify in the *graph-prototype-block*. You can enhance the display using one or more *sidebar-statement-blocks*. For classification variables that have many values, you can use the COLUMNS= option or the ROWS= option, or both with the PANELNUMBER= option to generate multiple panel displays.

The order of the value pairings for the classification variables is determined by the order that the variables are specified on the CLASSVARS= argument. The last named variable's values vary most rapidly (like nested DO loops). Variable values are always returned in data order.

By default, the first data cell to be filled is in the layout's top left corner, and data cells are filled from left-to-right, top-to-bottom. Use the START= option to change the starting data cell to the bottom left corner, and use the ORDER= option to determine whether data cells fill by column or by row. See the START= option for illustrations on how START= and ORDER= interact to manage the fill sequence for data cells.

Note: The DATAPANEL layout is designed to be the outermost layout in the template.

Prototype Block

You must specify a single *graph-prototype-block* within the LAYOUT DATAPANEL block, using the following syntax:

LAYOUT PROTOTYPE </*options*>;

GTL-statements;

ENDLAYOUT;

The *graph-prototype-block* determines the graphical content of each data cell and is repeated within each data cell, based on the subsets of the classification variables.

For more information about the LAYOUT PROTOTYPE block and the list of available options, see "LAYOUT PROTOTYPE Statement" on page 186.

Sidebar Blocks

A LAYOUT DATAPANEL enables you to display *sidebars* outside of the axis areas. A sidebar spans across columns or rows and is useful for displaying information that applies to all of the columns or all of the rows. For example, sidebars are useful for displaying a legend.

A SIDEBAR statement has the following syntax:

SIDEBAR </ *options* >;

GTL-statement(s);

ENDSIDEBAR;

The following example shows a SIDEBAR block that displays a legend at the top of the layout grid.

```
sidebar / align=top;
  discretelegend 'p' 'a' / across=2;
endsidebar;
```

Creating Your Inset Data

When you use the INSET= option to insert an inset, no predefined information is available for the inset. You must create the desired inset information as part of your input data. This is most typically done as follows (see the chapter on classification panels and the chapter on insets in *SAS Graph Template Language: User's Guide* for complete examples):

- Create a separate data set for the inset columns making sure that the column names are different from the other columns used in graph. The number observations of inset data should match the number of cells in the classification panel. The ordering of the inset observations should be the same as population order of the cells of the classification panel, taking into account the CLASSVARS= argument and the ORDER= and START= options. Typically, the number of observations for the inset data is smaller than the other input data for the graph.
- Merge the inset data set with the data set for the graph using a DATA or PROC SQL step. Do not match-merge the observations of the two data sets (no BY processing). The resulting data set typically has the inset columns padded with missing values.
- Use the merged data set to produce the graph, specifying the inset column names in this option's *variable-list*.

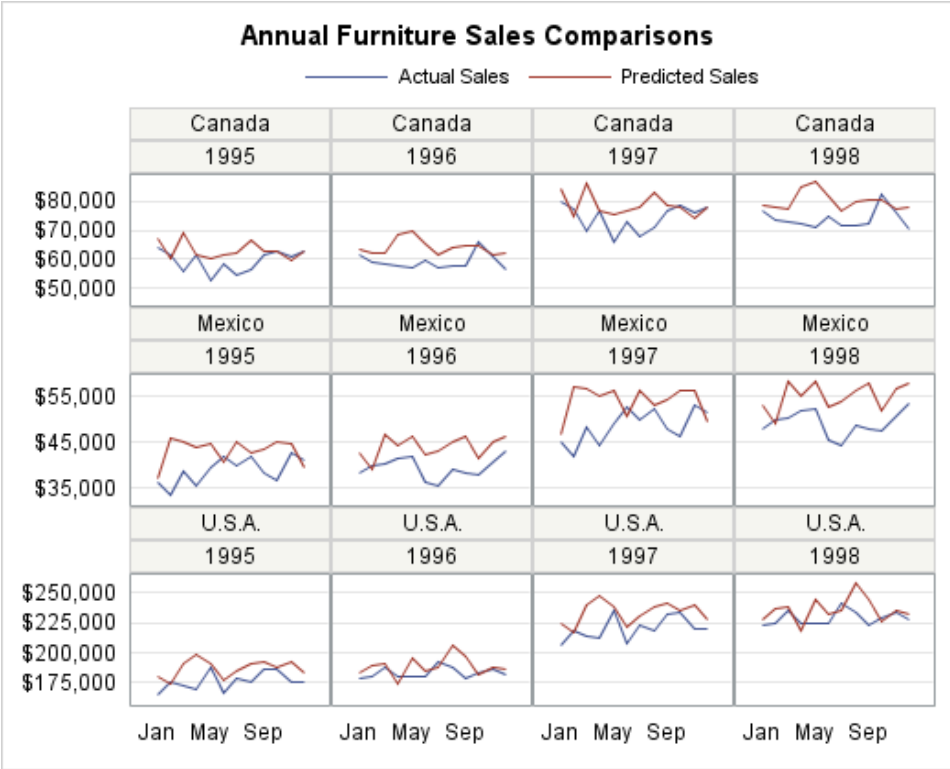
Example: LAYOUTDATAPANEL Statement

This example shows a four-column, three-row data panel using two classification variables. With this layout, each data cell is subsetted and labeled with the values of the classification variables.

- The ROWDATARANGE=UNION option assures that an axis range is computed separately for each row using the data ranges of all Y= columns in that row. This facilitates the visual comparison of the data cells.
- A SIDEBAR block is used to place the legend at the bottom of the lattice.

Example Graph

The following graph was generated by the "Example Program" on page 107:



Example Program

```
proc template;
 define statgraph layoutdatapanel;
  begingraph;
    entrytitle "Annual Furniture Sales Comparisons";
    layout datapanel classvars=(country year) /
      columns=4 rows=3 rowdatarange=union
      headerlabeldisplay=value
      headerbackgroundcolor=GraphAltBlock:color
      rowaxisopts=(display=(tickvalues) griddisplay=on
        linearopts=(tickvalueformat=dollar12.))
      columnaxisopts=(display=(tickvalues)
        timeopts=(tickvalueformat=monname3.));
      layout prototype / cycleattrs=true;
        seriesplot x=month y=TotalActual / name="Actual";
        seriesplot x=month y=TotalPredict / name="Predict";
      endlayout;
      sidebar / align=top;
        discretelegend "Actual" "Predict" / border=false;
      endsidebar;
    endlayout;
  endgraph;
 end;
run;

proc summary data=sashelp.prdsal2 nway;
  class country year month;
```

```
  var actual predict;
  output out=prdsal2 sum=TotalActual TotalPredict;
run;

proc sgrender data=prdsal2 template=layoutdatapanel;
run;
```

LAYOUT GLOBALLEGEND Statement

Creates a compound legend containing multiple discrete legends positioned at the bottom of a graph.

Restrictions: Only one global legend is allowed in a graph.

Continuous legends are not supported inside the global legend.

Requirements: You must place the GLOBALLEGEND block directly inside the BEGINGRAPH block. Do not embed it in any other GTL statement block.

When the LAYOUT GLOBALLEGEND block is used, all of the template's legend statements must be specified within the LAYOUT GLOBALLEGEND block. Any legend statements that are specified outside of the LAYOUT GLOBALLEGEND block are ignored.

See: "DISCRETELEGEND, MERGEDLEGEND Statements" on page 1303

Syntax

LAYOUT GLOBALLEGEND </*options*>;

<*discreteLegend-statement(s)* | *mergedLegend-statement(s)*>;
ENDLAYOUT;

Summary of Optional Arguments

Appearance options

BORDER=TRUE | FALSE
: specifies whether a border is drawn around the layout.

BORDERATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
: specifies the attributes of the border line around the layout.

DISPLAYCLIPPED=TRUE | FALSE
: specifies whether the global legend is displayed when any portion of its nested legends cannot be fully rendered because of space constraints.

GUTTER=*dimension*
: specifies the gap between nested layouts.

OUTERPAD=AUTO | *dimension* | (*pad-options*)
: specifies the amount of extra space to add outside the layout border.

PAD=*dimension* | *(pad-options)*

specifies the amount of extra space that is added inside the layout border.

TYPE=ROW | COLUMN
specifies whether nested legends are arranged into a single row or column.

WEIGHTS=UNIFORM | PREFERRED | (*weight-list*)
specifies the preferred space allocation for the nested legends.

Legend title options

LEGENDTITLEPOSITION=LEFT | TOP
specifies the position of each nested legend's title.

TITLE="*string*"
specifies a title for the global legend.

TITLEATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font attributes of the global legend title.

Location options

HALIGN=CENTER | LEFT | RIGHT
specifies the layout's horizontal alignment within the graph area that is defined by the BEGINGRAPH block.

Optional Arguments

BORDER=TRUE | FALSE
specifies whether a border is drawn around the layout.

Default FALSE

Interaction If this option is set to FALSE, then the BORDERATTRS= option is ignored.

See "boolean " on page xii for other Boolean values that you can use.

BORDERATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the attributes of the border line around the layout.

Default The GraphBorderLines style element.

Interaction BORDER= TRUE must be set for this option to have any effect.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

DISPLAYCLIPPED=TRUE | FALSE
specifies whether the global legend is displayed when any portion of its nested legends cannot be fully rendered because of space constraints. When the graph size is reduced, parts of a nested legend (title, legend symbol, or legend value) might be clipped (truncated). When clipping occurs and this option is FALSE, the entire global legend is removed from the graph and the space for it is reclaimed by the remainder of the graph. When this option is TRUE, the global

legend always appears, even if some parts of the nested legends have been clipped.

Default FALSE

Interaction This option overrides any DISPLAYCLIPPED option that is set on its nested legend statements.

See "boolean " on page xii for other Boolean values that you can use.

GUTTER=*dimension*
specifies the gap between nested layouts.

Default 0

Note The default units for *dimension* are pixels.

See "dimension" on page xiii

HALIGN=CENTER | LEFT | RIGHT
specifies the layout's horizontal alignment within the graph area that is defined by the BEGINGRAPH block.

Default CENTER

Note When CENTER is in effect and the outermost layout is an overlay-type layout, the global legend is centered below the wall area if it can fit within the wall width.

LEGENDTITLEPOSITION=LEFT | TOP
specifies the position of each nested legend's title. Specifying LEFT places each title to the left of the legend items for that legend. Specifying TOP places each title above the legend items for that legend.

Default LEFT

OUTERPAD=AUTO | *dimension* | (*pad-options*)
specifies the amount of extra space to add outside the layout border.

AUTO
specifies that the default outside padding for this component is used.

dimension
specifies a dimension to use for the extra space at the left, right, top, and bottom of the layout border.

(*pad-options*)
a space-separated list of one or more name-value pair pad options, enclosed in parentheses.

The list can contain one or more of the following pad options:

LEFT=*dimension*
specifies the amount of extra space to add to the left side.

RIGHT=*dimension*
specifies the amount of extra space to add to the right side.

TOP=*dimension*
specifies the amount of extra space to add to the top.

BOTTOM=*dimension*
specifies the amount of extra space to add to the bottom.

Note Sides that are not assigned padding are padded with the default amount.

Tip Use *pad-options* to create non-uniform padding.

Default AUTO

Notes The default units for *dimension* are pixels.

Starting with SAS 9.4M1, the default padding between the global legend and the plot area (including the axes) is increased to 10 pixels. If the new default padding is not desirable, then use this option to adjust it.

See “dimension” on page xiii

PAD=*dimension* | *(pad-options)*
specifies the amount of extra space that is added inside the layout border.

dimension
specifies a dimension to use for the extra space at the left, right, top, and bottom of the border.

(*pad-options*)
a space-separated list of one or more name-value-pair pad options enclosed in parentheses.

The list can include one or more of the following pad options:

LEFT=*dimension*
specifies the amount of extra space added to the left side.

Default 0

RIGHT=*dimension*
specifies the amount of extra space added to the right side.

Default 0

TOP=*dimension*
specifies the amount of extra space added to the top.

Default 0

BOTTOM=*dimension*
specifies the amount of extra space added to the bottom.

Default 0

Note Sides that are not assigned padding are padded with the default amount.

Tip Use *pad-options* to create non-uniform padding.

Note The default units for *dimension* are pixels.

See "dimension" on page xiii

TITLE="*string*"
specifies a title for the global legend.

Default No title is displayed for the global legend.

Restriction The string must be enclosed in quotation marks.

Tip The title for the global legend is independent of the titles for its nested legends.

TITLEATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font attributes of the global legend title.

Default The GraphLabelText style element.

Interaction For this option to have any effect, the TITLE= option must also be specified.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Text Options" on page 1606 for available *text-options*.

TYPE=ROW | COLUMN
specifies whether nested legends are arranged into a single row or column.

Default ROW

Interaction When this option is set to ROW, the relative width of each legend is determined by the setting for the WEIGHTS= option.

WEIGHTS=UNIFORM | PREFERRED | (*weight-list*)
specifies the preferred space allocation for the nested legends.

UNIFORM
allocates an equal amount of space for all nested legends.

PREFERRED
allocates the preferred amount of space for each nested legend.

(*weight-list*)
a space-separated list of preferred space allocations, enclosed in parentheses. The list can combine numbers with the keyword PREFERRED. Each number is a proportional weight for the corresponding nested legend (the weights do not have to sum to 1.0). Keyword PREFERRED specifies that the preferred space should be allocated to the corresponding nested legend. The order of the weights that are specified in the list should correspond to

the order of the legend statements that are nested in the GLOBALLEGEND layout.

Default UNIFORM

Restriction The option is supported only for TYPE=ROW.

Tip When a *weight-list* is specified, all the legends using PREFERRED get their preferred space. Any remaining space is divided among the legends, in proportion to the numeric values specified in the *weight-list*.

Details

A global legend layout can contain multiple discrete or merged legends. Continuous legends are not supported inside the global legend block.

A global legend is placed at the bottom of the graph, just above the footnote(s). All of the discrete or merged legend statements that are nested within the global legend block are arranged into a single row or column, depending on the setting for the TYPE= option.

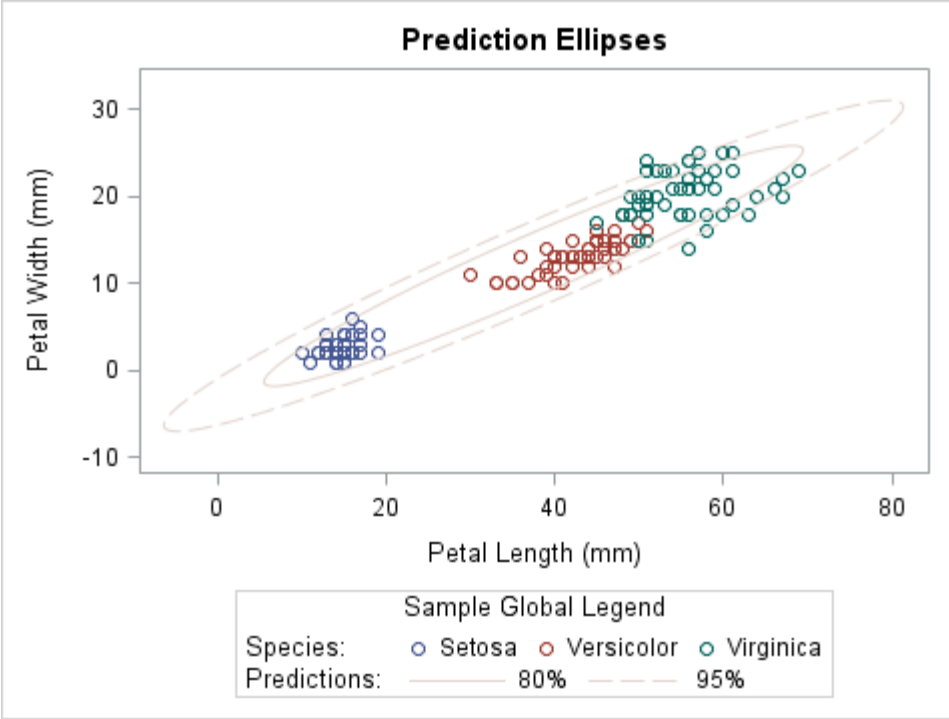
Depending on the outermost layout type and the legend content, the legend is centered on the graph wall area or on the graph output area. For example, if the outermost layout is an OVERLAY layout, then when positioning the legend, the GLOBALLEGEND statement first attempts to center the legend on the graph wall area. If that position causes the legend to be clipped, then it attempts to center the legend on the entire output area instead. In that case, the legend might appear to be slightly off-center with respect to the graph.

Only one global legend block is permitted in a graph. The block must be located within the BEGINGRAPH block, but outside of the outermost layout block.

When a global legend block is used, only the legend statements that are specified within the global legend block are displayed in the graph. Any legend statements that are specified outside of the global legend block are ignored.

Example: LAYOUT GLOBALLEGEND Statement

The following graph was generated by the “Example Program” on page 114:



Example Program

```
proc template;
  define statgraph globallegend;
    begingraph;
      entrytitle "Prediction Ellipses";
      layout overlay;
        scatterplot x=petallength y=petalwidth / group=species
name="sp";
        ellipse x=petallength y=petalwidth / type=predicted alpha=0.2
          name="p80" legendlabel="80%" outlineattrs=graphconfidence;
        ellipse x=petallength y=petalwidth / type=predicted alpha=0.05
          name="p95" legendlabel="95%" outlineattrs=graphconfidence2;
      endlayout;
      layout globalLegend / type=column title="Sample Global Legend";
        discretelegend "sp" / title="Species:";
        discretelegend "p80" "p95" / title="Predictions:";
      endLayout;
    endgraph;
  end;
run;

proc sgrender data=sashelp.iris template=globallegend;
run;
```

LAYOUT GRIDDED Statement

Assembles the results of nested *GTL-statements* into a grid.

Note: Empty cells might be omitted from the grid. See "Details" on page 122.

Syntax

LAYOUT GRIDDED </*options*>;
GTL-statements;
ENDLAYOUT;

Summary of Optional Arguments

Appearance options

BACKGROUNDCOLOR=*style-reference* | *color*
specifies the color of the layout background.

BORDER=TRUE | FALSE
specifies whether a border is drawn around the layout.

BORDERATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the attributes of the border line around the layout.

COLUMNGUTTER=*dimension*
specifies the amount of empty space between the columns.

OPAQUE=TRUE | FALSE
specifies whether the layout background is opaque (TRUE) or transparent (FALSE).

OUTERPAD=AUTO | *dimension* | (*pad-options*)
specifies the amount of extra space to add outside the layout border.

PAD=*dimension* | *(pad-options)*
specifies the amount of extra space that is added inside the layout border.

SHRINKFONTS=TRUE | FALSE
specifies whether fonts in the layout are scaled down.

Grid options

COLUMNS=*integer*
specifies the number of columns in the layout.

ROWS=*integer*
specifies the number of rows in the layout.

Layout options

ROWGUTTER=*dimension*

specifies the amount of empty space between the rows.

Legend options

LOCATION=INSIDE | OUTSIDE
: specifies whether the legend appears inside or outside the plot area when nested within an overlay-type layout.

Location options

AUTOALIGN=NONE | AUTO | (*location-list*)
: specifies whether this layout is automatically aligned within its parent when nested within an overlay-type layout.

HALIGN=CENTER | LEFT | RIGHT | *number*
: specifies this layout's horizontal alignment within its parent when nested within an overlay-type or REGION layout.

VALIGN=CENTER | TOP | BOTTOM | *number*
: specifies this layout's vertical alignment within its parent when nested within an overlay-type or REGION layout.

Panel options

ORDER=ROWMAJOR | COLUMNMAJOR
: specifies whether data cells are populated by column priority or by row priority.

Optional Arguments

AUTOALIGN=NONE | AUTO | (*location-list*)
specifies whether this layout is automatically aligned within its parent when nested within an overlay-type layout.

NONE
: does not automatically align the layout within its overlay-type parent layout.

  This layout's position within its parent layout is therefore set by the HALIGN= and VALIGN= options.

AUTO
: within the overlay-type parent layout, attempts to center the layout in the area that is farthest from any surrounding data point markers.

  This option is available only if the parent layout contains a scatter plot. Otherwise, it is ignored.

(*location-list*)
: within the parent layout, restricts the layout's possible locations to those locations in the specified *location-list*, and uses the *location-list* position that least collides with the parent layout's other graphics features.

  The *location-list* is a space-separated list that can contain any of these locations: TOPLEFT, TOP, TOPRIGHT, LEFT, CENTER, RIGHT, BOTTOMLEFT, BOTTOM, and BOTTOMRIGHT.

Default NONE

Restriction This option is ignored if this layout statement is the outermost layout or if the parent layout is not an overlay-type layout.

Interactions When this option is not NONE and the parent layout is an overlay-type layout, the HALIGN= and VALIGN= options are ignored.

This option is ignored if LOCATION= OUTSIDE.

See "LAYOUT OVERLAY Statement" on page 159 for more information about how child positions are determined in an overlay-type layout.

BACKGROUNDCOLOR=*style-reference* | *color*
specifies the color of the layout background.

style-reference
specifies a style reference in the form *style-element:style-attribute*.

Only the style attribute named COLOR or CONTRASTCOLOR is used.

color
specifies a color by name.

See color on page xii

Default The GraphBackground:Color style reference.

Interaction OPAQUE=TRUE must be in effect in order for the color to be seen. By default, OPAQUE=FALSE.

BORDER=TRUE | FALSE
specifies whether a border is drawn around the layout.

Default FALSE

Interaction If this option is set to FALSE, then the BORDERATTRS= option is ignored.

See "boolean " on page xii for other Boolean values that you can use.

BORDERATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the attributes of the border line around the layout.

Default The GraphBorderLines style element.

Interaction BORDER= TRUE must be set for this option to have any effect.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

COLUMNGUTTER=*dimension*
specifies the amount of empty space between the columns.

Default 0

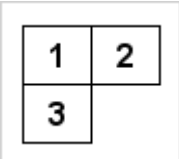
Note If there are *n* columns, then there are *n*-1 gutters.

See "dimension" on page xiii

COLUMNS=*integer*

specifies the number of columns in the layout. This option is used to create a grid with a fixed number of columns, without concern for how many rows. For example, the following settings ensure that columns 1 and 2 in the first row are filled with content, as shown in the figure:

```
layout gridded / columns=2 order=rowmajor border=true ;
  entry '1' /border=true;
  entry '2' /border=true;
  entry '3' /border=true;
endlayout;
```



Defaults If ORDER= ROWMAJOR, then the default is 1.

If ORDER=COLUMNMAJOR, then as many columns are created as needed to satisfy the ROWS= request.

Restriction Assuming ORDER=ROWMAJOR, if COLUMNS=*n* and there are *m* cells defined, and *n* > *m*, then only *m* columns are created (there are *n* - *m* cells with zero size).

HALIGN=CENTER | LEFT | RIGHT | *number*

specifies this layout's horizontal alignment within its parent when nested within an overlay-type or REGION layout.

number

specifies the horizontal alignment as a fraction of the parent container's width.

Range 0 to 1, where 0 is all the way to the left and 1 is all the way to the right.

Interaction For a *number* setting to take effect, LOCATION=INSIDE must be set. A *number* setting is invalid on this option when LOCATION=OUTSIDE.

Default CENTER

Restriction This option has effect only when this layout is nested within a REGION layout, or when this layout is nested in an overlay-type layout and AUTOALIGN=NONE.

See "LAYOUT OVERLAY Statement" on page 159 for more information about how child positions are determined in an overlay-type or REGION layout.

LOCATION=INSIDE | OUTSIDE
specifies whether the legend appears inside or outside the plot area when nested within an overlay-type layout.

Default INSIDE

Restriction This option has effect only when the GRIDDED layout block appears within an overlay-type layout. For more information about how child positions are determined in an overlay-type layout, see "LAYOUT OVERLAY Statement" on page 159.

Interactions If this option is set to OUTSIDE, then the HALIGN= and VALIGN= options must specify a keyword (LEFT, RIGHT, or CENTER). The *number* setting for the alignment is invalid when the layout is positioned outside of the plot area.

The actual position is determined by this option's setting plus the settings for the AUTOALIGN= or HALIGN= and VALIGN= options.

OPAQUE=TRUE | FALSE
specifies whether the layout background is opaque (TRUE) or transparent (FALSE).

Default FALSE

Interaction When this option is set to FALSE, the background color is not used.

See "boolean " on page xii for other Boolean values that you can use.

ORDER=ROWMAJOR | COLUMNMAJOR
specifies whether data cells are populated by column priority or by row priority.

ROWMAJOR
fills all the columns in a row, from left to right, before going to the next row.

COLUMNMAJOR
fills all the rows in a column, from top to bottom, before going to the next column.

Default ROWMAJOR

Requirements If this option is set to COLUMNMAJOR, then the ROWS= option must be specified to indicate how many rows to fill before wrapping to the next column. The default number of rows is 1.

If this option is set to ROWMAJOR, then the COLUMNS= option must be specified to indicate how many columns to fill before wrapping to the next column. The default number of columns is 1.

Interactions The ROWS= option is ignored when ORDER=ROWMAJOR.

The COLUMNS= option is ignored when ORDER=COLUMNMAJOR.

See ROWS= on page 121

COLUMNS= on page 118

OUTERPAD=AUTO | *dimension* | (*pad-options*)
specifies the amount of extra space to add outside the layout border.

AUTO
specifies that the default outside padding for this component is used.

dimension
specifies a dimension to use for the extra space at the left, right, top, and bottom of the layout border.

(*pad-options*)
a space-separated list of one or more name-value pair pad options, enclosed in parentheses.

The list can contain one or more of the following pad options:

LEFT=*dimension*
specifies the amount of extra space to add to the left side.

RIGHT=*dimension*
specifies the amount of extra space to add to the right side.

TOP=*dimension*
specifies the amount of extra space to add to the top.

BOTTOM=*dimension*
specifies the amount of extra space to add to the bottom.

Note Sides that are not assigned padding are padded with the default amount.

Tip Use *pad-options* to create non-uniform padding.

Default AUTO

Note The default units for *dimension* are pixels.

See “dimension” on page xiii

PAD=*dimension* | *(pad-options)*
specifies the amount of extra space that is added inside the layout border.

dimension
specifies a dimension to use for the extra space at the left, right, top, and bottom of the border.

(*pad-options*)
a space-separated list of one or more name-value-pair pad options enclosed in parentheses.

The list can include one or more of the following pad options:

LEFT=*dimension*
specifies the amount of extra space added to the left side.

Default 0

RIGHT=*dimension*
specifies the amount of extra space added to the right side.

Default 0

TOP=*dimension*
specifies the amount of extra space added to the top.

Default 0

BOTTOM=*dimension*
specifies the amount of extra space added to the bottom.

Default 0

Note Sides that are not assigned padding are padded with the default amount.

Tip Use *pad-options* to create non-uniform padding.

Note The default units for *dimension* are pixels.

See "dimension" on page xiii

ROWGUTTER=*dimension*
specifies the amount of empty space between the rows.

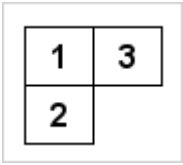
Default 0

Note If there are *n* rows, then there are *n*-1 gutters.

See "dimension" on page xiii

ROWS=*integer*
specifies the number of rows in the layout. This option is used to create a grid with a fixed number of rows, without concern for how many columns. For example, the following settings ensure that rows 1 and 2 in the first column are filled with content, as shown in the figure:

```
layout gridded / rows=2 order=columnmajor border=true ;
  entry '1' /border=true;
  entry '2' /border=true;
  entry '3' /border=true;
endlayout;
```



Defaults If ORDER= COLUMNMAJOR, then the default is 1.

If ORDER=ROWMAJOR, then this option is ignored and as many rows are created as needed to satisfy the COLUMNS= request.

Restriction Assuming ORDER=COLUMNMAJOR, if ROWS=*n* and there are *m* cells defined, and *n* > *m*, then only *m* rows are created (there are *n* - *m* cells with zero size).

SHRINKFONTS=TRUE | FALSE
specifies whether fonts in the layout are scaled down.

Default FALSE

Note If SHRINKFONTS=TRUE, the font scaling applies to all child layouts within the parent layout. If a child layout also specifies SHRINKFONTS=TRUE, the fonts for the children of that child layout are further scaled down.

See "boolean " on page xii for other Boolean values that you can use.

VALIGN=CENTER | TOP | BOTTOM | *number*
specifies this layout's vertical alignment within its parent when nested within an overlay-type or REGION layout.

number
specifies the vertical alignment as a fraction of the parent container's height.

Range 0 to 1, where 0 is on the bottom and 1 is on the top.

Interaction For a *number* setting to take effect, LOCATION=INSIDE must be set. A *number* setting is invalid on this option when LOCATION=OUTSIDE.

Default CENTER

Restriction This option has effect only when this layout is nested within a REGION layout, or when this layout is nested in an overlay-type layout and AUTOALIGN=NONE.

See "LAYOUT OVERLAY Statement" on page 159 for more information about how child positions are determined in an overlay-type or REGION layout.

Details

A GRIDDED layout is commonly used to create small tables of text that are nested within other layouts. The layout might also be used to span and center a single entry (a legend, for example) across a set of grids. Or it might be used to display a grid of graphs when there is no need to scale axis data ranges or align graphs across grid cells.

The GRIDDED layout automatically decides how much area to allocate to cell contents:

- Text items have a fixed size based on the amount of text and the font properties.

- Graphs take up the remaining space.

The layout's grid size is determined by the COLUMNS= and ROWS= options. The resulting columns and rows can be separated by areas called "gutters," which are controlled by the COLUMNGUTTER= and ROWGUTTER= options.

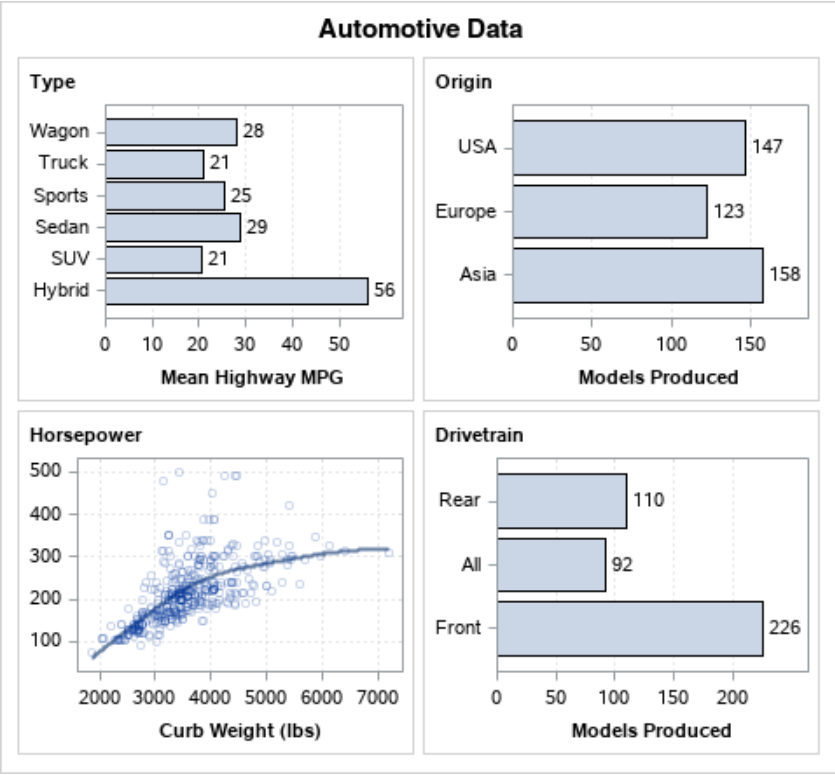
By default, the results of the GTL statements are placed into the grid sequentially from left to right, wrapping to a new row each time the current row is filled. You can use the ORDER= option to fill cells from top to bottom down a column. In that case, the layout cells wrap to a new column each time the current column is filled. The GTL statements can include text statements, plot statements, and layout blocks. Each statement or layout block provides content for one cell in the grid.

If a statement or layout block for a grid cell does not produce any output, then the space for that cell might not be retained as an empty cell in the grid. In that case, the empty cell is removed, and the remaining cells (if any) fill the gap in the grid. A statement produces no output when required data for that statement does not resolve. A layout block produces no output when it contains no statements or when none of the statements contained in the block produce any output.

Examples

Example 1: Creating a 2-By-2 Grid of Plots

This example shows you how to create a simple 2-by-2 grid of plots. Each plot in the grid must be the same size and have independent axes. The GRIDDED layout is the ideal choice for these requirements. The following graph was generated by the "Example Program" on page 124:

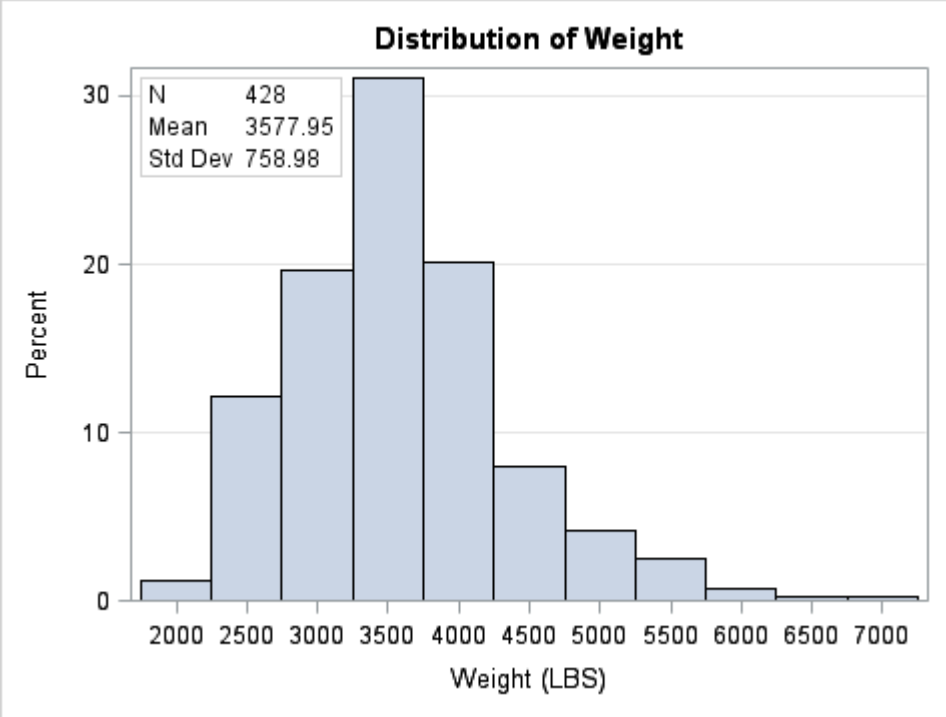


Example Program

```
/* Define the graph template */
proc template;
  define statgraph graphgridded;
    begingraph / subpixel=on;
      entrytitle "Automotive Data";
      layout gridded / columns=2 rows=2 rowgutter=5 columngutter=5;
        /* Define graph for row 1 cell 1 */
       layout overlay / border=on pad=5
         xaxisopts=(label="Mean Highway MPG"
           griddisplay=on gridattrs=(color=lightgray pattern=dot))
         yaxisopts=(label="Type" labelposition=top);
         barchart x=type y=Mpg_Highway / stat=mean orient=horizontal
           barlabel=true barlabelformat=5.0;
       endlayout;

       /* Define graph for row 1 cell 2 */
       layout overlay / border=on pad=5
         yaxisopts=(label="Origin" labelposition=top)
         xaxisopts=(label="Models Produced"
           griddisplay=on gridattrs=(color=lightgray pattern=dot));
         barchart x=Origin y=Models / name="cars" stat=freq
           barlabel=true orient=horizontal;
       endlayout;

       /* Define graph for row 2 cell 1*/
       layout overlay / border=on pad=5
         xaxisopts=(label="Curb Weight (lbs)"
           griddisplay=on gridattrs=(color=lightgray pattern=dot)
           linearopts=(tickvaluesequence=(start=2000 end=8000
           increment=1000)))
         yaxisopts=(label="Horsepower" labelposition=top
           griddisplay=on gridattrs=(color=lightgray pattern=dot));
         pbsplineplot x=weight y=horsepower;
         scatterplot x=weight y=horsepower / datatransparency=0.8;
       endlayout;

       /* Define graph for row 2 cell 1*/
       layout overlay / border=on pad=5
         yaxisopts=(label="Drivetrain" labelposition=top
           linearopts=(tickvaluesequence=(start=2000 end=8000
             increment=1000)))
         xaxisopts=(label="Models Produced"
           griddisplay=on gridattrs=(color=lightgray pattern=dot));
         barchart category=drivetrain / stat=freq
           barlabel=true orient=horizontal;
        endlayout;
      endlayout;
    endgraph;
  end;
run;

proc sgrender data=sashelp.cars template=graphgridded;
run;
```

Example 2: Creating an Inset

The following graph was generated by the "Example Program" on page 125:



Example Program

The GRIDDED layout offers the best way to nest a table of information inside another layout. In the GRIDDED layout, you can control the content, text justification, and fonts of columns. Because this example nests the GRIDDED layout within an OVERLAY layout, you can control where it appears within the plot area. The AUTOALIGN= option enables you to specify a prioritized list of possible positions where the layout should be drawn. The position actually used is the first one that avoids collision with the histogram. Also, the GRIDDED layout is set to be opaque so that the grid lines do not show through. This example also illustrates a reusable template in the sense that it works for any numeric column specified by the dynamic variable VAR. Also, SGE functions for computing the N, MEAN, STDDEV of the column are used in the table to compute the statistics as the template is executed.

```
proc template;
 define statgraph inset;
  dynamic VAR;
  begingraph;
   entrytitle "Distribution of " VAR;
   layout overlay / yaxisopts=(griddisplay=on);
    histogram VAR / scale=percent;
    layout gridded / columns=2
        autoalign=(topleft topright) border=true
        opaque=true backgroundcolor=GraphWalls:color;
```

```
      entry halign=left "N";
      entry halign=left eval(strip(put(n(VAR),12.0)));
      entry halign=left "Mean";
      entry halign=left eval(strip(put(mean(VAR),12.2)));
      entry halign=left "Std Dev";
      entry halign=left eval(strip(put(stddev(VAR),12.2)));
     endlayout;
    endlayout;
  endgraph;
 end;
run;

proc sgrender data=sashelp.cars template=inset;
   dynamic VAR="Weight";
run;
```

LAYOUT LATTICE Statement

Creates a grid of graphs that automatically aligns plot areas and tick display areas across grid cells to facilitate data comparisons among graphs.

Note: Empty cells might be omitted from the lattice. See "Cell Contents" on page 144.

Syntax

LAYOUT LATTICE </*options*>;
GTL-statement(s) | cell-statement-block(s);
<**COLUMNAXES**;
COLUMNAXIS / *axis-options*;
<... *more-COLUMNAXIS-statements* ...>
ENDCOLUMNAXES;>
<**COLUMN2AXES**;
COLUMNAXIS / *axis-options*;
<... *more-COLUMNAXIS-statements* ...>
ENDCOLUMN2AXES;>
<**ROWAXES**;
ROWAXIS / *axis-options*;
<... *more-ROWAXIS-statements* ...>
ENDROWAXES;>
<**ROW2AXES**;
ROWAXIS / *axis-options*;
<... *more-ROWAXIS-statements* ...>
ENDROW2AXES;>

<**COLUMNHEADERS**;

GTL-statement(s);

ENDCOLUMNHEADERS;

<... *more-header-statement-block(s)* ...> >

<**SIDEBAR** </*options*>;

GTL-statement(s);

ENDSIDEBAR;>

<... *more-sidebar-statement-blocks* ...> >

ENDLAYOUT;

Summary of Optional Arguments

Appearance options

BACKGROUNDCOLOR=*style-reference* | *color*
specifies the color of the layout background.

BORDER=TRUE | FALSE
specifies whether a border is drawn around the layout.

BORDERATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the attributes of the border line around the layout.

COLUMNGUTTER=*dimension*
specifies the amount of empty space that is between the columns.

OPAQUE=TRUE | FALSE
specifies whether the layout background is opaque (TRUE) or transparent (FALSE).

OUTERPAD=AUTO | *dimension* | (*pad-options*)
specifies the amount of extra space to add outside the layout border.

PAD=*dimension* | *(pad-options)*
specifies the amount of extra space that is added inside the layout border.

SHRINKFONTS=TRUE | FALSE
specifies whether fonts in the layout are scaled down.

Cell options

COLUMNWEIGHTS=UNIFORM | PREFERRED | (*weight-list*)
specifies the proportional width of each column relative to the overall grid width, not including the headings and sidebars.

ROWWEIGHTS=UNIFORM | PREFERRED | (*weight-list*)
specifies the proportional height of each row relative to the overall grid height, not including the headings and sidebars.

Column options

COLUMN2DATARANGE=DATA | UNION | UNIONALL
specifies how the X2-axis data ranges of graphs within the lattice columns are scaled.

COLUMNDATARANGE=DATA | UNION | UNIONALL

specifies how the X-axis data ranges of graphs within the lattice columns are scaled.

Lattice options

COLUMNS=*integer*
specifies the number of columns in the lattice.

ROWS=*integer*
specifies the number of rows in the lattice.

SKIPEMPTYCELLS=TRUE | FALSE
specifies whether row and column axes skip the unused cells in a partially filled lattice.

Layout options

ROWGUTTER=*dimension*
specifies the amount of empty space between the rows.

Location options

AUTOALIGN=NONE | AUTO | (*location-list*)
specifies whether this layout is automatically aligned within its parent when nested within an overlay-type layout.

HALIGN=CENTER | LEFT | RIGHT | *number*
specifies this layout's horizontal alignment within its parent when nested within an overlay-type or REGION layout.

VALIGN=CENTER | TOP | BOTTOM | *number*
specifies this layout's vertical alignment within its parent when nested within an overlay-type or REGION layout.

Panel options

ORDER=ROWMAJOR | COLUMNMAJOR
specifies whether data cells are populated by column priority or by row priority.

Row options

ROW2DATARANGE=DATA | UNION | UNIONALL
specifies how the Y2-axis data ranges of graphs within the lattice rows are scaled.

ROWDATARANGE=DATA | UNION | UNIONALL
specifies how the Y-axis data ranges of graphs within the lattice rows are scaled.

Optional Arguments

AUTOALIGN=NONE | AUTO | (*location-list*)
specifies whether this layout is automatically aligned within its parent when nested within an overlay-type layout.

NONE
does not automatically align the layout within its overlay-type parent layout.

This layout's position within its parent layout is therefore set by the HALIGN= and VALIGN= options.

AUTO
within the overlay-type parent layout, attempts to center the layout in the area that is farthest from any surrounding data point markers.

This option is available only if the parent layout contains a scatter plot. Otherwise, it is ignored.

(*location-list*)
within the parent layout, restricts the layout's possible locations to those locations in the specified *location-list*, and uses the *location-list* position that least collides with the parent layout's other graphics features.

The *location-list* is a space-separated list that can contain any of these locations: TOPLEFT, TOP, TOPRIGHT, LEFT, CENTER, RIGHT, BOTTOMLEFT, BOTTOM, and BOTTOMRIGHT.

Default NONE

Restriction This option is ignored if this layout statement is the outermost layout or if the parent layout is not an overlay-type layout.

Interaction When this option is not NONE and the parent layout is an overlay-type layout, the HALIGN= and VALIGN= options are ignored.

See "LAYOUT OVERLAY Statement" on page 159 for more information about how child positions are determined in an overlay-type layout.

Example In the following example, the LATTICE layout is the child of the OVERLAY layout. The child layout appears in either the top right or top left position, based on which position has more "unoccupied" area.

```
dynamic VAR STAT1 STAT2 STAT3;
layout overlay;
  histogram VAR;
  layout lattice / AUTOALIGN=(TOPRIGHT TOPLEFT)
columns=1;
     entry STAT1;
     entry STAT2;
     entry STAT3;
  endlayout;
endlayout;
```

BACKGROUNDCOLOR=*style-reference* | *color*
specifies the color of the layout background.

style-reference
specifies a style reference in the form *style-element:style-attribute*.

Only the style attribute named COLOR or CONTRASTCOLOR is used.

color
specifies a color by name.

See color on page xii

Default The GraphBackground:Color style reference.

Interaction OPAQUE=TRUE must be in effect in order for the color to be seen. By default, OPAQUE=FALSE.

BORDER=TRUE | FALSE
specifies whether a border is drawn around the layout.

Default FALSE

Interaction If this option is set to FALSE, then the BORDERATTRS= option is ignored.

See "boolean " on page xii for other Boolean values that you can use.

BORDERATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the attributes of the border line around the layout.

Default The GraphBorderLines style element.

Interaction BORDER= TRUE must be set for this option to have any effect.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

COLUMNDATARANGE=DATA | UNION | UNIONALL
specifies how the X-axis data ranges of graphs within the lattice columns are scaled.

DATA
scales the X-axis data ranges separately for each cell in the lattice.

UNION
scales the X-axis data ranges separately for each column in the lattice.

This setting is supported only if all plots across the column can share the same data range and axis type. For more information, see "Plot Axis Types Must Agree on Common Axes" on page 1049.

UNIONALL
scales the X-axis data ranges across all columns in the lattice.

This setting is supported only if all plots across the column can share the same data range and axis type. For more information, see "Plot Axis Types Must Agree on Common Axes" on page 1049.

Default DATA

Interactions The data ranges are scaled only if the data values are continuous and the graphs have the same orientation. If graphs cannot use the same X-axis range or if COLUMNDATARANGE=DATA, then the X-axis range of each graph is determined from the data.

If any plot statement in any cell contains a XAXIS=X2 option, then that plot's X values are ignored whenever COLUMNDATARANGE= is set to UNION or UNIONALL.

Tips

If column axes are used and if a lattice cell contains a LAYOUT OVERLAY statement with the XAXISOPTS= option specified, then the XAXISOPTS= option is ignored. In that case, use the COLUMNAXIS statement to specify the desired column X-axis features. For more information, see "Row and Column Axis Statements" on page 146 .

By default, each cell has its own axes, which are managed using axis options in the layout statement for that cell. To consolidate the cell X axes into column X axes, set this option to UNION or UNIONALL. Then in the LAYOUT LATTICE statement block, specify a COLUMNAXES block that includes a COLUMNAXIS statement for each column X axis that needs to be managed.

COLUMN2DATARANGE=DATA | UNION | UNIONALL

specifies how the X2-axis data ranges of graphs within the lattice columns are scaled.

DATA

scales the X2-axis data ranges separately for each cell in the lattice.

UNION

scales the X2-axis data ranges separately for each column in the lattice.

This setting is supported only if all plots across the column can share the same data range and axis type. For more information, see "Plot Axis Types Must Agree on Common Axes" on page 1049.

UNIONALL

scales the X2-axis data ranges across all columns in the lattice.

This setting is supported only if all plots across the column can share the same data range and axis type. For more information, see "Plot Axis Types Must Agree on Common Axes" on page 1049.

Default

DATA

Interactions

The data ranges are scaled only if the data values are continuous and the graphs have the same orientation. If graphs cannot use the same X2-axis range or if COLUMN2DATARANGE=DATA, then the X2-axis range of each graph is determined from the data.

If any plot statement in any cell contains a XAXIS=X option, then that plot's X values are ignored whenever COLUMN2DATARANGE= is set to UNION or UNIONALL.

Tips

By default, each cell has its own axes, which are managed using axis options in the layout statement for that cell. To consolidate the cell X2 axes into column X2 axes, set this option to UNION or UNIONALL. Then in the LAYOUT LATTICE statement block, specify a COLUMN2AXES block that includes a COLUMNAXIS statement for each column X2 axes that needs to be managed.

If column X2 axes are used and if a lattice cell contains a LAYOUT OVERLAY statement with the X2AXISOPTS= option specified, then the X2AXISOPTS= option is ignored. In that case, use one or more

COLUMNAXIS statements to specify the desired column X2-axis features. For more information, see "Row and Column Axis Statements" on page 146 .

COLUMNGUTTER=*dimension*
specifies the amount of empty space that is between the columns.

Default 0

Note If there are *n* columns, then there are *n*-1 gutters.

See "dimension" on page xiii

COLUMNS=*integer*
specifies the number of columns in the lattice.

Defaults If ORDER= ROWMAJOR, then the default is 1.

If ORDER=COLUMNMAJOR, then as many columns are created as are needed to satisfy the ROWS= request.

Interactions If both ROWS=*n* and COLUMNS=*m* are specified, then an *n* by *m* grid of cells is created. If the number of statements that define cell contents is greater than *n* x *m*, then the grid size does not expand and some statements are not displayed. If the number of statements that define cell contents is less than *n* x *m*, then the grid will contain empty cells.

If this option is not defined and ORDER=COLUMNMAJOR, then the number of columns is dynamically determined by the number of defined cells.

COLUMNWEIGHTS=UNIFORM | PREFERRED | (*weight-list*)
specifies the proportional width of each column relative to the overall grid width, not including the headings and sidebars.

UNIFORM
equally divides the total available width among all of the columns.

PREFERRED
specifies that each column gets its preferred width.

Preferred widths are determined as follows:

- Columns that contain one or more vertically one-dimensional plots get the maximum preferred width from the vertically one-dimensional plots.
- The remaining columns that do not contain vertically one-dimensional plots get an equal amount of width from the remaining space.

Interaction If a one-dimensional box plot is specified in the preferred column, then the box plot's BOXWIDTH= option is ignored.

Notes The PREFERRED option is used for LATTICE layouts that mix one-dimensional and two-dimensional plots in the grid. It

enables the layout to compute the weights automatically for columns that contain one-dimensional plots.

Examples of one-dimensional plots include axis tables, block plots, fringe plots, and box plots with Y= values only.

(*weight-list*)
a space-separated list of column weights.

The list should contain a weight for each column, which can be expressed as one of the following:

PREFERRED
specifies that the corresponding column gets its preferred width as described previously.

Note The PREFERRED option should be used on columns that contain only one-dimensional plots. Using the PREFERRED keyword on columns that contain a mix of one-dimensional and two-dimensional plots might cause unexpected results. In that case, use a numeric weight instead.

Tip The PREFERRED option is particularly useful for axis tables.

number
specifies that the corresponding column gets a width that is based on the proportion of the specified number to the total of the numbers in the weight list.

For example, the following weight specifications are equivalent:

```
columnweights=(0.2 0.3 0.5)
```

```
columnweights=(2 3 5)
```

In these examples, the first column gets 20% of the available width, the second column gets 30%, and the third column gets 50%.

If the list contains the PREFERRED keyword, then the number specifies the proportion of the width that remains after the preferred width or widths are calculated and subtracted from the available width.

Requirements The values in the weight list must be enclosed in parentheses.

If there are *n* columns in the grid, then the weight list should contain *n* weights, one for each column.

All of the numbers in the list must be positive.

At least one number in the list must be nonzero.

Note The weights for all of the columns are specified as a proportion and, as such, are not required to total 1.0.

Example Here is an example that specifies the preferred width for the first column, 20% of the remaining width to the second column, and 80% of the remaining width to the third column.

```
columnweights=(preferred 0.2 0.8)
```

HALIGN=CENTER | LEFT | RIGHT | *number*
specifies this layout's horizontal alignment within its parent when nested within an overlay-type or REGION layout.

number
specifies the horizontal alignment as a fraction of the parent container's width.

Range 0 to 1, where 0 is all the way to the left and 1 is all the way to the right.

Interaction For a *number* setting to take effect, LOCATION=INSIDE must be set. A *number* setting is invalid on this option when LOCATION=OUTSIDE.

Default CENTER

Restriction This option has effect only when this layout is nested within a REGION layout, or when this layout is nested in an overlay-type layout and AUTOALIGN=NONE.

See "LAYOUT OVERLAY Statement" on page 159 for more information about how child positions are determined in an overlay-type or REGION layout.

Example In the following example, the LATTICE layout is the child of the OVERLAY layout and is positioned in the OVERLAY's top right corner.

```
dynamic VAR STAT1 STAT2 STAT3;
layout overlay;
   histogram VAR;
   layout lattice / VALIGN=TOP HALIGN=RIGHT
      columns=1;
      entry STAT1;
      entry STAT2;
      entry STAT3;
   endlayout;
endlayout;
```

OPAQUE=TRUE | FALSE
specifies whether the layout background is opaque (TRUE) or transparent (FALSE).

Default FALSE

Interaction When this option is set to FALSE, the background color is not used.

See "boolean " on page xii for other Boolean values that you can use.

ORDER=ROWMAJOR | COLUMNMAJOR
specifies whether data cells are populated by column priority or by row priority.

ROWMAJOR
fills all the columns in a row, from left to right, before going to the next row.

COLUMNMAJOR
fills all the rows in a column, from top to bottom, before going to the next column.

Default ROWMAJOR

Requirements If this option is set to COLUMNMAJOR, then the ROWS= option must be specified to indicate how many rows to fill before wrapping to the next column. The default number of rows is 1.

If this option is set to ROWMAJOR, then the COLUMNS= option must be specified to indicate how many columns to fill before wrapping to the next column. The default number of columns is 1.

OUTERPAD=AUTO | *dimension* | (*pad-options*)
specifies the amount of extra space to add outside the layout border.

AUTO
specifies that the default outside padding for this component is used.

dimension
specifies a dimension to use for the extra space at the left, right, top, and bottom of the layout border.

(*pad-options*)
a space-separated list of one or more name-value pair pad options, enclosed in parentheses.

The list can contain one or more of the following pad options:

LEFT=*dimension*
specifies the amount of extra space to add to the left side.

RIGHT=*dimension*
specifies the amount of extra space to add to the right side.

TOP=*dimension*
specifies the amount of extra space to add to the top.

BOTTOM=*dimension*
specifies the amount of extra space to add to the bottom.

Note Sides that are not assigned padding are padded with the default amount.

Tip Use *pad-options* to create non-uniform padding.

Default AUTO

Note The default units for *dimension* are pixels.

See “dimension” on page xiii

PAD=*dimension* | *(pad-options)*
specifies the amount of extra space that is added inside the layout border.

dimension
specifies a dimension to use for the extra space at the left, right, top, and bottom of the border.

(*pad-options*)
a space-separated list of one or more name-value-pair pad options enclosed in parentheses.

The list can include one or more of the following pad options:

LEFT=*dimension*
specifies the amount of extra space added to the left side.

Default 0

RIGHT=*dimension*
specifies the amount of extra space added to the right side.

Default 0

TOP=*dimension*
specifies the amount of extra space added to the top.

Default 0

BOTTOM=*dimension*
specifies the amount of extra space added to the bottom.

Default 0

Note Sides that are not assigned padding are padded with the default amount.

Tip Use *pad-options* to create non-uniform padding.

Note The default units for *dimension* are pixels.

See "dimension" on page xiii

ROWDATARANGE=DATA | UNION | UNIONALL
specifies how the Y-axis data ranges of graphs within the lattice rows are scaled.

DATA
scales the Y-axis data ranges separately for each cell in the lattice.

UNION
scales the Y-axis data ranges separately for each row in the lattice.

This setting is supported only if all plots down the row can share the same data range and axis type. For more information, see "Plot Axis Types Must Agree on Common Axes" on page 1049.

UNIONALL
scales the Y-axis data ranges across all rows in the lattice.

This setting is supported only if all plots down the row can share the same data range and axis type. For more information, see "Plot Axis Types Must Agree on Common Axes" on page 1049.

Default DATA

Interactions The data ranges are scaled only if the data values are continuous and the graphs have the same orientation. If graphs cannot use the same vertical range or if ROWDATARANGE=DATA, then the vertical range of each graph is determined from the data.

If any plot statement in any cell contains a YAXIS=Y2 option, then that plot's Y values are ignored whenever ROWDATARANGE= is set to UNION or UNIONALL.

Tips By default, each cell has its own axes, which are managed using axis options in the layout statement for that cell. To consolidate the cell Y axes into a row Y axis, set this option to UNION or UNIONALL. Then in the LAYOUT LATTICE statement block, specify a ROWAXES block that contains a ROWAXIS statement for each row Y axis that needs to be managed.

If row axes are used and if a lattice cell contains a LAYOUT OVERLAY with the YAXISOPTS= option specified, then the YAXISOPTS option is ignored. In that case, use one or more ROWAXIS statements to specify desired row Y-axis features. For more information, see "Row and Column Axis Statements" on page 146 .

ROW2DATARANGE=DATA | UNION | UNIONALL

specifies how the Y2-axis data ranges of graphs within the lattice rows are scaled.

DATA

scales the Y2-axis data ranges separately for each cell in the lattice.

UNION

scales the Y2-axis data ranges separately for each row in the lattice.

This setting is supported only if all plots down the row can share the same data range and axis type. For more information, see "Plot Axis Types Must Agree on Common Axes" on page 1049.

UNIONALL

scales the Y2-axis data ranges across all rows in the lattice.

This setting is supported only if all plots down the row can share the same data range and axis type. For more information, see "Plot Axis Types Must Agree on Common Axes" on page 1049.

Default DATA

Interactions The Y2-axis data ranges are scaled only if the data values are continuous and the graphs have the same orientation. If graphs cannot use the same vertical range or if ROW2DATARANGE=DATA, then the vertical range of each graph is determined from the data.

If any plot statement in any cell contains a YAXIS=Y2 option, then that plot's Y values are ignored whenever ROW2DATARANGE= is set to UNION or UNIONALL.

Tips By default, each cell has its own axes, which are managed using axis options in the layout statement for that cell. To consolidate the cell Y axes into row X2 axes, set this option to UNION or UNIONALL, and then in the LAYOUT LATTICE statement block, specify a ROW2AXES block that contains a ROWAXIS statement for each row Y2 axis that needs to be managed.

If row Y2 axes are used and if a lattice cell contains a LAYOUT OVERLAY with the Y2AXISOPTS= option specified, then the Y2AXISOPTS option is ignored. In that case, use one or more ROWAXIS statements to specify the desired row Y2-axis features. For more information, see "Row and Column Axis Statements" on page 146 .

ROWGUTTER=*dimension*
specifies the amount of empty space between the rows.

Default 0

Note If there are *n* rows, then there are *n*-1 gutters.

See "dimension" on page xiii

ROWS=*integer*
specifies the number of rows in the lattice.

Defaults If ORDER=COLUMNMAJOR, then the default is 1.

If ORDER=ROWMAJOR, then as many ROWS are created as needed to satisfy the COLUMNS= request.

Interactions If both ROWS=*n* and COLUMNS=*m* are specified, then an *n* by *m* grid of cells is created. If the number of statements that define cell contents is greater than *n* x *m*, then the grid size does not expand and some statements are not displayed. If the number of statements that define cell contents is less than *n* x *m*, then the grid will contain empty cells.

If ORDER=ROWMAJOR and ROWS= is not defined, then the number of rows is dynamically determined by the number of defined cells.

ROWWEIGHTS=UNIFORM | PREFERRED | (*weight-list*)
specifies the proportional height of each row relative to the overall grid height, not including the headings and sidebars.

UNIFORM
equally divides the total available height among all of the rows.

PREFERRED
specifies that each row gets its preferred height.

Preferred height is determined as follows:

- Rows that contain one or more horizontally one-dimensional plots get the maximum preferred height from the horizontally one-dimensional plots.
- The remaining rows that do not contain horizontally one-dimensional plots get an equal amount of height from the remaining space.

Notes The PREFERRED option is used for LATTICE layouts that mix one-dimensional and two-dimensional plots in the grid. It enables the layout to compute the weights automatically for rows that contain one-dimensional plots.

Examples of one-dimensional plots include axis tables, block plots, fringe plots, and box plots with Y= values only.

(*weight-list*)
a space-separated list of row weights.

The list should contain a weight for each row, which can be expressed as one of the following:

PREFERRED
specifies that the corresponding row gets its preferred height as described previously.

Note The PREFERRED option should be used on rows that contain only one-dimensional plots. Using the PREFERRED keyword on rows that contain a mix of one-dimensional and two-dimensional plots might cause unexpected results. In that case, use a numeric weight instead.

number
specifies that the corresponding row gets a height that is based on the proportion of the specified number to the total of the numbers in the weight list.

For example, the following weight specifications are equivalent:

```
rowweights=(0.2 0.3 0.5)
```

```
rowweights=(2 3 5)
```

In these examples, the first row gets 20% of the available height, the second row gets 30%, and the third row gets 50%.

If the list contains the PREFERRED keyword, then the number specifies the proportion of the height that remains after the preferred height or heights are calculated and subtracted from the available height.

Requirements The values in the weight list must be enclosed in parentheses.

If there are *n* rows in the grid, then the weight list should contain *n* weights, one for each row.

All of the numbers in the list must be positive.

At least one number in the list must be nonzero.

Note The weights for all of the rows are specified as a proportion and, as such, are not required to total 1.0.

Example Here is an example that specifies 25% of the available height for the first row, 25% for the second row, and 50% for the third row.

```
rowweights=(1 1 2)
```

SHRINKFONTS=TRUE | FALSE
specifies whether fonts in the layout are scaled down.

Default FALSE

Note If SHRINKFONTS=TRUE, the font scaling applies to all child layouts within the parent layout. If a child layout also specifies SHRINKFONTS=TRUE, the fonts for the children of that child layout are further scaled down.

See “boolean ” on page xii for other Boolean values that you can use.

SKIPEMPTYCELLS=TRUE | FALSE
specifies whether row and column axes skip the unused cells in a partially filled lattice.

FALSE
displays row and column axes at their normal locations.

TRUE
skips empty cells and “snaps” the row and column axes to the nearest populated cell, both vertically and horizontally.

Default FALSE

See “boolean ” on page xii for other Boolean values that you can use.

VALIGN=CENTER | TOP | BOTTOM | *number*
specifies this layout’s vertical alignment within its parent when nested within an overlay-type or REGION layout.

number
specifies the vertical alignment as a fraction of the parent container’s height.

Range 0 to 1, where 0 is on the bottom and 1 is on the top.

Interaction For a *number* setting to take effect, LOCATION=INSIDE must be set. A *number* setting is invalid on this option when LOCATION=OUTSIDE.

Default CENTER

Restriction This option has effect only when this layout is nested within a REGION layout, or when this layout is nested in an overlay-type layout and AUTOALIGN=NONE.

See "LAYOUT OVERLAY Statement" on page 159 for more information about how child positions are determined in an overlay-type or REGION layout.

Example In the following example, the LATTICE layout is the child of the OVERLAY layout. The child layout appears in either the top right or top left position, based on which position has more "unoccupied" area.

```
dynamic VAR STAT1 STAT2 STAT3;
layout overlay / height=500px width=600px;
   histogram VAR;
   layout lattice / VALIGN=TOP HALIGN=RIGHT
      height=80px width=70px columns=1;
      entry STAT1;
      entry STAT2;
      entry STAT3;
   endlayout;
endlayout;
```

SIDEBAR Optional Arguments

ALIGN=TOP | BOTTOM | LEFT | RIGHT
specifies the alignment of the sidebar.

Default BOTTOM

Tip You can use ENTRY statements to place rotated text in the right or left side bar.

SPACEFILL=TRUE | FALSE
specifies whether to fill all the area of the sidebar with its contents.

Default TRUE

Tip To prevent a layout block within the sidebar from expanding to the sidebar boundaries, set this option to FALSE.

See "boolean " on page xii for other Boolean values that you can use.

Details

Statement Description

The LAYOUT LATTICE statement creates a grid of graphs that are aligned across rows and columns. For plot statements that are specified in the layout block or nested in a LAYOUT OVERLAY statement, the LATTICE layout automatically aligns the plot areas and tick display areas in the plots.

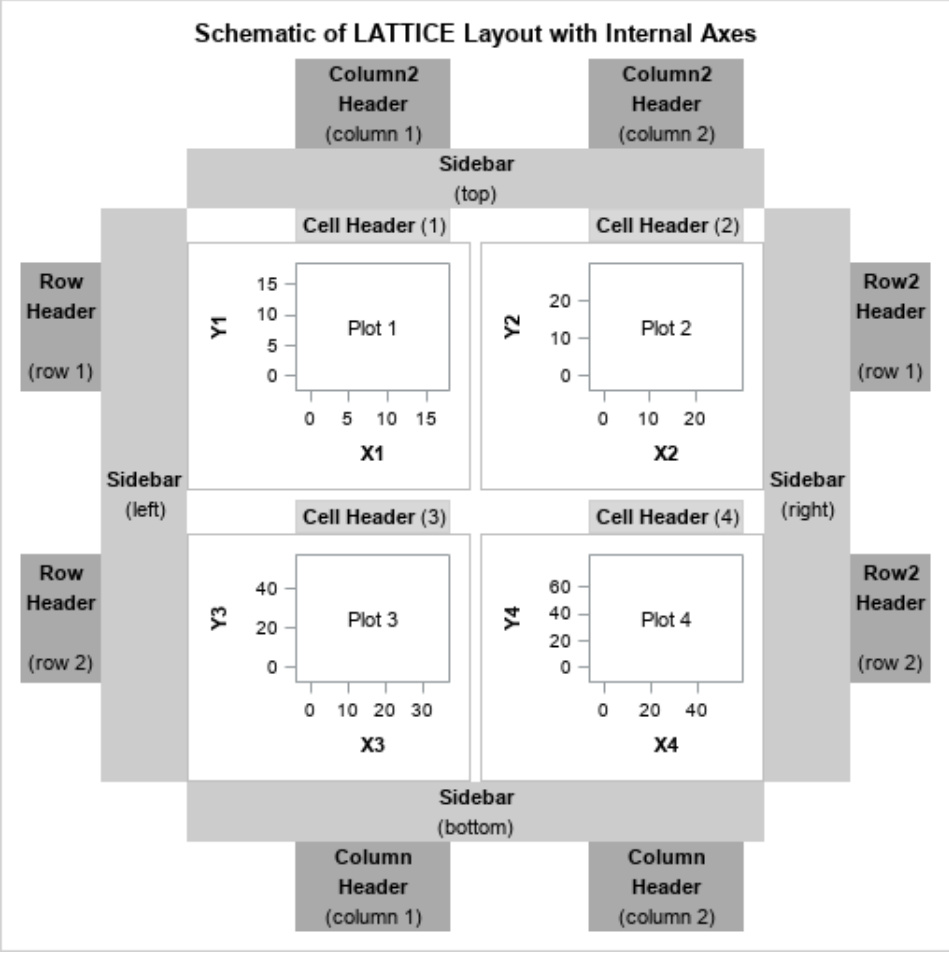
Note: To achieve the alignment, the LATTICE layout automatically aligns plot areas and tick display areas across rows and columns. Also, it overrides axis offset settings in the OVERLAY layouts that you specify in those rows and columns. (For

details about offsets and the tick display area, see "Adjusting Axis Offsets" on page 1053.) If you do not want this alignment, then you might use LAYOUT GRIDDED instead. For example, if you have a heterogeneous panel of graphs, such as a mix of scatter plots, box plots, bar charts, or other types of graphs, then you might consider using LAYOUT GRIDDED rather than LAYOUT LATTICE.

The layout can unify the scale of the data ranges that are displayed in the plots, based on the values set for the COLUMNDATARANGE= and ROWDATARANGE= options. If one or more plots within the template use the XAXIS= option to produce independent X2 (top) axes, then the X2 data scales can be unified, based on the values set for the COLUMN2DATARANGE= option. If one or more plots within the template use the YAXIS= option to produce independent Y2 (right) axes, then the Y2 data scales can be unified, based on the values set for the ROW2DATARANGE= options. The data ranges can be scaled separately for each column, for each row, or for both. Or they can be scaled across all columns, all rows, or all of both.

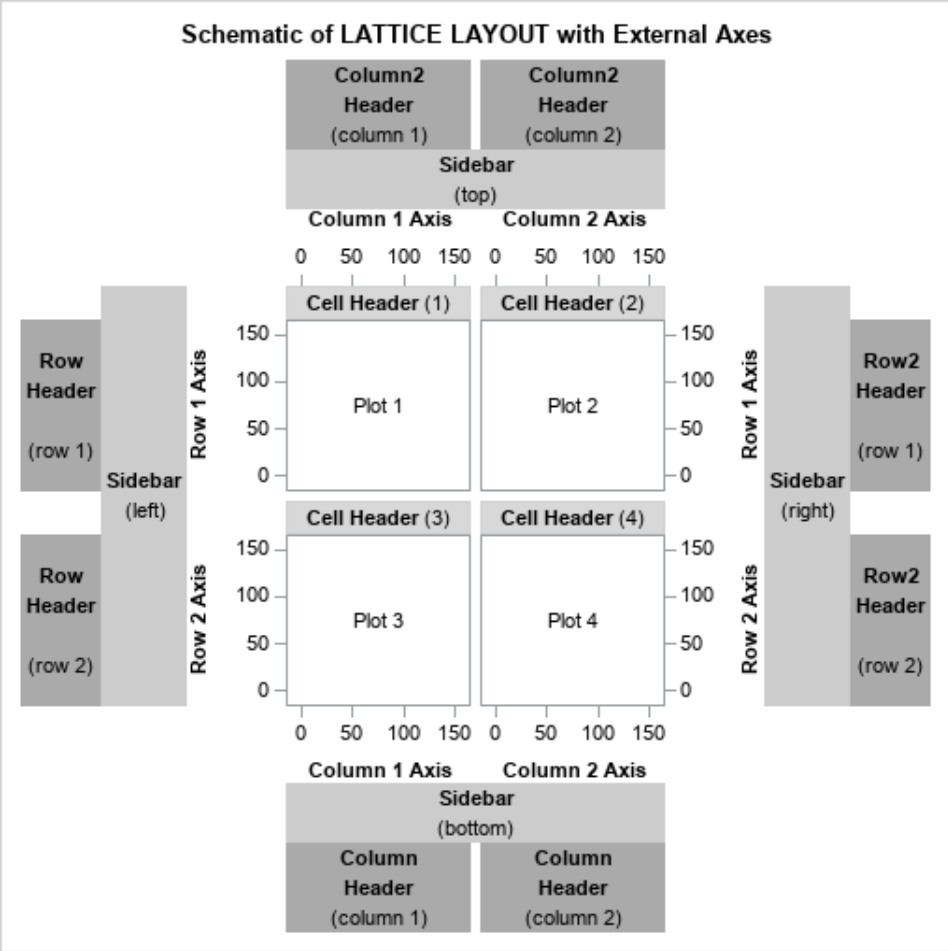
When the data-range scales are unified, you can simplify the lattice by displaying only the row and column axes that apply to all of the graphs across the corresponding columns or rows. See "Row and Column Axis Statements" on page 146 for more details.

The following figure shows the parts of the LATTICE layout with the default axis display (internal axes are displayed).



This next figure shows the parts of the LATTICE layout when the graph display is simplified so that only row and column axes are displayed.

Note: The figure shows secondary X (top) and secondary Y (right) axes. The layout also enables you to generate independent X2 (top) and independent Y2 (right) axes. For details, see "Row and Column Axis Statements" on page 146



The rows and columns can be separated by areas called "gutters," which are controlled by the COLUMNGUTTER= and ROWGUTTER= options. In addition, the COLUMNWEIGHTS= and ROWWEIGHTS= options can be used to allocate a proportion of available space to each row and column.

The LATTICE layout automatically decides how much area to allocate to cell contents:

- Text items have a fixed size based on the amount of text and the font properties.
- Graphs take up the remaining space.

The layout's grid size is determined by the COLUMNS= and ROWS= options.

By default, the results of the *GTL-statements* are placed into the grid sequentially from left to right, wrapping to a new row each time the current row is filled. You can

use the ORDER= option to fill cells from top to bottom down a column. In that case, the lattice cells wrap to a new column each time the current column is filled.

Cell Contents

The following general syntax is used to define the contents of each cell in a LAYOUT LATTICE:

GTL-statement(s) | cell-statement-block(s)

A *cell-statement-block*, when used, has the following syntax:

CELL;

<CELLHEADER; *GTL-statement(s);* ENDCELLHEADER;>

GTL-statement(s);

ENDCELL;

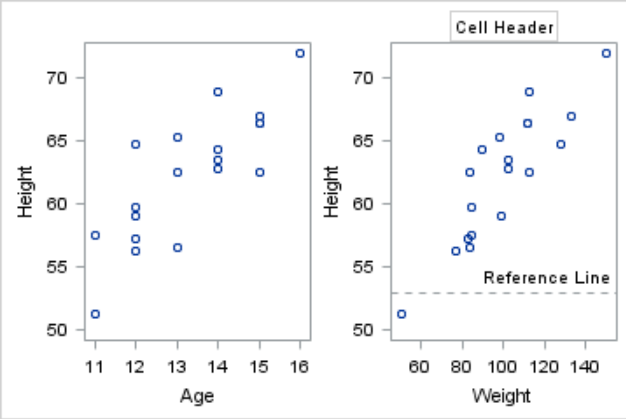
The following guidelines apply to defining cell content:

- The contents of each cell is generated by GTL statements, which can be specified independently or enclosed in a CELL block.
- Independent GTL statements include text statements, plot statements, or layout blocks. Each independently specified GTL statement or layout block provides content for one cell.
- A CELL block can include text statements, plot statements, or layout blocks. Each CELL block provides content for one cell.
- Within a CELL block, you can use a CELLHEADER block to generate one or more header lines within the cell. Specify each header line on a separate GTL statement within the CELLHEADER block. The header block is typically used to specify one or more text statements, but other statements are allowed within the block. For example, you can specify a LAYOUT GRIDDED statement to produce a grid of text for the header
- You can use only one CELLHEADER block per CELL block. If you specify more than one, then only the last one is used.
- If you do not specify a CELLHEADER block in a CELL block, then the enclosed GTL statements produce the same results that they would produce if they were specified independently.
- If more than one plot statement is needed to generate contents for a cell, you should place the plot statements in a layout block such as LAYOUT OVERLAY. Otherwise, unexpected results might occur. This applies to independent GTL statements and to GTL statements in a CELL block. See Figure 4.3 on page 145.

If a CELL block, or an independent statement or layout block for a lattice cell does not produce any output, then the space for that cell might not be retained as an empty cell in the lattice. In that case, the empty cell is removed, and the remaining cells (if any) fill the gap in the lattice. A statement produces no output when required data for that statement does not resolve. A layout block produces no output when it contains no statements or when none of the statements contained in the block produce any output.

The example code shows a LAYOUT LATTICE block that uses one GTL statement and one CELL block to generate the two-column lattice shown in the following figure:

Figure 4.1 *Lattice Layout with Independent Plot Statements and a CELL Block*

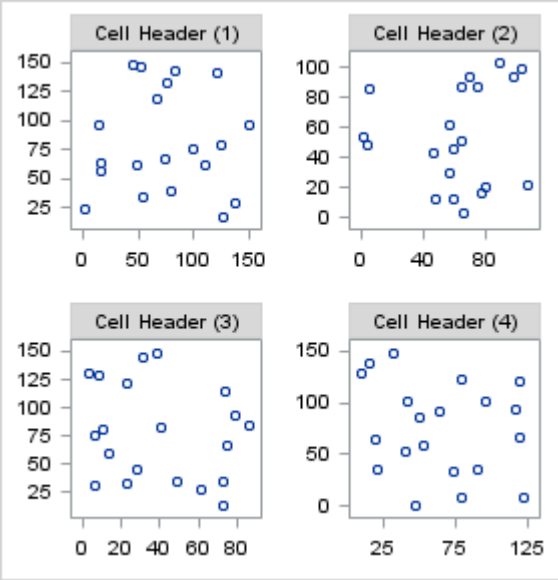



```
proc template;
  define statgraph cellcontents;
    begingraph;
      layout lattice /
        columngutter=5 columns=2;

        /* independent plot statement - defines first cell */
        scatterplot x=age y=height;

        /* cell block - defines second cell */
        cell;
          cellheader;
            entry "Cell Header" / border=true;
          endcellheader;
          /* two plot statements are needed - enclose
             the statements in a LAYOUT OVERLAY block */
          layout overlay;
            scatterplot x=weight y=height;
            referenceline y=53 / lineattrs=(pattern=shortdash)
              curvelabellocation=inside curvelabel="Reference Line";
          endlayout;
        endcell;
      endlayout;
    endgraph;
  end;
run;

proc sgrender data=sashelp.class template=cellcontents;
run;
```

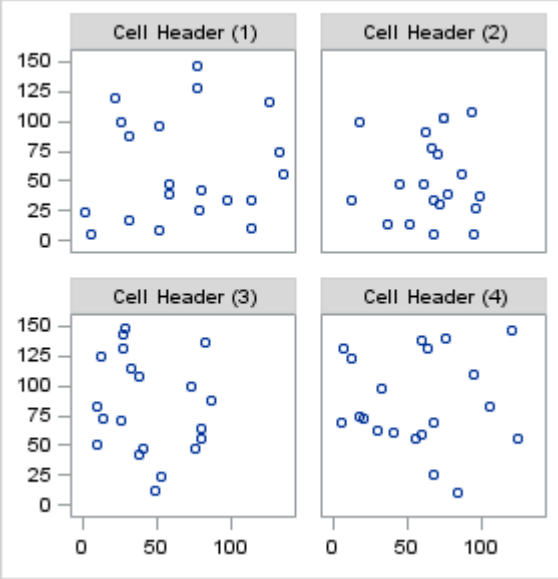
Row and Column Axis Statements

Overview

By default, each cell in the lattice has its own internal axes, which are managed using axis options in the layout statement for that cell. Here is an example of a lattice with internal axes.



Notice that the axes ranges for each plot in the lattice differ. If the data ranges for each plot are comparable, you can unity the axes to a common scale for all of the plots in the lattice. In that case, you can also simplify and clarify your lattice by creating row and column axes that are shared by the cells in the lattice. Here is an example of a lattice with row and column axes.



Row and column axes are defined by row and column axis statement blocks in the LAYOUT LATTICE statement block. Row and column axis statement blocks are

useful only if the data ranges across the affected columns or rows are comparable and can be unified to a common scale. For example, row and column axes are not supported if an affected lattice cell contains a LAYOUT OVERLAYEQUATED statement. If the axis ranges are not unified for the affected columns or rows, then the row and column axis statement blocks in the LAYOUT LATTICE statement block are ignored.

Use the options shown in the following table to unify the axis data ranges in the lattice.

Axis	Option
X	COLUMNDATARANGE=
X2	COLUMN2DATARANGE=
Y	ROWDATARANGE=
Y2	ROW2DATARANGE=

Specifying Row and Column Axis Features

For columns, the features for the column X axes (bottom) are specified within a COLUMNAXES block, which contains one COLUMNAXIS statement for each column X axis that needs to be manage. The COLUMNAXIS statement provides a DISPLAYSECONDARY= option, which enables you to display a column secondary X (top) axis that mirrors the column primary X axis but can have different display features. In that case, the axis features that you specify in the COLUMNAXIS statement apply to both the column primary and column secondary X axes.

If one or more plots within the LAYOUT LATTICE statement block use the XAXIS=X2 option to produce independent X2 (top) axes, then axis features for the column X2 axes are specified within a COLUMN2AXES block, nesting one COLUMNAXIS statement for each column that contains an X2 axis that needs to be managed. Within the COLUMN2AXES block, the COLUMNAXIS statement's DISPLAYSECONDARY= option enables you to display a column secondary X2 (bottom) axis that mirrors the column primary X2 axis but can have different display features. Here again, the axis features that you specify in the COLUMNAXIS statement apply to both the column primary and the column secondary X2 axes.

Note: If you specify independent X and X2 scales at the same time, then the DISPLAYSECONDARY= option is ignored in the COLUMNAXIS statement. This is true whether the COLUMNAXIS statement is specified in a COLUMNAXES or COLUMN2AXES block.

For both the COLUMNAXES and COLUMN2AXES blocks, if a lattice cell within the column contains a LAYOUT OVERLAY statement with the XAXISOPTS= or X2AXISOPTS= option specified, these LAYOUT OVERLAY statement options are ignored. In that case, specify the desired axis features in one or more COLUMNAXIS statements in the COLUMNAXES block.

For rows, axis features for the row Y axes (left) are specified within a ROWAXES block, nesting one ROWAXIS statement for each row that contains a Y axis that needs to be managed. The ROWAXIS statement provides a DISPLAYSECONDARY= option, which enables you to display a row secondary Y (right) axis that mirrors the row primary Y axis but can have different display features. In that case, the axis features that you specify in the ROWAXIS statement apply to both the row primary and row secondary Y axes.

If one or more plots within the LAYOUT LATTICE statement block use the YAXIS= option to produce independent Y2 (right) axes, then axis features for the row Y2 axes (right) are specified within a ROW2AXES block, nesting one ROWAXIS statement for each row that contains a Y2 axis that needs to be managed. Within the ROW2AXES block, the ROWAXIS statement's DISPLAYSECONDARY= option enables you to display a row secondary Y2 (left) axis that mirrors the row primary Y2 axis but can have different display features. Here again, the axis features that you specify in the ROWAXIS statement apply to both the row primary and row secondary Y2 axes.

Note: If you specify independent Y and Y2 scales at the same time, then the DISPLAYSECONDARY= option is ignored in the ROWAXIS statement. This is true whether the ROWAXIS statement is specified in a ROWAXES or ROW2AXES block.

For both the ROWAXES and ROW2AXES blocks, if a lattice cell within the row contains a LAYOUT OVERLAY statement with the YAXISOPTS= or Y2AXISOPTS= option specified, these LAYOUT OVERLAY statement options are ignored. In that case, specify the desired axis features in one or more ROWAXIS statements in the ROWAXES block.

Syntax and Restrictions for the Axis Statements

The following table shows the general syntax for row and column axis-statement blocks.

Row or Column X and Y Axes	Row or Column X2 and Y2 Axes
COLUMNAXES; COLUMNAXIS / *axis-options*; <…COLUMNAXIS-*n*;> ENDCOLUMNAXES;	**COLUMN2AXES**; COLUMNAXIS / *axis-options*; <…COLUMNAXIS-*n*;> ENDCOLUMN2AXES;
ROWAXES; ROWAXIS / *axis-options*; <…ROWAXIS-*n*;> ENDROWAXES;	**ROW2AXES**; ROWAXIS / *axis-options*; <…ROWAXIS-*n*;> ENDROW2AXES;

In the LAYOUT LATTICE block, the following restrictions apply:

- If the LAYOUT LATTICE statement sets the row or column axis data range to DATA, then the corresponding axes block is ignored. The data range must be set to UNION or UNIONALL to create row and column axes.
- Only one COLUMNAXES block can be used to manage column X axes, and only one COLUMN2AXES block can be used to manage column X2 axes. If more than one of either block is specified, then only the last one of that block type is used.
- Within a COLUMNAXES or COLUMN2AXES block, one COLUMNAXIS statement should be specified for each column that contains axes that you need to manage. Both axes blocks can contain a COLUMNAXIS statement for the same column. For example, to manage the axes in the first column of the lattice, the COLUMNAXES block can contain a COLUMNAXIS statement that manages the column's X axes. The COLUMN2AXES block can contain a COLUMNAXIS statement that manages the column's X2 axes.
- Only one ROWAXES block can be used to manage row Y axes, and only one ROWAXES block can be used to manage row Y2 axes. If more than one of either block is specified, then only the last one of that block type is used.
- Within a ROWAXES or ROW2AXES block, one ROWAXIS statement should be specified for each row that contains axes that need to be managed. Both axes blocks can contain a ROWAXIS statement for the same row. For example, to manage the axes in the first row of the lattice, the ROWAXES block can contain a ROWAXIS statement that manages the row's Y axes. The ROW2AXES block can contain a ROWAXIS statement that manages the column's Y2 axes.
- If the number COLUMNLAXIS or ROWAXIS statements is greater than the number needed, then the extra statements are ignored. If the number of statements is fewer than the number needed, then the additional COLUMNAXIS or ROWAXIS statements are automatically generated with DISPLAY=NONE option in effect for each.

For the list of *axis-options*, see "Row and Column Axis Options for LAYOUT LATTICE" on page 1140 .

The following example shows a LAYOUT LATTICE block that uses a ROWAXES block to set the row Y axis and to display grid lines for the row display.

```
begingraph;
   layout lattice /
      rowdatarange=union
      columns=2;

      /* axis definitions */
      rowaxes;
         rowaxis /griddisplay=on;
      endrowaxes;

      /* cell contents */
      scatterplot x=x y=t;
      scatterplot x=x y=y;

   endlayout;
endgraph;
```

Here, the LAYOUT LATTICE statement specifies the ROWDATARANGE option to unify the data ranges across rows in the lattice. Because LAYOUT LATTICE

specifies COLUMNS=2 and there are two plot statements in the template, the resulting graph has two columns and only one row. Thus, only one ROWAXIS statement is needed in the ROWAXES block to specify axis attributes for that row of graphs. A ROW2AXES block is not needed because neither SCATTERPLOT statement in the template maps data to the Y2 axis.

For more information and examples that demonstrate how data are mapped to the axes, see "Plot Data Are Mapped to a Designated Axis" on page 1040 .

Header Statements

Header statements are used to display one or more headers for the rows and columns in a LATTICE layout. Each statement is specified as a block in the form *statement - ENDstatement*. The header block is typically used to specify one or more text statements, but other statements are allowed within the block. For example, you could specify a LAYOUT GRIDDED statement to produce a grid of text for the header.

The general syntax for a COLUMNHEADERS statement is

COLUMNHEADERS;

GTL-statement(s);

ENDCOLUMNHEADERS;

The following header statements are available:

Header Statement	Description
COLUMNHEADERS	specifies a header for the primary (bottom) column-header position.
COLUMN2HEADERS	specifies a header for the secondary (top) column-header position.
ROWHEADERS	specifies a header for the primary (left) row-header position. ENTRY statements can be used to specify rotated text.
ROW2HEADERS	specifies a header for the secondary (right) row-header position. ENTRY statements can be used to specify rotated text.

- The LAYOUT LATTICE aligns headers with the columns, or the rows, or both.
- Each of the header blocks COLUMNHEADERS, COLUMN2HEADERS, ROWHEADERS, and ROW2HEADERS can be used once in a LAYOUT LATTICE block. If more than one block is specified for one of the statements, then only the last specified block for that statement is used.

The following example shows a LAYOUT LATTICE block that uses a COLUMNHEADERS block to display column headers above the left and right columns in the lattice.

```
begingraph;
   layout lattice / columns=2;

      /* Lattice header definitions */
      columnheaders;
         entry "Left Column";
         entry "Right Column";
      endcolumnheaders;

      /* cell contents */
      scatter x=x y=t;
      scatter x=x y=y;

   endlayout;
 endgraph;
```

Sidebar Statements

A LAYOUT LATTICE supports the display of a sidebar between a row or column header and a row or column axis. (See the figures in "Statement Description" on page 141 .) A sidebar spans across columns or rows and is useful for displaying information that applies to all of the columns or all of the rows. For example, sidebars are useful for displaying legends.

A SIDEBAR statement has the following syntax:

SIDEBAR </*options*>;

GTL-statement(s);

ENDSIDEBAR;

- You can specify up to four SIDEBAR blocks in a LAYOUT LATTICE, one for each of the top, bottom, left, and right sidebar positions.
- If two or more SIDEBAR blocks have the same alignment, then the sidebar information forms two or more columns (ALIGN=LEFT or ALIGN=RIGHT) within the sidebar area. Or it forms two or more rows (ALIGN=TOP or ALIGN=BOTTOM) within the sidebar area.
- Only one statement (such as ENTRY or DISCRETELEGEND) or one layout block (such as LAYOUT GRIDDED) is allowed in a SIDEBAR block. To create multi-line text in a sidebar, nest ENTRY statements within a LAYOUT GRIDDED block.
- The LAYOUT LATTICE automatically aligns a sidebar with the lattice columns or rows.

The following example shows a LAYOUT LATTICE block that uses a SIDEBAR block to display a top sidebar in the lattice.

```
begingraph;
 layout lattice / columns=2;

  sidebar / align=top;
    layout gridded / border=true ;
      entry "Top Sidebar" ;
      entry "(spans both columns)";
    endlayout;
  endsidebar;
```

```
  scatterplot x=x y=t;
  scatterolot x=x y=y;

 endlayout;
begingraph;
```

Examples

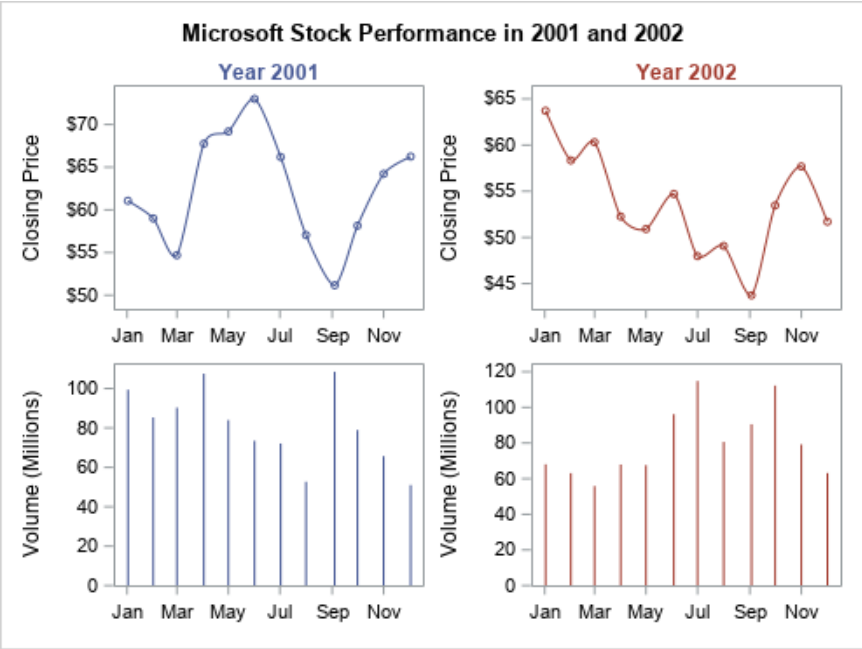
Example 1: Lattice with Internal Axes

This example shows you how to create a four-cell lattice of graphs (two rows, two columns), where each graph has its own, independently managed X and Y axes. The following features are used in this example:

- the following LAYOUT LATTICE statement options:
  - The COLUMNS= option specifies the number of columns in the lattice.
  - The COLUMNGUTTER= and ROWGUTTER= options specify the spacing between the lattice cells.
- A COLUMN2HEADER block in the LAYOUT LATTICE statement block displays headers at the top of each column. ENTRY statements provide the text for each header.
- Four LAYOUT OVERLAY statement blocks in the LAYOUT LATTICE statement block provide the content for each cell.
- Axis options in each LAYOUT OVERLAY statement manage the axes for each plot.

Example Graph

The following graph was generated by the “Example Program” on page 153:



Example Program

```
/* Create the stock data for Microsoft for the years 2001 and 2002 */
data stockyear1 stockyear2;
  set sashelp.stocks(where=(stock eq "Microsoft" and year(date) in
(2001 2002)));
  volume = volume/1000000;
  if year(date) = 2001 then
    output work.stockyear1;
  else if year(date)=2002 then
    output work.stockyear2;
run;

data msstock;
  merge work.stockyear1(rename=(date=year1date close=year1close
volume=year1vol))
    work.stockyear2(rename=(date=year2date close=year2close
volume=year2vol));
  format year1date year2date monname3. year1close year2close dollar6.;
run;

/* Create the graph template */
proc template;
  define statgraph graphlattice;
    begingraph;
      entrytitle "Microsoft Stock Performance in 2001 and 2002";
      layout lattice / columns=2 columngutter=5 rowgutter=5;
        /* Column headers */
        column2headers;
          entry textattrs=GraphData1(weight=bold size=9pt) "Year 2001";
          entry textattrs=GraphData2(weight=bold size=9pt) "Year 2002";
        endcolumn2headers;
```

```
        /* Row 1 content (cells 1-2) */
        layout overlay /
          xaxisopts=(display=(ticks tickvalues)
            timeopts=(viewmax='01DEC2001'd tickvalueformat=monname3.))
          yaxisopts=(label="Closing Price");
          seriesplot x=year1date  y=year1close / display=all
smoothconnect=true
            lineattrs=GraphData1 markerattrs=GraphData1;
        endlayout;
        layout overlay /
          xaxisopts=(display=(ticks tickvalues)
            timeopts=(viewmax='01DEC2002'd tickvalueformat=monname3.))
          yaxisopts=(label="Closing Price");
          seriesplot x=year2date  y=year2close / display=all
smoothconnect=true
            lineattrs=GraphData2 markerattrs=GraphData2;
        endlayout;

        /* Row 2 content (cells 3-4) */
        layout overlay /
          xaxisopts=(display=(ticks tickvalues)
            timeopts=(viewmax='01DEC2001'd tickvalueformat=monname3.))
          yaxisopts=(label="Volume (Millions)");
          needleplot x=year1date  y=year1vol / displaybaseline=off
            lineattrs=GraphData1;
        endlayout;
        layout overlay /
          xaxisopts=(display=(ticks tickvalues)
            timeopts=(viewmax='01DEC2002'd tickvalueformat=monname3.))
          yaxisopts=(label="Volume (Millions)");
          needleplot x=year2date  y=year2vol / displaybaseline=off
            lineattrs=GraphData2;
        endlayout;
      endlayout;
    endgraph;
  end;
run;

proc sgrender data=msstock template=graphlattice;
run;
```

Example 2: Lattice with Row and Column Axes

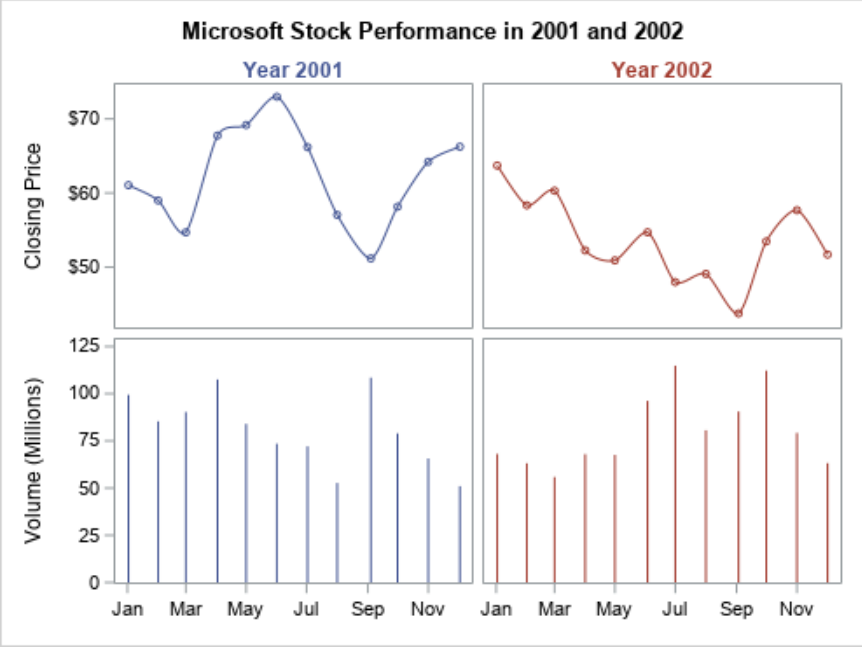
In the lattice shown in “Example 1: Lattice with Internal Axes” on page 152, because the axes in each cell are independently managed, the axis ranges can vary across the plots. However, the axis ranges in each plot in that lattice are comparable. In that case, you can use options COLUMNDATARANGE= and ROWDATARANGE= in the LAYOUT LATTICE statement to create uniform axes for the plots in individual columns or rows, or for all of the plots in all of the columns or rows. The axes are scaled to accommodate the data ranges in all of the included plots. In addition, you can use COLUMNAXES and ROWAXES statement blocks in the LAYOUT LATTICE statement block to consolidate the individual internal axes into common row and column axes. This example shows you how to modify the lattice in “Example 1:

Lattice with Internal Axes" on page 152 to use common row and column axes for the plots in the lattice. The following features are used in this example:

- the following LAYOUT LATTICE statement options:
  - The COLUMNS= option specifies the number of columns in the lattice.
  - The COLUMNGUTTER= and ROWGUTTER= options specify the spacing between the lattice cells.
  - The COLUMNDATARANGE=UNION and ROWDATARANGE=UNION options specify uniform axes for each row and column.
- A COLUMN2HEADER block in the LAYOUT LATTICE statement block displays headers at the top of each column, and ENTRY statements provide the header text.
- A COLUMNAXES statement block in the LAYOUT LATTICE statement block specifies COLUMNAXIS statements, which manage each column axis. Likewise, a ROWAXES statement block provides ROWAXIS statements, which manage each row axis.
- Four LAYOUT OVERLAY statement blocks in the LAYOUT LATTICE statement block provide the content for each cell. No axis options can be used in the LAYOUT OVERLAY statements in this case because axes blocks are used to manage common row and column axes.

Example Graph

The following graph was generated by the "Example Program" on page 156:



Example Program

```
/* Create the stock data for Microsoft for the years 2001 and 2002 */
data stockyear1 stockyear2;
  set sashelp.stocks(where=(stock eq "Microsoft" and year(date) in
(2001 2002)));
  volume = volume/1000000;
  if year(date) = 2001 then
    output work.stockyear1;
  else if year(date)=2002 then
    output work.stockyear2;
run;

data msstock;
  merge work.stockyear1(rename=(date=year1date close=year1close
volume=year1vol))
    work.stockyear2(rename=(date=year2date close=year2close
volume=year2vol));
  format year1date year2date monname3. year1close year2close dollar6.;
run;

/* Create the graph template */
proc template;
  define statgraph graphlattice;
    begingraph;
      entrytitle "Microsoft Stock Performance in 2001 and 2002";
      layout lattice / columns=2 columndatarange=union columngutter=5
        rowdatarange=union rowgutter=5;
        /* Column headers */
        column2headers;
          entry textattrs=GraphData1(weight=bold size=9pt) "Year 2001";
          entry textattrs=GraphData2(weight=bold size=9pt) "Year 2002";
        endcolumn2headers;

        /* Column and row axes */
        columnaxes;
          columnaxis / display=(ticks tickvalues)
            timeopts=(viewmax='01DEC2001'd tickvalueformat=monname3.);
          columnaxis / display=(ticks tickvalues)
            timeopts=(viewmax='01DEC2002'd tickvalueformat=monname3.);
        endcolumnaxes;
        rowaxes;
          rowaxis / label="Closing Price";
          rowaxis / label="Volume (Millions)";
        endrowaxes;

        /* Row 1 content */
        layout overlay;
          seriesplot x=year1date  y=year1close / display=all
smoothconnect=true
            lineattrs=GraphData1 markerattrs=GraphData1;
        endlayout;
        layout overlay;
          seriesplot x=year2date  y=year2close / display=all
smoothconnect=true
```

```
            lineattrs=GraphData2 markerattrs=GraphData2;
        endlayout;

        /* Row 2 content */
        layout overlay;
          needleplot x=year1date  y=year1vol / displaybaseline=off
             lineattrs=GraphData1;
        endlayout;
        layout overlay;
          needleplot x=year2date  y=year2vol / displaybaseline=off
             lineattrs=GraphData2;
        endlayout;
      endlayout;
    endgraph;
  end;
run;

proc sgrender data=msstock template=graphlattice;
run;
```

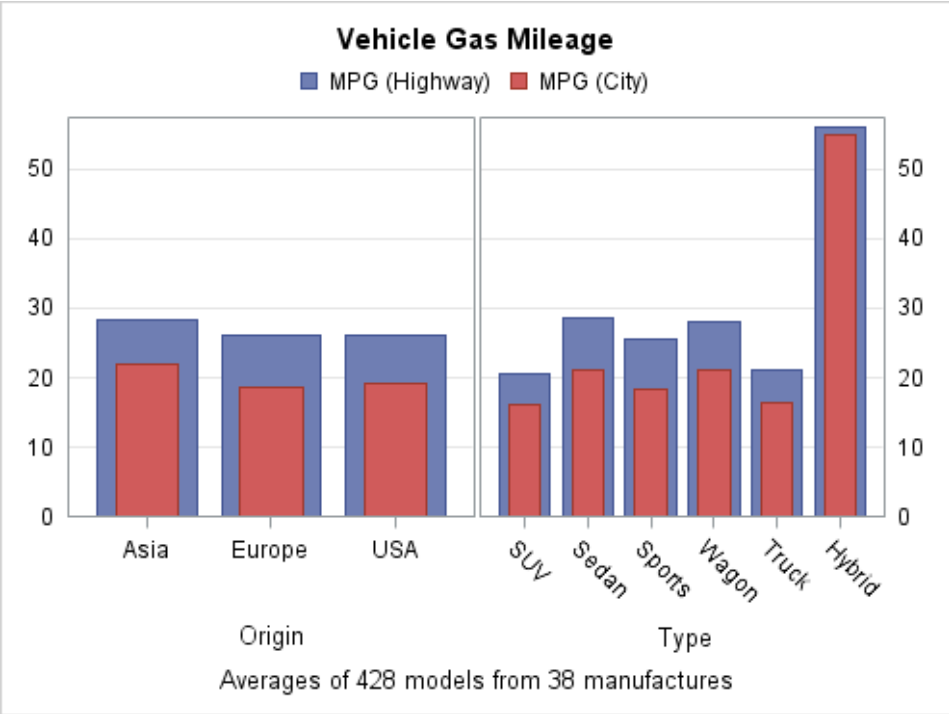
Example 3: Lattice with Sidebar

This example shows a two-cell lattice (two columns, one row) with a legend placed in a sidebar at the top of the graph. A ROWAXES block is used in the example to create a row Y axis. The following features are used in this example:

- The ROWDATARANGE=UNION option in the LAYOUT LATTICE statement ensures that the data ranges of all Y= columns in the row cells are merged into a common axis range. This facilitates the visual comparison of the cells.
- A SIDEBAR block in the LAYOUT LATTICE statement block creates a sidebar at the top of the lattice. A DISCRETELEGEND statement populates the sidebar with a graph legend.
- The DISPLAYSECONDARY= option in the ROWAXIS statement displays a secondary Y axis on the right. The secondary Y axis is a duplicate of the primary Y axis, which makes it easier to read Y-axis values when viewing the bar chart in the right cell.

Example Graph

The following graph was generated by the “Example Program” on page 158:



Example Program

```
proc template;
  define statgraph layoutlattice;
    begingraph;
      entrytitle "Vehicle Gas Mileage";
      entryfootnote "Averages of 428 models from 38 manufactures";
      layout lattice / columns=2 rowdatarange=union;
        layout overlay / cycleattrs=true;
          barchart x=origin y=mpg_highway / stat=mean barwidth=.8
name="H" ;
          barchart x=origin y=mpg_city / stat=mean barwidth=.5
name="C" ;
        endlayout;
        layout overlay / cycleattrs=true;
          barchart x=type y=mpg_highway / stat=mean barwidth=.8;
          barchart x=type y=mpg_city / stat=mean barwidth=.5;
        endlayout;
        sidebar / align=top;
          discretelegend "H" "C" / border=false;
        endsidebar;
        rowaxes;
          rowaxis / display=(tickvalues) displaysecondary=(tickvalues)
            griddisplay=on;
        endrowaxes;
      endlayout;
    endgraph;
  end;
run;
proc sgrender data=sashelp.cars template=layoutlattice;
```

```
run;
```

LAYOUT OVERLAY Statement

Builds a composite from one or more *GTL-statements*. The composite could be an entire graph. Or, if this layout is nested in a GRIDDED or LATTICE layout, then the composite typically provides contents for one cell in the parent layout.

Restrictions: You can add one or more 2-D plots to the graph area that the LAYOUT OVERLAY statement creates, but all of the graphs will share the same set of axes.

3-D plots are not allowed.

Interaction: When nested within another layout type, the OVERLAY layout defines the graph display for one cell of the parent layout. A separate OVERLAY layout is specified for each cell.

Tips: If you want equal sized units on the X and Y axes, use the LAYOUT OVERLAYEQUATED statement.

By default, the first plot specified in the LAYOUT OVERLAY block defines the axis characteristics. If you want another plot to define the axis characteristics, specify PRIMARY=TRUE in the statement for that plot.

Overlaid plots are stacked in the order in which they are specified. The last plot specified is placed on top. When plots are stacked, a plots's graphical data might obscure the graphical data of the plots beneath it. In that case, you can change the plot order or use transparency to make all of the graphical data visible.

The LAYOUT OVERLAY block is primarily used to specify 2-D plot statements, but you can also specify other statements such as DISCRETELEGEND, CONTINUOUSLEGEND, and ENTRY.

Syntax

LAYOUT OVERLAY <*/options*>;

GTL-statements;

<**INNERMARGIN** <*/options(s)*>;

block-plot-statement(s); | *axis-table statement(s)*;

ENDINNERMARGIN;>

<... *more-innermargin-blocks* ...> >

ENDLAYOUT;

Summary of Optional Arguments

Appearance options

ASPECTRATIO=AUTO | *positive-number*

specifies the aspect ratio of the plot's wall area.

BACKGROUNDCOLOR=*style-reference* | *color*
specifies the color of the layout background.

BORDER=TRUE | FALSE
specifies whether a border is drawn around the layout.

BORDERATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the attributes of the border line around the layout.

CYCLEATTRS=TRUE | FALSE
specifies whether the default visual attributes of markers, lines, and fills in nested plot statements automatically change from plot to plot.

OPAQUE=TRUE | FALSE
specifies whether the layout background is opaque (TRUE) or transparent (FALSE).

OUTERPAD=AUTO | *dimension* | (*pad-options*)
specifies the amount of extra space to add outside the layout border.

PAD=*dimension* | *(pad-options)*
specifies the amount of extra space that is added inside the layout border.

WALLCOLOR=*style-reference* | *color*
specifies the fill color of the plot wall area.

WALLDISPLAY=STANDARD | ALL | NONE | (*display-options*)
specifies whether the plot's wall and wall outline are displayed.

Axes options

X2AXISOPTS=(*axis-options*)
specifies one or more X2 axis options.

XAXISOPTS=(*axis-options*)
specifies one or more X-axis options.

Y2AXISOPTS=(*axis-options*)
specifies one or more Y2 axis options.

YAXISOPTS=(*axis-options*)
specifies one or more Y-axis options.

Optional Arguments

ASPECTRATIO=AUTO | *positive-number*
specifies the aspect ratio of the plot's wall area. The ratio is expressed as a positive decimal fraction representing *wall-height* divided by *wall-width*. For example, 0.75 is a 3/4 aspect ratio and 1.0 is a square aspect ratio.

Default AUTO. The wall area is sized to the maximum area that can fill the available space inside the OVERLAY layout.

Interaction When the LAYOUT OVERLAY statement is nested in a LAYOUT LATTICE block, the ASPECTRATIO= option is ignored unless ROWDATARANGE=DATA, COLUMNDATARANGE=DATA, ROW2DATARANGE=DATA, and COLUMN2DATARANGE=DATA are in effect in the LAYOUT LATTICE statement.

See "LAYOUT LATTICE Statement" on page 126

BACKGROUNDCOLOR=*style-reference* | *color*
specifies the color of the layout background.

style-reference
specifies a style reference in the form *style-element:style-attribute*.

Only the style attribute named COLOR or CONTRASTCOLOR is used.

color
specifies a color by name.

See color on page xii

Default The GraphBackground:Color style reference.

Interaction OPAQUE=TRUE must be in effect in order for the color to be seen. By default, OPAQUE=FALSE.

BORDER=TRUE | FALSE
specifies whether a border is drawn around the layout.

Default FALSE

Interaction If this option is set to FALSE, then the BORDERATTRS= option is ignored.

See "boolean " on page xii for other Boolean values that you can use.

BORDERATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the attributes of the border line around the layout.

Default The GraphBorderLines style element.

Interaction BORDER= TRUE must be set for this option to have any effect.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

CYCLEATTRS=TRUE | FALSE
specifies whether the default visual attributes of markers, lines, and fills in nested plot statements automatically change from plot to plot.

FALSE
does not cycle the default visual attributes of multiple plots.

For example, if you overlay three series plots, then each series line has the same default visual properties.

TRUE
attempts to use the GraphData1–GraphDataN style elements to assign different visual properties to applicable plots (scatter plots and series plots and others).

Some plots in the layout do not participate in the cycling (for example, reference lines and drop lines).

Default FALSE

See "Rotating Visual Attributes for Each Plot in an Overlay" on page 210

"boolean " on page xii for other Boolean values that you can use.

Example In the following example, the first three series plots are assigned line properties that are based on the GraphData1, GraphData2, and GraphData3 style elements. The fourth series plot does not participate in the attribute cycling because its LINEATTRS= option assigns a line style.

```
layout overlay / cycleattrs=true;
   seriesplot x=date y=var1;
   seriesplot x=date y=var2;
   seriesplot x=date y=var3;
   seriesplot x=date y=var4 / lineattrs=GraphReference;
endlayout;
```

OPAQUE=TRUE | FALSE
specifies whether the layout background is opaque (TRUE) or transparent (FALSE).

Default FALSE

Interaction When this option is set to FALSE, the background color is not used.

See "boolean " on page xii for other Boolean values that you can use.

OUTERPAD=AUTO | *dimension* | (*pad-options*)
specifies the amount of extra space to add outside the layout border.

AUTO
specifies that the default outside padding for this component is used.

dimension
specifies a dimension to use for the extra space at the left, right, top, and bottom of the layout border.

(*pad-options*)
a space-separated list of one or more name-value pair pad options, enclosed in parentheses.

The list can contain one or more of the following pad options:

LEFT=*dimension*
specifies the amount of extra space to add to the left side.

RIGHT=*dimension*
specifies the amount of extra space to add to the right side.

TOP=*dimension*
specifies the amount of extra space to add to the top.

BOTTOM=*dimension*
specifies the amount of extra space to add to the bottom.

Note Sides that are not assigned padding are padded with the default amount.

Tip Use *pad-options* to create non-uniform padding.

Default AUTO

Note The default units for *dimension* are pixels.

See "dimension" on page xiii

PAD=*dimension* | *(pad-options)*
specifies the amount of extra space that is added inside the layout border.

dimension
specifies a dimension to use for the extra space at the left, right, top, and bottom of the border.

(*pad-options*)
a space-separated list of one or more name-value-pair pad options enclosed in parentheses.

The list can include one or more of the following pad options:

LEFT=*dimension*
specifies the amount of extra space added to the left side.

Default 0

RIGHT=*dimension*
specifies the amount of extra space added to the right side.

Default 0

TOP=*dimension*
specifies the amount of extra space added to the top.

Default 0

BOTTOM=*dimension*
specifies the amount of extra space added to the bottom.

Default 0

Note Sides that are not assigned padding are padded with the default amount.

Tip Use *pad-options* to create non-uniform padding.

Note The default units for *dimension* are pixels.

See "dimension" on page xiii

WALLCOLOR=*style-reference* | *color*
specifies the fill color of the plot wall area.

style-reference
specifies a style reference in the form *style-element:style-attribute*.

Only the style- attribute named COLOR or CONTRASTCOLOR is used.

color
specifies a color by name.

See color on page xii

Default The GraphWalls:Color style reference.

Interaction This option is ignored if WALLDISPLAY=NONE or WALLDISPLAY=(OUTLINE).

WALLDISPLAY=STANDARD | ALL | NONE | (*display-options*)
specifies whether the plot's wall and wall outline are displayed.

STANDARD
displays a filled wall.

The setting of the FrameBorder attribute of the GraphWalls style element determines whether the wall outline is displayed.

ALL
displays a filled, outlined wall.

NONE
displays no wall and no wall outline.

(*display-options*)
specifies a space-separated list of one or more display options, enclosed in parentheses.

The list can contain one or more of the following options:

OUTLINE	displays the wall outline.
FILL	displays a filled wall area.

Default STANDARD

Tips Use the WALLCOLOR= option to control the fill color of the wall.

The appearance attributes of the wall fill and outline for occupied cells are set by the GraphWalls style element. For empty cells, the outline color is set by the ContrastColor attribute of the GraphBorderLines style element, the line style is solid, and the line thickness is 1 pixel.

XAXISOPTS=(*axis-options*)
specifies one or more X-axis options.

Requirements Axis options must be enclosed in parentheses and separated by spaces.

Each option must be specified as a *name = value* pair, and each pair must be separated by a space.

See "Axis Options for LAYOUT OVERLAY" on page 1055 for a list of axis options.

X2AXISOPTS=(*axis-options*)
specifies one or more X2 axis options.

Requirements Axis options must be enclosed in parentheses and separated by spaces.

Each option must be specified as a *name = value* pair, and each pair must be separated by a space.

See "Axis Options for LAYOUT OVERLAY" on page 1055 for a list of axis options.

YAXISOPTS=(*axis-options*)
specifies one or more Y-axis options.

Requirements Axis options must be enclosed in parentheses and separated by spaces.

Each option must be specified as a *name = value* pair, and each pair must be separated by a space.

See "Axis Options for LAYOUT OVERLAY" on page 1055 for a list of options.

Y2AXISOPTS=(*axis-options*)
specifies one or more Y2 axis options.

Requirements Axis options must be enclosed in parentheses and separated by spaces.

Each option must be specified as a *name = value* pair, and each pair must be separated by a space.

See "Axis Options for LAYOUT OVERLAY" on page 1055 for a list of options.

Details

The LAYOUT OVERLAY statement builds a composite using one or more *GTL-statements*. You can specify one or more two-dimensional plots within the layout, provided all plots can share the same type of axes. You can also specify one or more insets, such as nested layout statements (for example, LAYOUT GRIDDED), ENTRY statements, and legend statements (for example, CONTINUOUSLEGEND or DISCRETELEGEND).

The following general logic applies to rendering the composite:

Note: The details for positioning insets also apply to insets that are specified within a LAYOUT REGION block.

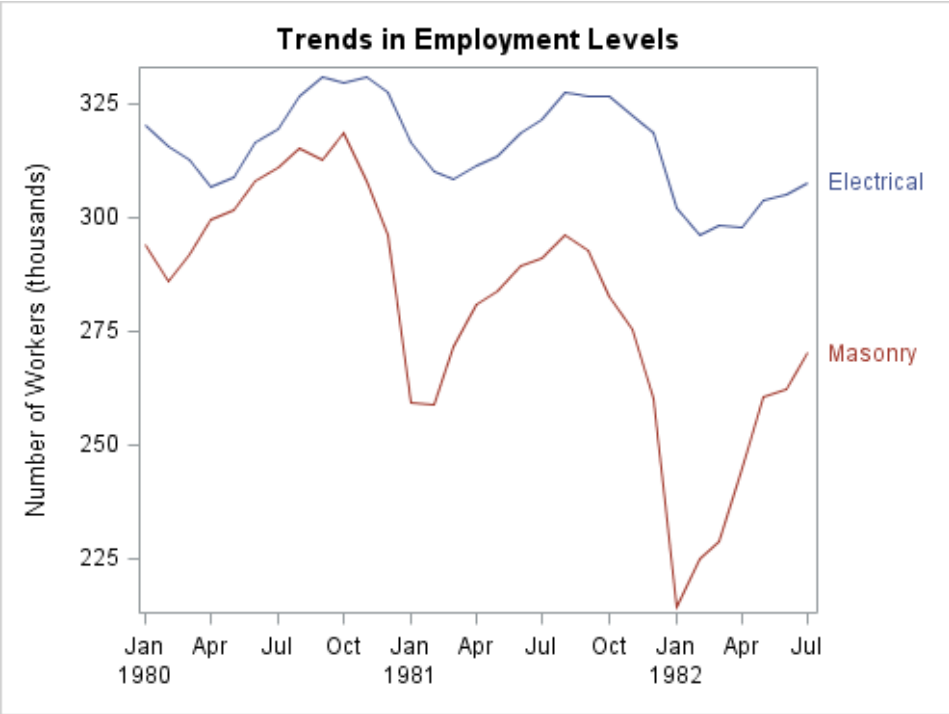
- All plot statements are rendered first. Plot statement results are always rendered in the plot area. The plots are stacked on top of one another in the order in which they are specified, with the last one on top. It is possible for one plot's graphical data to obscure graphical data beneath it. You can control this by selectively ordering the plot statements, or by using transparency on the individual plots, or by doing both.
- The insets are rendered next, in the order in which they are specified. As with the plot statements, it is possible for the insets to obscure the results of other statements in the layout.
- To control the horizontal and vertical positioning of some insets, you can use the inset statement's AUTOALIGN= option, or its HALIGN= and VALIGN= options. Each nested inset determines its own relative position in the parent OVERLAY. This positioning achieves the best results for text-based insets whose size can be easily fit within an open area of the graph wall. A large text-based inset might not fit well, and an inset that contains a plot might be dropped from the display without warning when the template is executed.
- Some insets, like legends, can be positioned inside or outside of the plot area using the inset statement's LOCATION= option. The inset's AUTOALIGN= or HALIGN= and VALIGN= settings are then relative to that location.

Generally, the first specified plot determines the layout's default axis characteristics. To enable another plot to define the axis characteristics, set PRIMARY=TRUE for that plot. For more information about the default axis characteristics, see "When Plots Share Data and a Common Axis" on page 1046. See also the LAYOUT OVERLAYEQUATED and the LAYOUT OVERLAY3D statements.

An OVERLAY layout can also contain an inner margin, which is a nested region at the top or bottom of the OVERLAY container. One or more inner margin plots can be specified, and each is specified within an INNERMARGIN block. Within the INNERMARGIN block, only one-dimensional plot statements such as BLOCKPLOT and AXISTABLE can be specified. See "INNERMARGIN Statement" on page 193.

Example: Simple Overlay

This example shows how to create a simple overlay of two series plots using the OVERLAY layout. The following figure shows the output.



Here is the SAS code.

```
data workers;
  format Date monyy5.;
  input Date monyy5. Electric Masonry;
datalines;
JAN80    320.3    293.8
FEB80    315.7    285.8
MAR80    312.6    292
APR80    306.5    299.3
MAY80    308.6    301.7
JUN80    316.3    307.9
JUL80    319.5    310.7
AUG80    326.4    314.9
SEP80    330.8    312.7
OCT80    329.3    318.5
NOV80    330.6    307.7
DEC80    327.2    296.2
JAN81    316.2    259.2
FEB81    310.1    258.8
MAR81    308.5    271.5
APR81    311.1    281
MAY81    313.6    283.7
JUN81    318.3    289.3
JUL81    321.3    291.1
AUG81    327.4    295.9
SEP81    326.7    292.7
OCT81    326.4    282.6
NOV81    322.5    275.5
DEC81    318.6    260.2
JAN82    301.9    214.3
FEB82    296.1    224.8
MAR82    298.3    228.7
APR82    297.7    244.7
```

```
MAY82    303.5    260.4
JUN82    305     262.2
JUL82    307.6    270.4
;
proc template;
  define statgraph layoutoverlay;
    begingraph;
      entrytitle "Trends in Employment Levels";
      layout overlay / cycleattrs=true
          xaxisopts=(display=(ticks tickvalues))
          yaxisopts=(label="Number of Workers (thousands)");
        seriesplot x=date y=electric /
          curvelabel="Electrical"
          curvelabellocation=outside;
        seriesplot x=date y=masonry / curvelabel="Masonry"
          curvelabellocation=outside;
      endlayout;
    endgraph;
  end;
run;

proc sgrender data=workers template=layoutoverlay;
run;
```

LAYOUT OVERLAYEQUATED Statement

Builds a composite from one or more *GTL-statements*. The composite could be an entire graph. Or, if this layout is nested in another layout, such as a GRIDDED layout, then the composite typically provides contents for one cell in the parent layout. In an OVERLAYEQUATED layout, the display unit of the X axis always equals the display unit of the Y axis.

Restrictions:

All overlaid plots share common X and Y axes.

3-D plots are not allowed.

The axis type for both X and Y axes is always linear and is derived directly from the data. Plot types that have discrete or binned axes cannot be used with this layout. This includes BOXPLOT, BOXPLOTPARM, BARCHARTPARM, HISTOGRAM and HISTOGRAMPARM. It also includes HEATMAP and HEATMAPPARM when at least one of the plot variables is of type character, or TRUE is in effect for at least one of the options DISCRETEX=, DISCRETEY=, XBINAXIS=, and YBINAXIS=.

You can add one or more of the following X-Y plots to the graph area that the LAYOUT OVERLAYEQUATED statement creates: BANDPLOT, CONTOURPLOTPARM, ELLIPSE, ELLIPSEPARM, LOESSPLOT, NEEDLEPLOT, PBSPLINEPLOT, REGRESSIONPLOT, SCATTERPLOT, SERIESPLOT, STEPPLOT, or VECTORPLOT. You can also add HEATMAP and HEATMAPPARM plots when both plot variables are numeric, and FALSE is in effect for options DISCRETEX=, DISCRETEY=, XBINAXIS=, and YBINAXIS. As long as one of these plots is present, you can also add FRINGEPLOT, LINEPARM, MODELBAND, REFERENCELINE, DROPLINE, DISCRETELEGEND, CONTINUOUSLEGEND, and text-based statements such as ENTRY.

This layout has only two independent axes from a data standpoint, X and Y. If any contained plot uses an X=X2 or Y=Y2 option, then the option is ignored and the data is mapped to the X or Y axis. However, the X2 and Y2 axes can be displayed using the DISPLAYSECONDARY= suboption of the XAXISOPTS= and YAXISOPTS= options.

Interaction: When nested within another layout type, the OVERLAYEQUATED layout defines the graph display for one cell of the parent layout. A separate OVERLAYEQUATED layout is specified for each cell.

Tips: By default, the first plot specified in the LAYOUT OVERLAYEQUATED block defines the axis characteristics. If you want another plot to define the axis characteristics, specify PRIMARY=TRUE in the statement for that plot.

Overlaid plots are stacked in the order in which they are specified. The last plot specified is placed on top. When plots are stacked, a plots's graphical data might obscure the graphical data of the plots beneath it. In that case, you can change the plot order or use transparency to make all of the graphical data visible.

Syntax

LAYOUT OVERLAYEQUATED <*/options*>;

GTL-statements;
ENDLAYOUT;

Summary of Optional Arguments

Appearance options

BACKGROUNDCOLOR=*style-reference* | *color*
specifies the color of the layout background.

BORDER=TRUE | FALSE
specifies whether a border is drawn around the layout.

BORDERATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the attributes of the border line around the layout.

CYCLEATTRS=TRUE | FALSE
specifies whether the default visual attributes of markers, lines, and fills in nested plot statements automatically change from plot to plot.

OPAQUE=TRUE | FALSE
specifies whether the layout background is opaque (TRUE) or transparent (FALSE).

OUTERPAD=AUTO | *dimension* | (*pad-options*)
specifies the amount of extra space to add outside the layout border.

PAD=*dimension* | *(pad-options)*
specifies the amount of extra space that is added inside the layout border.

WALLCOLOR=*style-reference* | *color*
specifies the fill color of the plot wall area.

WALLDISPLAY=STANDARD | ALL | NONE | (*display-options*)
specifies whether the plot's wall and wall outline are displayed.

Axes options

COMMONAXISOPTS=(*common-axis-options*)
specifies one or more options to apply to both the X and Y equated axes.

EQUATETYPE=FIT | SQUARE | SQUAREDATA | EQUATE
specifies how to draw the axis area.

XAXISOPTS=(*axis-options*)
specifies one or more X-axis options.

YAXISOPTS=(*axis-options*)
specifies one or more Y-axis options.

Optional Arguments

BACKGROUNDCOLOR=*style-reference* | *color*
specifies the color of the layout background.

style-reference
specifies a style reference in the form *style-element:style-attribute*.

Only the style attribute named COLOR or CONTRASTCOLOR is used.

color
specifies a color by name.

See color on page xii

Default The GraphBackground:Color style reference.

Interaction OPAQUE=TRUE must be in effect in order for the color to be seen. By default, OPAQUE=FALSE.

BORDER=TRUE | FALSE
specifies whether a border is drawn around the layout.

Default FALSE

Interaction If this option is set to FALSE, then the BORDERATTRS= option is ignored.

See "boolean " on page xii for other Boolean values that you can use.

BORDERATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the attributes of the border line around the layout.

Default The GraphBorderLines style element.

Interaction BORDER= TRUE must be set for this option to have any effect.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

COMMONAXISOPTS=(*common-axis-options*)
specifies one or more options to apply to both the X and Y equated axes.

Requirements Axis options must be enclosed in parentheses.

Each option must be specified as a *name = value* pair and must be separated by a space.

See "Options That Apply to Both Equated Axes" on page 1197 for a list of options.

CYCLEATTRS=TRUE | FALSE
specifies whether the default visual attributes of markers, lines, and fills in nested plot statements automatically change from plot to plot.

FALSE
does not cycle the default visual attributes of multiple plots.

For example, if you overlay three series plots, then each series line has the same default visual properties.

TRUE
attempts to use the GraphData1–GraphDataN style elements to assign different visual properties to applicable plots (scatter plots and series plots and others).

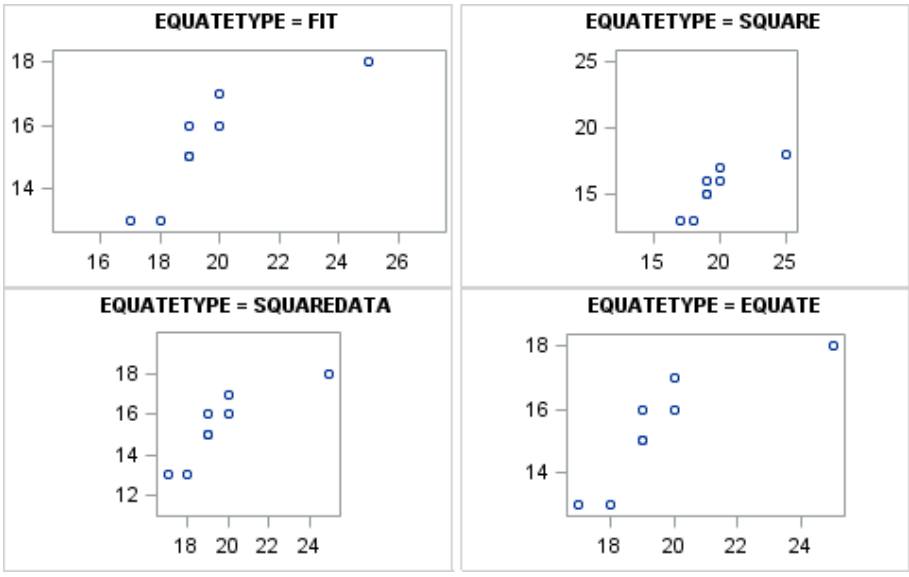
Some plots in the layout do not participate in the cycling (for example, reference lines and drop lines).

Default FALSE

See "Rotating Visual Attributes for Each Plot in an Overlay" on page 210

"boolean " on page xii for other Boolean values that you can use.

EQUATETYPE=FIT | SQUARE | SQUAREDATA | EQUATE
specifies how to draw the axis area.



FIT
specifies that the X and Y axes have equal increments between tick values.

The data ranges of both axes are compared to establish a common increment size. The axes might be of different lengths and have a different number of tick marks. Each axis represents its own data range. One axis might be extended to use available space in the plot area. If a TICKVALUELIST= or TICKVALUESEQUENCE= axis option is used on COMMONAXISOPTS= , then it is ignored.

SQUARE
specifies that both the X and Y axes have the same length and the same major tick values.

The axis length and tick values are chosen so that the minimum and maximum of both X and Y appear in the range of values appearing on both axes.

SQUAREDATA
specifies that both the X and Y axes have the same data range, but they can have different tick values.

A UNION of the data ranges does not occur in this case. For example, if the X-axis values are 20 to 40 (range of 20) and the Y-axis values are 200 to 260 (range of 60), then both axes have a range of 60 units, but the X axis can have tick values 0, 20, 40, and 60, and the Y axis can have tick values 200, 220, 240, and 260.

EQUATE
same as FIT except that neither axis is extended to use available space in the plot area.

Default FIT

OPAQUE=TRUE | FALSE
specifies whether the layout background is opaque (TRUE) or transparent (FALSE).

Default FALSE

Interaction When this option is set to FALSE, the background color is not used.

See “boolean ” on page xii for other Boolean values that you can use.

OUTERPAD=AUTO | *dimension* | (*pad-options*)
specifies the amount of extra space to add outside the layout border.

AUTO
specifies that the default outside padding for this component is used.

dimension
specifies a dimension to use for the extra space at the left, right, top, and bottom of the layout border.

(*pad-options*)
a space-separated list of one or more name-value pair pad options, enclosed in parentheses.

The list can contain one or more of the following pad options:

LEFT=*dimension*
specifies the amount of extra space to add to the left side.

RIGHT=*dimension*
specifies the amount of extra space to add to the right side.

TOP=*dimension*
specifies the amount of extra space to add to the top.

BOTTOM=*dimension*
specifies the amount of extra space to add to the bottom.

Note Sides that are not assigned padding are padded with the default amount.

Tip Use *pad-options* to create non-uniform padding.

Default AUTO

Note The default units for *dimension* are pixels.

See "dimension" on page xiii

PAD=*dimension* | *(pad-options)*
specifies the amount of extra space that is added inside the layout border.

dimension
specifies a dimension to use for the extra space at the left, right, top, and bottom of the border.

(*pad-options*)
a space-separated list of one or more name-value-pair pad options enclosed in parentheses.

The list can include one or more of the following pad options:

LEFT=*dimension*
specifies the amount of extra space added to the left side.

Default 0

RIGHT=*dimension*
specifies the amount of extra space added to the right side.

Default 0

TOP=*dimension*
specifies the amount of extra space added to the top.

Default 0

BOTTOM=*dimension*
specifies the amount of extra space added to the bottom.

Default 0

Note Sides that are not assigned padding are padded with the default amount.

Tip Use *pad-options* to create non-uniform padding.

Note The default units for *dimension* are pixels.

See "dimension" on page xiii

WALLCOLOR=*style-reference* | *color*
specifies the fill color of the plot wall area.

style-reference
specifies a style reference in the form *style-element:style-attribute*.

Only the style- attribute named COLOR or CONTRASTCOLOR is used.

color
specifies a color by name.

See color on page xii

Default The GraphWalls:Color style reference.

Interaction This option is ignored if WALLDISPLAY=NONE or WALLDISPLAY=(OUTLINE).

WALLDISPLAY=STANDARD | ALL | NONE | (*display-options*)
specifies whether the plot's wall and wall outline are displayed.

STANDARD
displays a filled wall.

The setting of the FrameBorder attribute of the GraphWalls style element determines whether the wall outline is displayed.

ALL
displays a filled, outlined wall.

NONE
displays no wall and no wall outline.

(*display-options*)
specifies a space-separated list of one or more display options, enclosed in parentheses.

The list can contain one or more of the following options:

OUTLINE	displays the wall outline.
FILL	displays a filled wall area.

Default STANDARD

Tips Use the WALLCOLOR= option to control the fill color of the wall.

The appearance attributes of the wall fill and outline for occupied cells are set by the GraphWalls style element. For empty cells, the outline

color is set by the ContrastColor attribute of the GraphBorderLines style element, the line style is solid, and the line thickness is 1 pixel.

XAXISOPTS=(*axis-options*)
specifies one or more X-axis options.

Requirements Axis options must be enclosed in parentheses and separated by spaces.

Each option must be specified as a *name = value* pair, and each pair must be separated by a space.

See "Options That Apply Separately to an X or Y Equated Axis" on page 1203 for a list of options.

YAXISOPTS=(*axis-options*)
specifies one or more Y-axis options.

Requirements Axis options must be enclosed in parentheses and separated by spaces.

Each option must be specified as a *name = value* pair, and each pair must be separated by a space.

See "Options That Apply Separately to an X or Y Equated Axis" on page 1203 for a list of options..

Details

The LAYOUT OVERLAYEQUATED statement is similar to the LAYOUT OVERLAY statement: it builds a composite using one or more *GTL-statements*. Similar to a LAYOUT OVERLAY, you can specify one or more 2-D plots within the layout, provided all plots can share the same type of axes. (Additional restrictions are discussed in a moment.) You can also specify one or more insets.

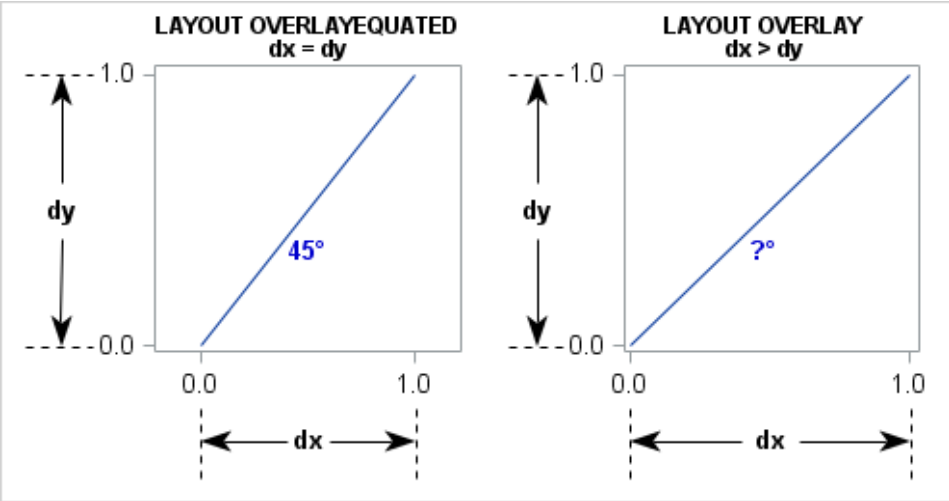
As an overlay-type layout, OVERLAYEQUATED has the same behavioral characteristics as an OVERLAY layout. It uses the same general logic for rendering the composite (see "LAYOUT OVERLAY Statement" on page 159 for details), and its default axis characteristics are generally determined by the first specified plot, unless you use PRIMARY=TRUE on an alternative plot statement (see "When Plots Share Data and a Common Axis" on page 1046).

OVERLAYEQUATED differs from OVERLAY in several ways. With OVERLAYEQUATED,

- The axis type for both X and Y axes is always linear. Thus, plot types that have discrete or binned axes cannot be used within this layout. This includes BOXPLOT, BOXPLOTPARM, BARCHARTPARM, HISTOGRAM, and HISTOGRAMPARM. It also includes HEATMAP and HEATMAPPARM when one or both axes are binned.

- For equal data intervals on both axes, the display distance is the same. For example, an interval of 2 on the X axis maps to the same display distance as an interval of 2 on the Y axis.
- The aspect ratio of the plot display equals the aspect ratio of the plot data. In other words, a 45-degree slope in data is represented by a 45-degree slope in the display. The EQUATETYPE= option determines how the axes are drawn.

The following figure illustrates how a series plot might map differently when specified in an OVERLAYEQUATED layout versus an OVERLAY layout:

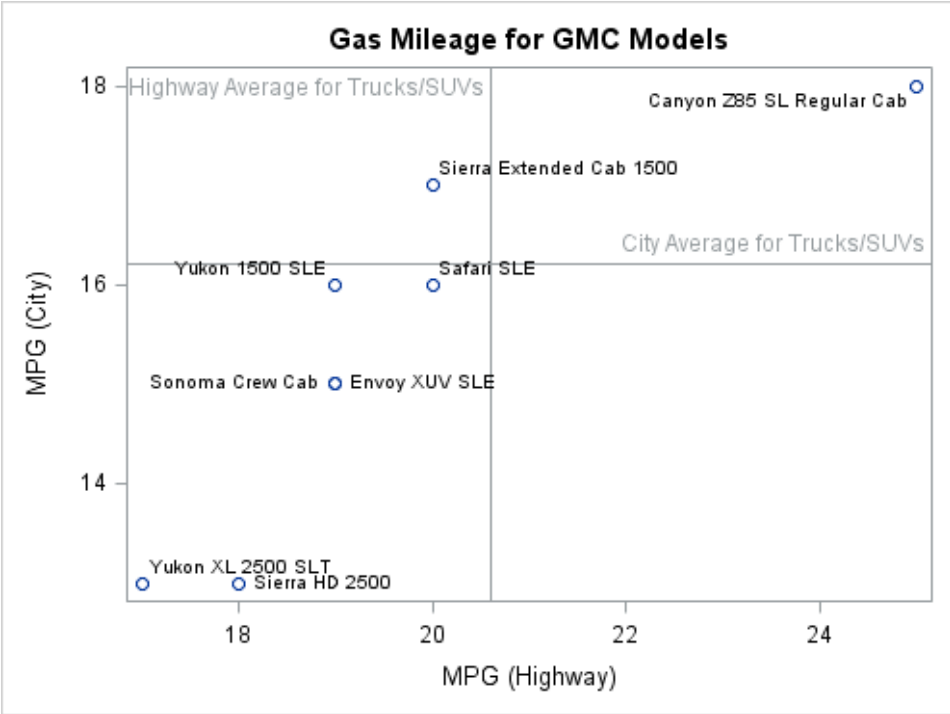


From a data standpoint, this layout has only two independent axes, X and Y. If any plots within the layout block use an XAXIS=X2 or YAXIS=Y2 option, then the option is ignored and the data are mapped to the X or Y axis. To display X2 and Y2 axes, use the DISPLAYSECONDARY= suboption of the XAXISOPTS= and YAXISOPTS= options.

If an OVERLAYEQUATED statement is nested in a LATTICE layout, then some of the LATTICE's alignment and external axis features are not supported on the OVERLAYEQUATED layout.

Example: LAYOUT OVERLAYEQUATED Statement

The following graph was generated by the "Example Program" on page 177:



Example Program

```
proc template;
  define statgraph layoutoverlayequated;
    begingraph;
      entrytitle "Gas Mileage for GMC Models";
      layout overlayequated / equatetype=fit;
        referenceline y=16.2 /
         curvelabel="City Average for Trucks/SUVs"
         curvelabellocation=inside
         curvelabelattrs=GraphReference;
        referenceline x=20.6 /
         curvelabel="Highway Average for Trucks/SUVs"
         curvelabellocation=inside
         curvelabelattrs=GraphReference;
        scatterplot x=mpg_highway y=mpg_city /
         datalabel=model;
      endlayout;
    endgraph;
  end;
run;
proc sgrender data=sashelp.cars
     template=layoutoverlayequated;
  where make="GMC";
run;
```

LAYOUT OVERLAY3D Statement

Builds a 3-D composite from one or more *GTL-statements*. The composite could be an entire graph. Or, if this layout is nested in a GRIDDED or LATTICE layout, then the composite typically provides contents for one cell in the parent layout.

Restriction: You can add one or more 3-D plots to the graph area that the LAYOUT OVERLAY3D statement creates, but all of the graphs will share the same set of axes.

Tips: By default, the first plot specified in the LAYOUT OVERLAY3D block defines the axis characteristics. If you want another plot to define the axis characteristics, specify PRIMARY=TRUE in the statement for that plot.

Overlaid plots are stacked in the order in which they are specified. The last plot specified is placed on top. When plots are stacked, a plots's graphical data might obscure the graphical data of the plots beneath it. In that case, you can change the plot order or use transparency to make all of the graphical data visible.

The LAYOUT OVERLAY3D block is primarily used to specify 3-D plot statements, but you can also specify other statements such as CONTINUOUSLEGEND.

Syntax

LAYOUT OVERLAY3D </*options*>;

GTL-statements;
ENDLAYOUT;

Summary of Optional Arguments

Appearance options

BACKGROUNDCOLOR=*style-reference* | *color*
specifies the color of the layout background.

BORDER=TRUE | FALSE
specifies whether a border is drawn around the layout.

BORDERATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the attributes of the border line around the layout.

CUBE=TRUE | FALSE
specifies whether the layout displays the lines that indicate the complete bounding cube of the axis planes.

CYCLEATTRS=TRUE | FALSE
specifies whether the default visual attributes of markers, lines, and fills in nested plot statements automatically change from plot to plot.

OPAQUE=TRUE | FALSE
specifies whether the layout background is opaque (TRUE) or transparent (FALSE).

OUTERPAD=AUTO | *dimension* | (*pad-options*)
specifies the amount of extra space to add outside the layout border.

PAD=*dimension* | *(pad-options)*
specifies the amount of extra space that is added inside the layout border.

ROTATE=*number*
specifies the angle of rotation.

TILT=*number*
specifies the angle of tilt in degrees.

WALLCOLOR=*style-reference* | *color*
specifies the fill color of the plot wall area.

WALLDISPLAY=STANDARD | ALL | NONE | (*display-options*)
specifies whether the plot's wall and wall outline are displayed.

ZOOM=*positive-number*
specifies a zoom factor.

Axes options

XAXISOPTS=(*axis-options*)
specifies one or more X-axis options.

YAXISOPTS=(*axis-options*)
specifies one or more Y-axis options.

ZAXISOPTS=(*axis-options*)
specifies one or more Z-axis options.

Optional Arguments

BACKGROUNDCOLOR=*style-reference* | *color*
specifies the color of the layout background.

style-reference
specifies a style reference in the form *style-element:style-attribute*.

Only the style attribute named COLOR or CONTRASTCOLOR is used.

color
specifies a color by name.

See color on page xii

Default The GraphBackground:Color style reference.

Interaction OPAQUE=TRUE must be in effect in order for the color to be seen. By default, OPAQUE=FALSE.

BORDER=TRUE | FALSE
specifies whether a border is drawn around the layout.

Default FALSE

Interaction If this option is set to FALSE, then the BORDERATTRS= option is ignored.

See "boolean " on page xii for other Boolean values that you can use.

BORDERATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the attributes of the border line around the layout.

Default The GraphBorderLines style element.

Interaction BORDER= TRUE must be set for this option to have any effect.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

CUBE=TRUE | FALSE
specifies whether the layout displays the lines that indicate the complete bounding cube of the axis planes.

Default TRUE

Note The cube lines are displayed independently of the wall borders and axis lines. Because some cube lines coincide with wall borders and axis lines, it might appear that turning off wall borders or axis lines has no effect when CUBE=TRUE.

Tip The color, thickness, and pattern of the cube lines are determined by the GraphAxisLines style element.

See "boolean " on page xii for other Boolean values that you can use.

CYCLEATTRS=TRUE | FALSE
specifies whether the default visual attributes of markers, lines, and fills in nested plot statements automatically change from plot to plot.

FALSE
does not cycle the default visual attributes of multiple plots.

For example, if you overlay three series plots, then each series line has the same default visual properties.

TRUE
attempts to use the GraphData1–GraphDataN style elements to assign different visual properties to applicable plots (scatter plots and series plots and others).

Some plots in the layout do not participate in the cycling (for example, reference lines and drop lines).

Default FALSE

See "Rotating Visual Attributes for Each Plot in an Overlay" on page 210

"boolean " on page xii for other Boolean values that you can use.

OPAQUE=TRUE | FALSE
specifies whether the layout background is opaque (TRUE) or transparent (FALSE).

Default FALSE

Interaction When this option is set to FALSE, the background color is not used.

See "boolean " on page xii for other Boolean values that you can use.

OUTERPAD=AUTO | *dimension* | (*pad-options*)
specifies the amount of extra space to add outside the layout border.

AUTO
specifies that the default outside padding for this component is used.

dimension
specifies a dimension to use for the extra space at the left, right, top, and bottom of the layout border.

(*pad-options*)
a space-separated list of one or more name-value pair pad options, enclosed in parentheses.

The list can contain one or more of the following pad options:

LEFT=*dimension*
specifies the amount of extra space to add to the left side.

RIGHT=*dimension*
specifies the amount of extra space to add to the right side.

TOP=*dimension*
specifies the amount of extra space to add to the top.

BOTTOM=*dimension*
specifies the amount of extra space to add to the bottom.

Note Sides that are not assigned padding are padded with the default amount.

Tip Use *pad-options* to create non-uniform padding.

Default AUTO

Note The default units for *dimension* are pixels.

See "dimension" on page xiii

PAD=*dimension* | *(pad-options)*
specifies the amount of extra space that is added inside the layout border.

dimension
specifies a dimension to use for the extra space at the left, right, top, and bottom of the border.

(*pad-options*)
a space-separated list of one or more name-value-pair pad options enclosed in parentheses.

The list can include one or more of the following pad options:

LEFT=*dimension*
specifies the amount of extra space added to the left side.

Default 0

RIGHT=*dimension*
specifies the amount of extra space added to the right side.

Default 0

TOP=*dimension*
specifies the amount of extra space added to the top.

Default 0

BOTTOM=*dimension*
specifies the amount of extra space added to the bottom.

Default 0

Note Sides that are not assigned padding are padded with the default amount.

Tip Use *pad-options* to create non-uniform padding.

Note The default units for *dimension* are pixels.

See "dimension" on page xiii

ROTATE=*number*
specifies the angle of rotation. Rotation is measured in a clockwise direction about a virtual axis parallel to the Z axis (vertical) and passing through the center of the bounding cube. A counterclockwise rotation can be specified with a negative value.

Default 54

TILT=*number*
specifies the angle of tilt in degrees. Tilt is measured in a clockwise direction about a virtual axis parallel to the X axis (vertical) and passing through the center of the bounding cube. A counterclockwise rotation can be specified with a negative value.

Default 20

WALLCOLOR=*style-reference* | *color*
specifies the fill color of the plot wall area.

style-reference
specifies a style reference in the form *style-element:style-attribute*.

Only the style- attribute named COLOR or CONTRASTCOLOR is used.

color
specifies a color by name.

See color on page xii

Default The GraphWalls:Color style reference.

Interaction This option is ignored if WALLDISPLAY=NONE or WALLDISPLAY=(OUTLINE).

WALLDISPLAY=STANDARD | ALL | NONE | (*display-options*)
specifies whether the plot's wall and wall outline are displayed.

STANDARD
displays a filled wall.

The setting of the FrameBorder attribute of the GraphWalls style element determines whether the wall outline is displayed.

ALL
displays a filled, outlined wall.

NONE
displays no wall and no wall outline.

(*display-options*)
specifies a space-separated list of one or more display options, enclosed in parentheses.

The list can contain one or more of the following options:

OUTLINE	displays the wall outline.
FILL	displays a filled wall area.

Default STANDARD

Tips Use the WALLCOLOR= option to control the fill color of the wall.

The appearance attributes of the wall fill and outline for occupied cells are set by the GraphWalls style element. For empty cells, the outline color is set by the ContrastColor attribute of the GraphBorderLines style element, the line style is solid, and the line thickness is 1 pixel.

See the CUBE= option.

XAXISOPTS=(*axis-options*)
specifies one or more X-axis options.

Requirements Axis options must be enclosed in parentheses and separated by spaces.

Each option must be specified as a *name = value* pair, and each pair must be separated by a space.

See "Axis Options for LAYOUT OVERLAY3D" on page 1119 for a list of axis options.

YAXISOPTS=(*axis-options*)
specifies one or more Y-axis options.

Requirements Axis options must be enclosed in parentheses and separated by spaces.

Each option must be specified as a *name = value* pair, and each pair must be separated by a space.

See "Axis Options for LAYOUT OVERLAY3D" on page 1119 for a list of axis options.

ZAXISOPTS=(*axis-options*)
specifies one or more Z-axis options.

Requirements Axis options must be enclosed in parentheses and separated by spaces.

Each option must be specified as a *name = value* pair, and each pair must be separated by a space.

See "Axis Options for LAYOUT OVERLAY3D" on page 1119 for a list of axis options..

ZOOM=*positive-number*
specifies a zoom factor. Factors greater than 1 move closer to the bounding cube, less than 1 move farther away

Default 1

Details

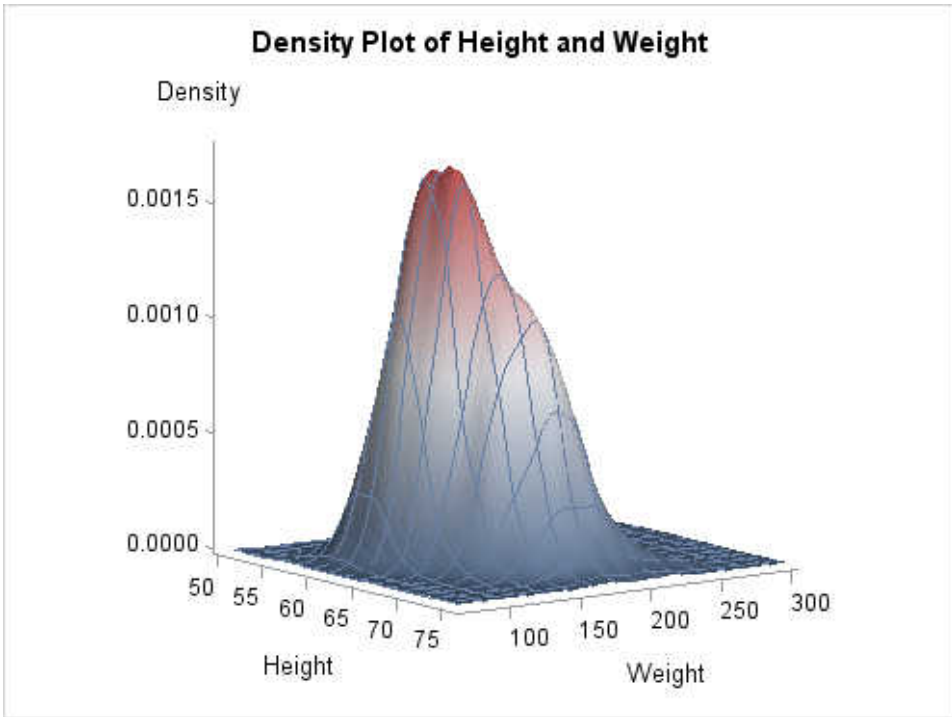
The LAYOUT OVERLAY3D statement builds a 3-D composite using one or more *GTL-statements*. You can specify one or more 3-D plots within the layout, provided all plots can share the same type of axes. You can also specify "annotations" (for example, with one or more ENTRY statements or LAYOUT GRIDDED statements). However, annotations in the OVERLAY3D layout are more likely to collide with other graphics features than are annotations in other overlay-type layouts.

As an overlay-type layout, OVERLAY3D has the same behavioral characteristics as an OVERLAY layout. It uses the same general logic for rendering the composite (see "LAYOUT OVERLAY Statement" on page 159 for details), and its default axis characteristics are generally determined by the first specified plot, unless you use PRIMARY=TRUE on another plot statement (see "When Plots Share Data and a Common Axis" on page 1046).

Within an OVERLAY3D layout, a graph's bounding cube can be tilted, rotated, and zoomed to provide a different viewpoint. By default, the outline of the bounding cube is displayed and the viewing rotation angle is 57 degrees, the tilt angle is 20 degrees, and the zoom factor is 1. See the CUBE= , ROTATE= , TILT= , and ZOOM= options for information about how to change the viewpoint.

Example: LAYOUT OVERLAY3D Statement

The following graph was generated by the "Example Program" on page 185:



Example Program

```
proc template;
  define statgraph layoutoverlay3d;
    begingraph;
      entrytitle "Density Plot of Height and Weight";
      layout overlay3d / tilt=10  rotate=54
                         walldisplay=none cube=false;
        surfaceplotparm x=height y=weight z=density /
          surfacecolorgradient=density;
      endlayout;
    endgraph;
  end;
run;
proc sgrender data=sashelp.gridded template=layoutoverlay3d;
run;
```

LAYOUT PROTOTYPE Statement

Builds a composite from one or more *plot-statements*. The composite is used as a prototype or "rubber stamp" that repeats in each cell of a parent DATALATTICE or DATAPANEL layout.

Restrictions: You can specify only one LAYOUT PROTOTYPE block in a LAYOUT DATAPANEL or LAYOUT DATALATTICE block. If you specify more than one, then only the last prototype block specified is honored. The remaining prototype blocks are ignored.

Only the following plots can be used in a LAYOUT PROTOTYPE block: BANDPLOT, BARCHART, BARCHARTPARM, BLOCKPLOT, BOXPLOTPARM, COUNTOURPLOTPARM, DROPLINE, ELLIPSEPARM, FRINGEPLOT, HEATMAPPARM, HISTOGRAMPARM, LINECHART, LINEPARM, NEEDLEPLOT, REFERENCELINE, SCATTERPLOT, SERIESPLOT, STEPPLOT, and VECTORPLOT.

SCATTERPLOTMATRIX plots, 3-D plots, and region plots such as PIECHART or MOSAICPLOTPARM cannot be used in the LAYOUT PROTOTYPE block.

ENTRY, DISCRETELEGEND, and CONTINUOUSLEGEND statements cannot be used in the LAYOUT PROTOTYPE block.

A plot statement cannot be used if it contains a column defined with an EVAL expression.

You can add one or more two-dimensional plots and one-dimensional plots to the graph area that the LAYOUT PROTOTYPE statement creates, provided all of the graphs can share the same axis type.

If you include a plot statement with a CURVELABEL= option (such as SERIESPLOT), then only CURVELABELLOCATION=INSIDE is supported.

If you include a plot statement that supports a CLIP= option (such as LINEPARM or ELLIPSEPARM), then the CLIP value is always set to TRUE.

Requirement: The LAYOUT PROTOTYPE statement must be nested in a LAYOUT DATAPANEL or LAYOUT DATALATTICE block.

Note: Nesting an INNERMARGIN block in the LAYOUT PROTOTYPE statement is valid in SAS 9.4M1 and later releases.

See: "LAYOUT DATAPANEL Statement" on page 79
"LAYOUT DATALATTICE Statement" on page 51

Syntax

LAYOUT PROTOTYPE </option(s)>;
plot-statements;
<**INNERMARGIN** </*options(s)*>;
block-plot-statement(s); | *axis-table statement(s)*;
ENDINNERMARGIN;>
<... *more-innermargin-blocks* ...> >
ENDLAYOUT;

Optional Arguments

ASPECTRATIO=AUTO | *positive-number*
specifies the aspect ratio of the prototype cell. The ratio is expressed as a positive decimal fraction representing *wall-height* divided by *wall-width*. For example, 0.75 is a 3/4 aspect ratio and 1.0 is a square aspect ratio.

Default AUTO. The prototype cell is sized to the maximum area that can fill the available space inside the layout cell.

Note If AUTO is not used for the aspect ratio, then the entire DATALATTICE or DATAPANEL grid is affected and changes shape.

CYCLEATTRS=TRUE | FALSE
specifies whether the default visual attributes of markers, lines, and fills in nested plot statements automatically change from plot to plot.

FALSE
does not cycle the default visual attributes of multiple plots.

For example, if you overlay three series plots, then each series line has the same default visual properties.

TRUE
attempts to use the GraphData1–GraphDataN style elements to assign different visual properties to applicable plots (scatter plots and series plots and others).

Some plots in the layout do not participate in the cycling (for example, reference lines and drop lines).

Default FALSE

See “Rotating Visual Attributes for Each Plot in an Overlay” on page 210

“boolean ” on page xii for other Boolean values that you can use.

WALLCOLOR=*style-reference* | *color*
specifies the fill color of the plot wall area.

style-reference
specifies a style reference in the form *style-element*:*style-attribute*.

Only the style- attribute named COLOR or CONTRASTCOLOR is used.

color
specifies a color by name.

See color on page xii

Default The GraphWalls:Color style reference.

Interaction This option is ignored if WALLDISPLAY=NONE or WALLDISPLAY=(OUTLINE).

WALLDISPLAY=STANDARD | ALL | NONE | (*display-options*)
specifies whether the plot’s wall and wall outline are displayed.

STANDARD
displays a filled wall.

The setting of the FrameBorder attribute of the GraphWalls style element determines whether the wall outline is displayed.

ALL
displays a filled, outlined wall.

NONE
displays no wall and no wall outline.

(*display-options*)
specifies a space-separated list of one or more display options, enclosed in parentheses.

The list can contain one or more of the following options:

OUTLINE	displays the wall outline.
FILL	displays a filled wall area.

Default STANDARD

Tips Use the WALLCOLOR= option to control the fill color of the wall.

The appearance attributes of the wall fill and outline for occupied cells are set by the GraphWalls style element. For empty cells, the outline color is set by the ContrastColor attribute of the GraphBorderLines style element, the line style is solid, and the line thickness is 1 pixel.

When the wall outline is suppressed, adjacent lines such as axis lines and cell-header borders are still displayed. To suppress the axis lines, use the appropriate display option for the axes. The cell-header borders cannot be suppressed.

Details

The LAYOUT PROTOTYPE statement defines a plot prototype or “rubber stamp” that repeats automatically. It assembles the results of nested GTL statements into a single axis area. The plots are drawn in the order in which they are specified. The results of the last statement are placed on top.

The *plot-statements* determine the graphical content of the cells in the parent layout, based on the subsetting of the specified classification variables. For an example, see “LAYOUT DATALATTICE Statement” on page 51 or “LAYOUT DATAPANEL Statement” on page 79.

A PROTOTYPE layout is essentially a restricted OVERLAY layout with the same general rules for overlaying plots. The main difference is that there are no axis options available on the LAYOUT PROTOTYPE statement. Axis properties are set with the ROWAXISOPTS= and COLUMNAXISOPTS= options of the parent DATAPANEL or DATALATTICE statement.

In SAS 9.4 and later releases, a PROTOTYPE layout can also contain an inner margin, which is a nested region at the top or bottom of the PROTOTYPE container. One or more inner margin plots can be specified, and each is specified within an INNERMARGIN block. Within the INNERMARGIN block, only one-dimensional plot statements such as BLOCKPLOT and AXISTABLE can be specified. See "INNERMARGIN Statement" on page 193.

LAYOUT REGION Statement

Creates the drawing area for a plot that does not use axes.

Restrictions: A LAYOUT REGION block cannot contain more than one plot.

A LAYOUT REGION block can contain a PIECHART or MOSAICPLOTPARM plot only.

Syntax

LAYOUT REGION </*options*>;

GTL-statements;
ENDLAYOUT;

Optional Arguments

BACKGROUNDCOLOR=*style-reference* | *color*
specifies the color of the layout background.

style-reference
specifies a style reference in the form *style-element:style-attribute*.

Only the style attribute named COLOR or CONTRASTCOLOR is used.

color
specifies a color by name.

See color on page xii

Default The GraphBackground:Color style reference.

Interaction OPAQUE=TRUE must be in effect in order for the color to be seen. By default, OPAQUE=FALSE.

BORDER=TRUE | FALSE
specifies whether a border is drawn around the layout.

Default FALSE

Interaction If this option is set to FALSE, then the BORDERATTRS= option is ignored.

See "boolean " on page xii for other Boolean values that you can use.

BORDERATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the attributes of the border line around the layout.

Default The GraphBorderLines style element.

Interaction BORDER= TRUE must be set for this option to have any effect.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

OPAQUE=TRUE | FALSE
specifies whether the layout background is opaque (TRUE) or transparent (FALSE).

Default FALSE

Interaction When this option is set to FALSE, the background color is not used.

See "boolean " on page xii for other Boolean values that you can use.

OUTERPAD=AUTO | *dimension* | (*pad-options*)
specifies the amount of extra space to add outside the layout border.

AUTO
specifies that the default outside padding for this component is used.

dimension
specifies a dimension to use for the extra space at the left, right, top, and bottom of the layout border.

(*pad-options*)
a space-separated list of one or more name-value pair pad options, enclosed in parentheses.

The list can contain one or more of the following pad options:

LEFT=*dimension*
specifies the amount of extra space to add to the left side.

RIGHT=*dimension*
specifies the amount of extra space to add to the right side.

TOP=*dimension*
specifies the amount of extra space to add to the top.

BOTTOM=*dimension*
specifies the amount of extra space to add to the bottom.

Note Sides that are not assigned padding are padded with the default amount.

Tip Use *pad-options* to create non-uniform padding.

Default AUTO

Note The default units for *dimension* are pixels.

See "dimension" on page xiii

PAD=*dimension* | *(pad-options)*
specifies the amount of extra space that is added inside the layout border.

dimension
specifies a dimension to use for the extra space at the left, right, top, and bottom of the border.

(*pad-options*)
a space-separated list of one or more name-value-pair pad options enclosed in parentheses.

The list can include one or more of the following pad options:

LEFT=*dimension*
specifies the amount of extra space added to the left side.

Default 0

RIGHT=*dimension*
specifies the amount of extra space added to the right side.

Default 0

TOP=*dimension*
specifies the amount of extra space added to the top.

Default 0

BOTTOM=*dimension*
specifies the amount of extra space added to the bottom.

Default 0

Note Sides that are not assigned padding are padded with the default amount.

Tip Use *pad-options* to create non-uniform padding.

Note The default units for *dimension* are pixels.

See "dimension" on page xiii

Details

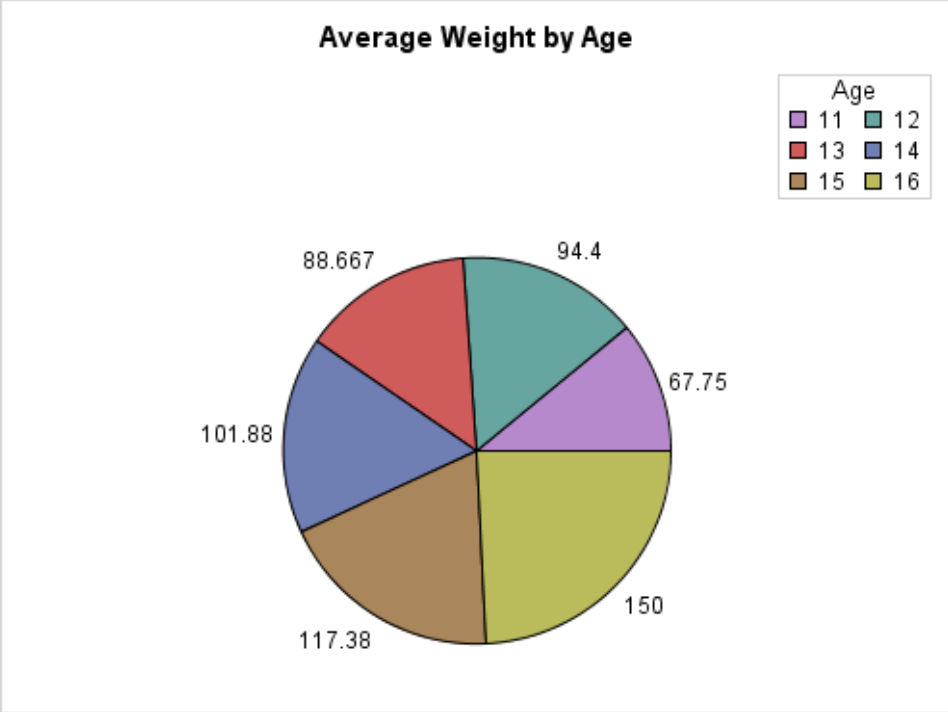
The REGION layout provides a container for plots that do not use axes. Within the LAYOUT REGION block, you can specify a single plot statement of a type that never uses axes, such as a PIECHART or MOSAICPLOTPARM. If multiple plot

statements are specified, then only the first one is honored. You can also specify one or more insets, such as nested layout statements (for example, LAYOUT GRIDDED), ENTRY statements, and legend statements (CONTINUOUSLEGEND or DISCRETELEGEND). For example, you could specify a PIECHART statement with a DISCRETELEGEND statement and an ENTRY statement. You can also nest one or more layout blocks within the REGION layout. For example, you could nest a LAYOUT GRIDDED statement that creates a small table of text.

When nested within another layout type, such as a GRIDDED or LATTICE layout, the REGION layout defines the graphical display for one cell of the parent layout. A separate REGION layout is specified for each cell.

Example: LAYOUT REGION Statement

The following graph was generated by the "Example Program" on page 192:



Example Program

```
proc template;
  define statgraph layoutregion;
    begingraph;
      entrytitle "Average Weight by Age";
      layout region;
        piechart category=age response=weight /
          stat=mean name="p"
          datalabelcontent=(response) datalabellocation=outside;
        discretelegend "p" / title="Age" across=2
```

```
          border=true halign=right valign=top;
      endlayout;
    endgraph;
  end;

proc sgrender data=sashelp.class template=layoutregion;
run;
```

INNERMARGIN Statement

Provides a nested region in a LAYOUT OVERLAY or LAYOUT PROTOTYPE container in which a block plot or axis table can be placed.

Restriction: This statement is valid in LAYOUT OVERLAY and LAYOUT PROTOTYPE blocks only.

Notes: Two or more INNERMARGIN blocks that have the same alignment are stacked.

Multiple statements within an INNERMARGIN block are stacked.

For an X axis, the offsets on each end of the Y axis are increased to make room for the inner margin plots. For a Y axis, the offsets on each end of the X axis are increased to make room for the inner margin plots.

Syntax

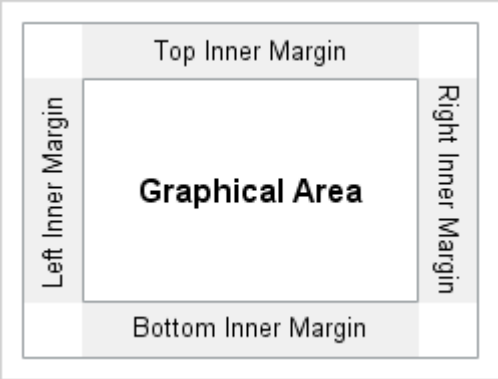
INNERMARGIN < */options*>;

block-plot-statement(s); | *axis-table statement(s);*

ENDINNERMARGIN;

Optional Arguments

ALIGN=TOP | BOTTOM | LEFT | RIGHT
specifies the alignment of the inner margin.



Default BOTTOM

Restrictions For a block plot, only TOP and BOTTOM are valid. LEFT and RIGHT are ignored.

For an axis table, LEFT and RIGHT can be used for a Y or Y2 axis.

Multiple statements within an INNERMARGIN block are stacked.

Note For an inner margin with ALIGN=TOP or ALIGN=BOTTOM, the offsets on each end of the Y axis are increased to reserve space for the inner margin plots. For an inner margin with ALIGN=LEFT or ALIGN=RIGHT, the offsets on each end of the X axis are increased to reserve space for the inner margin plots.

BACKGROUNDCOLOR=*style-reference* | *color*
specifies the color of the inner margin background.

style-reference
specifies a style reference in the form *style-element:style-attribute*. Only the style attributes named COLOR or CONTRASTCOLOR are used.

color
specifies a color by name.

See color on page xii

Default The graph wall color. (See WALLCOLOR=.)

Interaction For this option to have any effect, the OPAQUE= option must be set to TRUE.

Note The inner margin background is set to the wall color even when WALLDISPLAY= NONE.

GUTTER=*dimension*
specifies the gap between stacked items in the inner margin.

Note: This feature applies to SAS 9.4M2 and to later releases.

Default 0

Requirement The inner margin must contain two or more stacked items for this option to have any effect.

Note The default units for *dimension* are pixels.

See “dimension” on page xiii

OPAQUE=TRUE | FALSE
specifies whether the inner margin's background is opaque.

TRUE
specifies that the background is opaque.

FALSE
specifies that the background is transparent.

Default FALSE

Interaction When this option is FALSE, the BACKGROUNDCOLOR= option is ignored.

Tip To prevent axis color bars and grid lines from passing through the axis table, set OPAQUE=TRUE.

See "boolean " on page xii for other Boolean values that you can use.

PAD=*dimension* | *(pad-options)*
specifies the amount of extra space that is added inside the inner-margin border.

Note: This feature applies to SAS 9.4M2 and to later releases.

dimension
specifies a dimension to use for the extra space at the left, right, top, and bottom of the border.

(pad-options)
a space-separated list of one or more name-value-pair pad options enclosed in parentheses.

The list can include one or more of the following pad options:

LEFT=*dimension*
specifies the amount of extra space added to the left side.

Default 0

RIGHT=*dimension*
specifies the amount of extra space added to the right side.

Default 0

TOP=*dimension*
specifies the amount of extra space added to the top.

Default 5 px for the first inner margin adjacent to the bottom of the plot area. Otherwise, 0.

BOTTOM=*dimension*
specifies the amount of extra space added to the bottom.

Default 5 px for the first inner margin adjacent to the top of the plot area. Otherwise, 0.

Note Sides that are not assigned padding are padded with the default amount.

Tip Use *pad-options* to create non-uniform padding.

Note The default units for *dimension* are pixels.

See "dimension" on page xiii

SEPARATOR=TRUE | FALSE
specifies whether a separating line is drawn between the inner margin and the rest of the layout content.

Note: This option is valid starting in SAS 9.4M1.

Default FALSE

Tip Use the SEPARATORATTRS= option to specify the attributes of the separating line.

See "Example: Overlay with an Inner Margin Plot" on page 197

"boolean " on page xii for other Boolean values that you can use.

SEPARATORATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the attributes of the inner margin separating line.

Note: This option is valid starting in SAS 9.4M1.

Default The graphAxisLines style element

Interaction This option is ignored when SEPARATOR=FALSE.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

"Example: Overlay with an Inner Margin Plot" on page 197

Details

An inner margin is a nested region in an OVERLAY container. You can specify one or more inner margin plots. Specify each plot within an INNERMARGIN block. Within an INNERMARGIN block, you can specify only the BLOCKPLOT and AXISTABLE statements. See "Example: Overlay with an Inner Margin Plot" on page 197.

Example: Overlay with an Inner Margin Plot

Example Overview

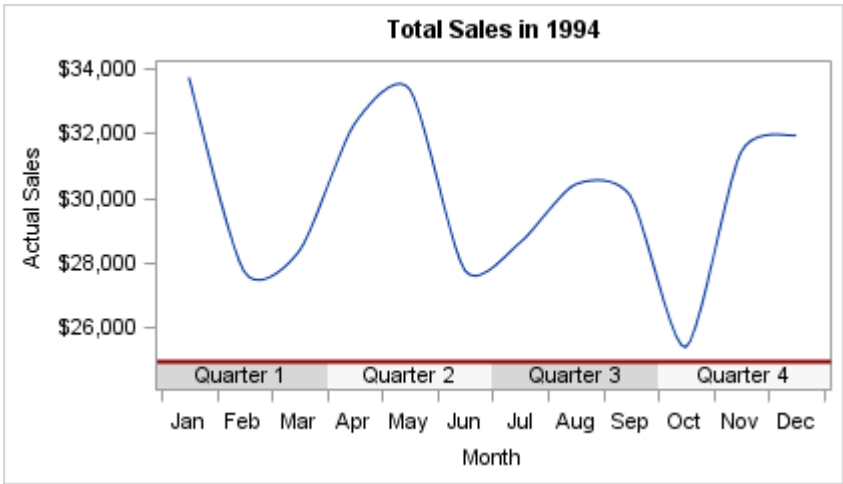
This example shows how to place a plot in an inner margin of an OVERLAY layout. It creates a graph that shows monthly total sales for a specific year. A LINECHART statement is used to draw the plot. The months are shown along the category axis, and the total sales values are shown along the response axis. The Sashelp.Prdsale data set is used as the data source. The tick marks on the category axis are positioned between the midpoints to align with the beginning of each month.

A BLOCKPLOT statement in an INNERMARGIN block is used to display the quarters above the category axis. The INNERMARGIN statement uses the default alignment, so the inner margin is positioned at the bottom of the layout container, beneath the line chart. Alternate shading is used in the block plot to show the block boundaries. Because the tick marks are positioned between the midpoints, they align with the block boundaries. The SEPARATOR= and SEPARATORATTRS= options are used in the INNERMARGIN statement to specify a dark-red, two-pixel-wide separator line between the inner margin and the rest of the graph.

Note: The INNERMARGIN statement SEPARATOR= and SEPARATORATTRS= options are valid in SAS 9.4M1 and later releases.

Example Output

Here is the output for this example.



Example Program

Here is the SAS code.

```
/* Create a format for the quarters */
proc format;
   value quartername 1="Quarter 1" 2="Quarter 2"
      3="Quarter 3" 4="Quarter 4";
run;

/* Define the graph template */
proc template;
   define statgraph innermargin;
      dynamic year;
      begingraph / subpixel=on;
         entrytitle "Total Sales in " year;
         layout overlay /
            xaxisopts=(type=discrete
discreteopts=(ticktype=inbetween));
            innermargin /
               separator=true
               separatorattrs=(color=darkred thickness=2px);
               blockplot x=month block=quarter /
                  filltype=alternate
                  fillattrs=(color=cxd7d7d7)
                  altfillattrs=(color=cxf7f7f7)
                  display=(fill values) valuehalign=center;
            endinnermargin;
            linechart category=month response=actual /
               smoothconnect=true;
          endlayout;
       endgraph;
    end;
run;

/* Generate the graph */
proc sgrender data=sashelp.prdsale template=innermargin;
   format quarter quartername.;
   where year=1994;
   dynamic year=1994;
run;
```

PART 4

Plot Statements

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5

Key Concepts for Using Plots

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Minimum Requirements to Generate a Plot

ODS graphics are generated by template definitions that determine a graph's layout and appearance and specify the variable roles to be represented in the graph display. A graph can be rendered from a compiled template by associating the template with a data source at run time.

The following SAS program shows the basic structure needed to meet the minimum requirements for generating a plot using GTL:

```
proc template;
  define statgraph minimumreq;
    begingraph;
      layout overlay;
        scatterplot x=weight y=height;
      endlayout;
    endgraph;
```

```
  end;
run;

proc sgrender data=sashelp.class template=minimumreq;
run;
```

- The DEFINE STATGRAPH statement on PROC TEMPLATE is required to open a definition block for defining and naming a graphics template. The END statement closes the template definition.
- A BEGINGRAPH statement block is required to define the outermost container for the graph. The ENDGRAPH statement closes the block.
- At least one layout statement block is required for specifying the elements that compose the graph. To generate a plot, the layout block must contain at least one plot statement. The ENDLAYOUT statement closes the layout block.
- The PROC TEMPLATE statement must be run to compile the template and save it in the template store (Sasuser.Templat by default).
- The PROC SGRENDER statement is required to produce a graph from a compiled template. The DATA= option specifies a run-time data source to use, and the TEMPLATE= option specifies the template to use. The input data source must satisfy any restrictions that are imposed by the template. For example, it must contain any variables that have been specified on the template's GTL statements.

ODS Graphics Environment

The ODS GRAPHICS statement manages the settings of the ODS Graphics environment and is a statement that you will probably use frequently in your SAS sessions. For example, the ODS GRAPHICS statement provides options that control the physical aspects of your graphs, such as the image size and the name of the image file that is created for the graph.

The default image size of 640 pixels by 480 pixels (4:3 aspect ratio) for ODS Graphics is set in the SAS Registry. You can change the image size using the WIDTH= option, or the HEIGHT= option, or both in the ODS GRAPHICS statement. To name the output image file, use the IMAGENAME= option.

The following ODS GRAPHICS statement sets a 320-pixel width for the graph and names the output image file *modelfit*:

```
ods graphics / width=320px
               imagename="modelfit" reset;

proc sgrender data=sashelp.class template=modelfit;
run;

ods graphics off;
```

- The WIDTH= option sets the image width to 320 pixels. Because no HEIGHT= option is used, SAS uses the design aspect ratio of the graph to compute the appropriate height. (The width of 320px is half the default width, so SAS sets the height to 240px, which is half the default height.)
- The IMAGENAME= option sets the name of the output image file to *modelfit*. The RESET option ensures that each time the graph is produced, the previous version of the image file is replaced. Otherwise, image names are incremented (modelfit1, modelfit2, and so on) every time the graph is produced.

In general, it is good practice to specify only one sizing option without the other—just the WIDTH= option or just the HEIGHT= option. That way SAS can maintain the design aspect ratio of the graph, which might be important for many graphs. For example, a graph that has multiple columns or a statistics table on the side needs a wide aspect ratio. Specifying both width and height in such cases might produce unpredictable results.

Note: Size settings in the ODS GRAPHICS statement affect all of the graphs that are rendered in the SAS session, unless they are changed by another ODS GRAPHICS statement. The size for a graph produced by an individual template can be set with the DESIGNWIDTH= and DESIGNHEIGHT= options in the BEGINGRAPH statement. Size settings in the ODS GRAPHICS statement override size settings in the BEGINGRAPH statement and remain in effect unless they are changed in another ODS GRAPHICS statement or ODS GRAPHICS are turned off.

For more information about using the ODS GRAPHICS statement in GTL, see *SAS Graph Template Language: User's Guide*. For a more complete discussion of the ODS GRAPHICS statement, see "ODS GRAPHICS Statement" on page 1561.

Display Attributes

Overview

The display attributes for the lines, colors, marker symbols, and text used in a graph are derived from the ODS style that is in effect when the graph is produced. These display attributes might also be influenced by grouped data. To override default display attributes, all GTL plot statements provide options that manage the graph's visual appearance. For example, a BOXPLOT statement provides an OUTLIERATTRS= option that manages the visual appearance of outliers.

Two ways are generally available for modifying a graph's display attributes:

- Change the ODS style that is in effect for the graph. "ODS Styles" on page 18 provides an overview of the use of styles in a graph. *SAS Graph Template Language: User's Guide* discusses the use of styles in more detail.

- Override default style settings using GTL statement options. Some examples are given in the sections that follow.

Display Attributes for Non-Grouped Data

Appendix 3, "Display Attributes," on page 1599 documents the attribute settings that can be specified for the lines, data markers, text, or area fills in a plot. The defaults for these attributes are defined on style elements, but you can use attribute options on the plot statement to change the defaults.

For example, the LINEPARM statement provides a LINEATTRS= option that specifies the color, line pattern, or line thickness of the plot line. For non-grouped data, if you do not set a line pattern in your template, then the default line pattern for the plot is obtained from the GraphDataDefault:LineStyle style reference.

To change the default line pattern, a PATTERN= suboption on LINEATTRS= is available. The following table shows the most common line patterns available for the PATTERN= suboption.

Table 5.1 *Commonly Used Line Patterns*

Pattern Number	Pattern Name	Example
1	Solid	
2	ShortDash	
4	MediumDash	
5	LongDash	
8	MediumDashShortDash	
14	DashDashDot	
15	DashDotDot	
20	Dash	
26	LongDashShortDash	
34	Dot	
35	ThinDot	
41	ShortDashDot	

Pattern Number	Pattern Name	Example
42	MediumDashDotDot	

"Available Line Patterns" on page 1607 provides the complete list of line patterns that can be used with GTL.

In the following template definition, the LINEPARM statement's LINEATTRS= option overrides the default line pattern by specifying PATTERN=DASH:

```
proc template;
  define statgraph patternchange;
    begingraph;
      layout overlay;
        scatterplot y=height x=weight;
        lineparm x=0 y=intercept  slope=slope /
          lineattrs=(pattern=dash);
      endlayout;
    endgraph;
  end;
run;
```

Other display options can be managed the same way. For example, the SCATTERPLOT statement provides a MARKERATTRS= option that specifies the color, size, symbol, and weight of the plot data markers. For non-grouped data, if you do not set a marker symbol in your template, then the default marker symbol is obtained from the GraphDataDefault:MarkerSymbol style reference.

To change the default marker symbol, a SYMBOL= suboption on MARKERATTRS= is available. The following table shows the marker symbols available for the SYMBOL= suboption.

Table 5.2 *Supported Marker Symbols*

Symbol Name	Plot Symbol	Symbol Name	Plot Symbol
ArrowDown	↓	StarFilled	★
Asterisk	✳	Tack	⊤
Circle	○	Tilde	∿
CircleFilled	●	Triangle	△
Diamond	◇	TriangleFilled	▲
DiamondFilled	◆	TriangleDown	▽

Symbol Name	Plot Symbol	Symbol Name	Plot Symbol
GreaterThan	>	TriangleDownFilled	▼
Hash	#	TriangleLeft	◁
HomeDown	⛉	TriangleLeftFilled	◀
HomeDownFilled	⛊	TriangleRight	▷
IBeam	I	TriangleRightFilled	▶
LessThan	<	Union	∪
Plus	+	X	×
Square	□	Y	Y
SquareFilled	■	Z	Z
Star	☆		

In the following template definition, the SCATTERPLOT statement's MARKERATTRS= option overrides the default marker symbol by specifying SYMBOL=CIRCLEFILLED, which uses a filled circle to represent the data points.

```
proc template;
  define statgraph symbolchange;
    begingraph;
      layout overlay;
        scatterplot y=height x=weight /
          markerattrs=(symbol=circlefilled);
      endlayout;
    endgraph;
  end;
run;
```

Display Attributes for Grouped Data

Appendix 3, "Display Attributes," on page 1599 documents the attribute settings that you can specify for the lines, data markers, text, or area fills in a plot. For a grouped plot (that is, when you use the GROUP= option in the plot statement), each distinct group value can be represented in the graph by a different combination of line pattern, color, and marker symbol (depending on the graph

type). The defaults for these features are set by the LineStyle, Color, ContrastColor, FillPattern, and MarkerSymbol attributes of the GraphData1–GraphDataN style elements. The MarkerSize and LineThickness style attributes are not honored in the case of grouped data.Table 5.1 on page 204 shows the common line patterns that are available, and Table 5.2 on page 205 shows the marker symbols that are available.

When missing group values are displayed, the default attributes of the missing value are set by the GraphMissing style element unless the MISSING= system option specifies a character other than "." or " ". In that case, missing group value attributes are determined by the GraphData1–GraphDataN style elements.

For grouped plots, attributes such as colors, line patterns, and marker symbols are used to distinguish the individual group values. The attributes are derived from the GraphData1–GraphDataN style elements in the current style. Each group value is assigned attributes from a GraphData1-GraphDataN style element sequentially (1 to N). When plotting a SAS data set, the group-value attributes are assigned in data order. When plotting a CAS in-memory table, the group-value attributes are assigned in ascending order of the group column character or unformatted numeric values. For information about attribute rotation, see "Attribute Rotation Patterns" in *SAS Graph Template Language: User's Guide*.

As discussed in "Rotating Visual Attributes for Each Plot in an Overlay" on page 210, plot options might also influence the attribute rotation pattern. For example, in the following template definition, the LINEPARM statement's LINEATTRS= option specifies PATTERN=DASH. This explicit setting overrides the default line pattern for the plot lines and uses dashed lines for all of the plots, leaving color to distinguish among group values.

```
proc template;
  define statgraph dashedline;
    begingraph;
      layout overlay;
        scatterplot y=height x=weight / group=gender;
        lineparm x=0 y=intercept  slope=slope / group=gender
          lineattrs=(pattern=dash);
      endlayout;
    endgraph;
  end;
run;
```

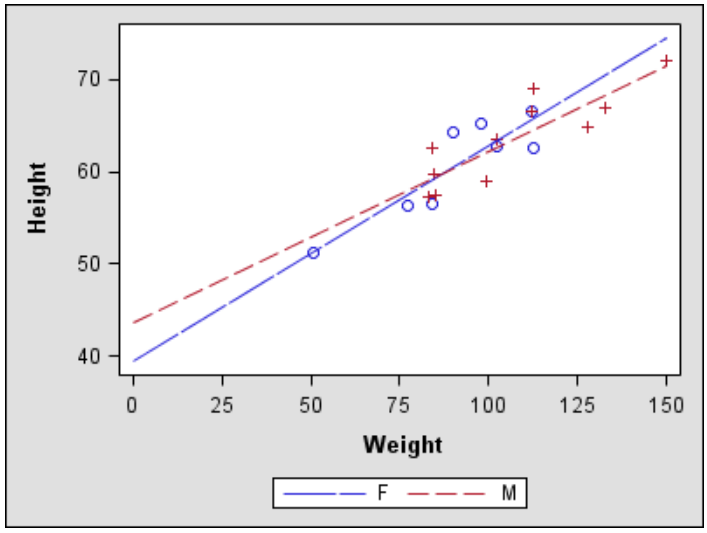
Rather than setting the same line pattern on all group values, you can change the default sequence of line patterns that is used for grouped values. To do so, set the LineStyle attribute in some of the style elements GraphData1–GraphDataN.

In the following example, a style is defined to change the line pattern for GraphData1 and GraphData2. In this example, the style is derived from the DEFAULT style. Values are set for the LineStyle attributes in the GraphData1 and GraphData2 style elements. The first default line in the sequence has long dashes (style value 6) and the second line has short dashes (style value 4). The LineStyle settings for the remaining GraphData elements are not set, so are derived from the parent style (DEFAULT). This new line sequence is used as the default line sequence for any plot that uses the MyDefault style. To apply the style to a graph, the STYLE= option is used in the ODS HTML statement to specify the style name.

Here is the code for this example.

```
/* Specify a path for the ODS output */
filename odsout "output-path";

/* Sort the SASHELP.CLASS data by sex and age. */
proc sort data=sashelp.class(keep=height weight sex age)
     out=class;
  by sex age;
run;

/* Generate slope and intercept data for plot reference lines. */
proc robustreg data=class method=m
      plots=none
      outest=stats(rename=(weight=slope));
   by sex;
   model height=weight;
run;

data class;
   merge class stats(keep=intercept slope sex);
run;

proc template;
   /* Create custom style MYDEFAULT from the STYLES.DEFAULT style. */
   define style MyDefault;
      parent=Styles.Default;
      style GraphData1 from GraphData1 /
         LineStyle=6;
      style GraphData2 from GraphData2 /
         LineStyle=4;
   end;

   /* Create the plot template. */
   define statgraph testPattern;
      begingraph;
         layout overlay;
            scatterplot y=height x=weight / group=sex;
            lineparm x=0 y=intercept slope=slope / group=sex
name="lines";
            discretelegend "lines";
         endlayout;
      endgraph;
    end;
run;

/* Generate the plot. */
ods _all_ close;
ods html path=odsout file="mydefaultstyle.html"
  style=MyDefault; /* Apply style MyDefault to the graph. */

proc sgrender data=class template=testPattern;
run;

ods html close;
ods html; /* Not required in SAS Studio */
```

Here is the output.



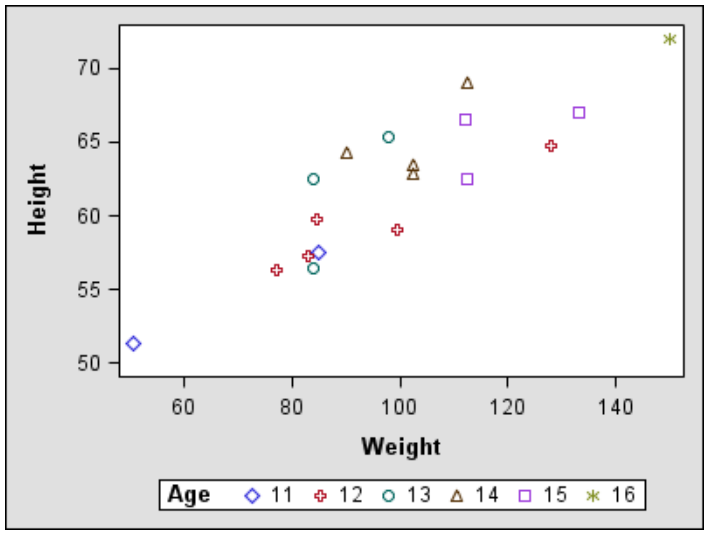
Similarly, for grouped data, you can set the MarkerSymbol attribute in each of the style elements GraphData1–GraphDataN. In the following example, a style is defined to change the MarkerSymbol attribute for GraphData1–GraphData3. This new sequence is used as the default marker symbol sequence for any grouped plot that uses the MyDefault style.

Here is the code for this example.

Note: The data that was generated in the previous example is used again in this example.

```
/* Specify a path for the ODS output */
filename odsout "output-path";

proc template;
   /* Create custom style MYDEFAULT from STYLES.DEFAULT. */
   define style MyDefault;
      parent=Styles.Default;
      style GraphData1 from GraphData1 /
         MarkerSymbol="DIAMOND";
      style GraphData2 from GraphData2 /
         MarkerSymbol="CROSS";
      style GraphData3 from GraphData3 /
         MarkerSymbol="CIRCLE";
   end;

   /* Create the plot template. */
   define statgraph testSymbols;
      begingraph;
         layout Overlay;
            scatterPlot y=height x=weight / group=age name="symbols";
            discretelegend "symbols" / title="Age";
         endlayout;
      endgraph;
   end;
run;

/* Generate the plot. */
```

```
ods _all_ close;
ods html path=odsout file="mydefaultstyle.html"
  style=MyDefault; /* Apply style MyDefault to the graph. */

proc sgrender data=class template=testSymbols;
run;
```



Rotating Visual Attributes for Each Plot in an Overlay

Overlay-type layouts provide the CYCLEATTRS= option, which specifies whether the default visual attributes of lines, marker symbols, and area fills in nested plot statements automatically change from plot to plot. When CYCLEATTRS=TRUE, all applicable plot statements (SCATTERPLOT, SERIESPLOT, and others) are sequentially assigned the next unused GraphDataN style element. (The sequence is overridden for plot statements that have an explicit setting, either through a style element assignment or option settings.) No plot retains its default (implicit) style element.

In the following example, assuming ungrouped data and the default attribute rotation pattern, the series plots are assigned line properties based on the GraphData1, GraphData2, and GraphData3 style elements. The reference line uses GraphReference, not GraphData4.

```
layout overlay / cycleattrs=true;
  seriesplot x=date y=var1;
  seriesplot x=date y=var2;
  seriesplot x=date y=var3;
  referenceline x=cutoff / lineattrs=GraphReference;
endlayout;
```

If one of the plots in this example uses grouped data, then the grouped plots also participate in the default cycles. For example, if the second plot has three groups,

then it generates three plots, which are assigned line properties based on the GraphData2, GraphData3, and GraphData4 style elements.

If the plot statement that uses grouped data also uses the INDEX= option to manage the group values (see "Remapping Groups for Grouped Data" on page 211), then the INDEX= option overrides the default behavior. In that case, the grouped plots do not participate in the default cycling.

When one or more of the plots within the layout override the default cycling behavior, the arrangement of the plots within the layout might affect the default mapping of the GraphDataN elements to those statements that participate in the default cycling.

Remapping Groups for Grouped Data

Indexing can be used to collapse the number of groups that are represented in a graph. For example, if 10 groups are in the data, then indexes 1 and 2 can be assigned to the first two groups, and index 3 can be assigned to all other groups. The third through tenth data groups are treated as a single group in the graph.

Indexing can control the order in which colors, area fills, marker symbols, and line styles are mapped to group values in a graph. This ordering method is needed only for coordinating the data display of multiple graphs when the default mapping would cause group values to be mismatched between graphs.

For example, consider two studies of three drugs, A, B, and C. If Study 1 uses all three drugs, then the first combination of color and marker symbol is mapped to Drug A. The second combination of color and marker symbol is mapped to Drug B, and the third is mapped to Drug C. If Study 2 omits Drug A, then the first combination of color and marker symbol is mapped to Drug B, and the second is mapped to Drug C. If the two graphs are viewed together, then this default mapping causes the group values to be mismatched. The visual attributes that represent Drug A in the first graph represent Drug B in the second graph. Those that represent Drug B in the first graph represent Drug C in the second group.

The GROUP= option mappings can be made consistent between the two graphs by creating an index column for each study. For these example studies, the GROUP and INDEX columns are the following:

Table 5.3 *Study 1*

Drug1	Index1
A	1
B	2
B	2
C	3

Table 5.4 Study 2

Drug2	Index2
B	2
C	3
C	3

If the graph for Study 1 specifies INDEX=INDEX1 and the graph for Study 2 specifies INDEX=INDEX2, then the second combination of color and marker symbol is mapped to Drug B in both graphs. The third combination of color and marker symbol is mapped to Drug C in both graphs.

Interactions between Options

When you use GTL statement options to manage the graph display, interactions between options might cause some option settings to be ignored. For example, an ENTRYTITLE statement provides BORDER= and BORDERATTRS= options for managing a border line around the graph title. Border attributes that are set on the BORDERATTRS= option have no effect on the graph title unless the title border line is displayed by setting BORDER=TRUE.

Similarly, if a BOXPLOT statement's DISPLAY= option suppresses the display of outliers in a box plot, then using the OUTLIERATTRS= option to set outlier attributes has no effect. The OUTLIERATTRS= settings take effect only if DISPLAY= enables the display of outliers.

The option interactions are not limited to options that simply manage visual elements. For example, on a BOXPLOT, if the EXTREME= option extends the box whiskers beyond the fences, then outliers are suppressed in the plot and options that affect the outliers are ignored, if set.

The documentation for each GTL statement identifies the option interactions that might occur on that statement.

Location and Position of Curve Labels

Overview

On plots that generate a curve line (a series plot or a density plot, for example), you can specify a label for the curve line. You can also determine the label's location in the graph. For example, the SERIESPLOT statement provides the following options for managing a curve label:

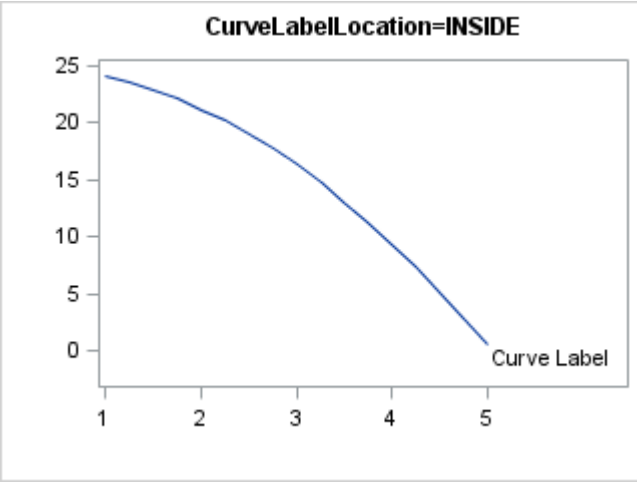
CURVELABEL
specifies a label for the curve line.

CURVELABELLOCATION
specifies the location of the curve line label relative to the plot area.

CURVELABELPOSITION
specifies the position of the label relative to the curve line.

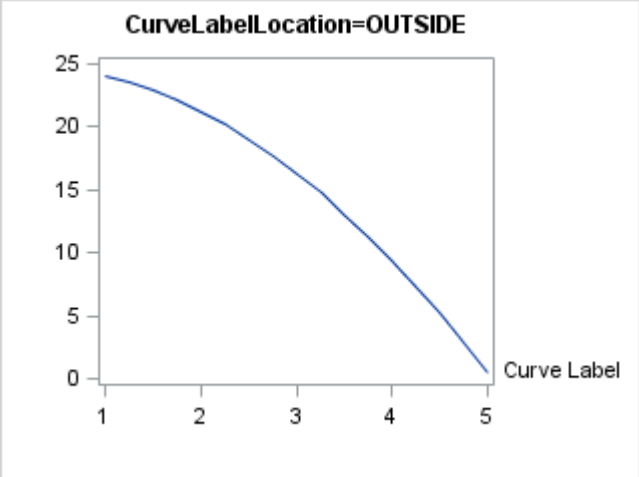
Curve Label Location Relative to the Plot Area

By default, the label for a curve line is displayed inside the plot area. The following figure shows the default location of the label for a series plot labeled "Curve Label":



Depending on the shape of the curve line, its distribution of values, and the other plot elements that must be displayed within the plot area, GTL might have to add an offset (see "Adjusting Axis Offsets" on page 1053) to one of the plot's axis lines to provide enough room for the curve label. To prevent the offset of the axis line, you

can move the curve label outside of the plot area by specifying CURVELABELLOCATION=OUTSIDE on the plot statement:



Regardless of whether the curve label is displayed inside or outside of the plot area, you can use the CURVELABELPOSITION= option to adjust the label's position relative to the curve line.

Curve Label Position Relative to the Curve Line

Given a curve label's location inside or outside of the plot area, a plot statement's CURVELABELPOSITION= option can adjust the label's position relative to the curve line. For example, the following positions are available for a series plot (for some plots, START and END are not available):

AUTO
: positions the curve label automatically near the end series line along unused axes whenever possible (typically Y2 or X2) to avoid collision with tick values. This position is used only when CURVELABELLOCATION=OUTSIDE.

MAX
: forces the curve label to appear near maximum series values (typically, to the right).

MIN
: forces the curve label to appear near minimum series values (typically, to the left).

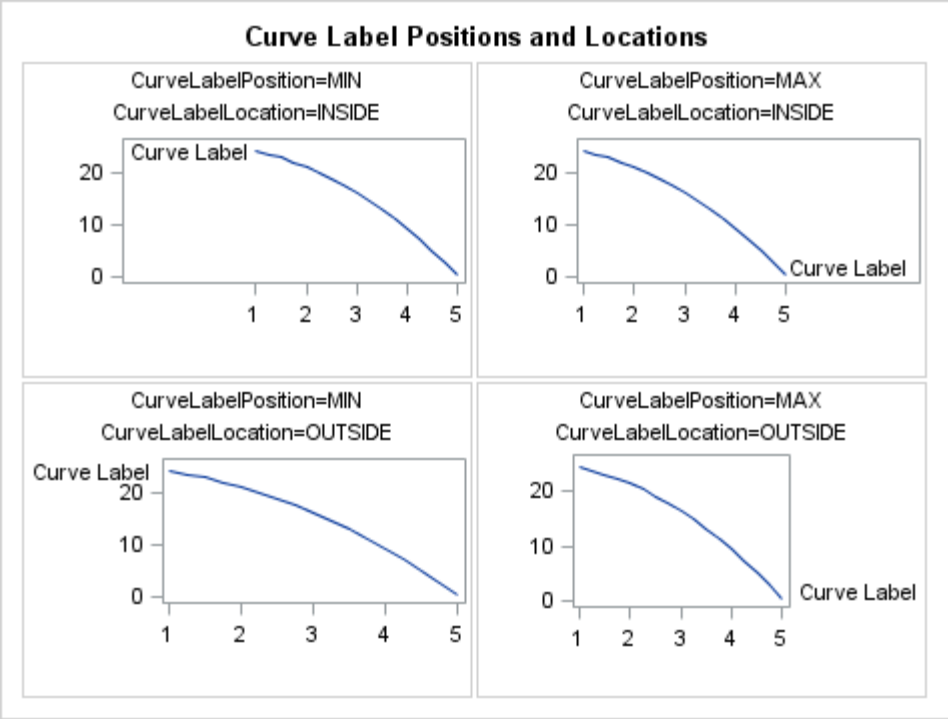
START
: forces the curve label to appear near the beginning of the curve. This position is particularly useful when the curve line has a spiral shape. It is used only when CURVELABELLOCATION=INSIDE.

END
: forces the curve label to appear near the end of the curve. This position is particularly useful when the curve line has a spiral shape. It is used only when CURVELABELLOCATION=INSIDE.

When CURVELABELLOCATION=INSIDE, you can choose whether to position the curve label near the START or END of the curve, or near the minimum data values (MIN) or maximum data values (MAX). START and END use a different algorithm than MIN and MAX. They are particularly useful for spiral-shaped curves whose end points do not correlate with the minimum and maximum data values. In those cases, START or END provides "better" label locations than MIN and MAX.

When CURVELABELLOCATION=OUTSIDE and CURVELABELPOSITION=AUTO, a "good" position is automatically chosen to avoid collision with the axis information.

The following figure shows the different combinations of label locations and positions:



- The minimum or maximum axis tick marks can be adjusted (see "Adjusting Axis Offsets" on page 1053) so that the label can be placed inside the plot area. Increasing label length decreases the area available for displaying plots.
- When CURVLABELLOCATION=OUTSIDE, you can set the CURVELABELPOSITION to MIN or MAX, but the label might collide with the axis ticks and tick values, unless you are aware of where the axes are positioned.

6

Plot Statements

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Dictionary

AXISTABLE Statement

Creates an event plot of input data along an axis of an X-Y plot.

Syntax

AXISTABLE X=*column* | *expression* VALUE=*column* </*options*>;

AXISTABLE Y=*column* | *expression* VALUE=*column* </*options*>;

Summary of Optional Arguments

Appearance options

CLASS=*column* | *expression*
: creates a separate row or column for each unique class value.

CLASSORDER=DATA | REVERSEDATA | ASCENDING | DESCENDING
: specifies the order in which the class values are displayed.

CLUSTERWIDTH=*number*
: specifies the width of the group clusters as a fraction of the midpoint spacing or bin width.

COLORGROUP=*column* | *expression* | *discrete-attr-var*
: specifies a column that is used to discretely map the color of the value text.

DATATRANSPARENCY=*number*
: specifies the degree of the transparency of the header, label, and values.

DISPLAY=STANDARD | ALL | (*display-options*)
: specifies which features to display.

DROPONMISSING=TRUE | FALSE
: specifies whether the entire axis table is dropped when all of the VALUE= column values are missing.

GUTTER=*dimension*
: specifies the gap between rows when a class variable is used.

INCLUDEMISSINGCLASS=TRUE | FALSE
specifies whether missing class values are represented in the table.

INDENT=*dimension*
specifies a value to be used with the INDENTWEIGHT= option to determine the indention for each text value.

INDENTWEIGHT=*numeric-column* | *expression*
specifies the indention weight (multiplier) for each observation.

PAD=*dimension* | *(pad-options)*
specifies the amount of extra space that is added inside the table border.

POSITION=*number*
positions the plot along the axis orthogonal to the axis used for the values.

SHOWMISSING=TRUE | FALSE
specifies whether missing values are represented in the table.

TEXTGROUP=*discrete-attr-var*
specifies the discrete attribute variable for a discrete attribute map that maps text attributes to values for each observation.

VALUEATTRS=*style-element* | *style-element*(*text-options*) | (*text-options*)
specifies the color and font attributes of the text values.

VALUEFORMAT=*format*
specifies a SAS format or a user-defined format for the table values.

VALUEHALIGN=AUTO | LEFT | CENTER | RIGHT
in a Y-axis table, specifies the horizontal alignment of the column values relative to the axis-table width.

VALUEJUSTIFY=AUTO | LEFT | CENTER | RIGHT
specifies the justification of the values in the axis table relative to the axis-table width.

Axes options

XAXIS=X | X2
specifies whether data are mapped to the primary X (bottom) axis or to the secondary X2 (top) axis.

YAXIS=Y | Y2
specifies whether data are mapped to the primary Y (left) axis or to the secondary Y2 (right) axis.

Header options

HEADERLABEL="string"
specifies the text for the table header.

HEADERLABELATTRS=*style-element* | *style-element*(*text-options*) | (*text-options*)
specifies the color and font attributes of the table header.

Label options

LABEL="*string*"
specifies the text for the table label.

LABELATTRS=*style-element* | *style-element*(*text-options*) | (*text-options*)
specifies the color and font attributes of the column label.

LABELHALIGN=AUTO | LEFT | CENTER | RIGHT

specifies the horizontal alignment of the column label when it is displayed.

LABELJUSTIFY=LEFT | CENTER | RIGHT
specifies the justification of the column label when it is displayed.

LABELPOSITION=MIN | MAX
specifies the end of the axis on which the label is displayed.

Midpoint options

CLASSDISPLAY=STACK | CLUSTER
specifies how the class values are displayed.

Plot reference options

NAME="*string*"
assigns a name to this plot statement for reference in other template statements.

Statistics options

STAT=AUTO | SUM | MEAN
specifies the statistic that is to be computed for the VALUE= column when the column is numeric.

Title options

TITLE="string"
specifies the text for the table title.

TITLEATTRS=*style-element* | *style-element*(*text-options*) | (*text-options*)
specifies the color and font attributes of the table title.

TITLEHALIGN=AUTO | CENTER | LEFT | RIGHT
specifies the horizontal alignment of the title bounding box of the axis table, relative to the axis table width.

TITLEJUSTIFY=LEFT | CENTER | RIGHT
specifies the justification of the lines of a multiline title in the title bounding box. The justification is relative to the axis table width.

Required Arguments

Either the X= or the Y= argument must be specified in the AXISTABLE statement. Specifying X= places an axis table along the X axis of a plot. Specifying Y= places an axis table along the Y axis of a plot.

X=*column* | *expression*
specifies the column for the X axis.

Requirement If not specified, then Y= must be specified.

Y=*column* | *expression*
specifies the column for the Y axis.

Requirement If not specified, then X= must be specified.

VALUE=*column*
specifies the column that contains the axis table values.

Optional Arguments

CLASS=*column* | *expression*
creates a separate row or column for each unique class value. Each row or column is labeled by the class value.

Interaction The DISPLAY= option that is in effect must include LABEL for any labels to appear.

Note If you specify a column in a SAS data set, the visual attributes for each class value are assigned in data order. If you specify a column in a CAS in-memory table, the visual attributes for each class value are assigned in ascending order of the class column character values or of unformatted numeric values.

Tip Use the LABELATTRS= option to modify the label text attributes.

CLASSDISPLAY=STACK | CLUSTER
specifies how the class values are displayed.

Note: This feature applied to SAS 9.4M2 and to later releases.

STACK
displays the class values vertically at each midpoint value on the X axis or horizontally on the Y axis.

CLUSTER
displays the class values horizontally at each midpoint value on the X axis or vertically on the Y axis.

Restriction CLUSTER applies only when the axis table is on a discrete axis.

Tip The CLUSTERWIDTH= option controls the cluster width.

Default STACK

Interaction The CLASS= option must be specified for this option to have any effect.

Note When you plot a SAS data set, the items for each group value are drawn in data order. When you plot a CAS in-memory table, they are drawn in ascending order of the group column character values or unformatted numeric values.

CLASSORDER=DATA | REVERSEDATA | ASCENDING | DESCENDING
specifies the order in which the class values are displayed.

Note: This feature applies to SAS 9.4M2 and to later releases.

DATA
displays the class values in the order in which they occur in the data.

REVERSEDATA
displays the class values in the reverse order from which they occur in the data.

Tip This option is useful when the plot axis is reversed.

ASCENDING
DESCENDING
displays the class values in ascending or descending order.

Defaults DATA if the data is a SAS data set.

ASCENDING if the data is a CAS in-memory table. Sorting is based on nonformatted values for numeric class values or on formatted values for character class values.

Interaction The CLASS= option must be specified for this option to have any effect.

Note In SAS 9.4M6 and earlier releases, when data stored in a CAS in-memory table is used and DATA or REVERSEDATA is specified, unpredictable results might occur. To generate consistent graphs in that case, specify ASCENDING or DESCENDING. Starting with SAS Viya 3.5 and SAS Studio 5.2, when data stored in a CAS in-memory table is used and DATA or REVERSEDATA is specified, it is ignored, and ASCENDING is used instead.

CLUSTERWIDTH=*number*
specifies the width of the group clusters as a fraction of the midpoint spacing or bin width.

Note: This feature applies to SAS 9.4M2 and to later releases.

Range 0–1, where 0 is the minimum width, which is one pixel wide, and 1 is the maximum possible width

Requirement For this option to take effect, the CLASS= option must also be specified, and the CLASSDISPLAY= option must be set to CLUSTER.

COLORGROUP=*column* | *expression* | *discrete-attr-var*
specifies a column that is used to discretely map the color of the value text.

discrete-attr-var
specifies a discrete attribute map variable.

The discrete attribute map variable is created by a DISCRETEATTRVAR statement.

Restriction A discrete attribute map variable specification must be a direct reference to the attribute map variable. It cannot be set by a dynamic variable.

Each unique value of this column is mapped to the Color attribute of the GraphData1–GraphDataN style elements that are in effect. If a discrete attribute variable is specified, the color mapping from its associated DISCRETEATTRMAP statement is used.

Interaction This option is ignored when the TEXTGROUP= option is specified.

Note If you specify a column in a SAS data set, colors are mapped to group values in data order. If you specify a column in a CAS in-memory table, colors are mapped to group values in ascending order of the group column character values or unformatted numeric values.

See "DISCRETEATTRVAR Statement" on page 1516

"DISCRETEATTRMAP Statement" on page 1505

DATATRANSPARENCY=*number*
specifies the degree of the transparency of the header, label, and values.

Default 0

Range 0–1, where 0 is opaque and 1 is entirely transparent

DISPLAY=STANDARD | ALL | (*display-options*)
specifies which features to display.

STANDARD
displays the table values and, if provided, the table label.

ALL
displays the same features as STANDARD.

(*display-options*)
specifies a space-separated list of display options, enclosed in parentheses.

The following options are supported:

LABEL
displays the table label.

The label can be the VALUE= column label or name, the LABEL= value, or the CLASS= value for the table, depending on the options that you specify.

VALUES
displays the column values.

Note: This feature applies to SAS 9.4M2 and to later releases.

Tip The column values are always displayed, even if DISPLAY=(LABEL) is specified. To hide the table label, specify DISPLAY=(VALUES).

Default STANDARD

Note If a table title is specified, it is always displayed.

DROPONMISSING=TRUE | FALSE
specifies whether the entire axis table is dropped when all of the VALUE= column values are missing.

Note: This feature applies to SAS 9.4M2 and to later releases.

Default FALSE

Tip The SHOWMISSING= option controls whether missing values are shown in the table.

See VALUE= on page 220

"boolean " on page xii for other Boolean values that you can use.

GUTTER=*dimension*
specifies the gap between rows when a class variable is used.

Note: This feature applies to SAS 9.4M2 and to later releases.

Defaults Y-axis table: 8 px

X-axis table: 0 px

Interaction The CLASS= option must be specified for this option to have any effect.

See "dimension" on page xiii

HEADERLABEL="string"
specifies the text for the table header.

Note: Starting with SAS 9.4M2, the HEADERLABEL= option is deprecated and is replaced with the TITLE= option. The syntax and functionality are the same. The HEADERLABEL= option is still honored, but the TITLE= option is preferred.

Default No table header is displayed

Tip Use the HEADERLABELATTRS= option to control the appearance of the table header.

HEADERLABELATTRS=*style-element* | *style-element*(*text-options*) | (*text-options*)
specifies the color and font attributes of the table header.

Note: Starting with SAS 9.4M2, the HEADERLABELATTRS= option is deprecated and is replaced with the TITLEATTRS= option. The syntax and

functionality are the same. The HEADERLABELATTRS= option is still honored, but the TITLEATTRS= option is preferred.

See TITLEATTRS= on page 232

INCLUDEMISSINGCLASS=TRUE | FALSE

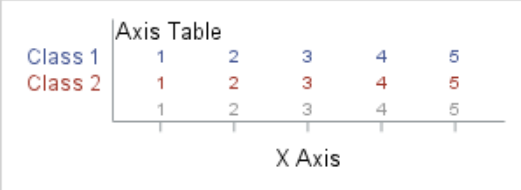
specifies whether missing class values are represented in the table.

Note: This feature applies to SAS 9.4M2 and to later releases.

Missing class values are included by default. When the data contains missing class values, the label for those values is either blank for missing character values or a dot for missing numeric values.

The following figure shows block plots for classes Class 1, Class 2, and any missing class values.

The following figure shows an X-axis axis table that displays values for classes Class 1, Class 2, and any missing class values.

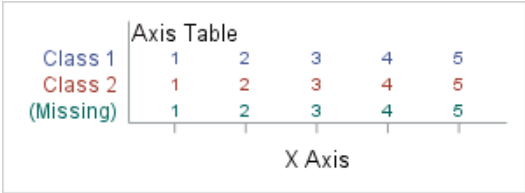


Notice that the label for the missing class values is blank. You can use the INCLUDEMISSINGCLASS=FALSE option to exclude the missing class values. If you want to keep the missing class values, then you can create a format that specifies a more meaningful label for the missing class. For example, here is a format that specifies a label for missing character and numeric class values.

```
proc format;
  value $missingClass " " = "(Missing)";
  value missingClass . = "(Missing)";
run;
```

A single space enclosed in quotation marks specifies a missing character value and a dot specifies a missing numeric value. Although it might seem appropriate to use empty quotation marks (‘’ or “”) to specify a missing character value, doing so produces unexpected results. To specify a missing character value, enclose a single space in quotation marks (‘ ’ or “ ”). You can use this format for the class columns in the PROC SGRENDER statement. In that case, if the class columns contain missing values, then the labels specified in the format statement are used for the missing classes.

The following figure shows the previous example when format $missingClass is applied to the class variable.



Note: In SAS 9.4M2 and in earlier releases, ODS Graphics does not support Unicode values in user-defined formats. Starting with SAS 9.4M3, ODS Graphics supports Unicode values in user-defined formats only if they are preceded by the (*ESC*) escape sequence. Example: `"(*ESC*){unicode beta}"`. ODS Graphics does not support an escape character that is defined in an ODS ESCAPECHAR statement in user-defined formats.

Default TRUE

Interaction The CLASS= option must be specified for this option to have any effect.

See "boolean " on page xii for other Boolean values that you can use.

INDENT=*dimension*
specifies a value to be used with the INDENTWEIGHT= option to determine the indention for each text value.

Default 1/8 inch

Interaction The INDENTWEIGHT= option must be specified for this option to have any effect.

See "dimension" on page xiii

INDENTWEIGHT=*numeric-column* | *expression*
specifies the indention weight (multiplier) for each observation.

Interaction For each observation, the INDENT= option value is multiplied by the value of the column specified by this option to determine the indention for that observation's value.

Note If the axis-table values are numeric and a user-defined format is applied to the values, indentation might not work well, especially if the format results in long strings.

Tip When using the INDENTWEIGHT= option, specify VALUEHALIGN=LEFT to ensure correct indentation. Otherwise, the indentation might not be as expected.

LABEL="*string*"
specifies the text for the table label.

Note: This feature applies to SAS 9.4M2 and to later releases.

Default The class values are used when the CLASS= option is set and CLASSDISPLAY=STACK is in effect. Otherwise, the VALUE= column label or name is used.

Interaction This option is ignored when the CLASS= option is in effect.

Note If the length of the label exceeds the available space, the label is split on blank space as needed to make it fit.

See CLASS= on page 221

LABELATTRS=*style-element* | *style-element*(*text-options*) | (*text-options*)
specifies the color and font attributes of the column label.

Defaults For non-grouped data, the GraphValueText style element.

For grouped data, the label color changes to match the group color derived from the ContrastColor attribute of the GraphData1–GraphDataN style elements.

Restriction Group behavior occurs only when the CLASS= and COLORGROUP= option values are the same.

Interaction If one or more text options are specified and they do not include all the font properties such as color, family, size, weight, and style, then the properties that are not specified are derived from the GraphValueText style element.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Text Options" on page 1606 for available *text-options*.

LABELHALIGN=AUTO | LEFT | CENTER | RIGHT
specifies the horizontal alignment of the column label when it is displayed.

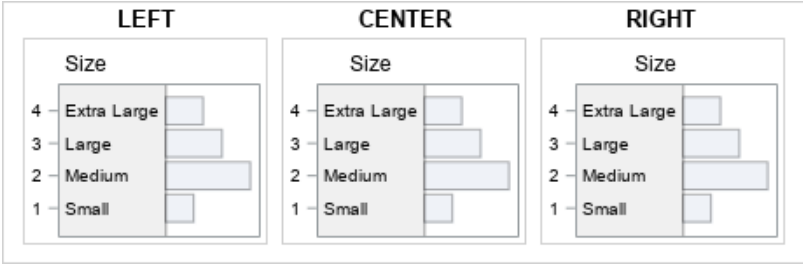
Note: This feature applies to SAS 9.4M2 and to later releases.

The alignment is relative to the axis-table width. The axis table width is set by the system to accommodate the maximum width of the values and, when displayed, the label.

AUTO
uses the effective value of the LABELJUSTIFY= option.

LEFT
CENTER
RIGHT
horizontally justifies the label left, center, or right.

The following figure shows these positions for the axis-table label Size.



Default AUTO

Restriction This option applies only to Y-axis tables.

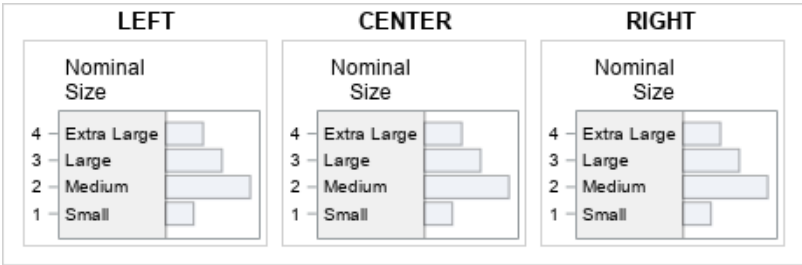
Interaction The DISPLAY= option must include LABEL for this option to have any effect.

LABELJUSTIFY=LEFT | CENTER | RIGHT

specifies the justification of the column label when it is displayed.

Note: This feature applies to SAS 9.4M2 and to later releases.

The justification is relative to the axis-table width. The axis table width is set by the system to accommodate the maximum width of the values and, when displayed, the label. The following figure shows the justifications LEFT, CENTER, and RIGHT for axis-table label Nominal Size.



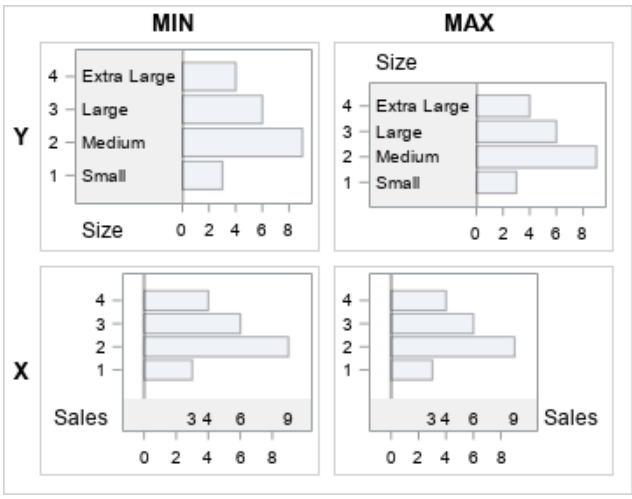
Default CENTER

Restriction This option applies only to Y-axis tables.

Interaction The DISPLAY= option must include LABEL for this option to have any effect.

LABELPOSITION=MIN | MAX

specifies the end of the axis on which the label is displayed. The label is aligned with the tick values on the axis. The following figure shows the MIN and MAX positions for Y axis and X-axis tables.



Default MIN

NAME="*string*"
assigns a name to this plot statement for reference in other template statements. The specified name is used primarily in legend statements to coordinate the use of colors and line patterns between the plot and the legend.

Restrictions The *string* is case sensitive, cannot contain spaces, and must define a unique name within the template.

This option does not support variables that are created by the DYNAMIC, MVAR, and NMVAR template statements.

PAD=*dimension* | *(pad-options)*
specifies the amount of extra space that is added inside the table border.

Note: This feature applies to SAS 9.4M2 and to later releases.

dimension
specifies a dimension to use for the extra space at the left, right, top, and bottom of the table border.

(*pad-options*)
specifies a space-separated list of one or more name-value-pair pad options, enclosed in parentheses.

The list can contain one or more of the following pad options:

LEFT=*dimension*
specifies the amount of extra space added to the left side.

Default 4 px

Restriction This option applies only to Y-axis tables.

RIGHT=*dimension*
specifies the amount of extra space added to the right side.

Default 4 px

Restriction This option applies only to Y-axis tables.

TOP=*dimension*
specifies the amount of extra space added to the top.

Default 0 px

Restriction This option applies only to X-axis tables.

BOTTOM=*dimension*
specifies the amount of extra space added to the bottom.

Default 0 px

Restriction This option applies only to X-axis tables.

Note Sides that are not assigned padding are padded with the default amount of space.

Tip Use *pad-options* to create non-uniform padding.

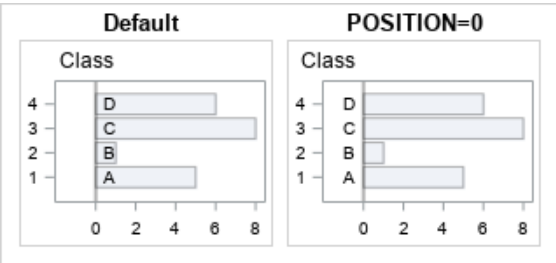
Note The default units for *dimension* are pixels.

See "dimension" on page xiii

POSITION=*number*
positions the plot along the axis orthogonal to the axis used for the values. This option enables you to position the plot when the AXISTABLE statement is not placed in an INNERMARGIN block.

number
specifies the position on the orthogonal axis as a fraction of the axis range.

When using the VALUEHALIGN option to align the values, in some cases, the axis-table values might not align properly within the space allocated for the axis table. For example, right-justifying the values might cause the values to overlap other graphical elements. In that case, rather than allocating more space for the axis table, you can use the POSITION= option to move the axis table to the left along the X axis as shown in the following figure.



Default Determined by the system.

Range 0 (bottom)–1 (top)

Interaction This option is ignored when the AXISTABLE statement is placed in an INNERMARGIN block. It is also ignored when the AXISTABLE statement is placed in a LAYOUT OVERLAY block by itself.

Tip To reserve space for the plot at either end of the orthogonal axis, specify the OFFSETMIN= or OFFSETMAX= option for the orthogonal axis.

SHOWMISSING=TRUE | FALSE
specifies whether missing values are represented in the table.

Note: This feature applies to SAS 9.4M2 and to later releases.

The values are evaluated before the column format is applied. When this option is set to FALSE, missing numeric and character values are hidden.

Default TRUE

See "boolean " on page xii for other Boolean values that you can use.

STAT=AUTO | SUM | MEAN
specifies the statistic that is to be computed for the VALUE= column when the column is numeric.

AUTO
computes the SUM statistic when the VALUE= column is numeric.

When the column is character, it uses the first column value as the statistic value.

SUM
MEAN
computes the SUM or MEAN statistic when the VALUE= column is numeric.

When the column is character, it uses the first column value as the statistic value.

Default AUTO

Interaction When the VALUE= column is character, the STAT= option always uses the first column value as the statistic value. In that case, SUM and MEAN are ignored.

TEXTGROUP=*discrete-attr-var*
specifies the discrete attribute variable for a discrete attribute map that maps text attributes to values for each observation. The discrete attribute variable is defined in a DISCRETEATTRVAR statement.

Restrictions A discrete attribute variable specification must be a direct reference to the attribute variable. It cannot be set by a dynamic variable.

The SIZE= specification in the discrete attribute map TEXTATTRS= option is ignored.

Interaction When this option is specified, the COLORGROUP= option is ignored .

TITLE="string"
specifies the text for the table title.

Note: This feature applies to SAS 9.4M2 and to later releases.

Default No table title is displayed

Note When an axis table is specified in the prototype of a data-driven layout, if the table is on the X axis, then the table title appears only in the first column of each row. If the table is on the Y axis, then the table title appears only in the first row of each column.

Tip Use the TITLEATTRS= option to control the appearance of the table title.

TITLEATTRS=*style-element* | *style-element*(*text-options*) | (*text-options*)
specifies the color and font attributes of the table title.

Note: This feature applies to SAS 9.4M2 and to later releases.

Default The GraphLabelText style element.

Interaction If one or more text options are specified and they do not include all the font properties such as color, family, size, weight, and style, then the properties that are not specified are derived from the GraphLabelText style element.

See "General Syntax for Attribute Options" on page 1599 for the syntax for using a *style-element*.

"Text Options" on page 1606 for available *text-options*.

TITLEHALIGN=AUTO | CENTER | LEFT | RIGHT
specifies the horizontal alignment of the title bounding box of the axis table, relative to the axis table width.

Note: This feature applies to SAS 9.4M2 and to later releases.

AUTO
aligns the title bounding box based on the table type:

- For a Y-axis table, aligns the title bounding box according to the effective TITLEJUSTIFY= option value.
- For an X-axis table, aligns the title bounding box LEFT.

CENTER
LEFT
RIGHT
horizontally aligns the table title bounding box center, left, or right.

Default AUTO

Restriction In SAS 9.4M2, this option applies only to Y-axis tables. Starting with SAS 9.4M3, this option applies to Y-axis tables and to X-axis tables.

Interaction The TITLE= option must be specified for this option to have any effect.

Tip For a multiline title in a Y-axis table, use TITLEJUSTIFY= to justify the title text lines in the title bounding box.

TITLEJUSTIFY=LEFT | CENTER | RIGHT
specifies the justification of the lines of a multiline title in the title bounding box. The justification is relative to the axis table width.

Note: This feature applies to SAS 9.4M2 and to later releases.

Default LEFT

Restrictions This option applies only to Y-axis tables.

The title must wrap to multiple lines for this option to have any effect.

Interaction The TITLE= option must be specified for this option to have any effect.

Tip Use TITLEHALIGN= to align the title bounding box.

VALUEATTRS=*style-element* | *style-element*(*text-options*) | (*text-options*)
specifies the color and font attributes of the text values.

Default The GraphDataText style element.

Interaction If one or more text options are specified and they do not include all the font properties such as color, family, size, weight, and style, then the properties that are not specified are derived from the GraphLabelText style element.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Text Options" on page 1606 for available *text-options*.

VALUEFORMAT=*format*
specifies a SAS format or a user-defined format for the table values.

Note: This feature applies to SAS 9.4M2 and to later releases.

Default The format that is in effect for the column specified in the VALUE= option. If no format is in effect, BEST6 is used for numeric columns.

Note Not all of the SAS formats are supported. See Appendix 4, "Format Support in ODS Graphics," on page 1621.

VALUEHALIGN=AUTO | LEFT | CENTER | RIGHT

in a Y-axis table, specifies the horizontal alignment of the column values relative to the axis-table width. The axis table width is set by the system to accommodate the maximum width of the values and, when displayed, the label.

Note: This feature applies to SAS 9.4M2 and to later releases.

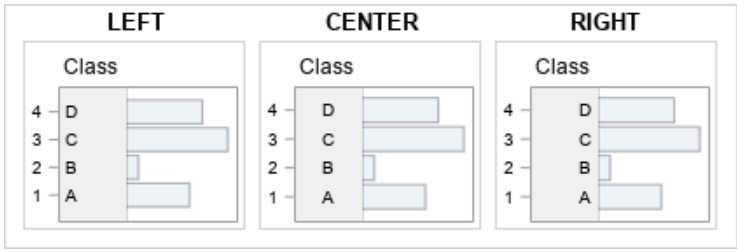
AUTO

uses the effective value of the VALUEJUSTIFY= option.

LEFT
CENTER
RIGHT

aligns the values left, center, or right relative to the axis-table width.

The following figure shows an example of each of these alignments.



Default AUTO

Restriction This option applies only to Y-axis tables.

Tip If the values do not align properly within the space allocated for the axis table, use the POSITION= on page 230 option to move the axis table along the X axis as needed.

VALUEJUSTIFY=AUTO | LEFT | CENTER | RIGHT

specifies the justification of the values in the axis table relative to the axis-table width. The axis table width is set by the system to accommodate the maximum width of the values and, when displayed, the label.

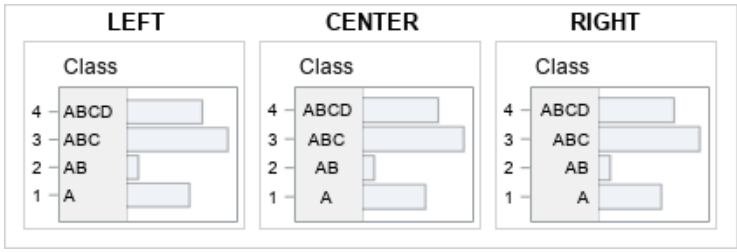
Note: This feature applies to SAS 9.4M2 and to later releases.

AUTO

uses LEFT for text values or RIGHT for numeric values.

CENTER
LEFT
RIGHT
horizontally aligns the table values center, left, or right, relative to the axis-table width.

The following figure shows an example of each of these alignments.



Default AUTO

Restriction This option applies only to Y-axis tables.

XAXIS=X | X2
specifies whether data are mapped to the primary X (bottom) axis or to the secondary X2 (top) axis.

Default X

Interaction The overall plot specification and the layout type determine the axis display. For more information, see "How Axis Features Are Determined" on page 1040.

YAXIS=Y | Y2
specifies whether data are mapped to the primary Y (left) axis or to the secondary Y2 (right) axis.

Default Y

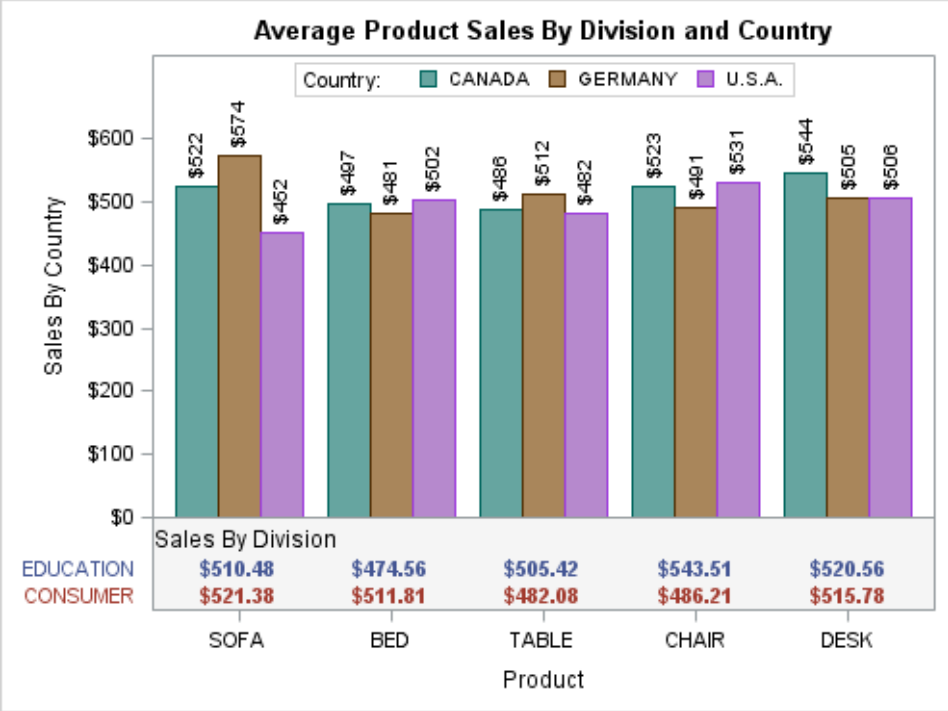
Interaction The overall plot specification and the layout type determine the axis display. For more information, see "How Axis Features Are Determined" on page 1040.

Details

The AXISTABLE statement enables you to place text values along the X or Y axis at specific values on the axis. It offers more flexibility than the BLOCKPLOT statement, which is used to denote changes in block values along the axis. The X and Y data does not need to be sorted.

Example: AXISTABLE Statement

This example shows how to add a table of average sales data by division below a bar chart of total sales by product and country. Here is the output that is generated by this example.



An inner margin is created at the bottom of the layout container to reserve space for the table. An AXISTABLE statement is used in the INNERMARGIN block to show the average sales by division for each product. Here is the SAS code for this example.

```
proc template;
  define statgraph axistable;
    begingraph;
      entrytitle "Average Product Sales By Division and Country";
      layout overlay / cycleattrs=true
        yaxisopts=(offsetmax=0.15 label="Sales By Country");
        innermargin / align=bottom opaque=true
backgroundcolor=cxf5f5f5;
          axistable x=product value=actual /
            name="division" stat=mean display=(label)
            headerlabel="Sales By Division"
            headerlabelattrs=GraphLabelText
            valueattrs=(size=9pt weight=bold)
            colorgroup=division class=division;
        endinnermargin;
        barchart category=product y=actual / name="country"
          barlabel=true barlabelformat=dollar5.0
          stat=mean group=country groupdisplay=cluster;
        discretelegend "country" / title="Country:" location=inside
          valign=top;
      endlayout;
```

```
   endgraph;
 end;
run;

proc sgrender data=sashelp.prdsale template=axistable;
run;
```

See Also

"Creating an Axis-Aligned Inset with an Axis Table" in *SAS Graph Template Language: User's Guide*

BANDPLOT Statement

Creates a band plot that typically shows confidence or prediction limits.

Requirements: You must specify either an X= argument or a Y= argument. You cannot specify both.

When you specify the X argument, you must also specify LIMITLOWER and LIMITUPPER arguments for Y values.

When you specify the Y argument, you must also specify LIMITLOWER and LIMITUPPER arguments for X values.

The plot data should be sorted by the X or Y variable that is used in the BANDPLOT statement. Otherwise, specify CONNECTORDER= AXIS in the BANDPLOT statement.

Syntax

BANDPLOT X=*column* | *expression*
LIMITLOWER=*number* | *numeric-column* | *expression*
LIMITUPPER=*number* | *numeric-column* | *expression* < */options* >;

BANDPLOT Y=*numeric-column* | *expression*
LIMITLOWER=*number* | *numeric-column* | *expression*
LIMITUPPER=*number* | *numeric-column* | *expression* < /option(s) >;

Summary of Optional Arguments

Appearance options

ANTIALIAS=AUTO | OFF
: specifies whether anti-aliasing is turned off for this plot.

CONNECTORDER=VALUES | AXIS
: specifies how to connect the data points to form the band lines.

CURVELABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font attributes of the band labels.

DATATRANSPARENCY=*number*
specifies the degree of the transparency of the band fill and band outline.

DISPLAY=(*display-options*) | STANDARD | ALL
specifies which band features to display.

EXTEND=TRUE | FALSE
specifies whether the constant or "step" band is to be drawn to the area bounded by the axes.

FILLATTRS=*style-element* | *style-element* (*fill-options*) | (*fill-options*)
specifies the appearance of the filled band area.

FILLPATTERNATTRS=*style-element* | (*fill-pattern-options*)
specifies the appearance of the pattern-filled areas.

INDEX=*positive-integer-column* | *expression*
specifies indices for mapping band attributes (fill and outline) to one of the GraphData1–GranphDataN style elements.

JUSTIFY=LEFT | CENTER | RIGHT
specifies the location of the data point relative to the step when TYPE=STEP.

OUTLINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the appearance of the band outlines.

TYPE=SERIES | STEP
specifies how the data points for lower and upper band boundaries are interpolated.

Axes options

XAXIS=X | X2
specifies whether data are mapped to the primary X (bottom) axis or to the secondary X2 (top) axis.

YAXIS=Y | Y2
specifies whether data are mapped to the primary Y (left) axis or to the secondary Y2 (right) axis.

Data tip options

ROLENAME=(*role-name-list*)
specifies user-defined roles that can be used to display information in the data tips.

TIP=(*role-list*) | NONE
specifies the information to display when the cursor is positioned over the band plot.

TIPFORMAT=(*role-format-list*)
specifies display formats for tip columns.

TIPLABEL=(*role-label-list*)
specifies display labels for tip columns.

Label options

CURVELABELLOCATION=INSIDE | OUTSIDE
specifies the location of the band labels relative to the plot area.

CURVELABELLOWER="*string*" | *column*
: specifies a label for the lower band limit.

CURVELABELPOSITION=AUTO | MAX | MIN | START | END
: specifies the position of the band labels relative to the curve line.

CURVELABELSPLIT=TRUE | FALSE
: specifies whether to split the band labels at the specified split characters.

CURVELABELSPLITCHAR="*character-list*"
: specifies one or more characters on which the band labels can be split if needed.

CURVELABELSPLITCHARDROP=TRUE | FALSE
: specifies whether the split characters are included in the band label text.

CURVELABELSPLITJUSTIFY=AUTO | CENTER | LEFT | RIGHT
: specifies the justification of the strings that are inside the band label blocks.

CURVELABELUPPER="*string*" | *column*
: specifies a label for the upper band limit.

LEGENDLABEL="*string*"
: specifies a label to be used in a discrete legend for this plot.

Midpoint options

GROUP=*column* | *discrete-attr-var* | *expression*
: creates a separate band plot for each unique group value of the specified column.

INCLUDEMISSINGGROUP=TRUE | FALSE
: specifies whether missing values of the group variable are included in the plot.

Plot reference options

MODELNAME="*plot-name*"
: specifies the name of the plot from which to derive the interpolation for the band.

NAME="*string*"
: assigns a name to this plot statement for reference in other template statements.

Required Arguments

You must specify either an X= or Y= argument. You cannot specify both. In addition, the LIMITLOWER= and LIMITUPPER= arguments must be used to specify the lower and upper lines for the band.

X=*column* | *expression*
: specifies X values. Numeric or character values can be used.

  Requirement You must also specify the LIMITLOWER= and the LIMITUPPER= arguments for the Y values.

Y=*column* | *expression*
: specifies Y values. Numeric or character values can be used.

Requirement You must also specify the LIMITLOWER= and the LIMITUPPER= arguments for the X values.

LIMITLOWER=*number* | *numeric-column* | *expression*
specifies a constant or column representing the values of the lower band line.

Interactions When this option is used with the X= option, it specifies the Y value or values.

When this option is used with the Y= option, it represents the X value or values.

Note If a constant is specified, then a straight line is drawn.

LIMITUPPER=*number* | *numeric-column* | *expression*
specifies a constant or column representing the values of the lower band line.

Interactions When this option is used with the X= option, it specifies the Y value or values.

When this option is used with the Y= option, it represents the X value or values.

Note If a constant is specified, then a straight line is drawn.

Optional Arguments

ANTIALIAS=AUTO | OFF
specifies whether anti-aliasing is turned off for this plot.

Note: This feature applies to SAS 9.4M2 and to later releases.

AUTO
specifies that anti-aliasing is controlled by the ANTIALIAS= option in the ODS GRAPHICS statement.

OFF
specifies that anti-aliasing is always disabled for this plot.

Default AUTO

Interaction This option overrides the ANTIALIAS= option in the ODS GRAPHICS statement.

CONNECTORDER=VALUES | AXIS
specifies how to connect the data points to form the band lines.

VALUES
connects data points in the order read from the X column (or Y column).

Note In SAS 9.4M6 and earlier releases, unexpected results might occur when VALUES is specified and data stored in a CAS in-memory table is used. In that case, use AXIS instead. Starting with SAS Viya 3.5 and

SAS Studio 5.2, VALUES is ignored when data stored in a CAS in-memory table is used.

AXIS
connects data points as they occur left-to-right along the X axis (or bottom-to-top along the Y axis).

Tip You can use this value to ensure the expected connect order for certain types of series lines (for example, time series) when the input data might not be sorted by the X column (or Y column).

Defaults VALUES if the data is a SAS data set

AXIS if the data is a CAS in-memory table

CURVELABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font attributes of the band labels.

Defaults For non-grouped data, the GraphValueText style element.

For grouped data, text color is derived from the GraphData1:ContrastColor–GraphDataN:ContrastColor style references. The font is derived from the GraphValueText style element.

Note When you specify *style-element*, only the style attributes COLOR, FONTFAMILY, FONTSIZE, FONTSTYLE, and FONTWEIGHT are used.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Text Options" on page 1606 for available *text-options*.

CURVELABELLOWER=*"string"* | *column*
specifies a label for the lower band limit.

Default No curve label is displayed for the lower band

Requirements For non-grouped data, use "string".

For grouped data, use a column to define the lower band labels for each group value. All of the labels for a specific group value must be the same. Otherwise, the results are unpredictable.

Tip The font and color attributes for the label are specified by the CURVELABELATTRS= option.

CURVELABELUPPER=*"string"* | *column*
specifies a label for the upper band limit.

Default No curve label is displayed for the upper band

Requirements For non-grouped data, use "*string*".

For grouped data, use a column to define the upper band labels for each group value. All of the labels for a specific group value must be the same. Otherwise, the results are unpredictable.

Tip The font and color attributes for the label are specified by the CURVELABELATTRS= option.

CURVELABELLOCATION=INSIDE | OUTSIDE
specifies the location of the band labels relative to the plot area.

INSIDE
locates the labels inside the plot area

OUTSIDE
locates the labels outside the plot area

Default INSIDE

Restriction OUTSIDE cannot be used when the BANDPLOT is used in multicell layouts such as LATTICE, DATAPANEL, or DATALATTICE where axes might be external to the grid.

Interactions This option is used with the CURVELABELPOSITION= option to determine where the band labels appear. For more information, see "Location and Position of Curve Labels" on page 213.

The EXTEND= option is ignored when CURVELABELLOCATION=INSIDE is in effect.

CURVELABELPOSITION=AUTO | MAX | MIN | START | END
specifies the position of the band labels relative to the curve line.

AUTO
positions the band labels automatically near the band boundary along unused axes whenever possible (typically Y2 and X2).

Restriction This option is used only when CURVELABELLOCATION=OUTSIDE.

MAX
forces the band labels to appear near maximum band values (maximum X-values for horizontal curves, and maximum Y-values for vertical curves).

MIN
forces the band label to appear near minimum band values (minimum X-values for horizontal curves, and minimum Y-values for vertical curves)

START
forces band labels to appear near the beginning of the curve.

Restriction This option is used only when CURVELABELLOCATION=INSIDE.

Tip This option is particularly useful when the curve line has a spiral shape.

END
forces band labels to appear near the end of the curve.

Restriction This option is used only when CURVELABELLOCATION=INSIDE.

Tip This option is particularly useful when the curve line has a spiral shape.

Defaults AUTO when CURVELABELLOCATION=OUTSIDE.

END when CURVELABELLOCATION=INSIDE.

Restrictions The AUTO setting is ignored if CURVELABELLOCATION=INSIDE is specified. The START and END settings are ignored if CURVELABELLOCATION=OUTSIDE is specified.

The BANDPLOT statement does not support the BEGINGRAPH statement option LABELPLACEMENT=SA on page 36.

Interaction This option is used with the CURVELABELLOCATION= option to determine where the band labels appear. For more information, see "Location and Position of Curve Labels" on page 213.

Note When you specify TICKVALUELIST=, VIEWMAX=, or VIEWMIN= in an axis statement, the data points that are used to determine the position of the band label might fall outside of the graph area. In that case, the band label might not be displayed or might be positioned incorrectly.

Tip When END is in effect, no attempt is made to avoid curve label collisions. If your curve labels collide, try using MAX instead.

CURVELABELSPLIT=TRUE | FALSE
specifies whether to split the band labels at the specified split characters. When a band label is split, the label is split on each occurrence of the specified split characters.

Default FALSE. The band label is not split.

Requirement The CURVELABEL= option must also be specified.

Interactions The CURVELABELSPLITCHAR= option specifies one or more characters on which the splits occur.

This option has no effect when CURVELABELPOSITION=AUTO.

See "boolean " on page xii for other Boolean values that you can use.

CURVELABELSPLITCHAR="*character-list*"
specifies one or more characters on which the band labels can be split if needed. When multiple split characters are specified, each character in the list is treated as a separate split character unless the specified characters appear consecutively in the band label. In that case, all of the specified split characters together are treated as a single split character.

When CURVELABEL= is specified and CURVELABELSPLIT=TRUE, the band labels are split unconditionally at each occurrence of any of the specified split characters. If the band label does not contain any of the specified characters, then the label is not split.

"character-list"
one or more characters with no delimiter between each character and enclosed in quotation marks.

Default A blank space

Requirements The list of characters must be enclosed in quotation marks.

Multiple characters must be specified with no delimiters. For example, to specify the split characters a, b, and c, use the following option:

```
curvelabelsplitchar="abc"
```

The CURVELABEL= option and the CURVELABELSPLIT=TRUE option must also be specified.

Interactions This option has no effect if CURVELABELPOSITION=AUTO.

The CURVELABELSPLITCHARDROP= option specifies whether the split characters are included in the band labels or are dropped.

Notes When multiple characters are specified, the order of the characters in the list is not significant.

The split characters are case sensitive.

Tip Use the CURVELABELSPLITJUSTIFY= option to specify the justification of the strings in the band label blocks.

CURVELABELSPLITCHARDROP=TRUE | FALSE
specifies whether the split characters are included in the band label text.

TRUE
drops the split characters from the band label text.

FALSE
includes the split characters in the band label text.

When CURVELABELSPLIT=TRUE and CURVELABELSPLITCHARDROP=FALSE, each split character remains as the last character in the current line. The characters that follow the split character, up to and including the next split character, are then wrapped to the next line.

The following figure shows an example of a band label with the following specifications:

- CURVELABELPOSITION=MAX
- CURVELABEL="Product*Group*A"
- CURVELABELSPLIT=TRUE

- CURVELABELSPLITCHARDROP=TRUE | FALSE
- CURVELABELSPLITCHAR="*"

Note: The horizontal line to the left of the label represents the maximum end of the band for reference.

When CURVELABELSPLITCHARDROP=TRUE, the asterisks are removed from the label. When CURVELABELSPLITCHARDROP=FALSE, each asterisk remains as the last character in the line prior to the new line.

Default TRUE. The split characters are dropped from the band labels.

Requirement The CURVELABEL= option and the CURVELABELSPLIT=TRUE option must also be specified.

Interaction The CURVELABELSPLITCHAR= option specifies the split characters.

See "boolean " on page xii for other Boolean values that you can use.

CURVELABELSPLITJUSTIFY=AUTO | CENTER | LEFT | RIGHT
specifies the justification of the strings that are inside the band label blocks.

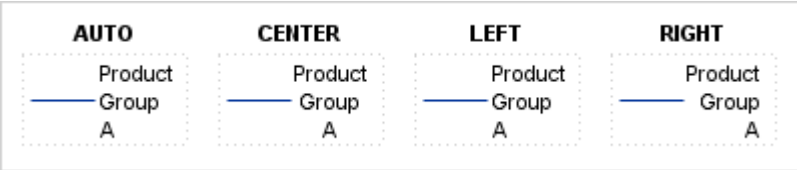
AUTO
justifies the labels based on the CURVELABELPOSITION= option.

CURVELABELPOSITION= Value	Justification
MAX or END	LEFT
MIN or START	RIGHT

CENTER
LEFT
RIGHT
justifies the labels center, left, or right, as specified.

The following figure shows an example in which CURVELABELPOSITION=MAX.

Note: The horizontal line to the left of each label represents the maximum end of the band for reference.



In this case, because CURVELABELPOSITION=MAX, AUTO left-justifies the lines of text.

Default AUTO

Requirement The CURVELABEL= option and the CURVELABELSPLIT=TRUE option must also be specified.

Interaction This option has no effect if CURVELABELPOSITION=AUTO.

DATATRANSPARENCY=*number*
specifies the degree of the transparency of the band fill and band outline.

Default 0

Range 0–1, where 0 is opaque and 1 is entirely transparent

Note This option does not affect the band curve labels.

Tip The FILLATTRS= option can be used to set transparency for just the band area. You can combine this option with FILLATTRS= to set one transparency for the band outline but a different transparency for the band fill. Example:

```
datatransparency=0.2 fillattrs=(transparency=0.6)
```

DISPLAY=(*display-options*) | STANDARD | ALL
specifies which band features to display.

(*display-options*)
specifies a space-separated list of one or more display options, enclosed in parentheses.

The list can contain one or more of the following options:

FILL
displays the band fill color

FILLPATTERN
displays the band fill pattern

Note This feature applies to SAS 9.4M5 and to later releases.

Tip For this option to have any effect, the active ODS style must specify a fill pattern or a fill pattern must be specified with the FILLPATTERNATTRS= option.

OUTLINE
displays the band outline

STANDARD
specifies FILL only

ALL
specifies all features: FILL, FILLPATTERN, and OUTLINE

Default The GraphBand:DisplayOpts style reference.

Tip Use the OUTLINEATTRS= and FILLATTRS= options to control the appearance of the band outline and fill color. Starting with SAS 9.4M5, use the FILLPATTERNATTRS= option to control the appearance of the band fill pattern.

EXTEND=TRUE | FALSE
specifies whether the constant or "step" band is to be drawn to the area bounded by the axes.

Default FALSE

Requirement When this option is used for a constant band, constants must be specified for the upper and lower band limits. This requirement does not apply to "step" bands.

Interactions This option is ignored when band labels are placed inside the plot area (CURVELABELLOCATION=INSIDE). To extend the bands in that case, use the CURVELABELLOCATION=OUTSIDE option.

If the X or Y value is character, then the EXTEND= option is honored only when the upper and lower limits specify a number.

Tip If this option is not specified, then there can be a small gap between the line and the axis. The gap is controlled by the axis offset. If the axis offset is set to 0, then there is no gap.

See "boolean " on page xii for other Boolean values that you can use.

FILLATTRS=*style-element* | *style-element* (*fill-options*) | (*fill-options*)
specifies the appearance of the filled band area.

Defaults For non-grouped data, the GraphConfidence:Color style reference.

For grouped data, the Color attribute of GraphData1–GraphDataN style elements.

Interaction For this option to have any effect, the fill must be enabled by the ODS style or by the DISPLAY= option.

Tip The DATATRANSPARENCY= option sets the transparency for both the band fill and band outline. You can combine this option with DATATRANSPARENCY= to set one transparency for the band outline and a different transparency for the band fill. Example:

```
datatransparency=0.2 fillattrs=(transparency=0.6)
```

See "General Syntax for Attribute Options" on page 1599 for the syntax for using a *style-element*.

"Fill Color Options" on page 1600 for available *fill-options* values.

FILLPATTERNATTRS=*style-element* | (*fill-pattern-options*)
specifies the appearance of the pattern-filled areas.

Note: This feature applies to SAS 9.4M5 and to later releases.

Defaults For non-grouped data, the ContrastColor and FillPattern attributes of GraphDataDefault.

For grouped data, the ContrastColor and FillPattern attributes of GraphData1–GraphDataN.

Interaction For this option to take effect, the DISPLAY= option must include FILLPATTERN among the display options.

Tip In order to change the fill pattern for each group value in ODS styles such as HTMLBlue that use color-priority attribute rotation, specify ATTRPRIORITY=NONE in an ODS GRAPHICS statement or in the BEGINGRAPH statement in your graph template. For more information, see "Attribute Rotation Patterns" in *SAS Graph Template Language: User's Guide*.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Fill Pattern Options" on page 1601 for available *fill-pattern-options*.

GROUP=*column* | *discrete-attr-var* | *expression*
creates a separate band plot for each unique group value of the specified column.

discrete-attr-var
specifies a discrete attribute map variable.

The discrete attribute map variable is created by a DISCRETEATTRVAR statement.

Restriction A discrete attribute map variable specification must be a direct reference to the attribute map variable. It cannot be set by a dynamic variable.

A distinct band is created for each group value by varying the visual attributes of the band display features. The display features are controlled by the current ODS style or by the DISPLAY= option. The default group appearance for each display feature is shown in the following table.

Display Feature[1]	Style Attributes That Control Default Group Appearance
Fill color	Color attribute of a GraphData1–GraphDataN style element or the GraphMissing style element.
Fill pattern [2]	FillPattern and ContrastColor attributes of a GraphData1–GraphDataN style element or the GraphMissing style element.

Display Feature[1]	Style Attributes That Control Default Group Appearance
	The ContrastColor attribute controls the color of the fill pattern. If the active ODS style does not specify FillPattern, fill patterns are not displayed by default.
Outline	ContrastColor and LineStyle attributes of a GraphData1–GraphDataN style element or the GraphMissing style element.

1 The default display features are determined by the DisplayOpts attribute of the GraphBand style element.
2 Fill patterns are valid for band plots starting with SAS 9.4M5.

Restrictions This option can be used only when a numeric column is specified for the upper limit or the lower limit of the band plot. The other limit could be a constant, if desired.

Starting with SAS 9.4M5, the number of vertices for a patterned line cannot exceed the maximum specified by the ODS GRAPHICS statement option LINEPATTERNOBSMAX=. The default is 10,000. If the limit is exceeded, the plot is not drawn and a note is written to the SAS log stating that the limit has been exceeded. In that case, increase LINEPATTERNOBSMAX= to the value suggested in the note or change the line pattern to SOLID.

Interactions To label grouped band plots, you must specify CURVELABELLOWER= *column* and CURVELABELUPPER= *column*

The group values are mapped in the order of the data, unless the INDEX= option is used to alter the default sequence of colors and line patterns.

The INCLUDEMISSINGGROUP option controls whether missing group values are considered a distinct group value.

Note If you specify a column in a SAS data set, the visual attributes for each group value are assigned in data order. If you specify a column in a CAS in-memory table, the visual attributes for each group value are assigned in ascending order of the group column character values or of unformatted numeric values.

Tips The representations that are used to identify the groups can be overridden individually. For example, each distinct group value is represented by a different line pattern for the band lines, but the PATTERN= suboption of the OUTLINEATTRS= option could be used to assign the same line pattern to all band outlines.

By default, ODS Graphics limits the number of groups to 1000. When this limit is exceeded, the GROUP= option is ignored. Use the GROUPMAX= option in the ODS GRAPHICS statement to change the maximum number of groups that can be processed.

See "DISCRETEATTRVAR Statement" on page 1516

INCLUDEMISSINGGROUP=TRUE | FALSE
specifies whether missing values of the group variable are included in the plot.

Default TRUE

Interaction For this option to take effect, the GROUP= option must also be specified.

Tip The attributes of the missing group value are determined by the GraphMissing style element unless a discrete attribute map is in effect, the INDEX= option is used, the MISSING= system option changes the default missing character, or a user-defined format is applied to the group value. In those cases, the attributes of the missing group value are determined by a GraphData1–GraphDataN style element instead of by the GraphMissing style element.

See "boolean " on page xii for other Boolean values that you can use.

INDEX=*positive-integer-column* | *expression*
specifies indices for mapping band attributes (fill and outline) to one of the GraphData1–GranphDataN style elements.

Requirements The column or expression value must be an integer value of 1 or greater. Otherwise, this option is ignored.

The positive-integer column must not contain missing values. Otherwise, the entire column is invalidated and this option is ignored.

All of the indexes for a specific group value must be the same. Otherwise, the results are unpredictable.

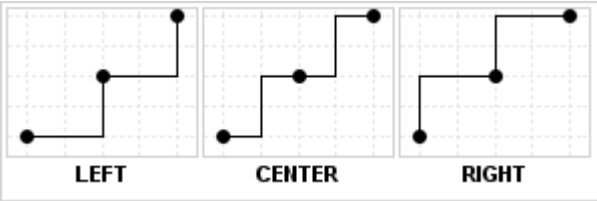
Interaction For this option to take effect, the GROUP= option must also be specified.

Notes The index values are 1-based indices. For the style attributes in GraphData1–GraphDataN, if the index value is greater than N, then a modulo operation remaps that index value to a number less than N to determine which style to use.

If you do not use this option, then the group values are mapped in the order of the data.

Tip You can use indexing to collapse the number of groups that are represented in a graph. For more information, see "Remapping Groups for Grouped Data" on page 211.

JUSTIFY=LEFT | CENTER | RIGHT
specifies the location of the data point relative to the step when TYPE=STEP.



Default LEFT

Requirement TYPE= STEP must also be specified for this option to have any effect.

Interaction If the MODELNAME= option is specified, then this option is ignored.

LEGENDLABEL="*string*"
specifies a label to be used in a discrete legend for this plot.

Default The *string* specified on the NAME= option.

Restriction This option applies only to an associated DISCRETELEGEND statement.

Interaction If the GROUP= option is specified, then this option is ignored.

MODELNAME="*plot-name*"
specifies the name of the plot from which to derive the interpolation for the band. When this option is used, the band plot forms prediction or confidence limits for the plot that supplies the fitted model.

Requirement *plot-name* must be the name that has been assigned on the associated plot's NAME= option.

Interaction This option overrides the JUSTIFY= and TYPE= options.

Tip If this option is not specified, then the interpolation is set by the TYPE= option.

NAME="*string*"
assigns a name to this plot statement for reference in other template statements. The specified name is used primarily in legend statements to coordinate the use of colors and line patterns between the plot and the legend.

Restrictions The *string* is case sensitive, cannot contain spaces, and must define a unique name within the template.

This option does not support variables that are created by the DYNAMIC, MVAR, and NMVAR template statements.

Interaction The *string* is used as the default legend label if the LEGENDLABEL= option is not used.

OUTLINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the appearance of the band outlines.

Defaults For non-grouped data, the GraphConfidence style element.

For grouped data, the ContrastColor and LineStyle attributes of the GraphData1–GraphDataN style elements.

Restriction Starting with SAS 9.4M5, the number of vertices for a patterned line cannot exceed the maximum specified by the ODS GRAPHICS statement option LINEPATTERNOBSMAX=. The default is 10,000. If the limit is exceeded, the plot is not drawn and a note is written to the SAS log stating that the limit has been exceeded. In that case, increase LINEPATTERNOBSMAX= to the value suggested in the note or change the line pattern to SOLID.

Interaction For this option to have any effect, the outline must be enabled by the ODS style or by the DISPLAY= option.

See "General Syntax for Attribute Options" on page 1599 for the syntax for using a *style-element*.

"Line Options" on page 1602 for available *line-options* values.

ROLENAME=(*role-name-list*)

specifies user-defined roles that can be used to display information in the data tips. This option provides a way to add to the data columns that appear in data tips that are specified by the TIP= option.

(*role-name-list*)

a space-separated list of *role-name = column* pairs.

Example The following example assigns the column Obs to the user-defined role TIP:

```
ROLENAME=(TIP1=OBS)
```

Default No user-defined roles

Requirement The role names that you choose must be unique and different from the predefined roles X, Y, LIMITUPPER, LIMITLOWER, GROUP, CURVELABELUPPER, and CURVELABELLOWER.

TIP=(*role-list*) | NONE

specifies the information to display when the cursor is positioned over the band plot. If this option is used, then it replaces all of the information that is displayed by default. Roles for columns that do not contribute to the band plot can be specified along with roles that do.

(*role-list*)

an ordered, space-separated list of unique BANDPLOT and user-defined roles. BANDPLOT roles include X , Y , LIMITUPPER , LIMITLOWER , GROUP , INDEX , CURVELABELUPPER , and CURVELABELLOWER .

User-defined roles are defined with the ROLENAME= option.

Note CURVELABELUPPER and CURVELABELLOWER are considered roles only when they are assigned a column of values. They are not

considered roles and do not display data tips when assigned a string.

Example This example displays data tips for the columns assigned to the roles X, LIMITUPPER, and LIMITLOWER as well as the column Obs, which is not assigned to any pre-defined BANDPLOT role. The Obs column must first be assigned a role.

```
ROLENAME=(TIP1=OBS)
TIP=(TIP1 X LIMITUPPER LIMITLOWER)
```

NONE
suppresses data tips from the plot.

Default The columns assigned to these roles are automatically included in the data tip information: X , Y , LIMITUPPER , LIMITLOWER , and GROUP .

Requirement To generate data tips in the output, you must include an ODS GRAPHICS ON statement that specifies the IMAGEMAP option, and you must write the output to the ODS HTML destination.

Interaction This option is ignored when the plot statement is in an OVERLAY or PROTOTYPE layout and the INCLUDERANGES= option is specified in the LINEAROPTS= or TIMEOPTS= option for either axis.

Tip The labels and formats for the TIP roles can be controlled with the TIPLABEL= and TIPFORMAT= options.

TIPFORMAT=(*role-format-list*)
specifies display formats for tip columns. This option provides a way to control the formats of columns that appear in data tips.

(role-format-list)
a space-separated list of *role-name* = *format* pairs.

Example
```
ROLENAME=(TIP1=SALARY)
TIP=(TIP1)
TIPFORMAT=(TIP1=DOLLAR12.)
```

Default The column format of the column assigned to the role or BEST6 if no format is assigned to a numeric column.

Restriction Only the roles that appear in the TIP= option are used.

Requirement A column must be assigned to each of the specified roles. (See the ROLENAME= option.)

TIPLABEL=(*role-label-list*)
specifies display labels for tip columns. This option provides a way to control the labels of columns that appear in data tips.

role-label-list
a space-separated list of *rolename* ="*string*" pairs.

Example
```
ROLENAME=(TIP1=PCT)
TIP=(TIP1)
TIPLABEL=(TIP1="Percent")
```

Default The column label or column name of the column assigned to the role.

Restriction Only the roles that appear in the TIP= option are used.

Requirement A column must be assigned to each of the specified roles. (See the ROLENAME= option.)

TYPE=SERIES | STEP
specifies how the data points for lower and upper band boundaries are interpolated.

SERIES
connects the data points using line segments (as in a SeriesPlot).

STEP
connects the data points (as in a StepPlot).

Default SERIES

Interactions TYPE=STEP must be specified to enable the JUSTIFY= option.

If the MODELNAME= option is specified, then this option is ignored.

XAXIS=X | X2
specifies whether data are mapped to the primary X (bottom) axis or to the secondary X2 (top) axis.

Default X

Interactions This option is ignored if the X= argument is not specified.

The overall plot specification and the layout type determine the axis display. For more information, see “How Axis Features Are Determined” on page 1040.

YAXIS=Y | Y2
specifies whether data are mapped to the primary Y (left) axis or to the secondary Y2 (right) axis.

Default Y

Interactions This option is ignored if the Y= argument is not specified.

The overall plot specification and the layout type determine the axis display. For more information, see “How Axis Features Are Determined” on page 1040.

Details

A band plot can specify an X column with Y upper and lower limits, or a Y column with X upper and lower limits. If you specify the X argument, then you must specify LIMITLOWER and LIMITUPPER arguments for the Y values to apply the limits to the Y axis. If you specify the Y argument, then you must specify LIMITLOWER and LIMITUPPER arguments for the X values to apply the limits to the X axis.

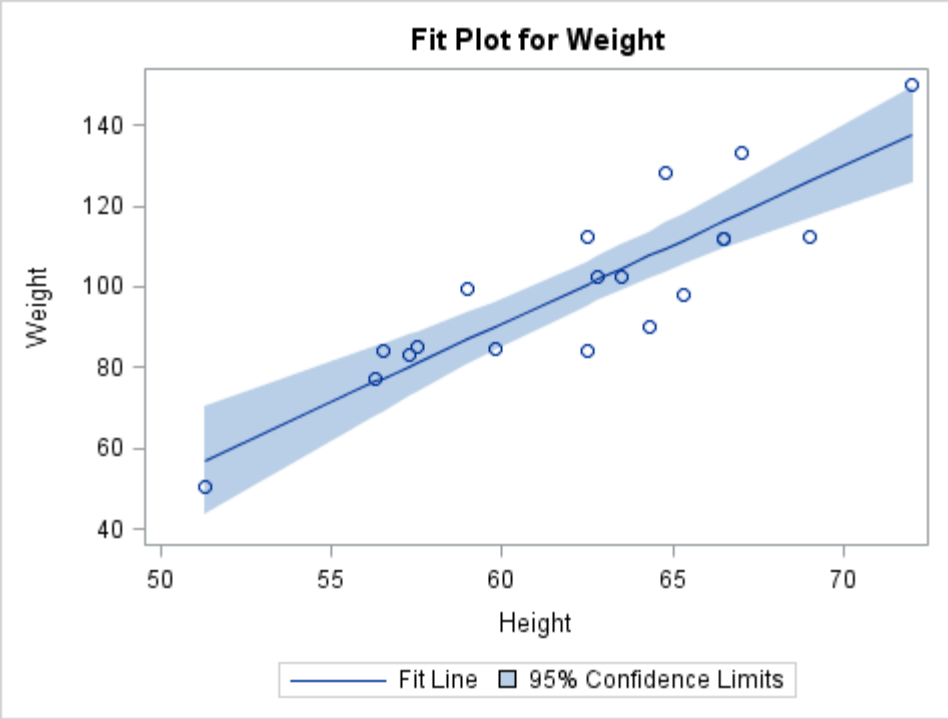
When you use a BANDPLOT statement to display prediction or confidence limits, the band plot can be used with another plot that specifies a fitted model. For example, it can be used with a series or step plot. In these cases, use the BANDPLOT option MODELNAME= or TYPE= to identify the interpolation for the band.

You can use the BANDPLOT statement in displays that are independent of other plots. For example, a band plot can be used to define yellow and green areas in an OVERLAY LAYOUT statement that also contains a scatter plot. This use implies concern for any of the scatter plot values that fall in the yellow area and comfort for any values that fall in the green area. For this use, the upper and lower limits would be specified by a constant.

Note: The BANDPLOT statement is optimized to work as a Confidence or Prediction band. If the band is self-intersecting (not sorted for X or for Y), then the resulting band is unpredictable. With unsorted data, the band that is generated for an output Raster Image might not match the band that is generated for an output Vector Graphic.

Example: BANDPLOT Statement

The following graph was generated by the "Example Program" on page 256:



Example Program

Here is the code for this example.

```
proc template;
  define statgraph bandplot;
    begingraph;
      entrytitle "Fit Plot for Weight";
      layout overlay;
        bandplot x=height limitupper=uppermean
          limitlower=lowermean /
          name="band" modelname="fit"
          legendlabel="95% Confidence Limits";
        scatterplot x=height y=weight / primary=true;
        seriesplot x=height y=predict / name="fit"
          legendlabel="Fit Line";
        discretelegend  "fit" "band";
      endlayout;
    endgraph;
  end;
run;

proc sgrender data=sashelp.classfit template=bandplot;
run;
```

BARCHART Statement

Creates a bar chart computed from input data.

Tips:

For charts that have a large number of bars that are very close together, slight variations in spacing that normally occur due to integer rounding can become more obvious. Subpixel rendering provides more precise bar spacing in that case. In SAS 9.4M2 and in earlier releases, specify SUBPIXEL=ON in the BEGINGRAPH statement to enable subpixel rendering. See SUBPIXEL= on page 39. Starting with SAS 9.4M3, subpixel rendering is enabled by default.

To disable subpixel rendering in SAS 9.4M3 and in later releases, specify SUBPIXEL=OFF in the BEGINGRAPH statement or in an ODS GRAPHICS statement. For information about the BEGINGRAPH statement SUBPIXEL= option, see SUBPIXEL= on page 39. For information about the ODS GRAPHICS statement SUBPIXEL= option, see "ODS GRAPHICS Statement" on page 1561.

Syntax

BARCHART CATEGORY=*column* | *expression* </option(s)>;

BARCHART CATEGORY=*column* | *expression*
RESPONSE=*numeric-column* | *expression* </*options*>;

Summary of Optional Arguments

Appearance options

BARWIDTH=*number*
: specifies the width of a bar as a ratio of the maximum possible width.

BASELINEATTRS=*style-element* | (*line-options*)
: specifies the appearance of the baseline.

CLUSTERWIDTH=*number*
: specifies the width of the group clusters as a fraction of the midpoint spacing or bin width.

COLORBYFREQ=TRUE | FALSE
: specifies whether the bar colors are based on statistical values when the COLORRESPONSE= option is not specified.

COLORMODEL=*color-ramp-style-element* | (*color-list*)
: specifies a color ramp to use with the COLORRESPONSE= option or the COLORBYFREQ= option.

COLORRESPONSE=*numeric-column* | *range-attr-var* | *expression*
: specifies the column or range attribute variable to use to map the bar colors to a continuous color gradient.

CONNECTATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)

specifies the appearance of the bar connect lines.

CONNECTBREAK=TRUE | FALSE
specifies whether the connect line is broken for values that have no observations.

DATASKIN=NONE | CRISP | GLOSS | MATTE | PRESSED | SHEEN
enhances the visual appearance of the filled bars.

DATATRANSPARENCY=*number*
specifies the degree of the transparency of the bar fill, bar outline, connect line, and bar labels, if displayed.

DISPLAY=(*display-options*) | STANDARD | ALL
specifies which bar features to display.

DISPLAYBASELINE=ON | OFF | AUTO
specifies whether the baseline is displayed.

DISPLAYZEROLENGTHBAR=TRUE | FALSE
specifies whether zero-length bars are drawn.

FILLATTRS=*style-element* | *style-element* (*fill-options*) | (*fill-options*)
specifies the appearance of the filled bar area.

FILLENDCOLOR=*color*
specifies the end color of the color gradient for the bar fill.

FILLPATTERNATTRS=*style-element* | (*fill-pattern-options*)
specifies the appearance of the pattern-filled areas.

FILLTYPE=SOLID | ALPHAGRADIENT | COLORGRADIENT | GRADIENT
specifies the bar fill type.

INDEX=*positive-integer-column* | *expression*
specifies indices for mapping bar attributes (fill and outline) to one of the GraphData1–GranphDataN style elements.

INTERVALBARWIDTH=*dimension*
specifies the width of the bars in an interval bar chart as a ratio of the interval width.

ORIENT=VERTICAL | HORIZONTAL
specifies the orientation of the Y axis and the bars.

OUTLINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the appearance of the bar outlines.

TARGET=*numeric-column* | *expression*
specifies the target value for each bar.

Axes options

BASELINEINTERCEPT=*number*
specifies the response axis intercept for the baseline.

PRIMARY=TRUE | FALSE
specifies that the data columns for this plot and the plot type be used for determining default axis features.

XAXIS=X | X2
specifies whether data are mapped to the primary X (bottom) axis or to the secondary X2 (top) axis.

YAXIS=Y | Y2
specifies whether data are mapped to the primary Y (left) axis or to the secondary Y2 (right) axis.

Data tip options

TIP=(*role-list*) | NONE
: specifies the information to display when the cursor is positioned over a bar.

TIPFORMAT=(*role-format-list*)
: specifies display formats for tip columns.

TIPLABEL=(*role-label-list*)
: specifies display labels for tip columns.

Label options

BARLABEL=TRUE | FALSE
: specifies whether the bar statistic value is displayed at the end of the bar.

BARLABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
: specifies the text properties of the bar label text.

BARLABELFITPOLICY=AUTO | NONE | INSIDEPREFERRED
: specifies a policy for avoiding collisions among the bar labels when labels are displayed.

BARLABELFORMAT=*format*
: specifies the text format used to display the bar label.

LEGENDLABEL="*string*"
: specifies a label to be used in a discrete legend for this plot.

SEGMENTLABEL=TRUE | FALSE
: specifies whether a label is displayed inside each bar segment.

SEGMENTLABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
: specifies the text properties of the text for the bar segment label.

SEGMENTLABELFITPOLICY=NONE | NOCLIP | THIN
: specifies a policy for fitting the bar segment labels within the bar segments.

SEGMENTLABELFORMAT=*format*
: specifies the text format for the bar segment labels.

Midpoint options

DISCRETEOFFSET=*number*
: specifies an amount to offset all bars from the category midpoints.

GROUP=*column* | *discrete-attr-var* | *expression*
: creates a separate bar segment or bar for each unique group value in the specified column.

GROUP100=NONE | MAGNITUDE | POSITIVE
: displays the computed response values (FREQ, SUM, or MEAN), normalized to 100%.

GROUPDISPLAY=STACK | CLUSTER
: specifies how to display grouped bars.

GROUPORDER=DATA | REVERSEDATA | ASCENDING | DESCENDING
: specifies the ordering of the groups within a category.

INCLUDEMISSINGGROUP=TRUE | FALSE

specifies whether missing values of the group variable are included in the plot.

ODS options

URL=*string-column*
specifies an HTML page to display when the bar is selected.

Plot reference options

NAME="*string*"
assigns a name to this plot statement for reference in other template statements.

Statistics options

COLORSTAT=FREQ | PCT | SUM | MEAN | PROPORTION
specifies the statistic to be calculated for the data range of the bar-color gradient.

STAT=FREQ | PCT | SUM | MEAN | PROPORTION
specifies the statistic to be computed for the Y axis.

Required Arguments

Specifying only CATEGORY= creates a bar chart with bars that, by default, represent frequency counts or percents of CATEGORY. Specifying both CATEGORY= and RESPONSE= creates a bar chart with bars representing summarized values of RESPONSE categorized by CATEGORY.

CATEGORY=*column* | *expression*
specifies the column or expression for the category values.

Notes You can use X= as an alternative to CATEGORY=. If you use X=, then be aware that the TIP=, TIPFORMAT=, and TIPLABEL= options recognize X as the category role and not as CATEGORY.

For interval category values, if a user-defined format is applied to the category column, the format should map each category value to only one unique formatted value. Otherwise, unexpected results might occur.

RESPONSE=*numeric-column* | *expression*
specifies the numeric column or expression for the response values.

Notes You can use Y= as an alternative to RESPONSE=. If you use Y=, then be aware that the TIP=, TIPFORMAT=, and TIPLABEL= options will recognize Y as the response role and not RESPONSE in that case.

This option is required only when you want summarized values of RESPONSE that are categorized by CATEGORY.

Optional Arguments

BARLABEL=TRUE | FALSE
specifies whether the bar statistic value is displayed at the end of the bar. For grouped clustered bars, each bar is labeled with the summarized value of the

bar. For grouped stacked bars, the segmented bar is labeled with the accumulated, summarized value of all the bar segments.

Default FALSE

Note By default, the bar-label format is derived from the format that is assigned to the response column or from BEST6 if no format is assigned. The derived format retains the precision of the response-column format and, if necessary, increases the format width to accommodate the summarized value on the response axis.

Tip The font and color attributes for the label are specified by the BARLABELATTRS= option. The text format is specified by the BARLABELFORMAT= option.

See "boolean " on page xii for other Boolean values that you can use.

BARLABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the text properties of the bar label text.

Default The GraphDataText style element.

Requirement For this option to take effect, BARLABEL=TRUE must be specified.

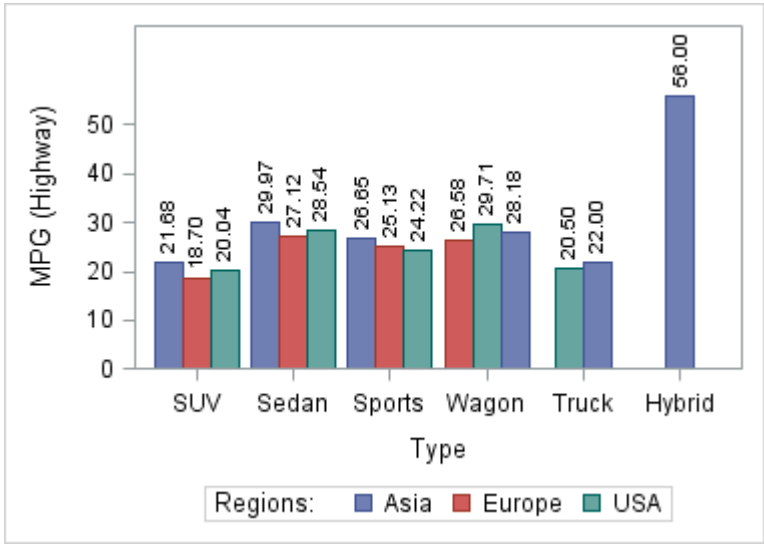
See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Text Options" on page 1606 for available *text-options*.

BARLABELFITPOLICY=AUTO | NONE | INSIDEPREFERRED
specifies a policy for avoiding collisions among the bar labels when labels are displayed.

AUTO
for a vertical bar chart, rotates the bar labels if the labels exceed the midpoint spacing.

For a horizontal bar chart, always draws the labels horizontally. The following figure shows an example.



See the BARWIDTH= option for more information about the bar spacing.

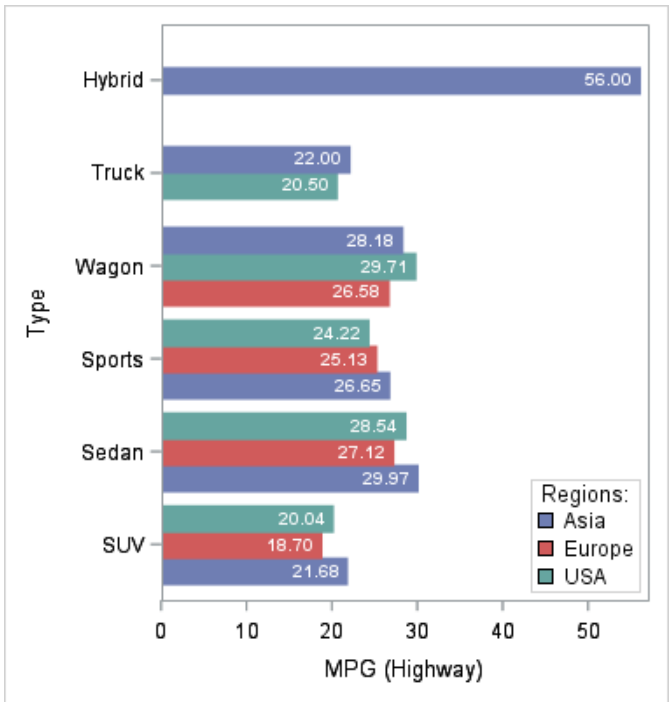
NONE
does not rotate the bar labels.

Labels that are too long overlap.

INSIDEPREFERRED
attempts to place the bar labels in a horizontal bar chart inside the bars.

The following figure shows an example.

Note: This feature applies to SAS 9.4M5 and to later releases.



Restrictions This option applies to non-grouped or cluster-grouped horizontal bar charts only.

Label splitting is not supported when a label is placed inside a bar.

Requirement For a grouped horizontal bar chart, the GROUPDISPLAY=CLUSTER option must be in effect. Otherwise, the INSIDEPREFERRED policy is ignored.

Interaction If SEGMENTLABEL=TRUE is in effect, the INSIDEPREFERRED policy is ignored, and the labels are placed outside.

Note If any bar label cannot fit inside the length of its bar, that label is placed outside of its bar and is fit using the AUTO fit policy.

Labels can collide along their length and along their height. In some cases, if one or more labels collide when the specified fit policy is used, then all of the labels are dropped from the display. When that occurs, the following warning message is written to the SAS log:

```
WARNING: The bar labels are suppressed. Use BARLABELFITPOLICY=NONE to
force the labels to be displayed.
```

> **TIP** If the labels collide along their height, then using the BARLABELATTRS= option to reduce the label font size might eliminate the collision.

Default AUTO

Requirement For this option to take effect, BARLABEL=TRUE must be specified.

BARLABELFORMAT=*format*

specifies the text format used to display the bar label.

Default The bar-label format is derived from the format that is applied to the response column or from BEST6 if no format is assigned. The derived format retains the precision of the response-column format and, if necessary, increases the format width to accommodate the summarized value on the response axis.

Requirement For this option to take effect, BARLABEL=TRUE must be specified.

Note When a bar-label format is specified with this option, the bar labels are formatted as specified by *format*. The specified format is not automatically expanded to accommodate values that are too wide.

Tip If you want the bar-label format to expand automatically for summarized values on the response axis, specify the format for the response column rather than in this option.

BARWIDTH=*number*
specifies the width of a bar as a ratio of the maximum possible width.

Default 0.85

Range 0–1, where 0 is the minimum width, which is one pixel wide, and 1 is the maximum possible width

Interaction Starting with SAS 9.4M3, the INTERVALBARWIDTH= option overrides this option for an interval bar chart.

Notes This option is needed only to change the default behavior.

By default, the bar width automatically adjusts based on the number of bars to be displayed and the wall width.

Tip To remove any inter-bar gap, set BARWIDTH=1.

BASELINEATTRS=*style-element* | (*line-options*)
specifies the appearance of the baseline.

Default The ContrastColor, LineThickness, and LineStyle attributes of the GraphAxisLines style element.

Notes The baseline is always drawn by default.

When *style-element* is specified, only the style element's Color, LineStyle, and LineThickness attributes are used.

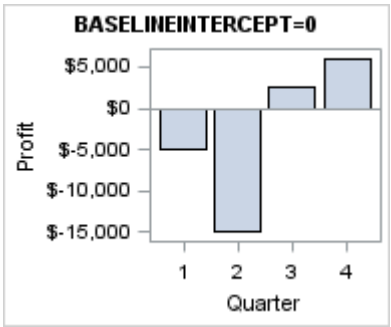
Tip To suppress the baseline, set the line thickness to 0:

```
baselineattrs=(thickness=0)
```

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

BASELINEINTERCEPT=*number*
specifies the response axis intercept for the baseline. Prior to SAS 9.4M5, the baseline is always displayed in the chart, whether for a specified value or for the default value. Starting with SAS 9.4M5, the baseline display is controlled by the DISPLAYBASELINE= option, which is ON by default. When the BASELINEINTERCEPT= option is used, the axis range is adjusted to include the baseline, and the baseline is placed at the specified value on the response axis.



Default 0

Interactions If GROUPDISPLAY=STACK is specified, then this option is ignored and the baseline is not displayed.

This option is ignored when the GROUP100= option is used.

If necessary, the response axis data range is extended to include the baseline intercept. When a logarithmic response axis is requested and BASELINEINTERCEPT= specifies 0 or a negative value, the response axis reverts to a linear axis. To restore the log axis in that case, set BASELINEINTERCEPT= to a positive value.

When DISPLAYBASELINE=AUTO is in effect, the baseline is not displayed if the baseline intercept is equal to the minimum or maximum value of the response-axis range.

Note Label positions are automatically adjusted to prevent the labels from overlapping.

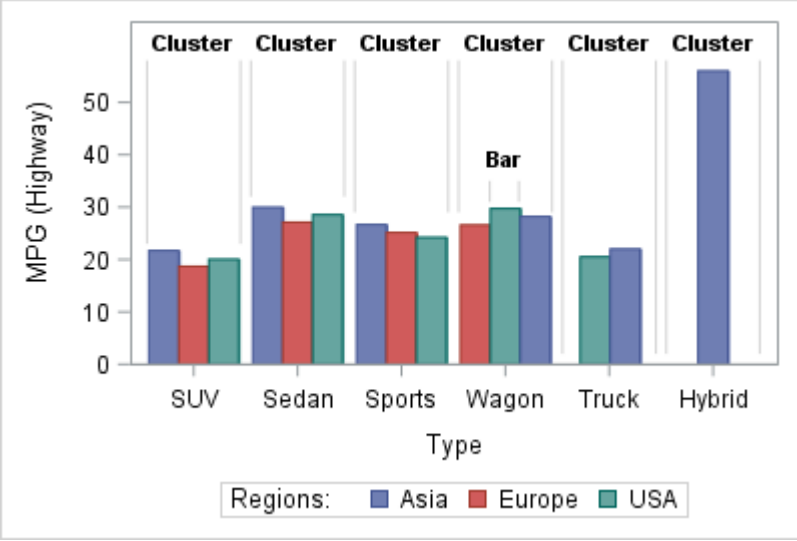
Tips Control the appearance of the baseline with the BASELINEATTRS= option.

To suppress the baseline prior to SAS 9.4M5, use the BASELINEATTRS= option to set the line thickness to 0. Starting with SAS 9.4M5, specify DISPLAYBASELINE=OFF.

The baseline does not add a tick or a tick value to the axis. To label the baseline, use a REFERENCELINE statement to overlay a line with the same X or Y value and include the CURVELABEL= option to specify the label text.

CLUSTERWIDTH=*number*

specifies the width of the group clusters as a fraction of the midpoint spacing or bin width.



Default 0.85

Range 0–1, where 0 is the minimum width, which is one pixel wide, and 1 is the maximum possible width

Requirement For this option to take effect, the GROUP= option must also be specified, and the GROUPDISPLAY= option must be set to CLUSTER.

Interaction When GROUPDISPLAY=CLUSTER, the default BARWIDTH is 1.0.

COLORBYFREQ=TRUE | FALSE

specifies whether the bar colors are based on statistical values when the COLORRESPONSE= option is not specified. Setting this option to `TRUE` enables you to color the bars based on frequency counts, percentages, or proportions.

Note: This feature applies to SAS 9.4M3 and to later releases.

Default FALSE

Requirement The COLORSTAT= option must be FREQ, PCT, or PROPORTION for this option to have any effect.

Interactions This option is ignored when the COLORRESPONSE= option is specified.

When the GROUP= option is specified with the COLORBYFREQ= option, the color attributes are controlled by the COLORBYFREQ= option.

The COLOR= suboption of the FILLATTRS=, FILLPATTERNATTRS=, and OUTLINEATTRS= options overrides this option for the associated Color attribute.

Note This option is independent of the STAT= and RESPONSE= options.

Tips Use the COLORSTAT= option to specify whether frequency counts, percentages, or proportions are computed for the COLORRESPONSE= column.

Use the FILLTYPE= option to specify whether each bar is filled with a solid color or with a gradient color.

See "Example 4: Bar Chart with Bar Colors Controlled by a Statistic" on page 298

COLORMODEL=*color-ramp-style-element* | (*color-list*)

specifies a color ramp to use with the COLORRESPONSE= option or the COLORBYFREQ= option.

color-ramp-style-element

specifies the name of a color-ramp style element.

The style element should contain these style attributes:

STARTCOLOR
specifies the color for the smallest data value of the COLORRESPONSE= column.

NEUTRALCOLOR
specifies the color for the midpoint of the range of the COLORRESPONSE= column.

ENDCOLOR
specifies the color for the highest data value of the COLORRESPONSE= column.

(*color-list*)
specifies a space-separated list of colors to use in the color ramp. You can use style attribute references such as GraphData3:Color, color names, or RGB, CMYK, HLS, and HSV (HSB) color codes to specify a color. The list can contain a mix of style attribute references, color names, and color codes.

Requirement The list of colors must be enclosed in parentheses.

See "color " on page xii

Defaults For outline-only bars, the ThreeColorAltRamp style element

For bars with fill, the ThreeColorRamp style element

Interaction For this option to take effect, the COLORRESPONSE= option or the COLORBYFREQ=TRUE option must also be specified.

Tip Use the DISPLAY= option to specify whether outlines and fills are displayed.

COLORRESPONSE=*numeric-column* | *range-attr-var* | *expression*
specifies the column or range attribute variable to use to map the bar colors to a continuous color gradient.

Note: This feature applies to SAS 9.4M3 and to later releases.

range-attr-var
specifies a range attribute map variable that is defined in a RANGEATTRVAR statement.

"RANGEATTRVAR Statement"

Restriction A range attribute map variable specification must be a direct reference to the attribute map variable. It cannot be set as a dynamic variable.

See "RANGEATTRVAR Statement" on page 1531

When a numeric column or expression is specified, the range of column or expression values are linearly mapped to the color ramp that is specified by the COLORMODEL= option. Each bar is colored using one color from the gradient range. When a range attribute map variable is specified, the colors that are defined in the associated range attribute map are used instead.

Requirement For a grouped plot, the COLORRESPONSE values should remain constant for each group value. If the COLORRESPONSE column has multiple values for a single GROUP value, unexpected results might occur.

Interactions The COLORBYFREQ= option is ignored when this option is specified.

When the GROUP= option is specified with the COLORRESPONSE= option, the color attributes are controlled by the COLORRESPONSE= option.

When fill, fill pattern, or both are displayed, this option overrides suboption COLOR= in the FILLATTRS= option and in the FILLPATTERNATTRS= option and varies the color according to the color gradient or the attribute map.

When only the outlines are displayed, this option overrides suboption COLOR= in the OUTLINEATTRS= option and varies the outline color according to the color gradient or the attribute map.

Tips To display a legend with this option in effect, use a CONTINUOUSLEGEND statement.

Use the COLORSTAT= option to specify the statistic to compute for the COLORRESPONSE= column.

Use the FILLTYPE= option to specify whether each bar is filled with a solid color or with a gradient color.

For a numeric column or expression, the ThreeColorRamp style element defines the fill color gradient, and the ThreeColorAltRamp style element defines the outline color gradient.

COLORSTAT=FREQ | PCT | SUM | MEAN | PROPORTION
specifies the statistic to be calculated for the data range of the bar-color gradient.

Note: This feature applies to SAS 9.4M3 and to later releases.

The statistics that are available depend on the COLORRESPONSE= and COLORBYFREQ= option specifications. When the COLORRESPONSE= option is specified, the following values are valid:

SUM

MEAN

When the COLORRESPONSE= option is not specified and COLORBYFREQ=TRUE is in effect, the following values are valid:

FREQ	frequency count
PCT	percentages between 0 and 100
PROPORTION	proportions between 0 and 1

Defaults FREQ when the COLORRESPONSE= option is not specified and COLORBYFREQ=TRUE is in effect.

SUM when the COLORRESPONSE= option is specified.

Interactions This option is ignored when the COLORRESPONSE= option is not specified and COLORBYFREQ=FALSE is in effect.

This option might affect existing SAS programs. For programs written before SAS 9.4M3, if STAT= and COLORRESPONSE= are specified in a BARCHART statement, then the bar-chart colors and color statistic might change from those of the previous SAS releases. To restore the original colors and color statistic in that case, set COLORSTAT= in the BARCHART statement to the same statistic that is specified in STAT=.

Note This option is independent of the STAT= and RESPONSE= options.

See COLORBYFREQ= on page 266

COLORRESPONSE= on page 267

STAT= on page 287

"Example 4: Bar Chart with Bar Colors Controlled by a Statistic" on page 298

CONNECTATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the appearance of the bar connect lines.

Default The GraphConnectLine style element.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

CONNECTBREAK=TRUE | FALSE
specifies whether the connect line is broken for values that have no observations.

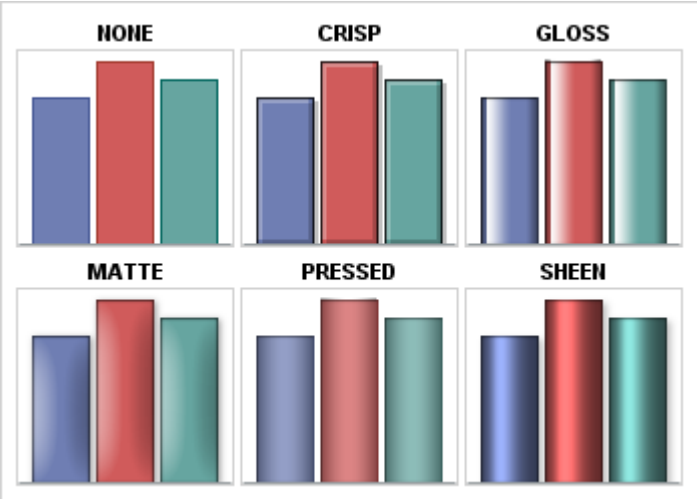
Note: This feature applies to SAS 9.4M5 and to later releases.

Default FALSE

Requirement DISPLAY= must include CONNECT for this option to have any effect.

Interaction This option is ignored when the GROUP= option is in effect.

DATASKIN=NONE | CRISP | GLOSS | MATTE | PRESSED | SHEEN
enhances the visual appearance of the filled bars. The following figure shows bars with each of the skins applied.



Default The DATASKIN= option value that is specified in the BEGINGRAPH statement. If not specified, then the GraphSkins:DataSkin style element value is used.

Restriction Starting with SAS 9.4M1, the maximum number of skinned graphical elements is limited to 200 per plot in an OVERLAY or PROTOTYPE layout. When this limit is exceeded for a plot, the specified data skin is not applied to that plot. In that case, use the DATASKINMAX= option in your ODS GRAPHICS statement to increase the maximum limit.

Requirement For this option to have any effect, the fill must be enabled by the ODS style or the DISPLAY= option.

Interactions This option overrides the BEGINGRAPH statement DATASKIN= option.

The data skin appearance is based on the FILLATTRS= color.

When a data skin is applied, all bar outlines are set by the skin, and the OUTLINEATTRS= option is ignored.

When FILLTYPE=GRADIENT is in effect, DATASKIN=SHEEN is ignored. In that case, use one of the other skins.

DATATRANSPARENCY=*number*
specifies the degree of the transparency of the bar fill, bar outline, connect line, and bar labels, if displayed.

Default 0

Range 0–1, where 0 is opaque and 1 is entirely transparent

Tip The FILLATTRS= option can be used to set transparency for just the filled bar area. You can combine this option with FILLATTRS= to set one transparency for the bar outlines and connect lines but a different transparency for the bar fills. Example:

```
datatransparency=0.2 fillattrs=(transparency=0.6)
```

DISCRETEOFFSET=*number*
specifies an amount to offset all bars from the category midpoints.

Default 0 (no offset, all bars are centered on the category midpoints)

Range -0.5 to +0.5, where 0.5 represents half the distance between category ticks. Normally, a positive offset is to the right when ORIENT=VERTICAL, and up when ORIENT=HORIZONTAL. (If the layout's axis options set REVERSE=TRUE, then the offset direction is also reversed.)

Tip Setting the discrete offset for the plots does not affect the axis minimum and maximum offsets. In some cases, setting a discrete offset can cause clipping at each end of the axis. In those cases, use the OFFSETMIN= and OFFSETMAX= axis options to increase the axis minimum and maximum offsets to accommodate the discrete offset.

See "About the DISCRETEOFFSET= Option" on page 292

"About the DISCRETEOFFSET= Option" on page 292 for information about the REVERSE=, OFFSETMIN=, and OFFSETMAX= axis options

ORIENT=

DISPLAY=(*display-options*) | STANDARD | ALL
specifies which bar features to display.

(*display-options*)
specifies a space-separated list of one or more display options, enclosed in parentheses.

The list can contain one or more of the following options:

CONNECT
displays the connect lines, which are line segments that connect adjacent midpoints at the end of each bar.

FILL
displays the bar fill color

FILLPATTERN
displays the bar fill pattern

Tip For this option to have any effect, the active ODS style must specify a fill pattern or a fill pattern must be specified with the FILLPATTERNATTRS= option.

OUTLINE
displays the bar outline

STANDARD
specifies FILL and OUTLINE

ALL
specifies all features: CONNECT, FILL, FILLPATTERN, and OUTLINE

Default The GraphBar:DisplayOpts style reference.

Interaction Connect lines are not drawn when the GROUP= option is in effect.

Note The connect lines are drawn in axis order starting with SAS 9.4M3. They are drawn in data order in prior releases.

Tips Use the OUTLINEATTRS=, FILLATTRS=, and FILLPATTERNATTRS= options to control the appearance of the bars.

Use CONNECTATTRS= to control the appearance of the connect lines.

You can specify both FILL and FILLPATTERN to combine solid fills and pattern fills in the bars.

DISPLAYBASELINE=ON | OFF | AUTO
specifies whether the baseline is displayed.

Note: This feature applies to SAS 9.4M5 and to later releases.

ON
always displays the baseline.

OFF
does not display the baseline.

AUTO
displays the baseline if the baseline intercept is within the response-axis range, excluding the minimum and maximum axis values.

This is the typical case when the bar chart includes both positive and negative bars, and the default baseline intercept of 0 is used. If the baseline intercept is equal to the minimum or maximum value of the response-axis range, the baseline is not displayed.

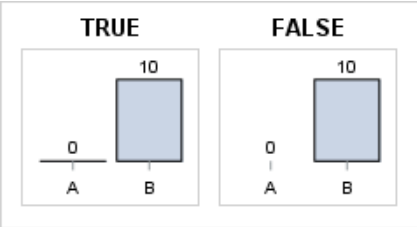
Default ON

Tip By default, the baseline intercept is 0. Use the BASELINEINTERCEPT= option to change the baseline intercept.

DISPLAYZEROLENGTHBAR=TRUE | FALSE
specifies whether zero-length bars are drawn.

Note: This feature applies to SAS 9.4M3 and to later releases.

A zero-length bar is displayed as a line spanning the normal bar width at the bar-chart baseline on the response axis. When this option is set to TRUE, zero-length bars are displayed. Otherwise, they are suppressed. The following figure shows a simple example of each outcome. In the figure, the plot wall outline, category axis line, and bar-chart baseline are suppressed for clarity.



Default TRUE

Interaction This option is ignored when the GROUP= and GROUPDISPLAY=STACK options are in effect. In that case, zero-length bar segments are drawn.

Note When this option is set to FALSE, the bar is not drawn, but other elements associated with the bar such as the target bar, the error bar, the bar label, and the data label, are drawn.

Tip This option is useful when the bar-chart baseline is suppressed.

FILLATTRS=*style-element* | *style-element* (*fill-options*) | (*fill-options*)
specifies the appearance of the filled bar area.

Defaults For non-grouped data, the GraphDataDefault:Color style reference

For grouped data, the Color attribute of the GraphData1–GraphDataN style elements.

Interaction When COLORRESPONSE= is in effect and the DISPLAY= option enables FILL display, the FILLATTRS= suboption COLOR= is ignored, and the bar fill colors vary according to the gradient.

Tip The DATATRANSPARENCY= option sets the transparency for the bar fills, bar outlines, and connect lines. You can combine this option with DATATRANSPARENCY= to set one transparency for the bar outlines and connect lines but a different transparency for the bar fills. Example:

```
datatransparency=0.2 fillattrs=(transparency=0.6)
```

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Fill Color Options" on page 1600 for available *fill-options*.

FILLENDCOLOR=*color*
specifies the end color of the color gradient for the bar fill.

Note: This feature applies to SAS 9.4M5 and to later releases.

Default The GraphWall style element Color attribute.

Requirement FILLTYPE=COLORGRADIENT must be in effect. Otherwise, this option is ignored.

See "color " on page xii

FILLPATTERNATTRS=*style-element* | (*fill-pattern-options*)
specifies the appearance of the pattern-filled areas.

Defaults For non-grouped data, the ContrastColor and FillPattern attributes of GraphDataDefault.

For grouped data, the ContrastColor and FillPattern attributes of GraphData1–GraphDataN.

Restriction In SAS 9.4M4 and in earlier releases, the only styles that are delivered by SAS that support fill patterns are JOURNAL2, JOURNAL3, and MONOCHROMEPRINTER. If *style-element* is specified and the active ODS style does not support fill patterns, this option is ignored.

Interactions For this option to take effect, the DISPLAY= option must include FILLPATTERN among the display options.

When COLORRESPONSE= is in effect and the DISPLAY= option enables FILLPATTERN display, the FILLPATTERNATTRS= suboption COLOR= is ignored, and the fill-pattern colors vary according to the gradient.

Tip In order to change the fill pattern for each group value in ODS styles such as HTMLBlue that use color-priority attribute rotation, specify ATTRPRIORITY=NONE in an ODS GRAPHICS statement or in the BEGINGRAPH statement in your graph template. For more information, see "Attribute Rotation Patterns" in *SAS Graph Template Language: User's Guide*.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Fill Pattern Options" on page 1601 for available *fill-pattern-options*.

FILLTYPE=SOLID | ALPHAGRADIENT | COLORGRADIENT | GRADIENT
specifies the bar fill type.

Note: This feature applies to SAS 9.4M2 and to later releases.

SOLID
fills each bar with the color that is assigned to that bar.

ALPHAGRADIENT
fills each bar with a color and a transparency gradient that starts at the bar top with the initial transparency that is assigned to that bar, and ends with full transparency at the bar baseline.

Note: This feature applies to SAS 9.4M5 and to later releases.

Tips The fill color is determined by a style element or by the FILLATTRS= option COLOR= suboption. The initial transparency is determined by the DATATRANSPARENCY= option or by the FILLATTRS= option TRANSPARENCY= suboption.

For grouped plots, use the FILLATTRS= option in a discrete attribute map to set the initial transparency in the gradients for specific values.

COLORGRADIENT

fills each bar with a color gradient that starts with the fill color that is assigned to that bar and ends with the color that is specified in the FILLENDCOLOR= option.

Note: This feature applies to SAS 9.4M5 and to later releases.

Alias GRADIENT

Interaction The SHEEN data skin cannot be used when FILLTYPE=GRADIENT is in effect. You can use one of the other data skins.

Tips Use the DATATRANSPARENCY= option or the FILLATTRS= option TRANSPARENCY= suboption to set the initial transparency in the gradients.

For grouped plots, use the FILLATTRS= option in a discrete attribute map to set the initial transparency in the gradients for specific values.

See "FILLENDCOLOR=*color*" on page 273

GRADIENT

fills each bar with a color and a transparency gradient that starts at the bar top with the initial transparency that is assigned to that bar, and ends with full transparency at the bar baseline.

Note: This option applies to SAS 9.4M2 through SAS 9.4M4. Starting with SAS 9.4M5, ALPHAGRADIENT replaces GRADIENT, and GRADIENT is changed to an alias of COLORGRADIENT.

Interactions The SHEEN data skin cannot be used when FILLTYPE=GRADIENT is in effect. You can use one of the other data skins.

In SAS 9.4M2, FILLTYPE=GRADIENT is ignored when GROUPDISPLAY=STACK is in effect. Starting with SAS 9.4M3, FILLTYPE=COLORGRADIENT is honored in that case.

Tips The initial fill color is determined by a style element or by the FILLATTRS= option COLOR= suboption. The initial transparency

is determined by the DATATRANSPARENCY= option or by the FILLATTRS= option TRANSPARENCY= suboption.

For grouped plots, use the FILLATTRS= option in a discrete attribute map to set the initial transparency in the gradients for specific values.

Default SOLID

Interaction The DISPLAY= option must include FILL for this option to have any effect.

Note The output for SAS programs written prior to SAS 9.4M5 that specify FILLTYPE=GRADIENT might change starting with SAS 9.4M5. To restore the original appearance, specify FILLTYPE=ALPHAGRADIENT.

See DATASKIN= on page 269

GROUP=*column* | *discrete-attr-var* | *expression*
creates a separate bar segment or bar for each unique group value in the specified column.

discrete-attr-var
specifies a discrete attribute map variable.

The discrete attribute map variable is created by a DISCRETEATTRVAR statement.

Restriction A discrete attribute map variable specification must be a direct reference to the attribute map variable. It cannot be set by a dynamic variable.

The bar display depends on the setting for the GROUPDISPLAY= option. For example, for a vertical bar chart with GROUPDISPLAY=STACK, bar segments are stacked to form the bar. The height of each segment represents the corresponding group value's proportional contribution to the response value.

A distinct bar or bar segment is created for each group value by varying the visual attributes of the bar display features. The display features are controlled by the current ODS style or by the DISPLAY= option. The default group appearance for each display feature is shown in the following table.

Display Feature [1]	Style Attributes That Control Default Group Appearance
Fill color	Color attribute of a GraphData1–GraphDataN style element or the GraphMissing style element.
Fill pattern	FillPattern and ContrastColor attributes of a GraphData1–GraphDataN style element or the GraphMissing style element. The ContrastColor attribute controls the color of the fill pattern. If the active ODS style does not specify FillPattern, fill patterns are not displayed by default.

Display Feature [1]	Style Attributes That Control Default Group Appearance
Outline	■ if the outline is enabled with fill color, fill pattern, or both, ContrastColor attribute of a GraphData1–GraphDataN style element or the GraphMissing style element with a solid line style ■ if the outline is the only display feature enabled, ContrastColor and LineStyle attributes of a GraphData1–GraphDataN style element or the GraphMissing style element

1 The default display features are determined by the DisplayOpts attribute of the GraphBar style element.

Interactions

Connect lines are not drawn for grouped data.

By default, the group values are mapped in the order of the data. Use the GROUPORDER= option to control the sorting order of the grouped bar segments. Use the INDEX= option to alter the default sequence of colors and line patterns.

The INCLUDEMISSINGGROUP option controls whether missing group values are considered a distinct group value.

When both the GROUP= and COLORRESPONSE= options are specified, the color attributes are controlled by the COLORRESPONSE= option.

Notes

The bar display depends on the setting for the GROUPDISPLAY= option.

If you specify a column in a SAS data set, the visual attributes for each group value are assigned in data order. If you specify a column in a CAS in-memory table, the visual attributes for each group value are assigned in ascending order of the group column character values or of unformatted numeric values.

Tips

The representations that are used to identify the groups can be overridden individually. For example, each distinct group value is represented by a different line pattern for the bar outlines, but you can use the PATTERN= setting on the OUTLINEATTRS= option to assign the same line pattern to all bar outlines and connect lines.

By default, ODS Graphics limits the number of groups to 1000. When this limit is exceeded, the GROUP= option is ignored. Use the GROUPMAX= option in the ODS GRAPHICS statement to change the maximum number of groups that can be processed.

See “Example 2: Grouped Vertical Bar Chart” on page 295

“DISCRETEATTRVAR Statement” on page 1516

GROUP100=NONE | MAGNITUDE | POSITIVE

displays the computed response values (FREQ, SUM, or MEAN), normalized to 100%.

Note: This feature applies to SAS 9.4M3 and to later releases.

NONE

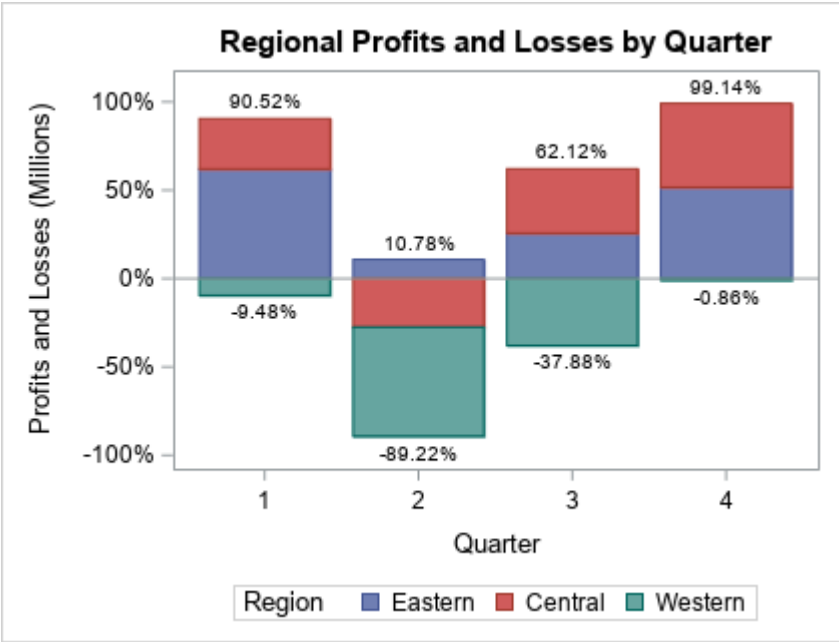
displays the summarized data.

MAGNITUDE

normalizes both the negative and positive values by magnitude to 100% of the midpoint value, and displays the group values, preserving the sign.

The positive values are displayed above the bars for a vertical bar chart and on the right end for a horizontal bar chart. The negative values are displayed enclosed in parentheses below the bars for a vertical bar chart and on the left end for a horizontal bar chart.

The following figure illustrates the effect of MAGNITUDE on stacked bars in a vertical bar chart.

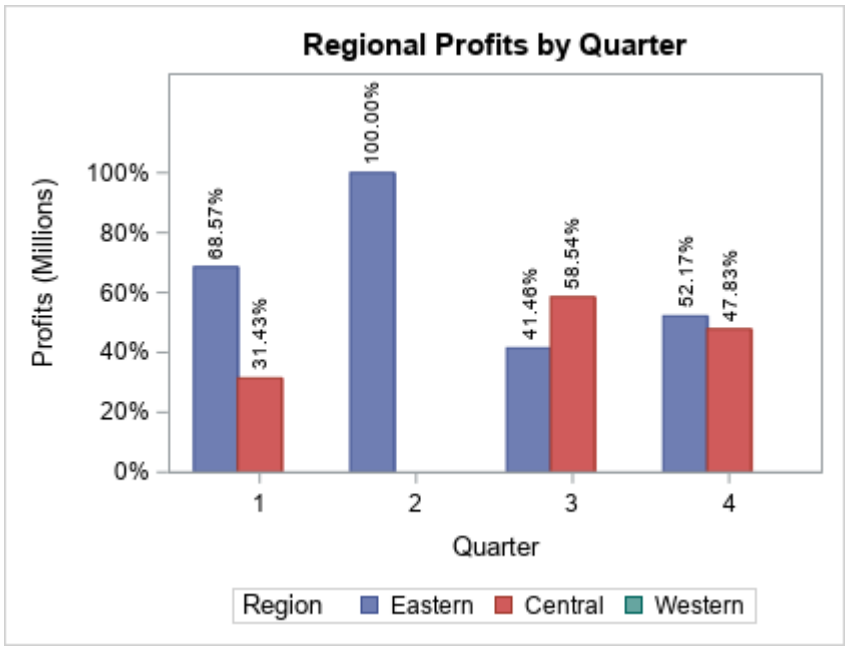


Notice that the group values for each midpoint value add up to 100%.

POSITIVE

drops the negative values and normalizes only the positive values to 100% of the midpoint value.

The following figure demonstrates the effect of POSITIVE on clustered bars in a vertical bar chart. This chart uses the same data as the chart in the previous figure.



Notice that the negative values are dropped from the chart and the group values for each midpoint value add up to 100%.

Default NONE

Requirement The GROUP= option must be specified for this option to have any effect.

Interactions When this option is used, the BASELINEINTERCEPT= and TARGET= options are ignored.

When MAGNITUDE or POSITIVE is specified and BARLABEL=TRUE is in effect, the BARLABELFORMAT= option is ignored and the bar labels are displayed as percentages with two-digit precision.

Note You can use this option with any value for the GROUPDISPLAY= option.

Tip To display the values, specify BARLABEL=TRUE.

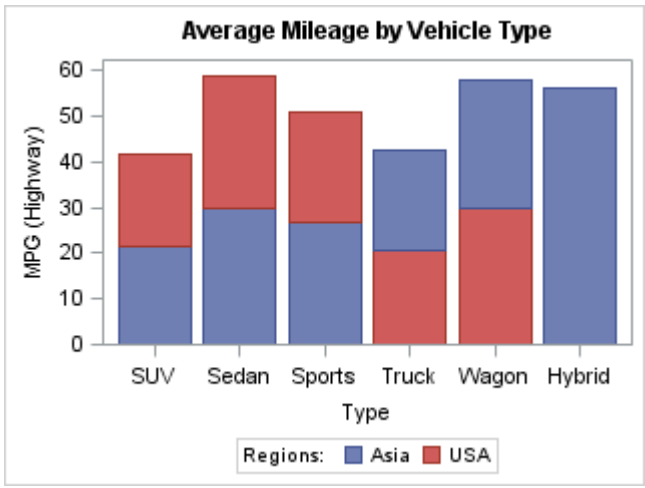
See “Example 2: Grouped Vertical Bar Chart” on page 295

GROUPDISPLAY=STACK | CLUSTER

specifies how to display grouped bars.

STACK

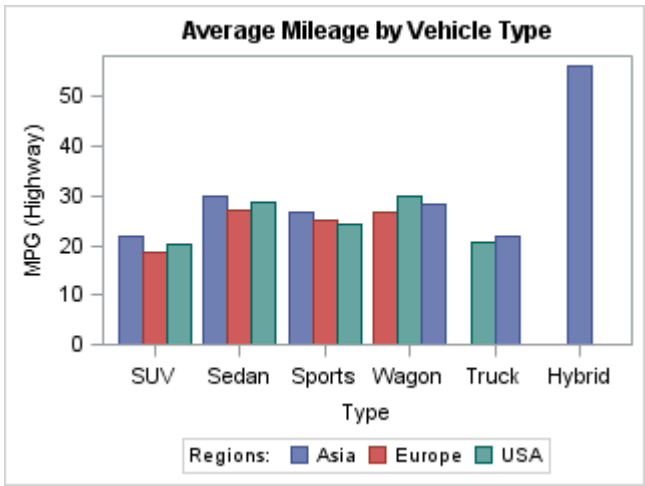
displays group values as stacked segments within the category bar.



CLUSTER

displays group values as separate adjacent bars that replace the single category bar.

Each cluster of group values is centered at the category midpoint on the axis. This example illustrates the clusters and also how groups are displayed when they have an unequal number of unique values.



Default STACK

Interaction When you use the BARLABEL= option and the GROUP= option, the BARLABEL values are displayed for each bar when GROUPDISPLAY=CLUSTER. When GROUPDISPLAY=STACK, the whole bar is labeled at the top.

Note When you plot a SAS data set, the items for each group value are drawn in data order. When you plot a CAS in-memory table, they are drawn in ascending order of the group column character values or unformatted numeric values.

Tip For a linear response axis, when STAT=MEAN or STAT=PCT, the axis tick values might be displayed as integer values when GROUPDISPLAY=STACK. Changing GROUPDISPLAY= to CLUSTER in that case might cause the axis values to change to decimal values.

To keep the integer axis values in both cases, you can specify the INTEGER=TRUE option for the response axis. See INTEGER= on page 1085.

GROUPORDER=DATA | REVERSEDATA | ASCENDING | DESCENDING
specifies the ordering of the groups within a category.

DATA
orders the groups within a category in the group-column data order.

REVERSEDATA
orders the groups within a category in the reverse group-column data order.

Note: This feature applies to SAS 9.4M2 and to later releases.

Tip This option is useful when you want to reverse the category axis.

ASCENDING
orders the groups within a category in ascending order.

DESCENDING
orders the groups within a category in descending order.

Defaults DATA if the data is a SAS data set.

ASCENDING if the data is a CAS in-memory table. Sorting is based on nonformatted values for numeric group values or on formatted values for character group values.

Interactions This option is ignored if the GROUP= option is not also specified.

By default, the groups in the legend are shown in the order that is specified in GROUPORDER.

Notes When plotting a SAS data set, attributes such as color, symbol, and pattern are assigned to each group in DATA order by default. When plotting a CAS in-memory table, attributes are assigned in ascending order of the group column character values or unformatted numeric values by default.

The ASCENDING and DESCENDING settings linguistically sort the group values within each category (or X value) for display position purposes only. For numeric data, the order is based on the unformatted values. For character data, the order is based on the formatted values. The data order of the observations and the visual attributes that are assigned to the group values remain unchanged.

In SAS 9.4M6 and earlier releases, when data stored in a CAS in-memory table is used and DATA or REVERSEDATA is specified, unpredictable results might occur. To generate consistent graphs in that case, specify ASCENDING or DESCENDING. Starting with SAS Viya 3.5 and SAS Studio 5.2, when data stored in a CAS in-memory table is used and DATA or REVERSEDATA is specified, it is ignored, and ASCENDING is used instead.

INCLUDEMISSINGGROUP=TRUE | FALSE
specifies whether missing values of the group variable are included in the plot.

Default TRUE

Interaction For this option to take effect, the GROUP= option must also be specified.

Tip The attributes of the missing group value are determined by the GraphMissing style element unless a discrete attribute map is in effect, the INDEX= option is used, the MISSING= system option changes the default missing character, or a user-defined format is applied to the group value. In those cases, the attributes of the missing group value are determined by a GraphData1–GraphDataN style element instead of by the GraphMissing style element.

See "boolean " on page xii for other Boolean values that you can use.

INDEX=*positive-integer-column* | *expression*
specifies indices for mapping bar attributes (fill and outline) to one of the GraphData1–GranphDataN style elements.

Requirements The column or expression value must be an integer value of 1 or greater. Otherwise, this option is ignored.

The positive-integer column must not contain missing values. Otherwise, the entire column is invalidated and this option is ignored.

All of the indexes for a specific group value must be the same. Otherwise, the results are unpredictable.

Interaction For this option to take effect, the GROUP= option must also be specified.

Notes The index values are 1-based indices. For the style attributes in GraphData1–GraphDataN, if the index value is greater than N, then a modulo operation remaps that index value to a number less than N to determine which style to use.

If you do not use this option, then the group values are mapped in the order of the data.

Tip You can use indexing to collapse the number of groups that are represented in a graph. For more information, see "Remapping Groups for Grouped Data" on page 211.

INTERVALBARWIDTH=*dimension*
specifies the width of the bars in an interval bar chart as a ratio of the interval width.

Note: This feature applies to SAS 9.4M3 and to later releases.

Default The width specified by the BARWIDTH= option.

Restriction This option applies only to an interval category axis. When the category axis is discrete, this option is ignored.

Interaction When the category data is interval, this option overrides the BARWIDTH= option.

Tips To make the category axis type linear or time, include TYPE=LINEAR or TYPE=TIME in the category axis options or assign the role of primary plot to a plot that makes the category axis linear or time.

The bar width that you specify with this option is honored even if the bars overlap. If the bars overlap, reduce the interval bar width or use the BARWIDTH= option instead.

See "dimension" on page xiii

LEGENDLABEL="*string*"
specifies a label to be used in a discrete legend for this plot.

Default The response-variable label. If a label is not defined, then the response-variable name is used.

Restriction This option applies only to an associated DISCRETELEGEND statement.

Interaction If the GROUP= option is specified, then this option is ignored.

NAME="*string*"
assigns a name to this plot statement for reference in other template statements. The specified name is used primarily in legend statements to coordinate the use of colors and line patterns between the plot and the legend.

Restrictions The *string* is case sensitive, cannot contain spaces, and must define a unique name within the template.

This option does not support variables that are created by the DYNAMIC, MVAR, and NMVAR template statements.

Interaction The *string* is used as the default legend label if the LEGENDLABEL= option is not used.

ORIENT=VERTICAL | HORIZONTAL
specifies the orientation of the Y axis and the bars.

Default VERTICAL

Notes When this option is set to HORIZONTAL, the category variable appears on the Y (or Y2) axis and the response variable appears on the X (or X2) axis. To set the axis properties for this chart, you should use the appropriate axis options of the layout container.

When this option is set to VERTICAL, the category variable appears on the X (or X2) axis and the response variable appears on the Y (or Y2) axis. To set the axis properties for this chart, you should use the appropriate axis options of the layout container.

If you change the orientation of the bar chart, then you should adjust the layout container's axis options appropriately.

OUTLINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the appearance of the bar outlines.

Defaults For non-grouped data, the ContrastColor, LineThickness, and LineStyle attributes of the GraphOutlines style element.

For grouped data and filled bars, the ContrastColor attribute of the GraphData1–GraphDataN style elements, and the LineThickness and LineStyle attributes of the GraphOutlines style element.

For grouped data and unfilled bars, the ContrastColor and LineStyle attributes of the GraphData1–GraphDataN style elements, and the LineThickness attribute of the GraphOutlines style element.

Interactions For this option to have any effect, outlines must be enabled by the ODS style or the DISPLAY= option.

If the DATASKIN= option applies a data skin, then this option is ignored.

When the COLORRESPONSE= and DISPLAY=(OUTLINE) options are in effect, the OUTLINEATTRS= suboption COLOR= is ignored, and the bar outline colors vary according to the gradient.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

PRIMARY=TRUE | FALSE
specifies that the data columns for this plot and the plot type be used for determining default axis features. This option is needed only when two or more plots within an overlay-type layout contribute to a common axis.

Default FALSE

Restriction This option is ignored if the plot is placed under a GRIDDED or LATTICE layout block.

Note In an OVERLAY layout, only one plot in an overlay can be the primary plot on a per-axis basis. When no plot is designated as the primary plot, the first plot that can be a primary plot is considered the primary plot. If multiple plots specify PRIMARY=TRUE for the same axis, then the last such plot encountered is considered the primary plot.

See "When Plots Share Data and a Common Axis" on page 1046

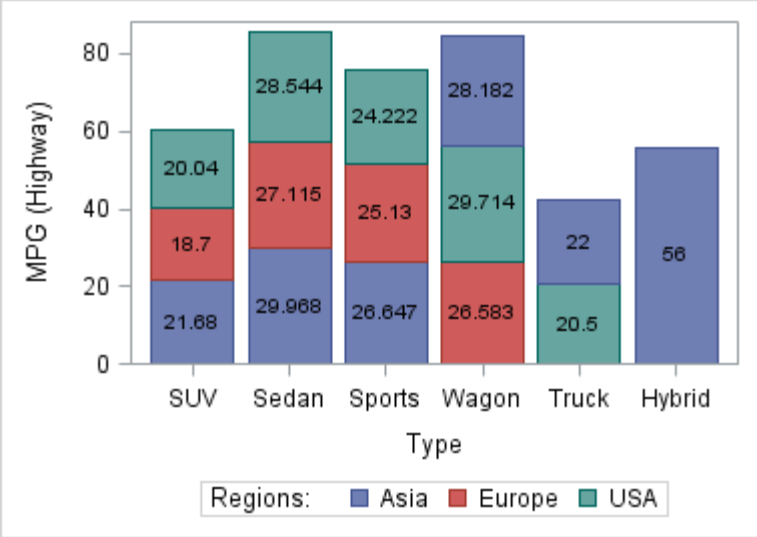
"boolean " on page xii for other Boolean values that you can use.

SEGMENTLABEL=TRUE | FALSE

specifies whether a label is displayed inside each bar segment.

Note: This feature applies to SAS 9.4M2 and to later releases.

For an ungrouped bar chart or for a grouped bar chart with GROUPDISPLAY=CLUSTER, AUTO displays a bar label inside each bar. The label displays the statistic for that bar. For a grouped bar chart with GROUPDISPLAY=STACK, AUTO displays a label inside each bar segment. Each segment label displays the statistic for that bar segment, as shown in the following figure.



When this value is set to FALSE, no labels are displayed inside the bars.

Default FALSE

Note By default, the segment-label format is derived from the format that is assigned to the response column or from BEST6 if no format is assigned. The derived format retains the precision of the response-column format and, if necessary, increases the format width to accommodate the summarized value on the response axis.

Tips For a grouped bar chart with GROUPDISPLAY=STACK, specify both SEGMENTLABEL=TRUE and BARLABEL=TRUE to display a label for each bar segment and a label for the entire bar.

Use the SEGMENTLABELATTRS= option to modify the appearance of the label text.

Use the SEGMENTLABELFITPOLICY= option to specify a policy for fitting the labels inside the bars.

Use the SEGMENTLABELFORMAT= option to modify the format of the segment labels.

See "boolean " on page xii for other Boolean values that you can use.

SEGMENTLABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the text properties of the text for the bar segment label.

Note: This feature applies to SAS 9.4M2 and to later releases.

Default The GraphDataText style element.

Interaction This option is ignored when SEGMENTLABEL=FALSE.

See "General Syntax for Attribute Options" on page 1599 for the syntax for using a *style-element*.

"Text Options" on page 1606 for available *text-options*.

SEGMENTLABELFITPOLICY=NONE | NOCLIP | THIN
specifies a policy for fitting the bar segment labels within the bar segments.

Note: This feature applies to SAS 9.4M2 and to later releases.

NONE
no attempt is made to fit each segment label within its bar. Long bar segment labels might overlap other graphical elements.

The segment labels are not considered when the axis ranges are computed. As a result, segment labels that extend beyond the plot area are clipped.

NOCLIP
does not clip bar segment labels that extend beyond the plot area.

Labels that do not fit within the plot area extend into the graph axis area and might overlap axis elements.

THIN
drops any bar segment label that does not fit within its segment.

For a vertical bar chart, the label width must not exceed the bar width, and the text height must not exceed the segment height. For a horizontal bar chart, the label text height must not exceed the bar width, and the label length must not exceed the segment length.

Default THIN

Interaction This option is ignored when SEGMENTLABEL=FALSE.

SEGMENTLABELFORMAT=*format*
specifies the text format for the bar segment labels.

Note: This feature applies to SAS 9.4M2 and to later releases.

Default The segment-label format is derived from the format that is assigned to the response column or from BEST6 if no format is assigned. The derived format retains the precision of the response-column format and, if necessary, increases the format width to accommodate the summarized value on the response axis.

Interaction This option is ignored when SEGMENTLABEL=FALSE.

Note When a segment-label format is specified with this option, the segment labels are formatted as specified by *format*. The specified format is not automatically expanded to accommodate values that are too wide.

Tip If you want the segment-label format to expand automatically for the summarized values on the response axis, specify the format for the response column rather than in this option.

STAT=FREQ | PCT | SUM | MEAN | PROPORTION
specifies the statistic to be computed for the Y axis. For bar charts with no RESPONSE= column:

FREQ	frequency count
PCT	percentages between 0 and 100
PROPORTION	proportions between 0 and 1

Note: Prior to SAS 9.4, PCT displayed proportions between 0 and 1. To restore the original PCT results in SAS 9.4 and later releases, specify PROPORTION instead.

For bar charts with a RESPONSE= column:

SUM
MEAN

Defaults For bar charts with no RESPONSE= column, the default is FREQ.

For bar charts with a RESPONSE= column, the default is SUM.

Interaction When the GROUP100=MAGNITUDE or GROUP100=POSTIVE option is in effect, the group values for each midpoint value are normalized to 100% of the midpoint value. See GROUP100= on page 324.

Note When this option is used with the GROUP=group option, the specified statistic is computed for each subgroup value of each group value. See “Example 2: Grouped Vertical Bar Chart” on page 295.

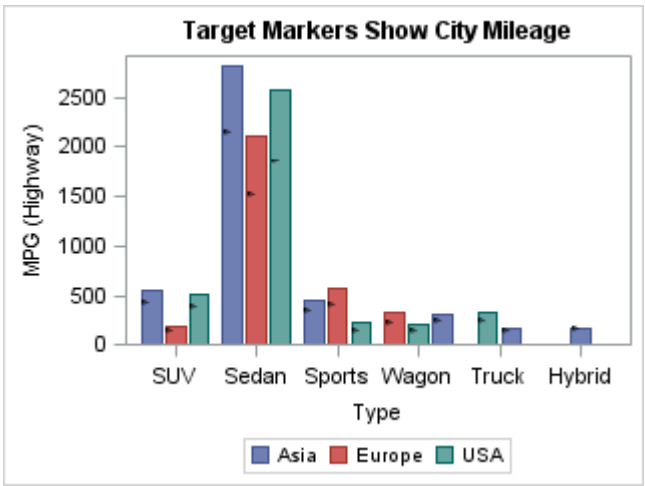
Tip If this option is used with COLORRESPONSE= in SAS programs that were written before SAS 9.4M3, the bar-chart colors and color statistic might change from those of the previous SAS releases. To restore the original colors and color statistic, set COLORSTAT= in the BARCHART statement to the same statistic that is specified in STAT=.

TARGET=*numeric-column* | *expression*

specifies the target value for each bar. The visual representation is a triangle with a line at the target value.

```
layout overlay;
  barchart category=type response=mpg_highway / barwidth=.8
    target=mpg_city group=origin groupdisplay=cluster
    name='bar';
  discretelegend 'bar';
endlayout;
```

```
layout overlay;
  barchartparm category=type response=mpg_highway / barwidth=.8
    target=mpg_city group=origin groupdisplay=cluster
    name='bar';
  discretelegend 'bar';
endlayout;
```



Default No targets are displayed.

Interactions For this option to take effect, the RESPONSE= argument must also be used.

If the GROUP= option is used and GROUPDISPLAY= STACK, then this option is ignored.

This option is ignored when the GROUP100= option is used.

Tips The statistic indicated by the STAT= option applies to the TARGET=column. If a constant value is desired for each target, then specify it only once for repeated category (X) values (or category

and GROUP combinations), and leave the other target values missing.

The target color is that of the bar outline.

TIP=(*role-list*) | NONE

specifies the information to display when the cursor is positioned over a bar. If this option is used, then the information specified replaces all of the information that is displayed by default.

(*role-list*)

an ordered, space-separated list of unique BARCHART roles. BARCHART roles include CATEGORY or X, RESPONSE or Y, COLORRESPONSE, INDEX, GROUP, and TARGET.

Notes For the category and response roles, the TIP= option recognizes only the category and response arguments that you use in the BARCHART statement. If you use the CATEGORY= and RESPONSE= arguments, then you must specify roles CATEGORY and RESPONSE. Conversely, if you use the X= and Y= arguments, then you must specify roles X and Y.

The COLORRESPONSE role is valid starting with SAS 9.4M3.

Example The following example displays data tips for the columns assigned only to the roles CATEGORY and RESPONSE:

```
TIP=(CATEGORY RESPONSE)
```

NONE

suppresses data tips and URLs (if requested) from the plot.

Default The columns assigned to these roles are automatically included in the data tip information: CATEGORY or X, RESPONSE or Y, COLORRESPONSE, and GROUP.

Requirement To generate data tips in the output, you must include an ODS GRAPHICS ON statement with the IMAGEMAP option specified, and you must write the output to the ODS HTML destination.

Interaction This option is ignored when the plot statement is in an OVERLAY or PROTOTYPE layout and the INCLUDERANGES= option is specified in the LINEAROPTS= or TIMEOPTS= option for either axis.

Tip You can control the labels and formats for the TIP roles with the TIPLABEL= and TIPFORMAT= options.

TIPFORMAT=(*role-format-list*)

specifies display formats for tip columns. This option provides a way to control the formats of columns that appear in data tips.

(*role-format-list*)

a space-separated list of *role-name* = *format* pairs.

Example
```
TIP=(RESPONSE)
TIPFORMAT=(RESPONSE=DOLLAR12.)
```

Default The column format of the column assigned to the role or BEST6 if no format is assigned to a numeric column.

Restriction Only the roles that appear in the TIP= option are used.

Requirement A column must be assigned to each of the specified roles.

TIPLABEL=(*role-label-list*)
specifies display labels for tip columns. This option provides a way to control the labels of columns that appear in data tips.

role-label-list
a space-separated list of *rolename* ="*string*" pairs.

Example
```
TIP=(RESPONSE)
TIPLABEL=(RESPONSE="Average Sales")
```

Default The column label or column name of the column assigned to the role.

Restriction Only the roles that appear in the TIP= option are used.

Requirement A column must be assigned to each of the specified roles.

URL=*string-column*
specifies an HTML page to display when the bar is selected.

string-column
specifies a column that contains a valid HTML page reference (HREF) for each bar that is to have an active link.

Example **http://www.sas.com**

Requirement To generate selectable bars, you must include an ODS GRAPHICS ON statement that specifies the IMAGEMAP option, and you must write the output to the ODS HTML destination.

Interactions This option has no effect when TIP=NONE.

This option is ignored when the plot statement is in an OVERLAY or PROTOTYPE layout and the INCLUDERANGES= option is specified in the LINEAROPTS= or TIMEOPTS= option for either axis.

Notes For non-grouped data, the values of the column are expected to be same for each unique category value. If they are not, then the results might be unpredictable.

For grouped data, the values of the column are expected to be the same for each unique category and GROUP combination.

Tips The URL value can be blank for some category values, meaning that no action is taken when the bars for those category values are selected.

The URL value can be the same for different category values, meaning that the same action is taken when the bars for those category values are selected.

By default, drill-down links open in a new browser window (link target _blank). To specify a different target for your drill-down links, such as _self or _parent, add the DRILLTARGET="*target*" option to your ODS GRAPHICS statement. See DRILLTARGET= on page 1568.

XAXIS=X | X2
specifies whether data are mapped to the primary X (bottom) axis or to the secondary X2 (top) axis.

Default X

Interaction The overall plot specification and the layout type determine the axis display. For more information, see "How Axis Features Are Determined" on page 1040.

YAXIS=Y | Y2
specifies whether data are mapped to the primary Y (left) axis or to the secondary Y2 (right) axis.

Default Y

Interactions This option is ignored if the RESPONSE= argument is not specified.

The overall plot specification and the layout type determine the axis display. For more information, see "How Axis Features Are Determined" on page 1040.

Details

Statement Description

The BARCHART statement creates a bar chart with bars that represent summarized response values. The response values are categorized by the unique category values or, starting with SAS 9.4M3, by the bins in binned category data. The BARCHART statement takes nonsummarized data as input and calculates the appropriate summarization statistics (sum, mean, and so on) for each unique category value or category bin. Prior to SAS 9.4M3, the category axis for a bar chart must be discrete. Starting with SAS 9.4M3, the category axis can be discrete, linear, or time. The response axis in all cases is interval.

When the chart is oriented vertically, the X (or X2) axis is used for CATEGORY and the Y (or Y2) axis is used for RESPONSE. When it is oriented horizontally, the X (or

X2) axis is used for RESPONSE and the Y (or Y2) axis is used for CATEGORY. (See ORIENT= on page 283.)

By default, if the category column is character, then the bars in the chart appear in the order in which the category values are present in the input data. If the category column is numeric, then the values are presented in ascending order. For non-grouped data, duplicated category values are summarized into a unique value. For grouped data, the category values are summarized as needed. (See the GROUP= option.)

Starting with SAS 9.4M3, for numeric category values, an interval bar chart is generated only when the category axis type is linear or time. To specify a category axis type of linear or time, include the TYPE= option in the category axis options, or assign the role of primary plot to a plot that sets the category axis type to linear or time automatically. By default, a bar is drawn for each unique category value, which can result in a large number of bars for numeric category data.

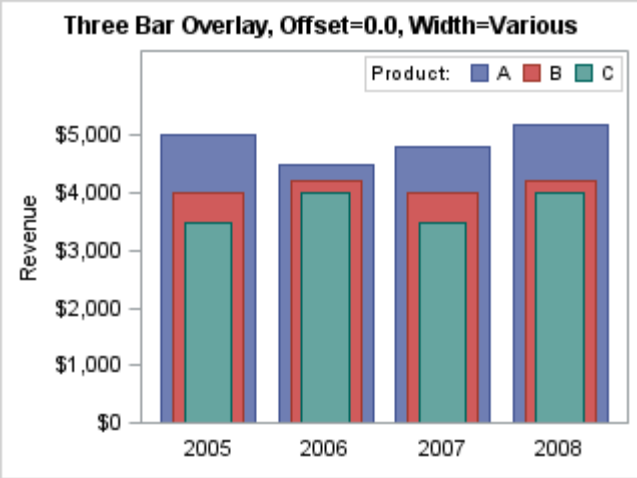
When binning is used, for each bin, a summarization statistic is computed, and a bar is drawn that represents that statistic. The width of each bar spans the width of the bin that it represents. The left-most edge of the bar represents the start of the bin, and the right-most edge represents the end. See "Example 1: Horizontal Bar Chart" on page 294.

> **TIP** Prior to SAS 9.4M3, use the HISTOGRAM statement to create a bar chart that represents response values along an interval axis.

About the DISCRETEOFFSET= Option

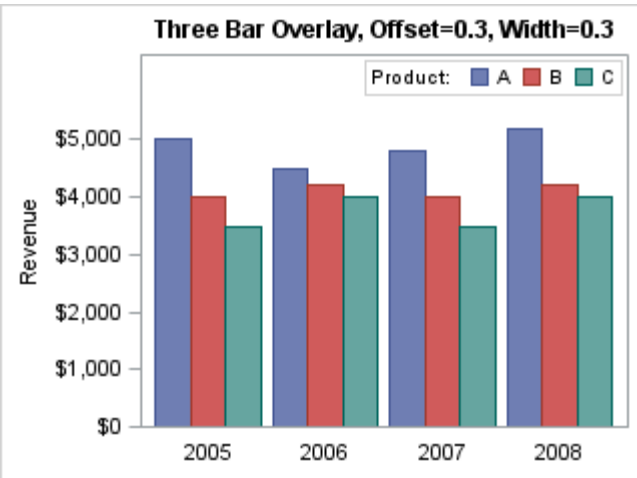
The DISCRETEOFFSET= option is useful for graphing multiple response variables side by side on a common axis. By default within an overlay-type layout, if multiple BARCHART statements are used with different response variables, then the bars for matching category values are centered on the midpoints and the bars are superimposed. To make it easier to distinguish among superimposed bars, you can assign a different BARWIDTH= setting to each BARCHART statement in the overlay:

```
layout overlay / cycleattrs=true
    xaxisopts=(display=(tickvalues))
    yaxisopts=(label="Revenue" offsetmax=0.2);

  barchart category=year response=A_revenue / stat=sum name="A"
    legendlabel="A" barwidth=0.8 ;
  barchart category=year response=B_revenue / stat=sum name="B"
    legendlabel="B" barwidth=0.6 ;
  barchart category=year response=C_revenue / stat=sum name="C"
    legendlabel="C" barwidth=0.4 ;

  discretelegend "A" "B" "C" / title="Product:"
    location=inside halign=right valign=top;
endlayout;
```



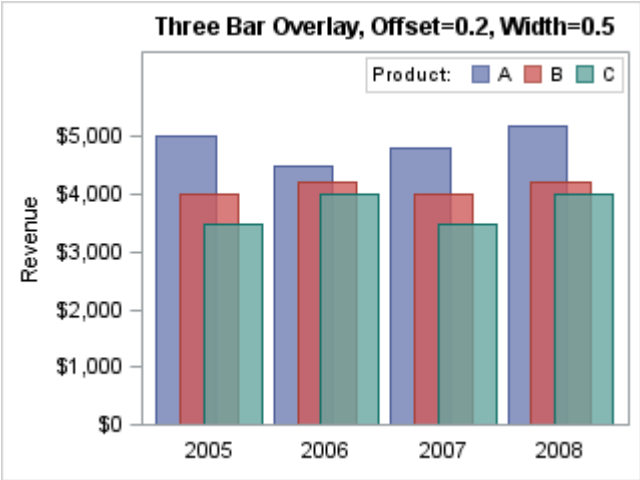
To place the different response values side by side, you can assign a different offset to each BARCHART statement. The BARWIDTH= option can be used with DISCRETEOFFSET= to create narrower bars that require less width within the plot area:

```
layout overlay / cycleattrs=true
    xaxisopts=(display=(tickvalues))
    yaxisopts=(label="Revenue" offsetmax=0.2);

  barchart category=year response=A_revenue / stat=sum name="A"
    legendlabel="A"
    discreteoffset=-0.3 barwidth=0.3 ;
  barchart category=year response=B_revenue / stat=sum name="B"
    legendlabel="B"
    discreteoffset=0    barwidth=0.3 ;
  barchart category=year response=C_revenue / stat=sum name="C"
    legendlabel="C"
    discreteoffset=+0.3 barwidth=0.3 ;

  discretelegend "A" "B" "C" / title="Product:"
    location=inside halign=right valign=top;
endlayout;
```



Different combinations of DISCRETEOFFSET and BARWIDTH can be used to get the effect that you want. Gaps can be created between bars by providing a narrower bar width. Or, bars can be overlapped if the bar widths are increased in proportion to the discrete offset.

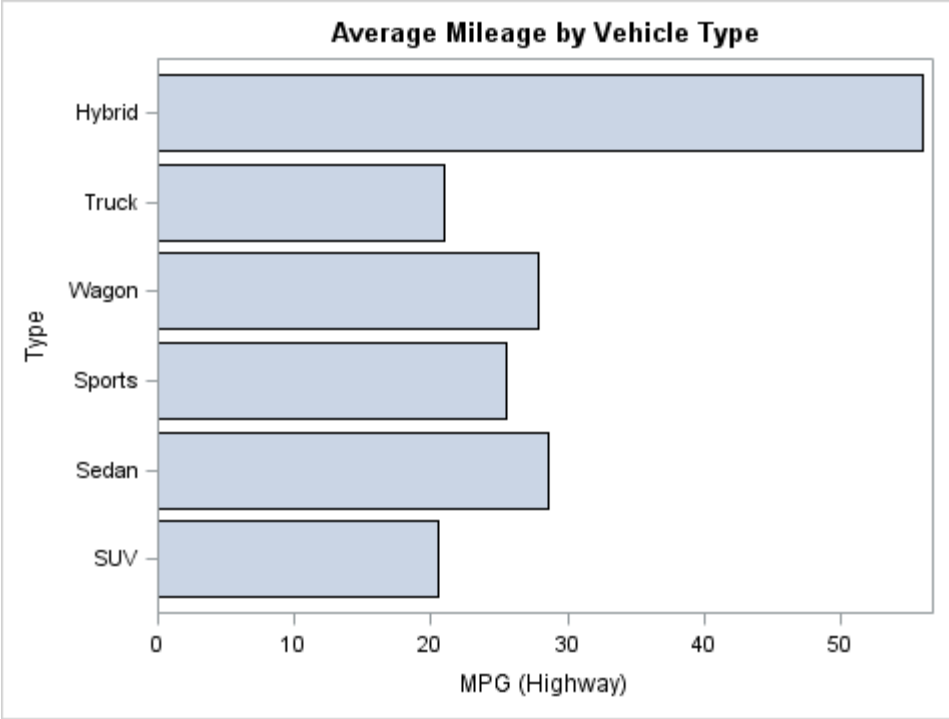
```
layout overlay / cycleattrs=true
    xaxisopts=(display=(tickvalues))
    yaxisopts=(label="Revenue" offsetmax=0.2);

  barchart category=year response=A_revenue / stat=sum name="A"
    legendlabel="A" datatransparency=0.2
    discreteoffset=-0.2 barwidth=0.5 ;
  barchart category=year response=B_revenue / stat=sum name="B"
    legendlabel="B" datatransparency=0.2
    discreteoffset=0   barwidth=0.5 ;
  barchart category=year response=C_revenue / stat=sum name="C"
    legendlabel="C" datatransparency=0.2
    discreteoffset=+0.2 barwidth=0.5 ;

  discretelegend "A" "B" "C" / title="Product:"
    location=inside halign=right valign=top;
endlayout;
```



Examples

Example 1: Horizontal Bar Chart

The following graph was generated by the “Example Program” on page 295:

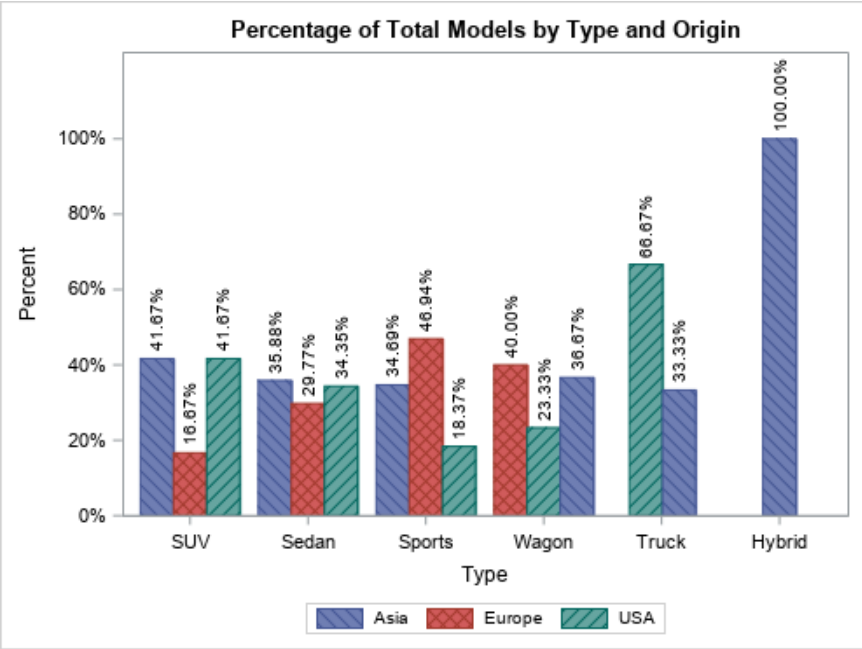


Example Program

```
proc template;
  define statgraph barchart;
    begingraph;
      entrytitle "Average Mileage by Vehicle Type";
      layout overlay;
        barchart category=type  response=mpg_highway /
          stat=mean orient=horizontal;
      endlayout;
    endgraph;
  end;

proc sgrender data=sashelp.cars template=barchart;
run;
```

Example 2: Grouped Vertical Bar Chart

The following graph was generated by the "Example Program" on page 296:



Example Program

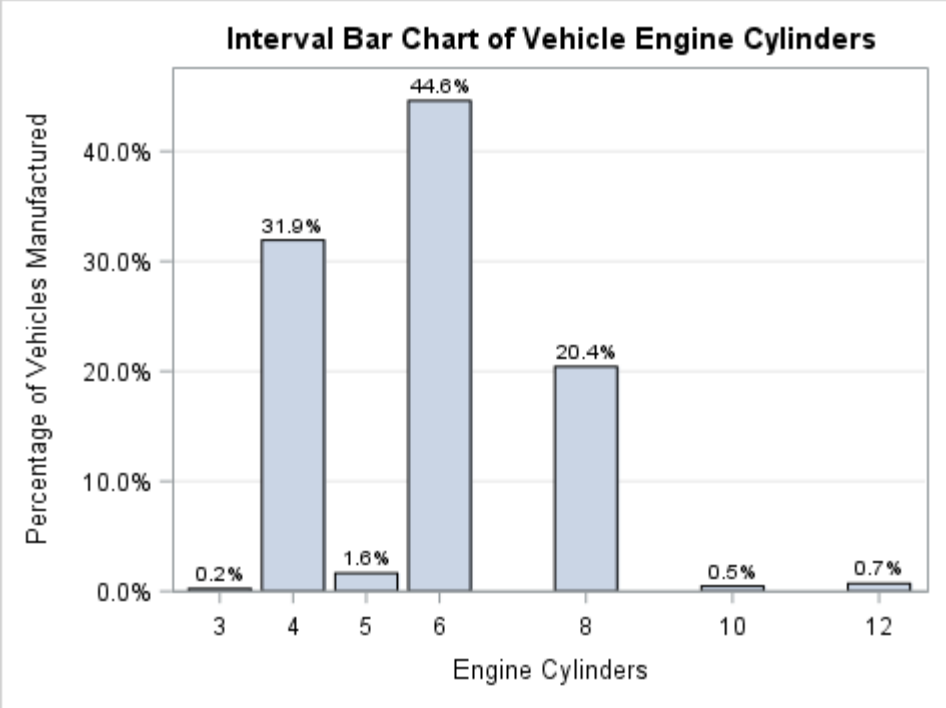
```
proc template;
  define statgraph barchart;
    begingraph / attrpriority=none;
      entrytitle "Percentage of Total Models by Type and Origin";
      layout overlay;
        barchart x=type / name="carmodels"
          stat=pct display=all
          group=origin groupdisplay=cluster group100=positive
          barlabel=true;
        discretelegend "carmodels";
      endlayout;
    endgraph;
  end;
run;

proc sgrender data=sashelp.cars template=barchart;
run;
```

Details

In the BARCHART statement, the STAT= option specifies the PCT statistic. The GROUP= specifies grouping by variable Origin. The GROUP100= option specifies normalization of the frequency statistic to 100% of the midpoint value. For each midpoint, the sum of the percentages is 100%. The BARLABEL=TRUE option enables the display of bar labels.

Example 3: Interval Bar Chart

Interval bar charts are available starting with SAS 9.4M3. In SAS 9.4M2 and in earlier releases, use the HISTOGRAM statement to generate an interval bar chart. The following graph was generated by the "Example Program" on page 297:



Example Program

Here is the SAS code.

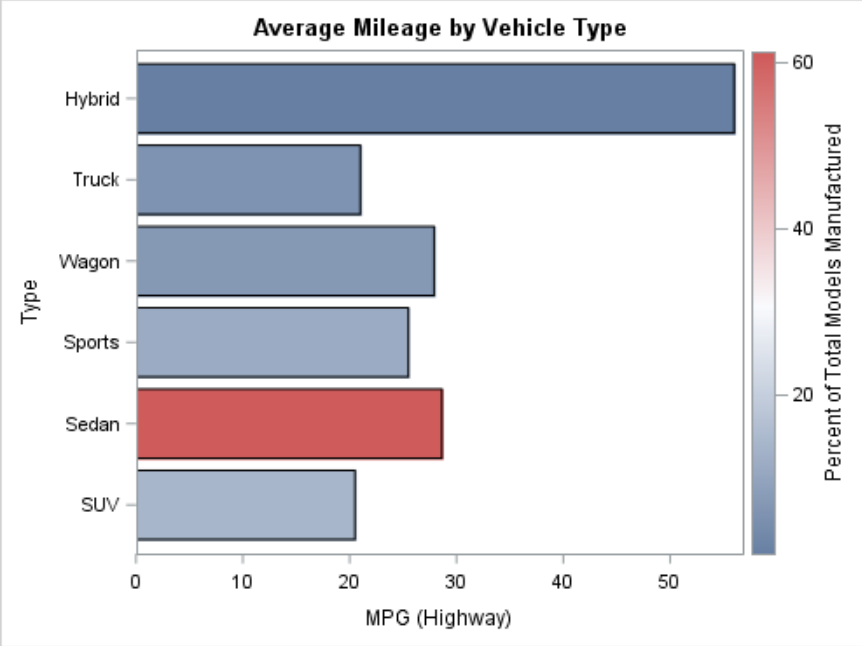
```
proc template;
  define statgraph cylinders;
    begingraph;
      entrytitle "Interval Bar Chart of Vehicle Engine Cylinders";
      layout overlay /
        xaxisopts=(label="Engine Cylinders" type=linear
          linearopts=(tickvaluelist=(3 4 5 6 8 10 12)))
        yaxisopts=(label="Percentage of Vehicles Manufactured"
          griddisplay=on linearopts=(tickvalueformat=percent7.1));
        barchart category=cylinders / stat=proportion
          barlabel=true barlabelformat=percent7.1;
      endlayout;
    endgraph;
  end;
run;

proc sgrender data=sashelp.cars template=cylinders;
run;
```

Details

An interval bar chart can be generated only when the category axis type is LINEAR or TIME. In this example, the TYPE=LINEAR option is included in the XAXISOPTS= options. With numeric category data, a bar is drawn for each unique category value. In some cases, that can generate too many bars in the resulting chart. In this example, there are only seven unique values. The TICKVALUELIST= option is used in the XAXISOPTS= option to display all of the values on the category axis.

Example 4: Bar Chart with Bar Colors Controlled by a Statistic

The ability to use a computed statistic to control the bar colors in a bar chart is available starting with SAS 9.4M3. This example uses the COLORBYFREQ=TRUE option to enable a computed statistic to control the bar colors and the COLOSTAT=PCT to specify percentage as the controlling statistic. Here is the output from "Example Program" on page 298.



Example Program

```
proc template;
  define statgraph barchart;
    begingraph;
      entrytitle "Average Mileage by Vehicle Type";
      layout overlay;
        barchart category=type response=mpg_highway / name="bar"
          stat=mean orient=horizontal
```

```
          colorbyfreq=true colorstat=pct;
        continuouslegend "bar" /
          title="Percent of Total Models Manufactured";
      endlayout;
    endgraph;
  end;
run;

proc sgrender data=sashelp.cars template=barchart;
run;
```

Example 5: Bar-Line Chart

This example uses the BARCHART and LINECHART statements to overlay a bar chart and line chart to create a bar-line chart. The following figure was generated by the "Example Program" on page 299.

Example Program

```
proc template;
   define statgraph barline;
      begingraph;
         entrytitle "Volume and Closing Price in 1H2001";
         layout overlay /
            xaxisopts=(label="Month"
timeopts=(tickvalueformat=monname3.))
            yaxisopts=(label="Volume (Millions)" offsetmin=0
               linearopts=(tickvaluesequence=(start=0 end=120
increment=20)
               tickvaluepriority=true))
            y2axisopts=(label="Close" offsetmin=0
```

```
               linearopts=(viewmin=50 viewmax=75));
            barchart category=date response=eval(volume/1000000) /
name="bar"
               legendlabel="Volume" datatransparency=0.6;
            linechart category=date response=close /
               legendlabel="Closing Price" vertexlabel=true
               vertexlabelattrs=(color=darkblue weight=bold)
               name="line" stat=sum yaxis=y2 display=(line markers)
               markerattrs=(symbol=circlefilled color=darkblue)
               lineattrs=(color=darkblue);
            discretelegend "bar" "line";
         endlayout;
      endgraph;
   end;
run;

proc sgrender data=sashelp.stocks template=barline;
   where stock eq "Microsoft" and year(date) eq 2001 and
      month(date) le 6;
   format date monname3. close dollar6.0;
run;
```

BARCHARTPARM Statement

Creates a bar chart specified by pre-summarized data.

Requirement: The input data must be pre-summarized, with appropriate summarization statistics (sum, mean, and so on) computed for the RESPONSE column.

Tips: For charts that have a large number of bars that are very close together, slight variations in spacing that normally occur due to integer rounding can become more obvious. Subpixel rendering provides more precise bar spacing in that case. In SAS 9.4M2 and in earlier releases, specify SUBPIXEL=ON in the BEGINGRAPH statement to enable subpixel rendering. See SUBPIXEL= on page 39. Starting with SAS 9.4M3, subpixel rendering is enabled by default.

To disable subpixel rendering in SAS 9.4M3 and in later releases, specify SUBPIXEL=OFF in the BEGINGRAPH statement or in an ODS GRAPHICS statement. For information about the BEGINGRAPH statement SUBPIXEL= option, see SUBPIXEL= on page 39. For information about the ODS GRAPHICS statement SUBPIXEL= option, see "ODS GRAPHICS Statement" on page 1561.

Syntax

BARCHARTPARM CATEGORY=*column* | *expression*
RESPONSE=*numeric-column* | *expression* <*/options*>;

Summary of Optional Arguments

Appearance options

BARWIDTH=*number*
: specifies the width of a bar as a ratio of the maximum possible width.

BASELINEATTRS=*style-element* | (*line-options*)
: specifies the appearance of the baseline.

CLUSTERWIDTH=*number*
: specifies the width of the group clusters as a fraction of the midpoint spacing or bin width.

COLORMODEL=*color-ramp-style-element* | (*color-list*)
: specifies a color ramp to use with the COLORRESPONSE= option.

COLORRESPONSE=*numeric-column* | *range-attr-var* | *expression*
: specifies the column or range attribute variable to use to map the bar colors to a continuous color gradient.

CONNECTATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
: specifies the appearance of the bar connect lines.

CONNECTBREAK=TRUE | FALSE
: specifies whether the connect line is broken for values that have no observations.

DATASKIN=NONE | CRISP | GLOSS | MATTE | PRESSED | SHEEN
: enhances the visual appearance of the filled bars.

DATATRANSPARENCY=*number*
: specifies the degree of the transparency of the bar fill, bar outline, error bars, connect line, and data labels, if displayed.

DISPLAY=(*display-options*) | STANDARD | ALL
: specifies which bar features to display.

DISPLAYBASELINE=ON | OFF | AUTO
: specifies whether the baseline is displayed.

DISPLAYZEROLENGTHBAR=TRUE | FALSE
: specifies whether zero-length bars are drawn.

ERRORBARATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
: specifies the attributes of the error bars that are associated with the data points.

ERRORBARCAPSCALE=*positive-number*
: specifies a positive number to use as a multiplier for determining the default width of the error-bar caps.

ERRORBARCAPSHAPE=SERIF | NONE
: specifies whether the error bars have a serif cap.

ERRORLOWER=*numeric-column* | *expression*
: specifies the values of the lower endpoints on the Y error bars.

ERRORUPPER=*numeric-column* | *expression*
: specifies the values of the upper endpoints on the Y error bars.

FILLATTRS=*style-element* | *style-element* (*fill-options*) | (*fill-options*)
: specifies the appearance of the filled bar area.

FILLENDCOLOR=*color*
: specifies the end color of the color gradient for the bar fill.

FILLPATTERNATTRS=*style-element* | (*fill-pattern-options*)
specifies the appearance of the pattern-filled areas.

FILLTYPE=SOLID | ALPHAGRADIENT | COLORGRADIENT | GRADIENT
specifies the bar fill type.

INDEX=*positive-integer-column* | *expression*
specifies indices for mapping bar attributes (fill and outline) to one of the GraphData1–GranphDataN style elements.

INTERVALBARWIDTH=*dimension*
specifies the width of the bars in an interval bar chart as a ratio of the interval width.

ORIENT=VERTICAL | HORIZONTAL
specifies the orientation of the Y axis and the bars.

OUTLINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the appearance of the bar outlines.

TARGET=*numeric-column* | *expression*
specifies the target value for each bar.

Axes options

BASELINEINTERCEPT=*number*
specifies the response axis intercept for the baseline.

PRIMARY=TRUE | FALSE
specifies that the data columns for this plot and the plot type be used for determining default axis features.

XAXIS=X | X2
specifies whether data are mapped to the primary X (bottom) axis or to the secondary X2 (top) axis.

YAXIS=Y | Y2
specifies whether data are mapped to the primary Y (left) axis or to the secondary Y2 (right) axis.

Data tip options

ROLENAME=(*role-name-list*)
specifies user-defined roles that can be used to display information in the data tips.

TIP=(*role-list*) | NONE
specifies the information to display when the cursor is positioned over a bar.

TIPFORMAT=(*role-format-list*)
specifies display formats for tip columns.

TIPLABEL=(*role-label-list*)
specifies display labels for tip columns.

Label options

DATALABEL=*column* | *expression*
specifies the label that appears at the end of each bar.

DATALABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font attributes of the labels that are specified in the DATALABEL= option.

DATALABELFITPOLICY=AUTO | NONE | ROTATE | SPLIT | SPLITALWAYS | INSIDEPREFERRED
: specifies a policy for avoiding collisions among the bar labels when labels are displayed.

DATALABELSPLITCHAR="*character-list*"
: specifies one or more characters on which the data labels can be split.

DATALABELSPLITCHARDROP=TRUE | FALSE
: specifies whether the split characters are included in the displayed data labels.

DATALABELTYPE=AUTO | COLUMN
: specifies whether the data labels display the RESPONSE values or the values of the column that is specified by the DATALABEL= option.

LEGENDLABEL="*string*"
: specifies a label to be used in a discrete legend for this plot.

SEGMENTLABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
: specifies the text properties of the text for the bar segment label.

SEGMENTLABELFITPOLICY=NONE | NOCLIP | THIN
: specifies a policy for fitting the bar segment labels within the bar segments.

SEGMENTLABELFORMAT=*format*
: specifies the text format for the bar segment labels.

SEGMENTLABELTYPE=NONE | AUTO
: specifies whether a label is displayed inside each bar segment.

Midpoint options

DISCRETEOFFSET=*number*
: specifies an amount to offset all bars from the category midpoints.

GROUP=*column* | *discrete-attr-var* | *expression*
: creates a separate bar segment or bar for each unique group value in the specified column.

GROUP100=NONE | MAGNITUDE | POSITIVE
: displays the response values, normalized to 100%.

GROUPDISPLAY=STACK | CLUSTER
: specifies how to display grouped bars.

GROUPORDER=DATA | REVERSEDATA | ASCENDING | DESCENDING
: specifies the ordering of the groups within a category.

INCLUDEMISSINGGROUP=TRUE | FALSE
: specifies whether missing values of the group variable are included in the plot.

ODS options

URL=*string-column*
: specifies an HTML page to display when the bar is selected.

Plot reference options

NAME="*string*"
: assigns a name to this plot statement for reference in other template statements.

Required Arguments

CATEGORY=*column* | *expression*
specifies the column for the unique category values. All values are treated as discrete.

Note You can use X= as an alternative to CATEGORY=. If you use X=, then be aware that the TIP=, TIPFORMAT=, and TIPLABEL= options will recognize X as the category role and not CATEGORY in that case.

RESPONSE=*numeric-column* | *expression*
specifies the column for the response values.

Note You can use Y= as an alternative to RESPONSE=. If you use Y=, then be aware that the TIP=, TIPFORMAT=, and TIPLABEL= options will recognize Y as the response role and not RESPONSE in that case.

Optional Arguments

BARWIDTH=*number*
specifies the width of a bar as a ratio of the maximum possible width.

Default 0.85

Range 0–1, where 0 is the minimum width, which is one pixel wide, and 1 is the maximum possible width

Interaction Starting with SAS 9.4M3, the INTERVALBARWIDTH= option overrides this option for an interval bar chart.

Notes This option is needed only to change the default behavior.

By default, the bar width automatically adjusts based on the number of bars to be displayed and the wall width.

Tip To remove any inter-bar gap, set BARWIDTH=1.

BASELINEATTRS=*style-element* | (*line-options*)
specifies the appearance of the baseline.

Default The ContrastColor, LineThickness, and LineStyle attributes of the GraphAxisLines style element.

Notes The baseline is always drawn by default.

When *style-element* is specified, only the style element's Color, LineStyle, and LineThickness attributes are used.

Tip To suppress the baseline, set the line thickness to 0:

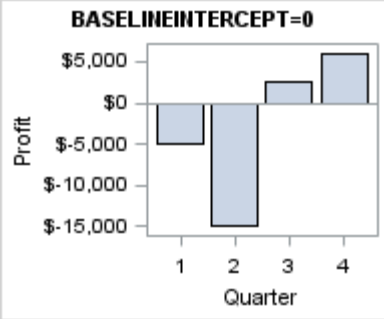
```
baselineattrs=(thickness=0)
```

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

BASELINEINTERCEPT=*number*

specifies the response axis intercept for the baseline. Prior to SAS 9.4M5, the baseline is always displayed in the chart, whether for a specified value or for the default value. Starting with SAS 9.4M5, the baseline display is controlled by the DISPLAYBASELINE= option, which is ON by default. When the BASELINEINTERCEPT= option is used, the axis range is adjusted to include the baseline, and the baseline is placed at the specified value on the response axis.



Default 0

Interactions If GROUPDISPLAY=STACK is specified, then this option is ignored and the baseline is not displayed.

If necessary, the response axis data range is extended to include the baseline intercept. When a logarithmic response axis is requested and BASELINEINTERCEPT= specifies 0 or a negative value, the response axis reverts to a linear axis. To restore the log axis in that case, set BASELINEINTERCEPT= to a positive value.

When DISPLAYBASELINE=AUTO is in effect, the baseline is not displayed if the baseline intercept is equal to the minimum or maximum value of the response-axis range.

Note Label positions are automatically adjusted to prevent the labels from overlapping.

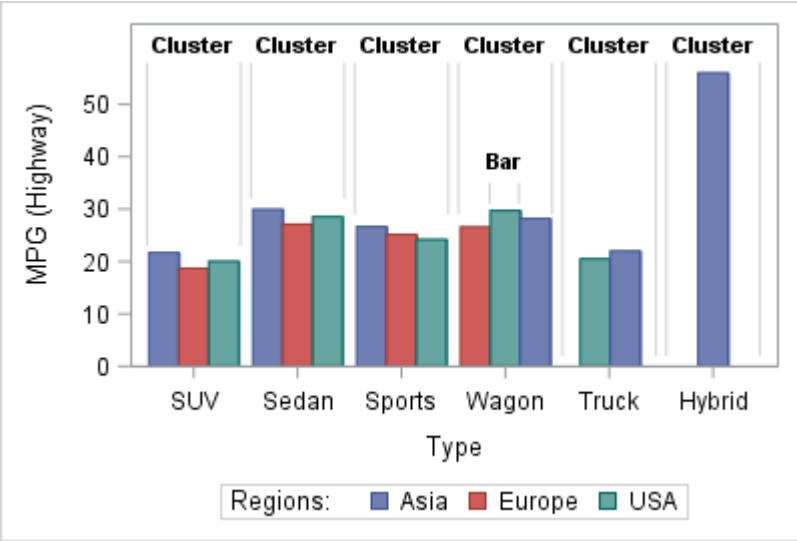
Tips Control the appearance of the baseline with the BASELINEATTRS= option.

To suppress the baseline prior to SAS 9.4M5, use the BASELINEATTRS= option to set the line thickness to 0. Starting with SAS 9.4M5, specify DISPLAYBASELINE=OFF.

The baseline does not add a tick or a tick value to the axis. To label the baseline, use a REFERENCELINE statement to overlay a line with the same X or Y value and include the CURVELABEL= option to specify the label text.

CLUSTERWIDTH=*number*

specifies the width of the group clusters as a fraction of the midpoint spacing or bin width.



Default 0.85

Range 0–1, where 0 is the minimum width, which is one pixel wide, and 1 is the maximum possible width

Requirement For this option to take effect, the GROUP= option must also be specified, and the GROUPDISPLAY= option must be set to CLUSTER.

Interaction When GROUPDISPLAY=CLUSTER, the default BARWIDTH is 1.0.

COLORMODEL=*color-ramp-style-element* | (*color-list*)
specifies a color ramp to use with the COLORRESPONSE= option.

color-ramp-style-element
specifies the name of a color-ramp style element.

The style element should contain these style attributes:

STARTCOLOR
specifies the color for the smallest data value of the COLORRESPONSE= column.

NEUTRALCOLOR
specifies the color for the midpoint of the range of the COLORRESPONSE= column.

ENDCOLOR
specifies the color for the highest data value of the COLORRESPONSE= column.

(*color-list*)
specifies a space-separated list of colors to use in the color ramp. You can use style attribute references such as GraphData3:Color, color names, or RGB, CMYK, HLS, and HSV (HSB) color codes to specify a color. The list can contain a mix of style attribute references, color names, and color codes.

Requirement The list of colors must be enclosed in parentheses.

See "color " on page xii

Defaults For outline-only bars, the ThreeColorAltRamp style element

For bars with fill, the ThreeColorRamp style element

Interaction For this option to take effect, the COLORRESPONSE= option must also be specified.

Tip Use the DISPLAY= option to specify whether outlines and fills are displayed.

COLORRESPONSE=*numeric-column* | *range-attr-var* | *expression*
specifies the column or range attribute variable to use to map the bar colors to a continuous color gradient.

Note: This feature applies to SAS 9.4M3 and to later releases.

range-attr-var
specifies a range attribute map variable that is defined in a RANGEATTRVAR statement.

"RANGEATTRVAR Statement"

Restriction A range attribute map variable specification must be a direct reference to the attribute map variable. It cannot be set as a dynamic variable.

See "RANGEATTRVAR Statement" on page 1531

When a numeric column or expression is specified, the range of column or expression values are linearly mapped to the color ramp that is specified by the COLORMODEL= option. Each bar is colored using one color from the gradient range. When a range attribute map variable is specified, the colors that are defined in the associated range attribute map are used instead.

Requirement For a grouped plot, the COLORRESPONSE values should remain constant for each group value. If the COLORRESPONSE column has multiple values for a single GROUP value, unexpected results might occur.

Interactions When the GROUP= option is specified with the COLORRESPONSE= option, the color attributes are controlled by the COLORRESPONSE= option.

When fill, fill pattern, or both are displayed, this option overrides suboption COLOR= in the FILLATTRS= option and in the FILLPATTERNATTRS= option and varies the color according to the color gradient or the attribute map.

When only the outlines are displayed, this option overrides suboption COLOR= in the OUTLINEATTRS= option and varies the outline color according to the color gradient or the attribute map.

Tips To display a legend with this option in effect, use a CONTINUOUSLEGEND statement.

Use the FILLTYPE= option to specify whether each bar is filled with a solid color or with a gradient color.

For a numeric column or expression, the ThreeColorRamp style element defines the fill color gradient, and the ThreeColorAltRamp style element defines the outline color gradient.

CONNECTATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the appearance of the bar connect lines.

Default The GraphConnectLine style element.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

CONNECTBREAK=TRUE | FALSE
specifies whether the connect line is broken for values that have no observations.

Note: This feature applies to SAS 9.4M5 and to later releases.

Default FALSE

Requirement DISPLAY= must include CONNECT for this option to have any effect.

Interaction This option is ignored when the GROUP= option is in effect.

DATALABEL=*column* | *expression*
specifies the label that appears at the end of each bar.

Restriction This option is ignored when one or both of the ERRORLOWER= and ERRORUPPER= options are in effect.

Interactions Starting with SAS 9.4M2, this option is ignored when DATALABELTYPE=AUTO.

When the GROUP= option is in effect, the data label values are displayed only when GROUPDISPLAY=CLUSTER.

If the GROUP= option is in effect and there are multiple input observations per bar for the GROUP= column, then the value for the DATALABEL= column should be the same for each observation that is on the same bar.

Tip The data-label format is the format that is assigned to *column* or is derived from BEST6 if no format is assigned. To change the data-label format, apply the new format to *column*.

DATALABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font attributes of the labels that are specified in the DATALABEL= option.

Default The GraphDataText style element.

Interaction For this option to take effect, the DATALABEL= option must also be used.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Text Options" on page 1606 for available *text-options*.

DATALABELFITPOLICY=AUTO | NONE | ROTATE | SPLIT | SPLITALWAYS | INSIDEPREFERRED
specifies a policy for avoiding collisions among the bar labels when labels are displayed.

AUTO
selects a collision avoidance policy based on the chart orientation and data type.

For a numeric column with ORIENT=VERTICAL, AUTO rotates the labels if they do not fit the midpoint spacing. For a character column, AUTO splits the labels if they do not fit the midpoint spacing.

Note When ORIENT=HORIZONTAL, AUTO always draws the labels horizontally.

Tip If character labels do not fit after splitting, then try using ROTATE instead of AUTO.

See ORIENT= on page 330 for information about chart orientation.

BARWIDTH= for information about bar spacing.

NONE
does not attempt to fit bar labels that collide.

ROTATE
rotates the bar labels for vertical bars if the labels collide in the available width.

Requirement The chart orientation must be vertical (ORIENT=VERTICAL).

SPLIT
splits the label for vertical bars at a split character only if a split is needed at that character in order to make the label fit the available space.

No split occurs at split characters that occur where a split is not needed. If the label does not contain any of the specified split characters, then a split does not occur. In that case, if the label does not fit the available space, then it might collide with the adjoining labels.

Requirement The chart orientation must be vertical (ORIENT=VERTICAL).

See the DATALABELSPLITCHAR= option for information about specifying the split characters

SPLITALWAYS
splits the label for vertical bars at every occurrence of a split character.

If the label does not contain any of the specified split characters, then a split does not occur.

Requirement The chart orientation must be vertical (ORIENT=VERTICAL).

See the DATALABELSPLITCHAR= option for information about specifying the split characters

INSIDEPREFERRED
attempts to place the data labels in a horizontal bar chart inside the bars.

Note: This feature applies to SAS 9.4M5 and to later releases.

Restrictions This option applies to non-grouped or cluster-grouped horizontal bar charts only.

Label splitting is not supported when a label is placed inside a bar.

Requirement For a grouped horizontal bar chart, the GROUPDISPLAY=CLUSTER option must be in effect. Otherwise, the INSIDEPREFERRED policy is ignored.

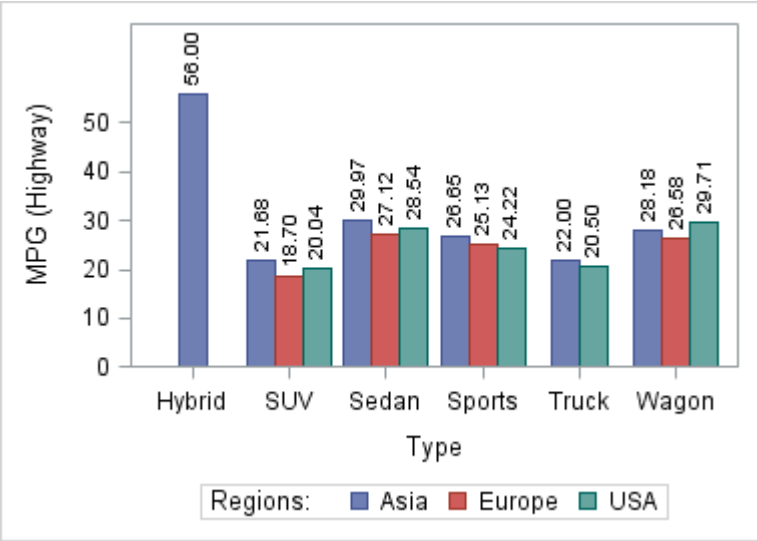
Interaction If SEGMENTLABEL=TRUE is in effect, the INSIDEPREFERRED policy is ignored, and the labels are placed outside.

Notes If any bar label does not fit inside its bar because the font height is too high, all of the bar labels are placed outside.

If any bar label cannot fit inside the length of its bar, that label is placed outside of its bar and is fit using the AUTO fit policy.

If the outside labels collide because the font height is greater than the midpoint space, then all labels are dropped.

Here is an example of a vertical bar chart where DATALABELFITPOLICY=AUTO and a numeric column is used as the data labels.

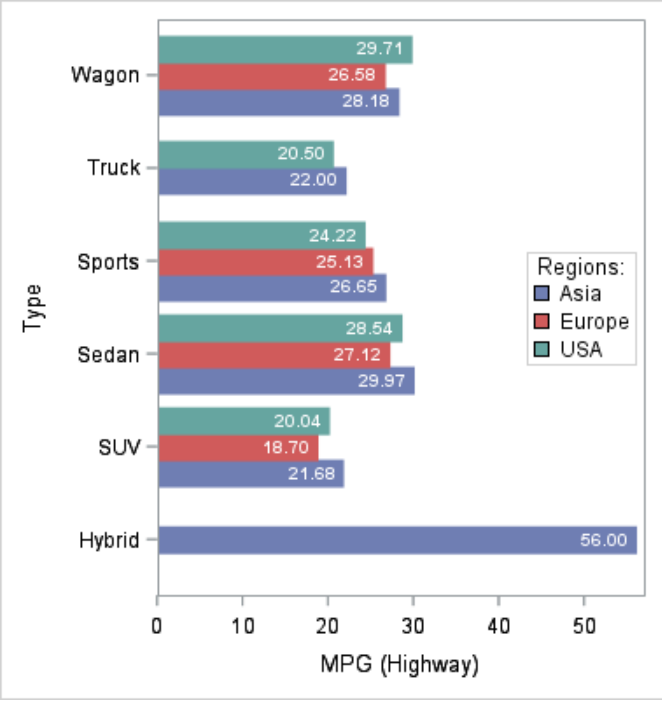


In this case, AUTO rotates the numeric labels to avoid collision.

In some cases, if one or more labels collide when the specified fit policy is used, then all of the labels are dropped from the display. When that occurs, the following warning message is written to the SAS log:

```
WARNING: The bar labels are suppressed. Use DATALABELFITPOLICY=NONE to
force the labels to be displayed.
```

Here is an example of a horizontal bar chart where DATALABELFITPOLICY=INSIDEPREFERRED and a numeric column is used as the data labels.



Default AUTO

Requirement The DATALABEL= option must also be specified.

Interaction When DATALABELTYPE=AUTO is in effect, for a vertical bar chart, only AUTO, NONE, and ROTATE are valid. All other values revert to AUTO. For a horizontal bar chart, only AUTO and NONE are valid. All other values revert to AUTO.

DATALABELSPLITCHAR="*character-list*"
specifies one or more characters on which the data labels can be split. When multiple split characters are specified, each character in the list is treated as a separate split character unless the specified characters appear consecutively in the data label. In that case, all of the specified split characters together are treated as a single split character.

When DATALABELFITPOLICY=SPLIT and a data label collision is detected, the data label is split on a specified split character only if a split is needed at that point in order to make the label fit. In that case, a split might not occur on every split character. When DATALABELFITPOLICY=SPLITALWAYS, the data label is split unconditionally on every occurrence of a split character. If the data label does not contain any of the specified split characters, then the label is not split.

"character-list"
specifies one or more characters with no space between each character and enclosed in quotation marks.

Default A blank space

Requirements The list of characters must be enclosed in quotation marks.

Multiple characters must be specified with no space between them. For example, to specify the split characters a, b, and c, use the following option:

```
datalabelsplitchar="abc"
```

The DATALABELFITPOLICY= option must specify SPLIT or SPLITALWAYS.

Interactions The DATALABELFITPOLICY= option specifies the policy that is used to manage the split behavior of the data label.

The DATALABELSPLITCHARDROP= option specifies whether the split characters are included in the displayed data label or are dropped.

Notes When multiple characters are specified, the order of the characters in the list is not significant.

The split characters are case sensitive.

DATALABELSPLITCHARDROP=TRUE | FALSE
specifies whether the split characters are included in the displayed data labels.

TRUE
drops a split character from the display when a split occurs at that character.

Split characters at which a split does not occur are left in place. The DATALABELFITPOLICY= option determines where the labels are split. When

DATALABELFITPOLICY=SPLIT, each label is split at a split character only where a split is needed in order to make the label fit the available space. At each split point, the split character is dropped, and the characters that follow the split character, up to but not including the split character at the next split point, are wrapped to the following line.

When DATALABELFITPOLICY=SPLITALWAYS, each label is split at every instance of a split character. All of the split characters are dropped. The characters that follow each split character, up to but not including the next split character, are wrapped to the next line.

The following figure shows how label Product*Group*1 is split when the DATALABELSPLITCHARDROP=TRUE and DATALABELSPLITCHAR="*" options are specified with the SPLIT and SPLITALWAYS fit policies.

In this example, when DATALABELFITPOLICY=SPLIT, the label is split at the first occurrence of the asterisk in order to make the label fit. No split is needed at the second asterisk. The first asterisk is dropped, and Group*1 wraps to the next line. Notice that the second asterisk is not dropped in this case. When DATALABELFITPOLICY=SPLITALWAYS, the label is split at every occurrence of the asterisk. In this case, both asterisks are dropped, and the characters that follow each asterisk wrap to the next line.

FALSE
includes the split characters in the data label display.

The DATALABELFITPOLICY= option determines how the split characters are displayed. When DATALABELFITPOLICY=SPLIT, each data label is split at a split character only where a split is needed in order to make the label fit the available space. A split might not occur at every split character in the label. At each split point, the split character remains as the last character in the current line. The characters that follow the split character, up to and including the split character at the next split point, are then wrapped to the following line. This process repeats until the entire data label is displayed.

When DATALABELFITPOLICY=SPLITALWAYS, each data label is split at every instance of a split character in the label regardless of whether a split is actually needed. Each split character remains as the last character in the current line. The characters that follow each split character, up to and including the next split character, are then wrapped to the next line.

The following figure shows how label Product*Group*1 is split when the DATALABELSPLITCHARDROP=FALSE and DATALABELSPLITCHAR="*" options are specified with the SPLIT and SPLITALWAYS fit policies.

In this example, when DATALABELFITPOLICY=SPLIT, the label is split at the first occurrence of the asterisk in order to make the label fit. No split is needed at the second asterisk. The characters that follow the first asterisk wrap to the next line. When DATALABELFITPOLICY=SPLITALWAYS, the label is split at every occurrence of the asterisk. Each asterisk remains as the last character in the current line, and the characters that follow are wrapped to the next line.

Default TRUE. A split character is dropped from the data-label display when a split occurs at that character.

Requirements The DATALABEL= option must also be specified.

The DATALABELFITPOLICY= option must specify SPLIT or SPLITALWAYS.

Interaction The DATALABELSPLITCHAR= option specifies the split characters.

See “boolean ” on page xii for other Boolean values that you can use.

DATALABELTYPE=AUTO | COLUMN

specifies whether the data labels display the RESPONSE values or the values of the column that is specified by the DATALABEL= option.

Note: This feature applies to SAS 9.4M2 and to later releases.

AUTO

the system determines how the labels are displayed.

The system displays the labels as follows:

- For an ungrouped bar chart, the summarized value for each bar is placed above the bar.
- For a grouped bar chart with stacked bars, the total of the summarized segment values for each bar is placed above the segmented bar.
- For a grouped bar chart with clustered bars, the summarized value for each bar in the cluster is placed above the bar.

Interactions AUTO overrides the DATALABEL= option.

When AUTO is in effect, some data-label fit policies are unavailable. See DATALABELFITPOLICY=.

COLUMN

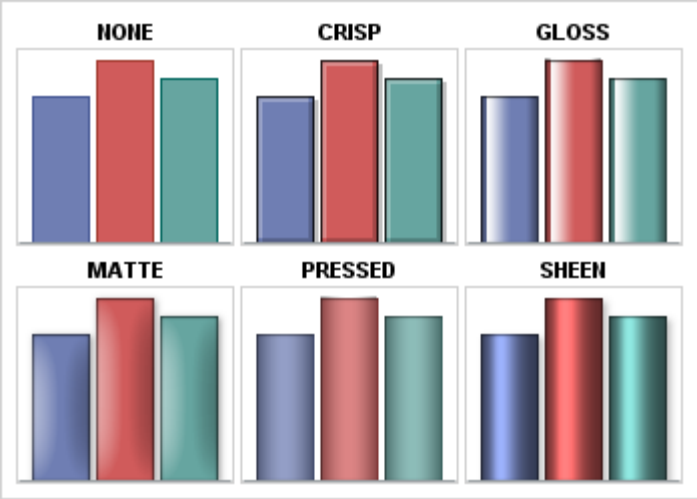
the data labels display the DATALABEL= column values.

Interaction The DATALABEL= option must be specified for COLUMN to have any effect. If the DATALABEL= option is not specified, AUTO is used instead.

Default COLUMN

Restriction The DATALABELTYPE= option and the DATALABEL= on page 308 option are ignored when one or both of the ERRORLOWER= on page 319 and ERRORUPPER= on page 320 options are in effect.

DATASKIN=NONE | CRISP | GLOSS | MATTE | PRESSED | SHEEN
enhances the visual appearance of the filled bars. The following figure shows bars with each of the skins applied.



Default The DATASKIN= option value that is specified in the BEGINGRAPH statement. If not specified, then the GraphSkins:DataSkin style element value is used.

Restriction Starting with SAS 9.4M1, the maximum number of skinned graphical elements is limited to 200 per plot in an OVERLAY or PROTOTYPE layout. When this limit is exceeded for a plot, the specified data skin is not applied to that plot. In that case, use the DATASKINMAX= option in your ODS GRAPHICS statement to increase the maximum limit.

Requirement For this option to have any effect, the fill must be enabled by the ODS style or the DISPLAY= option.

Interactions This option overrides the BEGINGRAPH statement DATASKIN= option.

The data skin appearance is based on the FILLATTRS= color.

When a data skin is applied, all bar outlines are set by the skin, and the OUTLINEATTRS= option is ignored.

When FILLTYPE=GRADIENT is in effect, DATASKIN=SHEEN is ignored. In that case, use one of the other skins.

DATATRANSPARENCY=*number*
specifies the degree of the transparency of the bar fill, bar outline, error bars, connect line, and data labels, if displayed.

Default 0

Range 0–1, where 0 is opaque and 1 is entirely transparent

Tip The FILLATTRS= option can be used to set transparency for just the bar fills. You can combine this option with FILLATTRS= to set one transparency for the bar outlines, error bars, and connect lines but a different transparency for the bar fills. Example:

```
datatransparency=0.2 fillattrs=(transparency=0.6)
```

DISCRETEOFFSET=*number*
specifies an amount to offset all bars from the category midpoints.

Default 0 (no offset, all bars are centered on the category midpoints)

Range -0.5 to +0.5, where 0.5 represents half the distance between category ticks. Normally, a positive offset is to the right when ORIENT=VERTICAL, and up when ORIENT=HORIZONTAL. (If the layout's axis options set REVERSE=TRUE, then the offset direction is also reversed.)

Tip Setting the discrete offset for the plots does not affect the axis minimum and maximum offsets. In some cases, setting a discrete offset can cause clipping at each end of the axis. In those cases, use the OFFSETMIN= and OFFSETMAX= axis options to increase the axis minimum and maximum offsets to accommodate the discrete offset.

See "About the DISCRETEOFFSET= Option" on page 338

"About the DISCRETEOFFSET= Option" on page 338 for information about the OFFSETMIN= and OFFSETMAX= axis options

ORIENT=

DISPLAY=(*display-options*) | STANDARD | ALL
specifies which bar features to display.

(*display-options*)
a space-separated list of one or more of the following options enclosed in parentheses:

CONNECT
displays the connect lines, which are line segments that connect adjacent midpoints at the end of each bar

FILL
displays the bar fill color

FILLPATTERN
displays the bar fill pattern

Tip For this option to have any effect, the active ODS style must specify a fill pattern or a fill pattern must be specified with the FILLPATTERNATTRS= on page 321 option.

OUTLINE
displays the bar outline

STANDARD
specifies FILL and OUTLINE

ALL
specifies all features: CONNECT, FILL, FILLPATTERN, and OUTLINE

Default The GraphBar:DisplayOpts style reference.

Interaction Connect lines are not drawn when the GROUP= option is in effect.

Note Error bars are automatically displayed whenever the ERRORUPPER= or ERRORLOWER= options are specified.

Tips Use the OUTLINEATTRS= , FILLATTRS= , and FILLPATTERNATTRS= options to control the appearance of the bars. Use CONNECTATTRS= to control the appearance of the connect lines.

Both FILL and FILLPATTERN can be specified to combine solid fills and pattern fills in the bars.

DISPLAYBASELINE=ON | OFF | AUTO
specifies whether the baseline is displayed.

Note: This feature applies to SAS 9.4M5 and to later releases.

ON
always displays the baseline.

OFF
does not display the baseline.

AUTO
displays the baseline if the baseline intercept is within the response-axis range, excluding the minimum and maximum axis values.

This is the typical case when the bar chart includes both positive and negative bars, and the default baseline intercept of 0 is used. If the baseline intercept is equal to the minimum or maximum value of the response-axis range, the baseline is not displayed.

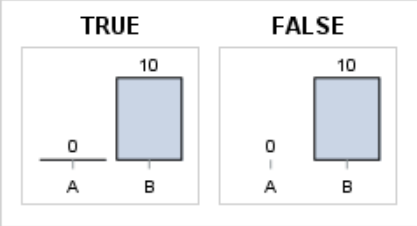
Default ON

Tip By default, the baseline intercept is 0. Use the BASELINEINTERCEPT= option to change the baseline intercept.

DISPLAYZEROLENGTHBAR=TRUE | FALSE
specifies whether zero-length bars are drawn.

Note: This feature applies to SAS 9.4M3 and to later releases.

A zero-length bar is displayed as a line spanning the normal bar width at the bar-chart baseline on the response axis. When this option is set to TRUE, zero-length bars are displayed. Otherwise, they are suppressed. The following figure shows a simple example of each outcome. In the figure, the plot wall outline, category axis line, and bar-chart baseline are suppressed for clarity.



Default TRUE

Interaction This option is ignored when the GROUP= and GROUPDISPLAY=STACK options are in effect. In that case, zero-length bar segments are drawn.

Note When this option is set to FALSE, the bar is not drawn, but other elements associated with the bar such as the target bar, the error bar, the bar label, and the data label, are drawn.

Tip This option is useful when the bar-chart baseline is suppressed.

ERRORBARATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the attributes of the error bars that are associated with the data points.

Default The GraphError style element ContrastColor, LineStyle, and LineThickness attributes.

Interaction For this option to take effect, error bars must be displayed by the ERRORLOWER= , ERRORUPPER= options.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

ERRORBARCAPSCALE=*positive-number*
specifies a positive number to use as a multiplier for determining the default width of the error-bar caps.

Note: This feature applies to SAS 9.4M5 and to later releases.

Default 1

Interaction This option is ignored when ERRORBARCAPSHAPE=NONE is in effect.

Tips Use the ERRORBARCAPSHAPE= option to specify the cap shape.

The thickness (height) of the SERIF, LINE, and BRACKET is determined by the thickness specified in the ERRORBARATTRS= option. The cap line pattern is always solid.

Examples Double the size of the error-bar caps:

```
errorbarcapscale=2
```

Reduce the size of the error-bar caps by 50%:

```
errorbarcapscale=0.5
```

ERRORBARCAPSHAPE=SERIF | NONE

specifies whether the error bars have a serif cap.

Default The GraphError:CapStyle style reference. If attribute CapStyle is not defined in the active style, then SERIF is the default value.

Interaction Starting with SAS 9.4M5, when ERRORBARCAPSCALE= is in effect, the display width for SERIF caps is the cap's default width multiplied by the value specified in ERRORBARCAPSCALE=.

Tip The appearance of the error bars is controlled by the ERRORBARATTRS= option.

ERRORLOWER=*numeric-column* | *expression*

specifies the values of the lower endpoints on the Y error bars.

Default The lower segment of the error bars is not drawn.

Requirement The error bar values must be absolute data values, not data values relative to the value of the bar.

Interactions If the GROUP= option is specified with GROUPDISPLAY=STACK or with GROUP100=POSITIVE or MAGNITUDE, then this option is ignored.

When this option is specified, the DATALABEL= on page 308 and DATALABELTYPE= on page 314 options are ignored, and data labels are not displayed.

Tip You can use the ERRORBARATTRS= option to control the appearance of the error bars.

ERRORUPPER=*numeric-column* | *expression*
specifies the values of the upper endpoints on the Y error bars.

Default The upper segment of the error bars is not drawn.

Requirement The error bar values must be absolute data values, not data values relative to the value of the bar.

Interactions If the GROUP= option is specified with GROUPDISPLAY=STACK or with GROUP100=POSITIVE or MAGNITUDE, then this option is ignored.

When this option is specified, the DATALABEL= on page 308 and DATALABELTYPE= on page 314 options are ignored, and data labels are not displayed.

Tip You can use the ERRORBARATTRS= option to control the appearance of the error bars.

FILLATTRS=*style-element* | *style-element* (*fill-options*) | (*fill-options*)
specifies the appearance of the filled bar area.

Defaults For non-grouped data, the GraphDataDefault:Color style reference.

For grouped data, the GraphData1:Color–GraphDataN:Color style references.

Interaction When COLORRESPONSE= is in effect and the DISPLAY= option enables FILL display, the FILLATTRS= suboption COLOR= is ignored, and the bar fill colors vary according to the gradient.

Tip The DATATRANSPARENCY= option sets the transparency for bar fills, bar outlines, error bars, and connect lines. You can combine this option with DATATRANSPARENCY= to set one transparency for the bar outlines, error bars, and connect lines but a different transparency for the bar fills. Example:

```
datatransparency=0.2 fillattrs=(transparency=0.6)
```

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element* .

"Fill Color Options" on page 1600 for available *fill-options*.

FILLENDCOLOR=*color*
specifies the end color of the color gradient for the bar fill.

Note: This feature applies to SAS 9.4M5 and to later releases.

Default The GraphWall style element Color attribute.

Requirement FILLTYPE=COLORGRADIENT must be in effect. Otherwise, this option is ignored.

See "color " on page xii

FILLPATTERNATTRS=*style-element* | (*fill-pattern-options*)
specifies the appearance of the pattern-filled areas.

Defaults For non-grouped data, the ContrastColor and FillPattern attributes of GraphDataDefault.

For grouped data, the ContrastColor and FillPattern attributes of GraphData1–GraphDataN.

Restriction In SAS 9.4M4 and in earlier releases, the only styles that are delivered by SAS that support fill patterns are JOURNAL2, JOURNAL3, and MONOCHROMEPRINTER. If *style-element* is specified and the active ODS style does not support fill patterns, this option is ignored.

Interactions For this option to take effect, the DISPLAY= option must include FILLPATTERN among the display options.

When COLORRESPONSE= is in effect and the DISPLAY= option enables FILLPATTERN display, the FILLPATTERNATTRS= suboption COLOR= is ignored, and the fill-pattern colors vary according to the gradient.

Tip In order to change the fill pattern for each group value in ODS styles such as HTMLBlue that use color-priority attribute rotation, specify ATTRPRIORITY=NONE in an ODS GRAPHICS statement or in the BEGINGRAPH statement in your graph template. For more information, see "Attribute Rotation Patterns" in *SAS Graph Template Language: User's Guide*.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Fill Pattern Options" on page 1601 for available *fill-pattern-options*.

FILLTYPE=SOLID | ALPHAGRADIENT | COLORGRADIENT | GRADIENT
specifies the bar fill type.

Note: This feature applies to SAS 9.4M2 and to later releases.

SOLID
fills each bar with the color that is assigned to that bar.

ALPHAGRADIENT
fills each bar with a color and a transparency gradient that starts at the bar top with the initial transparency that is assigned to that bar, and ends with full transparency at the bar baseline.

Note: This feature applies to SAS 9.4M5 and to later releases.

Tips The fill color is determined by a style element or by the FILLATTRS= option COLOR= suboption. The initial transparency is determined by

the DATATRANSPARENCY= option or by the FILLATTRS= option TRANSPARENCY= suboption.

For grouped plots, use the FILLATTRS= option in a discrete attribute map to set the initial transparency in the gradients for specific values.

COLORGRADIENT
fills each bar with a color gradient that starts with the fill color that is assigned to that bar and ends with the color that is specified in the FILLENDCOLOR= option.

Note: This feature applies to SAS 9.4M5 and to later releases.

Alias GRADIENT

Interaction The SHEEN data skin cannot be used when FILLTYPE=GRADIENT is in effect. You can use one of the other data skins.

Tips Use the DATATRANSPARENCY= option or the FILLATTRS= option TRANSPARENCY= suboption to set the initial transparency in the gradients.

For grouped plots, use the FILLATTRS= option in a discrete attribute map to set the initial transparency in the gradients for specific values.

See "FILLENDCOLOR=*color*" on page 320

GRADIENT
fills each bar with a color and a transparency gradient that starts at the bar top with the initial transparency that is assigned to that bar, and ends with full transparency at the bar baseline.

Note: This option applies to SAS 9.4M2 through SAS 9.4M4. Starting with SAS 9.4M5, ALPHAGRADIENT replaces GRADIENT, and GRADIENT is changed to an alias of COLORGRADIENT.

Interactions The SHEEN data skin cannot be used when FILLTYPE=GRADIENT is in effect. You can use one of the other data skins.

In SAS 9.4M2, FILLTYPE=GRADIENT is ignored when GROUPDISPLAY=STACK is in effect. Starting with SAS 9.4M3, FILLTYPE=COLORGRADIENT is honored in that case.

Tips The initial fill color is determined by a style element or by the FILLATTRS= option COLOR= suboption. The initial transparency is determined by the DATATRANSPARENCY= option or by the FILLATTRS= option TRANSPARENCY= suboption.

For grouped plots, use the FILLATTRS= option in a discrete attribute map to set the initial transparency in the gradients for specific values.

Default SOLID

Interaction The DISPLAY= option must include FILL for this option to have any effect.

Note The output for SAS programs written prior to SAS 9.4M5 that specify FILLTYPE=GRADIENT might change starting with SAS 9.4M5. To restore the original appearance, specify FILLTYPE=ALPHAGRADIENT.

See DATASKIN= on page 315

GROUP=*column* | *discrete-attr-var* | *expression*

creates a separate bar segment or bar for each unique group value in the specified column.

discrete-attr-var

specifies a discrete attribute map variable.

The discrete attribute map variable is created by a DISCRETEATTRVAR statement.

Restriction A discrete attribute map variable specification must be a direct reference to the attribute map variable. It cannot be set by a dynamic variable.

The bar display depends on the setting for the GROUPDISPLAY= option. For example, for a vertical bar chart with GROUPDISPLAY=STACK, bar segments are stacked to form the bar. The height of each segment represents the corresponding group value's proportional contribution to the response value.

A distinct bar or bar segment is created for each group value by varying the visual attributes of the bar display features. The display features are controlled by the current ODS style or by the DISPLAY= option. The default group appearance for each display feature is shown in the following table.

Display Feature[1]	Style Attributes That Control Default Group Appearance
Fill color	Color attribute of a GraphData1–GraphDataN style element or the GraphMissing style element.
Fill pattern	FillPattern and ContrastColor attributes of a GraphData1–GraphDataN style element or the GraphMissing style element. The ContrastColor attribute controls the color of the fill pattern. If the active ODS style does not specify FillPattern, fill patterns are not displayed by default.
Outline	■ if the outline is enabled with fill color, fill pattern, or both,

Display Feature[1]	Style Attributes That Control Default Group Appearance
	ContrastColor attribute of a GraphData1–GraphDataN style element or the GraphMissing style element with a solid line style ■ if the outline is the only display feature enabled, ContrastColor and LineStyle attributes of a GraphData1–GraphDataN style element or the GraphMissing style element

1 The default display features are determined by the DisplayOpts attribute of the GraphBar style element.

Interactions Connect lines are not drawn for grouped data.

By default, the group values are mapped in the order of the data. Use the GROUPORDER= option to control the sorting order of the group values.

The INCLUDEMISSINGGROUP option controls whether missing group values are considered a distinct group value.

When both the GROUP= and COLORRESPONSE= options are specified, the color attributes are controlled by the COLORRESPONSE= option.

Note If you specify a column in a SAS data set, the visual attributes for each group value are assigned in data order. If you specify a column in a CAS in-memory table, the visual attributes for each group value are assigned in ascending order of the group column character values or of unformatted numeric values.

Tips The representations that are used to identify the groups can be overridden individually. For example, each distinct group value is represented by a different line pattern for the bar outlines, but you could use the PATTERN= setting on the OUTLINEATTRS= option to assign the same line pattern to all bar outlines and connect lines.

Use the INDEX= option to alter the default sequence of colors, fill patterns, and line patterns.

By default, ODS Graphics limits the number of groups to 1000. When this limit is exceeded, the GROUP= option is ignored. Use the GROUPMAX= option in the ODS GRAPHICS statement to change the maximum number of groups that can be processed.

GROUP100=NONE | MAGNITUDE | POSITIVE
displays the response values, normalized to 100%.

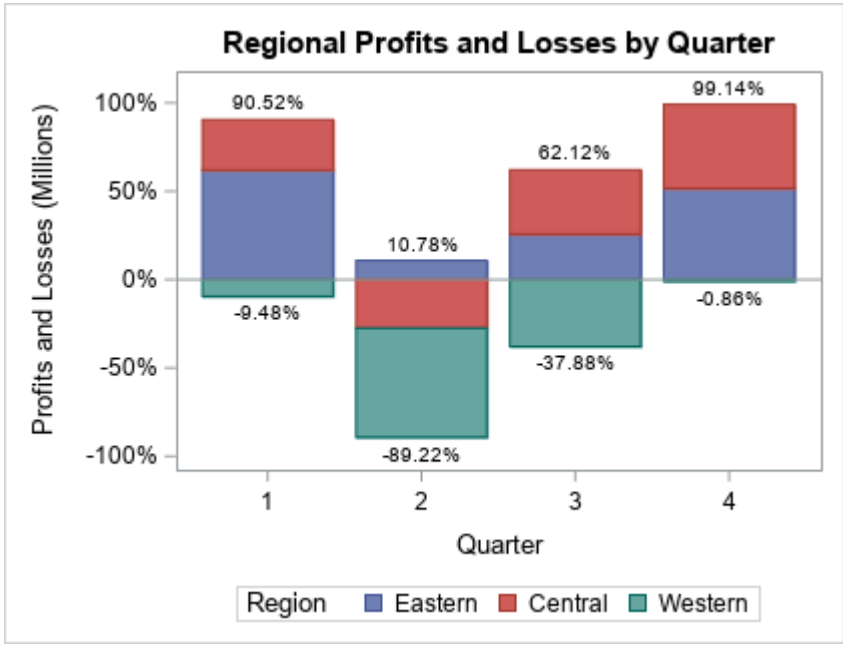
Note: This feature applies to SAS 9.4M3 and to later releases.

NONE
displays the data as received.

MAGNITUDE
normalizes both the negative and positive values by magnitude to 100% of the midpoint value, and displays the group values, preserving the sign.

The positive values are displayed above the bars for a vertical bar chart and on the right end for a horizontal bar chart. The negative values are displayed enclosed in parentheses below the bars for a vertical bar chart and on the left end for a horizontal bar chart.

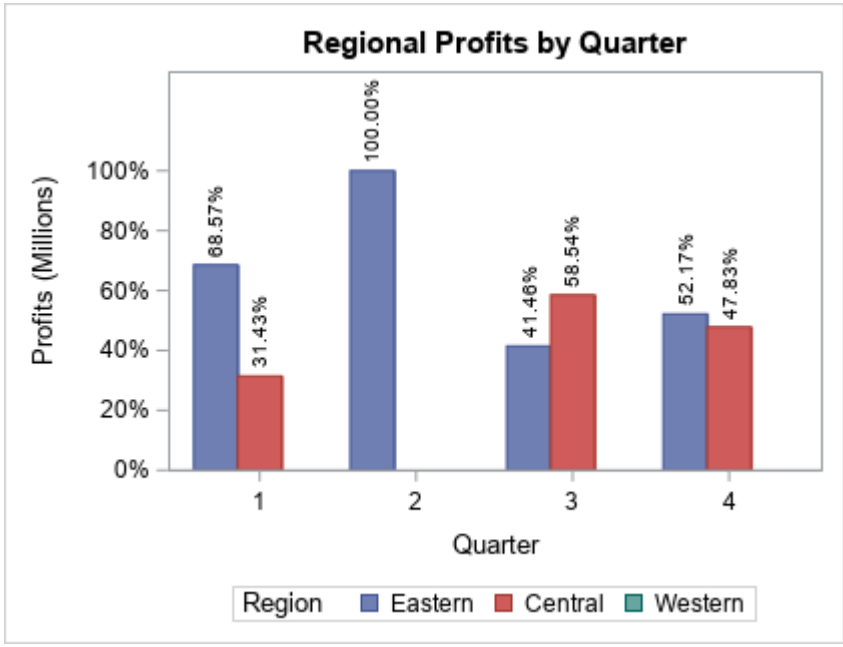
The following figure illustrates the effect of MAGNITUDE on stacked bars in a vertical bar chart.



Notice that the group values for each midpoint value add up to 100%.

POSITIVE
drops the negative values and normalizes only the positive values to 100% of the midpoint value.

The following figure demonstrates the effect of POSITIVE on clustered bars in a vertical bar chart. This chart uses the same data as the chart in the previous figure.



Notice that the negative values are dropped from the chart and the group values for each midpoint value add up to 100%.

Default NONE

Requirement The GROUP= option must be specified for this option to have any effect.

Interaction Error bars are not drawn when GROUP100=POSITIVE or MAGNITUDE. See ERRORLOWER= and ERRORUPPER=.

Note You can use this option with any value for the GROUPDISPLAY= option.

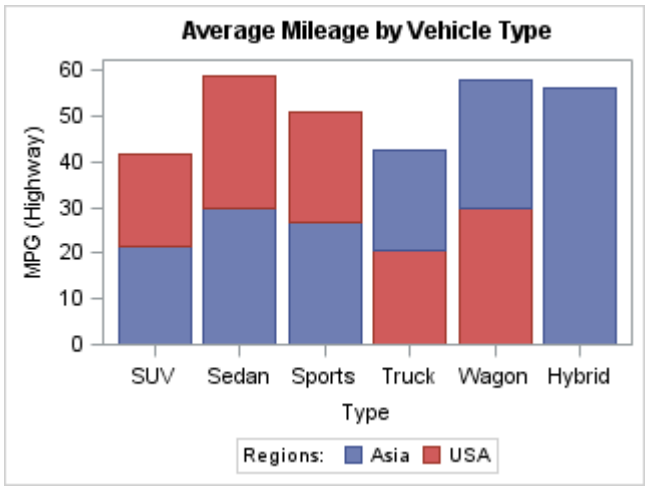
Tip To display the values, specify DATALABELTYPE=AUTO.

GROUPDISPLAY=STACK | CLUSTER

specifies how to display grouped bars.

STACK

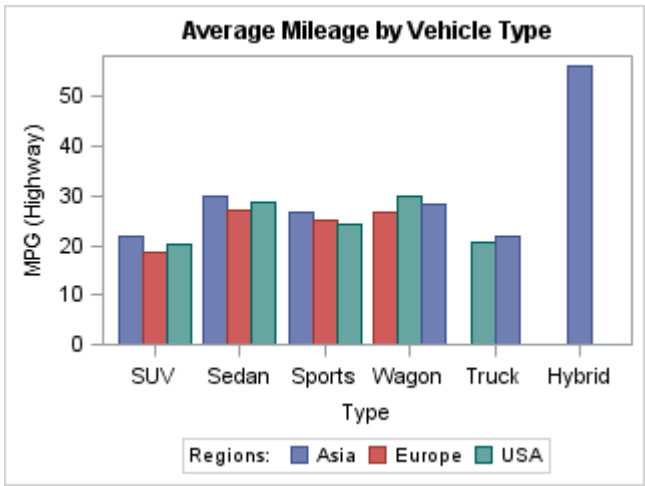
displays group values as stacked segments within the category bar.



CLUSTER

displays group values as separate adjacent bars that replace the single category bar.

Each cluster of group values is centered at the category midpoint on the axis. This example illustrates the clusters and also how groups are displayed when they have an unequal number of unique values.



Default STACK

Interactions When you use the DATALABEL= option and the GROUP= option, the DATALABEL values are displayed for each bar when GROUPDISPLAY=CLUSTER. When GROUPDISPLAY=STACK, the whole bar is labeled at the top.

Error bars are not drawn when GROUPDISPLAY=STACK.

When the TARGET= and GROUP= options are in effect, the target values are not displayed when GROUPDISPLAY=STACK. In that case, you must specify GROUPDISPLAY=CLUSTER to display the target values.

Note When you plot a SAS data set, the items for each group value are drawn in data order. When you plot a CAS in-memory table, they

are drawn in ascending order of the group column character values or unformatted numeric values.

GROUPORDER=DATA | REVERSEDATA | ASCENDING | DESCENDING
specifies the ordering of the groups within a category.

DATA
orders the groups within a category in the group-column data order.

REVERSEDATA
orders the groups within a category in the reverse group-column data order.

Note: This feature applies to SAS 9.4M2 and to later releases.

Tip This option is useful when you want to reverse the category axis.

ASCENDING
orders the groups within a category in ascending order.

DESCENDING
orders the groups within a category in descending order.

Defaults DATA if the data is a SAS data set.

ASCENDING if the data is a CAS in-memory table. Sorting is based on nonformatted values for numeric group values or on formatted values for character group values.

Interactions This option is ignored if the GROUP= option is not also specified.

By default, the groups in the legend are shown in the order that is specified in GROUPORDER.

Notes When plotting a SAS data set, attributes such as color, symbol, and pattern are assigned to each group in DATA order by default. When plotting a CAS in-memory table, attributes are assigned in ascending order of the group column character values or unformatted numeric values by default.

The ASCENDING and DESCENDING settings linguistically sort the group values within each category (or X value) for display position purposes only. For numeric data, the order is based on the unformatted values. For character data, the order is based on the formatted values. The data order of the observations and the visual attributes that are assigned to the group values remain unchanged.

In SAS 9.4M6 and earlier releases, when data stored in a CAS in-memory table is used and DATA or REVERSEDATA is specified, unpredictable results might occur. To generate consistent graphs in that case, specify ASCENDING or DESCENDING. Starting with SAS Viya 3.5 and SAS Studio 5.2, when data stored in a CAS in-memory table is used and DATA or REVERSEDATA is specified, it is ignored, and ASCENDING is used instead.

INCLUDEMISSINGGROUP=TRUE | FALSE
specifies whether missing values of the group variable are included in the plot.

Default TRUE

Interaction For this option to take effect, the GROUP= option must also be specified.

Tip The attributes of the missing group value are determined by the GraphMissing style element unless a discrete attribute map is in effect, the INDEX= option is used, the MISSING= system option changes the default missing character, or a user-defined format is applied to the group value. In those cases, the attributes of the missing group value are determined by a GraphData1–GraphDataN style element instead of by the GraphMissing style element.

See "boolean " on page xii for other Boolean values that you can use.

INDEX=*positive-integer-column* | *expression*
specifies indices for mapping bar attributes (fill and outline) to one of the GraphData1–GranphDataN style elements.

Requirements The column or expression value must be an integer value of 1 or greater. Otherwise, this option is ignored.

The positive-integer column must not contain missing values. Otherwise, the entire column is invalidated and this option is ignored.

All of the indexes for a specific group value must be the same. Otherwise, the results are unpredictable.

Interaction For this option to take effect, the GROUP= option must also be specified.

Notes The index values are 1-based indices. For the style attributes in GraphData1–GraphDataN, if the index value is greater than N, then a modulo operation remaps that index value to a number less than N to determine which style to use.

If you do not use this option, then the group values are mapped in the order of the data.

Tip You can use indexing to collapse the number of groups that are represented in a graph. For more information, see "Remapping Groups for Grouped Data" on page 211.

INTERVALBARWIDTH=*dimension*
specifies the width of the bars in an interval bar chart as a ratio of the interval width.

Note: This feature applies to SAS 9.4M3 and to later releases.

Default The width specified by the BARWIDTH= option.

Restriction This option applies only to an interval category axis. When the category axis is discrete, this option is ignored.

Interaction When the category data is interval, this option overrides the BARWIDTH= option.

Tips To make the category axis type linear or time, include TYPE=LINEAR or TYPE=TIME in the category axis options or assign the role of primary plot to a plot that makes the category axis linear or time.

The bar width that you specify with this option is honored even if the bars overlap. If the bars overlap, reduce the interval bar width or use the BARWIDTH= option instead.

See "dimension" on page xiii

LEGENDLABEL="*string*"
specifies a label to be used in a discrete legend for this plot.

Default The response-variable label. If a label is not defined, then the response-variable name is used.

Restriction This option applies only to an associated DISCRETELEGEND statement.

Interaction If the GROUP= option is specified, then this option is ignored.

NAME="*string*"
assigns a name to this plot statement for reference in other template statements. The specified name is used primarily in legend statements to coordinate the use of colors and line patterns between the plot and the legend.

Restrictions The *string* is case sensitive, cannot contain spaces, and must define a unique name within the template.

This option does not support variables that are created by the DYNAMIC, MVAR, and NMVAR template statements.

Interaction The *string* is used as the default legend label if the LEGENDLABEL= option is not used.

ORIENT=VERTICAL | HORIZONTAL
specifies the orientation of the Y axis and the bars.

Default VERTICAL

Notes When this option is set to VERTICAL, the category variable appears on the X (or X2) axis and the response variable appears on the Y (or Y2) axis. To set the axis properties for this chart, you should use the appropriate axis options of the layout container.

When this option is set to HORIZONTAL, the category variable appears on the Y (or Y2) axis and the response variable appears on the X (or X2) axis. To set the axis properties for this chart, you should use the appropriate axis options of the layout container.

If you change the orientation of the bar chart, then you should adjust the layout container's axis options appropriately.

OUTLINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the appearance of the bar outlines.

Defaults For non-grouped data, the ContrastColor, LineThickness, and LineStyle attributes of the GraphOutlines style element.

For grouped data and filled bars, the ContrastColor attribute of the GraphData1–GraphDataN style elements, and the LineThickness and LineStyle attributes of the GraphOutlines style element.

For grouped data and unfilled bars, the ContrastColor and LineStyle attributes of the GraphData1–GraphDataN style elements, and the LineThickness attribute of the GraphOutlines style element.

Interactions For this option to have any effect, outlines must be enabled by the ODS style or the DISPLAY= option.

If the DATASKIN= option applies a data skin, then this option is ignored.

When the COLORRESPONSE= and DISPLAY=(OUTLINE) options are in effect, the OUTLINEATTRS= suboption COLOR= is ignored, and the bar outline colors vary according to the gradient.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

PRIMARY=TRUE | FALSE
specifies that the data columns for this plot and the plot type be used for determining default axis features. This option is needed only when two or more plots within an overlay-type layout contribute to a common axis.

Default FALSE

Restriction This option is ignored if the plot is placed under a GRIDDED or LATTICE layout block.

Note In an OVERLAY layout, only one plot in an overlay can be the primary plot on a per-axis basis. When no plot is designated as the primary plot, the first plot that can be a primary plot is considered the primary plot. If multiple plots specify PRIMARY=TRUE for the same axis, then the last such plot encountered is considered the primary plot.

See "When Plots Share Data and a Common Axis" on page 1046

"boolean " on page xii for other Boolean values that you can use.

ROLENAME=(*role-name-list*)
specifies user-defined roles that can be used to display information in the data tips. This option provides a way to add to the data columns that appear in data tips that are specified by the TIP= option.

(*role-name-list*)
a space-separated list of *role-name = column* pairs.

Example The following example assigns the column Obs to the user-defined role TIP:

```
ROLENAME=(TIP1=OBS)
```

Default No user-defined roles

Requirement The role names that you choose must be unique and different from the predefined roles CATEGORY or X, RESPONSE or Y, ERRORLOWER, ERRORUPPER, GROUP, and INDEX.

SEGMENTLABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the text properties of the text for the bar segment label.

Note: This feature applies to SAS 9.4M2 and to later releases.

Default The GraphDataText style element.

Interaction This option is ignored when SEGMENTLABELTYPE=NONE.

See "General Syntax for Attribute Options" on page 1599 for the syntax for using a *style-element*.

"Text Options" on page 1606 for available *text-options*.

SEGMENTLABELFITPOLICY=NONE | NOCLIP | THIN
specifies a policy for fitting the bar segment labels within the bar segments.

Note: This feature applies to SAS 9.4M2 and to later releases.

NONE
no attempt is made to fit each segment label within its bar. Long bar segment labels might overlap other graphical elements.

The segment labels are not considered when the axis ranges are computed. As a result, segment labels that extend beyond the plot area are clipped.

NOCLIP
does not clip bar segment labels that extend beyond the plot area.

Labels that do not fit within the plot area extend into the graph axis area and might overlap axis elements.

THIN
drops any bar segment label that does not fit within its segment.

For a vertical bar chart, the label width must not exceed the bar width, and the text height must not exceed the segment height. For a horizontal bar chart, the label text height must not exceed the bar width, and the label length must not exceed the segment length.

Default THIN

Interaction This option is ignored when SEGMENTLABELTYPE=NONE.

SEGMENTLABELFORMAT=*format*
specifies the text format for the bar segment labels.

Note: This feature applies to SAS 9.4M2 and to later releases.

Default If DATALABELTYPE=AUTO is in effect, the segment-label format is derived from the response column format. If DATALABELTYPE=COLUMN is in effect, the segment-label format is derived from the DATALABEL= column format. If no format is applied to the column, the label format is derived from BEST6. The derived format retains the precision of the column format and, if necessary, increases the format width to accommodate the column values.

Interaction This option is ignored when SEGMENTLABELTYPE=NONE.

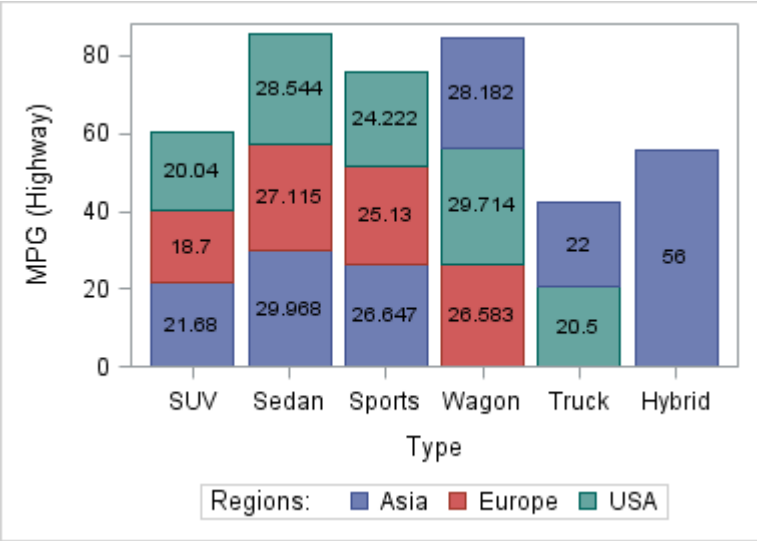
Note When a segment-label format is specified with this option, the segment labels are formatted as specified by *format*. The specified format is not automatically expanded to accommodate values that are too wide.

Tip If you want the segment-label format to expand automatically for the column values, specify the format for the response column or DATALABEL= column rather than in this option.

SEGMENTLABELTYPE=NONE | AUTO
specifies whether a label is displayed inside each bar segment.

Note: This feature applies to SAS 9.4M2 and to later releases.

For an ungrouped bar chart or for a grouped bar chart with GROUPDISPLAY=CLUSTER, AUTO displays a bar label inside each bar. The label for each bar displays the value for that bar. For a grouped bar chart with GROUPDISPLAY=STACK, AUTO displays a label inside each bar segment. The label for each bar segment displays the value for that segment.



When this value is set to NONE, no labels are displayed inside the bars.

Default NONE

Interaction The DATALABELTYPE= option determines whether the segment labels display the RESPONSE column values or the values of the column that is specified by the DATALABEL= option.

Note By default, the segment-label format is derived from the format that is assigned to the response column or from BEST6 if no format is assigned. The derived format retains the precision of the response column format and, if necessary, increases the format width to accommodate the column values.

Tips Use the SEGMENTLABELATTRS= option to modify the appearance of the label text.

Use the SEGMENTLABELFITPOLICY= option to specify a policy for fitting the labels inside the bars.

Use the SEGMENTLABELFORMAT= option to modify the format of the segment labels.

See "boolean " on page xii for other Boolean values that you can use.

TARGET=*numeric-column* | *expression*

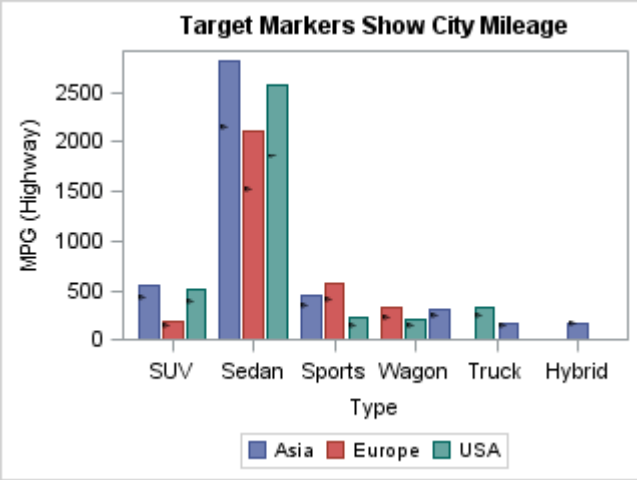
specifies the target value for each bar.

```
layout overlay;
  barchart category=type response=mpg_highway / barwidth=.8
    target=mpg_city group=origin groupdisplay=cluster
    name='bar';
  discretelegend 'bar';
endlayout;
```

The visual representation is a triangle with a line at the target value.

```
layout overlay;
  barchartparm category=type response=mpg_highway / barwidth=.8
    target=mpg_city group=origin groupdisplay=cluster
```

```
    name='bar';
  discretelegend 'bar';
endlayout;
```



Default No targets are displayed.

Interactions For this option to take effect, the RESPONSE= argument must also be used.

If the GROUP= option is used and GROUPDISPLAY= STACK, then this option is ignored.

Tip The target color is that of the bar outline.

TIP=(*role-list*) | NONE

specifies the information to display when the cursor is positioned over a bar. If this option is used, then the information specified replaces all of the information that is displayed by default. You can specify roles for columns that do not contribute to the bar chart along with roles that do.

(role-list)

an ordered, space-separated list of unique BARCHARTPARM roles and user-defined roles.

BARCHARTPARM roles include CATEGORY or X, RESPONSE or Y, COLORRESPONSE, ERRORUPPER, ERRORLOWER, INDEX, GROUP, and DATALABEL.

Notes For the category and response roles, the TIP= option recognizes only the category and response arguments that you use in the BARCHARTPARM statement. If you use the CATEGORY= and RESPONSE= arguments, then you must specify roles CATEGORY and RESPONSE. Conversely, if you use the X= and Y= arguments, then you must specify roles X and Y.

The COLORRESPONSE role is valid starting with SAS 9.4M3.

Tip Use the ROLENAME= option to define user-defined roles.

NONE
suppresses data tips and URLs (if requested) from the plot.

Default The columns assigned to these roles are automatically included in the data tip information: CATEGORY or X, RESPONSE or Y, COLORRESPONSE, ERRORLOWER, ERRORUPPER, and GROUP.

Requirement To generate data tips in the output, you must include an ODS GRAPHICS ON statement with the IMAGEMAP option specified, and you must write the output to the ODS HTML destination.

Interaction This option is ignored when the plot statement is in an OVERLAY or PROTOTYPE layout and the INCLUDERANGES= option is specified in the LINEAROPTS= or TIMEOPTS= option for either axis.

Tip You can control the labels and formats for the TIP roles with the TIPLABEL= and TIPFORMAT= options.

Example The following example displays data tips for the columns assigned to the roles CATEGORY and RESPONSE as well as for the column Pct. The Pct column is not assigned to any pre-defined bar chart role, so it must first be assigned a role.

```
ROLENAME=(TIP1=PCT)
TIP=(TIP1 CATEGORY RESPONSE)
```

TIPFORMAT=(*role-format-list*)
specifies display formats for tip columns. This option provides a way to control the formats of columns that appear in data tips.

(role-format-list)
a space-separated list of *role-name* = *format* pairs.

Example
```
ROLENAME=(TIP1=SALARY)
TIP=(TIP1)
TIPFORMAT=(TIP1=DOLLAR12.)
```

Default The column format of the column assigned to the role or BEST6 if no format is assigned to a numeric column.

Restriction Only the roles that appear in the TIP= option are used.

Requirement A column must be assigned to each of the specified roles. (See the ROLENAME= option.)

TIPLABEL=(*role-label-list*)
specifies display labels for tip columns. This option provides a way to control the labels of columns that appear in data tips.

role-label-list
a space-separated list of *rolename* ="*string*" pairs.

Example
```
ROLENAME=(TIP1=PCT)
TIP=(TIP1)
```

```
TIPLABEL=(TIP1="Percent")
```

Default The column label or column name of the column assigned to the role.

Restriction Only the roles that appear in the TIP= option are used.

Requirement A column must be assigned to each of the specified roles. (See the ROLENAME= option.)

URL=*string-column*
specifies an HTML page to display when the bar is selected.

string-column
specifies a column that contains a valid HTML page reference (HREF) for each bar that is to have an active link.

Example **`http://www.sas.com`**

Requirements To generate selectable bars, you must include an ODS GRAPHICS ON statement that specifies the IMAGEMAP option, and you must write the output to the ODS HTML destination.

For non-grouped data, the values of the column are expected to be same for each unique category value. If they are not, then only the first URL value for a given category value is used.

For grouped data, the values of the column are expected to be the same for each unique category and GROUP combination.

Interactions This option has no effect when TIP=NONE.

This option is ignored when the plot statement is in an OVERLAY or PROTOTYPE layout and the INCLUDERANGES= option is specified in the LINEAROPTS= or TIMEOPTS= option for either axis.

Tips The URL value can be blank for some category values, meaning that no action is taken when the bars for those category values are selected.

The URL value can be the same for different category values, meaning that the same action is taken when the bars for those category values are selected.

By default, drill-down links open in a new browser window (link target _blank). To specify a different target for your drill-down links, such as _self or _parent, add the DRILLTARGET="*target*" option to your ODS GRAPHICS statement. See DRILLTARGET= on page 1568.

XAXIS=X | X2
specifies whether data are mapped to the primary X (bottom) axis or to the secondary X2 (top) axis.

Default X

Interaction The overall plot specification and the layout type determine the axis display. For more information, see "How Axis Features Are Determined" on page 1040.

YAXIS=Y | Y2
specifies whether data are mapped to the primary Y (left) axis or to the secondary Y2 (right) axis.

Default Y

Interaction The overall plot specification and the layout type determine the axis display. For more information, see "How Axis Features Are Determined" on page 1040.

Details

Statement Description

The input data for the BARCHARTPARM statement is expected to be pre-summarized, with appropriate summarization statistics (sum, mean, and so on) computed for the response column. When the category values are not unique, the display is not meaningful. Prior to SAS 9.4M3, the category axis must be discrete. Starting with SAS 9.4M3, the category axis can be discrete, linear, or time. The response axis in all cases is interval.

When the chart is oriented vertically, the X (or X2) axis is used for category and the Y (or Y2) axis is used for response. When the chart is oriented horizontally, the X (or X2) axis is used for response and the Y (or Y2) axis is used for category. (See ORIENT= on page 330.) If the chart is the primary chart, then any charts or plots that are overlaid with it must have similar axis types.

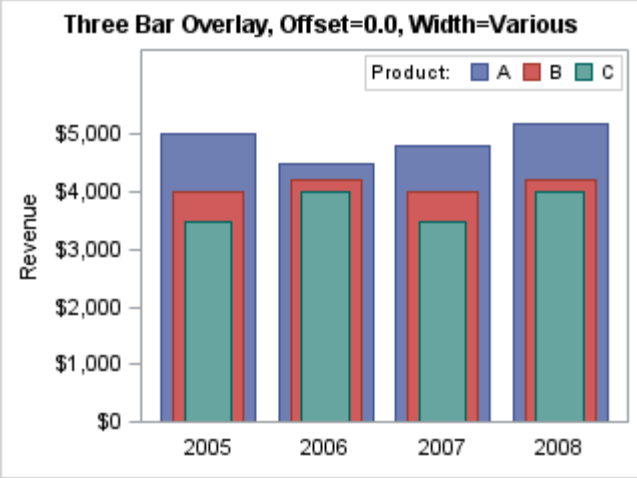
By default, if the CATEGORY= column is character, then the bars in the chart appear in the order in which the category values are present in the input data. If the CATEGORY= column is numeric, then the values are presented in ascending order.

About the DISCRETEOFFSET= Option

The DISCRETEOFFSET= option is useful for graphing multiple response variables side by side on a common axis. By default within an overlay-type layout, if multiple BARCHART statements are used with different response variables, then the bars for matching category values are centered on the midpoints and the bars are superimposed. To make it easier to distinguish among superimposed bars, you can assign a different BARWIDTH= setting to each BARCHARTPARM statement in the overlay:

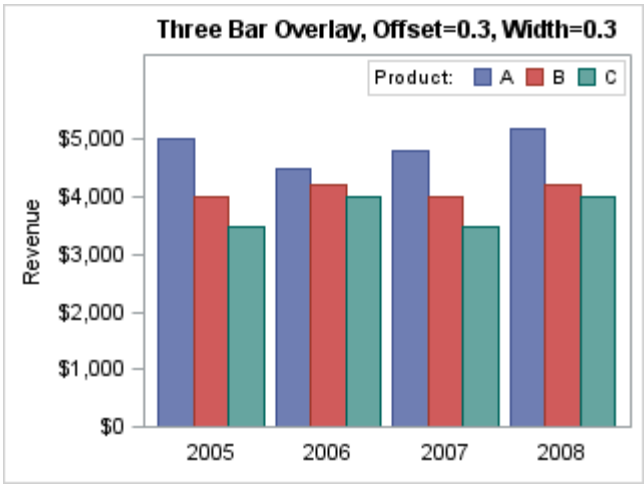
```
layout overlay / cycleattrs=true
    xaxisopts=(display=(tickvalues))
    yaxisopts=(label="Revenue" offsetmax=0.2);

  barchartparm category=year response=A_revenue / name="A"
```

```
    legendlabel="A" barwidth=0.8 ;
  barchartparm category=year response=B_revenue / name="B"
    legendlabel="B" barwidth=0.6 ;
  barchartparm category=year response=C_revenue / name="C"
    legendlabel="C" barwidth=0.4 ;

  discretelegend "A" "B" "C" / title="Product:"
    location=inside halign=right valign=top;
endlayout;
```



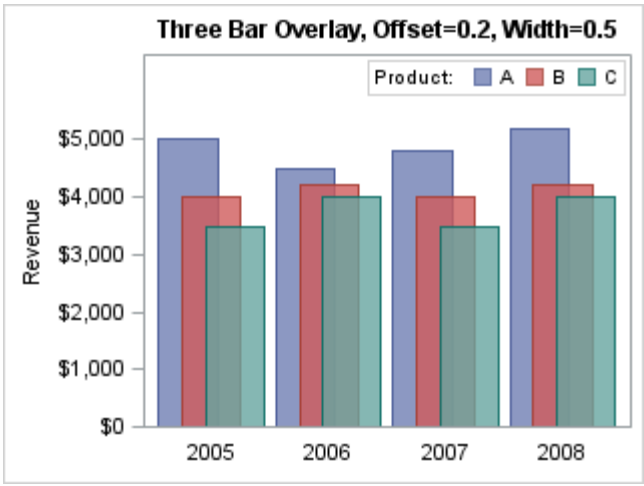
To place the different response values side by side, you can assign a different offset to each BARCHARTPARM statement. The BARWIDTH= option can be used with DISCRETEOFFSET= to create narrower bars that require less width within the plot area:

```
layout overlay / cycleattrs=true
    xaxisopts=(display=(tickvalues))
    yaxisopts=(label="Revenue" offsetmax=0.2);

  barchartparm category=year response=A_revenue / name="A"
    legendlabel="A"
    discreteoffset=-0.3 barwidth=0.3 ;
  barchartparm category=year response=B_revenue / name="B"
    legendlabel="B"
    discreteoffset=0    barwidth=0.3 ;
  barchartparm category=year response=C_revenue / name="C"
    legendlabel="C"
    discreteoffset=+0.3 barwidth=0.3 ;

  discretelegend "A" "B" "C" / title="Product:"
    location=inside halign=right valign=top;
endlayout;
```



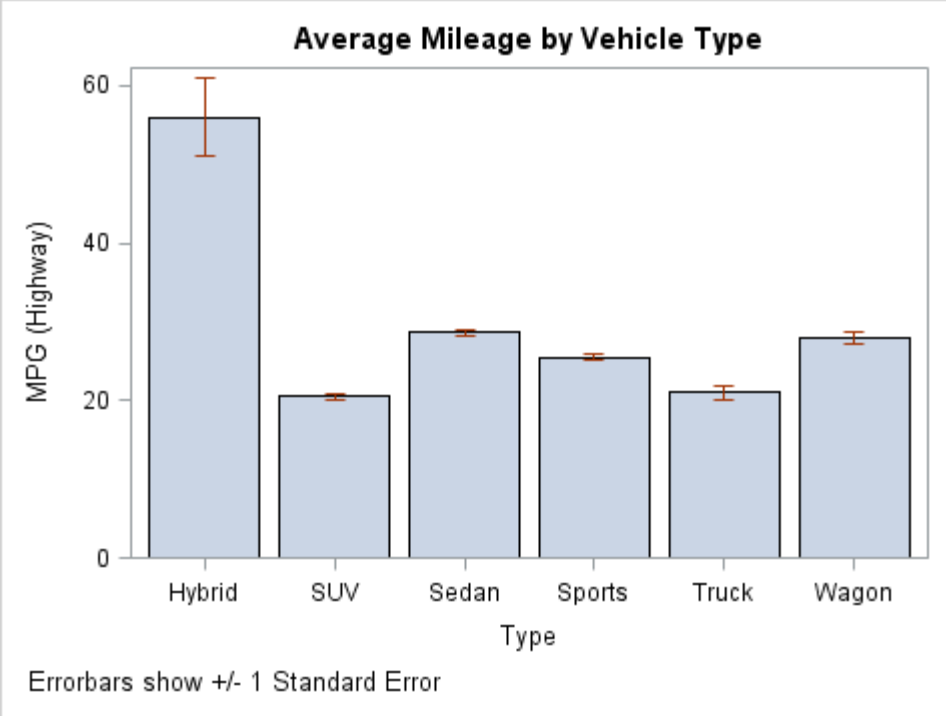
Different combinations of DISCRETEOFFSET and BARWIDTH can be used to get the effect that you want. Gaps can be created between bars by providing a narrower bar width. Or, bars can be overlapped if the bar widths are increased in proportion to the discrete offset.

```
layout overlay / cycleattrs=true
    xaxisopts=(display=(tickvalues))
    yaxisopts=(label="Revenue" offsetmax=0.2);

  barchartparm category=year response=A_revenue / name="A"
    legendlabel="A" datatransparency=0.2
    discreteoffset=-0.2 barwidth=0.5 ;
  barchartparm category=year response=B_revenue / name="B"
    legendlabel="B" datatransparency=0.2
    discreteoffset=0   barwidth=0.5 ;
  barchartparm category=year response=C_revenue / name="C"
    legendlabel="C" datatransparency=0.2
    discreteoffset=+0.2 barwidth=0.5 ;

  discretelegend "A" "B" "C" / title="Product:"
    location=inside halign=right valign=top;
endlayout;
```



Example: BARCHARTPARM Statement

The following graph was generated by the "Example Program" on page 341:



Example Program

```
proc template;
  define statgraph barchartparm;
    begingraph;
      entrytitle "Average Mileage by Vehicle Type";
      entryfootnote halign=left
        "Error bars show +/- 1 Standard Error";
      layout overlay;
        barchartparm category=type response=mean /
          errorlower=eval(mean-stderr)
          errorupper=eval(mean+stderr) ;
      endlayout;
    endgraph;
  end;
run;

/* create summarized data for barchartparm */
proc summary data=sashelp.cars nway;
  class type;
  var mpg_highway;
  output out=mileage mean=mean stderr=stderr ;
run;
```

```
proc sgrender data=mileage template=barchartparm;
run;
```

BIHISTOGRAM3DPARM Statement

Creates a three-dimensional bivariate histogram of three variables X, Y, and Z, where the values of X and Y have been gridded. The Z variable represents a response value for the frequency, percentage counts, or densities of each bin combination.

Restriction: BIHISTOGRAM3DPARM does not support the data tips that are enabled by the IMAGEMAP= option in the ODS GRAPHICS statement.

Requirements: The input data must be binned by both X and Y. That is, the values for X column and Y column must form a complete rectangular grid of bins. Input data with non-binned columns should be preprocessed with the KDE procedure (SAS/STAT), which enables you to set the number of bins for X and Y, or with a technique similar to that used in "Example: BIHISTOGRAM3DPARM Statement" on page 346.

The BIHISTOGRAM3DPARM statement must be specified within a LAYOUT OVERLAY3D statement and cannot be nested under an OVERLAY, OVERLAYEQUATED, or PROTOTYPE layout.

The input data for Z= column must be nonnegative.

Notes: In the plot display, the direction of the Z axis is upward rather than outward.

If the plot data is a CAS in-memory table, the data is sorted automatically by X and Y before it is plotted.

See: The KDE Procedure in *SAS/STAT User's Guide*

Syntax

BIHISTOGRAM3DPARM X=*numeric-column* | *expression*
Y=*numeric-column* | *expression*
Z=*non-negative-numeric-column* | *expression* </*options*>;

Summary of Optional Arguments

Appearance options

DATATRANSPARENCY=*number*
: specifies the degree of the transparency of the bins.

DISPLAY=(*display-options*) | STANDARD | ALL
: specifies which bin features to display.

FILLATTRS=*style-element* | *style-element* (*fill-options*) | (*fill-options*)
: specifies the appearance of the filled bins.

OUTLINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
: specifies the appearance of the bin outlines.

XVALUES=MIDPOINTS | LEFTPOINTS | RIGHTPOINTS
specifies whether the input X values represent midpoints, lower endpoints, or upper endpoints of the bins.

YVALUES=MIDPOINTS | LEFTPOINTS | RIGHTPOINTS
specifies whether the input Y values represent midpoints, lower endpoints, or upper endpoints of the bins.

Axes options

BINAXIS=TRUE | FALSE
specifies whether to use bins as the basis for the axis tick marks.

PRIMARY=TRUE | FALSE
specifies that the data columns for this plot and the plot type be used for determining default axis features.

Label options

ENDLABELS=TRUE | FALSE
specifies whether the axis ticks and value labels are drawn at the bin endpoints (TRUE) or at the bin midpoints (FALSE).

LEGENDLABEL="*string*"
specifies a label to be used in a discrete legend for this plot.

Plot reference options

NAME="*string*"
assigns a name to this plot statement for reference in other template statements.

Required Arguments

X=*numeric-column* | *expression*
specifies the bin location of the numeric X values.

Y=*numeric-column* | *expression*
specifies the bin location of the numeric Y values.

Z=*nonnegative-numeric-column* | *expression*
specifies the response values, such as the frequency counts, percentages, or densities.

Optional Arguments

BINAXIS=TRUE | FALSE
specifies whether to use bins as the basis for the axis tick marks.

TRUE
specifies that the ENDLABELS= option determines how the axis ticks and value labels are displayed.

FALSE
specifies that standard axes are used. Bin boundaries and midpoints that are set by the ENDLABELS= option are ignored.

Default TRUE

Interactions For this option to take effect, this plot must be the primary plot in the parent OVERLAY3D layout. For more information, see the PRIMARY= option.

When this option is set to TRUE, some X-axis options that are set on the parent layout might not apply, such as INTEGER=, TICKVALUELIST=, TICKVALUESEQUENCE=, and INCLUDERANGES=.

See "ENDLABELS=TRUE | FALSE" on page 344

"boolean " on page xii for other Boolean values that you can use.

DATATRANSPARENCY=*number*
specifies the degree of the transparency of the bins.

Default 0

Range 0–1, where 0 is opaque and 1 is entirely transparent

DISPLAY=(*display-options*) | STANDARD | ALL
specifies which bin features to display.

(*display-options*)
specifies a space-separated list of one or more display options, enclosed in parentheses.

The list can contain one or more of the following options:

FILL
displays the bin fill color

OUTLINE
displays the bin outline

STANDARD
specifies FILL

ALL
specifies FILL and OUTLINE

Default STANDARD

Tip Use the OUTLINEATTRS= and FILLATTRS= options to control the appearance of the bins.

ENDLABELS=TRUE | FALSE
specifies whether the axis ticks and value labels are drawn at the bin endpoints (TRUE) or at the bin midpoints (FALSE).

Default FALSE.

Interactions This option is ignored if this plot is not the primary plot in the parent layout. For more information, see the PRIMARY= option.

This option is ignored if BINAXIS= FALSE. By default, BINAXIS=TRUE.

See "boolean " on page xii for other Boolean values that you can use.

FILLATTRS=*style-element* | *style-element* (*fill-options*) | (*fill-options*)
specifies the appearance of the filled bins.

Default The GraphDataDefault style element.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Fill Color Options" on page 1600 for available *fill-options*.

LEGENDLABEL="*string*"
specifies a label to be used in a discrete legend for this plot.

Default The *string* specified on the NAME= option.

Restriction This option applies only to an associated DISCRETELEGEND statement.

NAME="*string*"
assigns a name to this plot statement for reference in other template statements. The specified name is used primarily in legend statements to coordinate the use of colors and line patterns between the plot and the legend.

Restrictions The *string* is case sensitive, cannot contain spaces, and must define a unique name within the template.

This option does not support variables that are created by the DYNAMIC, MVAR, and NMVAR template statements.

Interaction The *string* is used as the default legend label if the LEGENDLABEL= option is not used.

OUTLINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the appearance of the bin outlines.

Default The GraphOutlines style element.

Restriction This option uses only the color specification in the style element or line options. The line pattern and line thickness specifications are ignored.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

COLOR= on page 1602

PRIMARY=TRUE | FALSE
specifies that the data columns for this plot and the plot type be used for determining default axis features. This option is needed only when two or more plots within an overlay-type layout contribute to a common axis.

Default FALSE

Restriction This option is ignored if the plot is placed under a GRIDDED or LATTICE layout block.

See "When Plots Share Data and a Common Axis" on page 1046

"boolean " on page xii for other Boolean values that you can use.

XVALUES=MIDPOINTS | LEFTPOINTS | RIGHTPOINTS
specifies whether the input X values represent midpoints, lower endpoints, or upper endpoints of the bins.

Default MIDPOINTS

YVALUES=MIDPOINTS | LEFTPOINTS | RIGHTPOINTS
specifies whether the input Y values represent midpoints, lower endpoints, or upper endpoints of the bins.

Default MIDPOINTS

Details

Because the BIHISTOGRAM3DPARM statement does not perform a binning computation on the input columns, you must pre-bin the data. In addition, input data for the statement must be binned by both X and Y. That is, the values for the X column and the Y column must form a complete, rectangular grid of bins. Input data with non-binned columns should be preprocessed with the KDE procedure (SAS/STAT), which enables you to set the number of bins for X and Y. Alternatively, the data can be preprocessed with a technique similar to the example, where a pre-defined bin width is used.

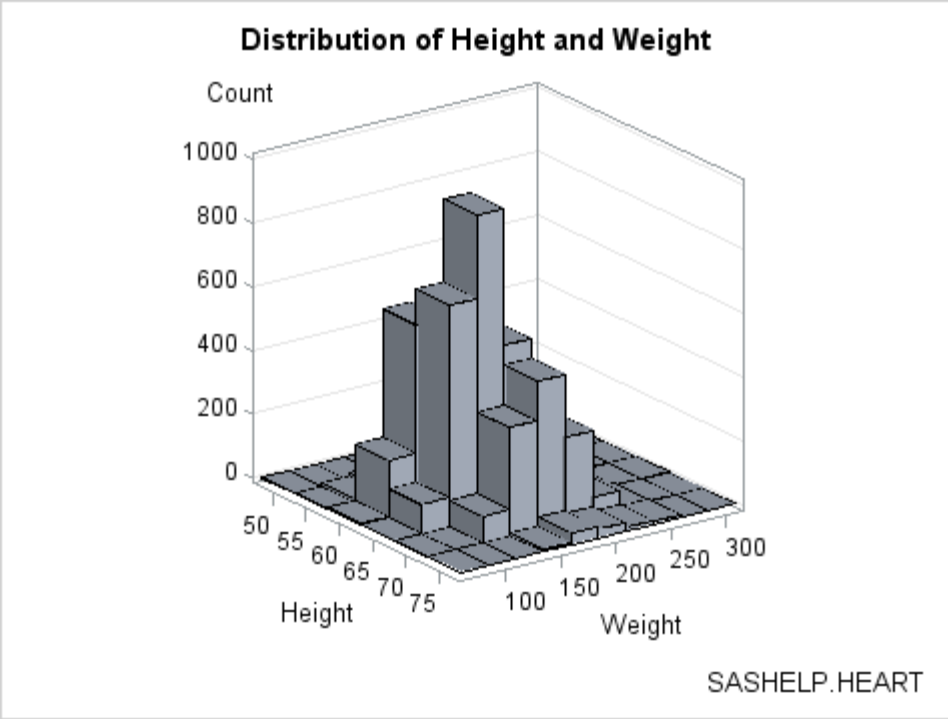
The bounding cube can be titled, rotated, and zoomed to provide a different viewpoint. By default, the outline of the bounding cube is displayed and the viewing rotation angle is 57 degrees, the tilt angle is 20 degrees and the zoom factor is 1. See the CUBE=, ROTATE=, TILT=, and ZOOM= options of the LAYOUT OVERLAY3D statement for information about how to change the viewpoint.

The X axis, Y axis, and Z axis are linear by default. You can change axis properties with the XAXISOPTS=, YAXISOPTS=, and ZAXISOPTS= options of the LAYOUT OVERLAY3D statement.

Note: When BINAXIS=TRUE, some axis options for the X- and Y-axes might not apply.

Example: BIHISTOGRAM3DPARM Statement

The following graph was generated by the "Example Program" on page 347:



Example Program

```
proc template;
  define statgraph bihistogram;
    begingraph;
      entrytitle "Distribution of Height and Weight";
      entryfootnote halign=right "SASHELP.HEART";
      layout overlay3d / cube=false zaxisopts=(griddisplay=on);
        bihistogram3dparm x=height y=weight z=count / display=all;
      endlayout;
    endgraph;
  end;
run;

data heart;
  set sashelp.heart(keep=height weight);
    if height ne . and weight ne .;
  height=round(height,5);
  weight=round(weight,25);
run;

proc summary data=heart nway completetypes;
  class height weight;
  var height;
  output out=stats(keep=height weight count) N=Count;
run;

proc sgrender data=stats template=bihistogram;
run;
```

BLOCKPLOT Statement

Creates one or more strips of rectangular blocks containing text values. The width of each block corresponds to specified numeric intervals.

Syntax

BLOCKPLOT X=*column* | *expression*
BLOCK=*column* | *expression* </*options*>;

Summary of Optional Arguments

Appearance options

ALTFILLATTRS=*style-element* | *style-element* (*fill-options*) | (*fill-options*)
specifies the appearance of alternate fills.

BLOCKINDEX=*positive-integer-column* | *expression*
specifies indices for remapping the assignment of the color of the block fills.

CLASS=*column* | *expression*
creates a separate block plot for each unique value of the specified column or expression.

DATATRANSPARENCY=*number*
specifies the degree of the transparency of the block fill and outline.

DISPLAY=(*display-options*) | STANDARD | ALL
specifies which block features to display.

EXTENDBLOCKONMISSING=TRUE | FALSE
specifies whether a missing value in the BLOCK column starts a new block or reverts to the previous nonmissing value.

FILLATTRS=*style-element* | *style-element* (*fill-options*) | (*fill-options*)
specifies the appearance of the block fills.

FILLTYPE=MULTICOLOR | ALTERNATE
specifies how the blocks are filled.

INCLUDEMISSINGCLASS=TRUE | FALSE
specifies whether missing values in the class column are included in the plot.

OUTLINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the appearance of the block outlines.

REPEATEDVALUES=TRUE | FALSE
specifies whether contiguous block values that are identical create separate blocks.

Axes options

XAXIS=X | X2
specifies whether data are mapped to the primary X (bottom) axis or to the secondary X2 (top) axis.

Label options

BLOCKLABEL=*column* | *expression*
specifies alternative text to display for the internal block text values.

LABEL=*"string"*
specifies an external label for a single block plot.

LABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font attributes of the external block label(s).

LABELPOSITION=LEFT | RIGHT | TOP | BOTTOM
specifies the alignment of BLOCK label.

Plot reference options

NAME=*"string"*
assigns a name to this plot statement for reference in other template statements.

Text options

VALUEATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the appearance of the internal block text values or the alternative values that are specified by the BLOCKLABEL= option.

VALUEFITPOLICY=NONE | SHRINK | SPLIT | SPLITALWAYS | TRUNCATE
specifies how text values are adjusted to fit within the containing block.

VALUEHALIGN=LEFT | CENTER | RIGHT | START
specifies the horizontal alignment of the value text within the blocks.

VALUESPLITCHAR=*"character-list"*
specifies one or more characters on which the values can be split, if needed.

VALUESPLITCHARDROP=TRUE | FALSE
specifies whether the split characters are included in the displayed values.

VALUEVALIGN=TOP | CENTER | BOTTOM
specifies the vertical alignment of the value text within the blocks.

Required Arguments

X=*column* | *expression*
specifies numeric X-axis positions. If the X axis is discrete and the specified column is numeric, values are treated as numeric-discrete. If the X axis is interval and the specified X column is numeric, the following guidelines apply:

- If the data is a SAS data set, you must sort the data in ascending order by the specified X column before you plot it.
- If the data is a CAS in-memory table, you do not need to sort the data. The data is automatically sorted in ascending order by the X column before it is plotted.

BLOCK=*column* | *expression*
specifies a value for each X position. Numeric values are converted to text strings according to an assigned format or according to BEST6.

Optional Arguments

ALTFILLATTRS=*style-element* | *style-element* (*fill-options*) | (*fill-options*)
specifies the appearance of alternate fills. This option in conjunction with the FILLATTRS= option controls fill appearance when FILLTYPE=ALTERNATE.

Default The GraphAltBlock style element.

Requirement FILLTYPE= ALTERNATE must set for this option to have any effect.

Interaction For this option to have any effect, the fill must be enabled by the ODS style or the DISPLAY= option.

Note If transparency is in effect with fill and the template includes a DISCRETELEGEND statement with the AUTOALIGN= option, the block plot bands might appear darker than normal. In that case, replace the AUTOALIGN= option in the DISCRETELEGEND statement with HALIGN= or VALIGN=.

Tips The FILLATTRS= option controls the fill color.

To make all block fill areas the same color, set the FILLATTRS= and ALTFILLATTRS= options to the same value.

The DATATRANSPARENCY= option sets the transparency for the block fills and the outlines. You can combine this option with DATATRANSPARENCY= to set one transparency for the outlines but a different transparency for the alternate block fills. Example:

```
datatransparency=0.2 altfillattrs=(transparency=0.6)
```

See “General Syntax for Attribute Options” on page 1599 for the syntax on using a *style-element*.

“Fill Color Options” on page 1600 for available *fill-options*.

BLOCKINDEX=*positive-integer-column* | *expression*
specifies indices for remapping the assignment of the color of the block fills.

Requirements FILLTYPE= MULTICOLOR must be set for this option to have any effect.

The column or expression value must be an integer value of 1 or greater. Otherwise, this option is ignored.

The positive-integer column must not contain missing values. Otherwise, the entire column is invalidated and this option is ignored.

All of the indices for a specific block value must be the same. Otherwise, the results are unpredictable.

Notes The index values are 1-based indices. For the style attributes in GraphData1–GraphDataN, if the index value is greater than N, then a modulo operation remaps that index value to a number less than N to determine which style element to use.

If this option is not used, then the color values are mapped in the order of GraphData1–GraphDataN.

BLOCKLABEL=*column* | *expression*
specifies alternative text to display for the internal block text values.

Default The BLOCK= values

Interaction The DISPLAY= option must include VALUES for the alternative text to appear.

Note The text for each block segment must be the same. Otherwise, the results are unpredictable.

Tips This option is particularly useful for showing regimes in forecasting and time series plots.

The font and color attributes for the alternative text are specified by the VALUEATTRS= option.

CLASS=*column* | *expression*
creates a separate block plot for each unique value of the specified column or expression. Each block plot is labeled externally by the class value.

Interactions The DISPLAY= option must include LABEL for any external labels to appear.

This option overrides the LABEL= option.

Note If you specify a column in a SAS data set, the visual attributes for each class value are assigned in data order. If you specify a column in a CAS in-memory table, the visual attributes for each class value are assigned in ascending order of the class column character values or of unformatted numeric values.

Tip The font and color attributes for the external labels are specified by the LABELATTRS= option.

DATATRANSPARENCY=*number*
specifies the degree of the transparency of the block fill and outline.

Default 0

Range 0–1, where 0 is opaque and 1 is entirely transparent

Notes This option does not affect the block values or labels.

If transparency is in effect with fill and the template includes a DISCRETELEGEND statement with the AUTOALIGN= option, the block plot bands might appear darker than normal. In that case, replace the

AUTOALIGN= option in the DISCRETELEGEND statement with HALIGN= or VALIGN=.

Tip The ALTFILLATTRS= option can be used to set transparency for just the alternate block fills. The FILLATTRS= option can be used to specify transparency for the block fills. You can combine this option with ALTFILLATTRS= and with FILLATTRS= to set one transparency for the outlines but a different transparency for the block fills. Example:

```
datatransparency=0.2
altfillattrs=(transparency=0.6) fillattrs=(transparency=0.6)
```

DISPLAY=(*display-options*) | STANDARD | ALL
specifies which block features to display.

(*display-options*)
specifies a space-separated list of one or more display options, enclosed in parentheses.

The list can contain one or more of the following options:

FILL
displays the block fill color

LABEL
displays the external block label or labels

OUTLINE
displays the block outline

VALUES
displays internal block values or the alternative block values that are specified by the BLOCKLABEL= option

STANDARD
specifies FILL and OUTLINE

ALL
specifies all features: FILL, LABEL, OUTLINE, and VALUES

Default STANDARD

Tips Use the OUTLINEATTRS=, FILLATTRS=, ALTFILLATTRS=, and BLOCKINDEX= options to control the appearance of the blocks.

Use the VALUEATTRS= and LABELATTRS= options to control the text appearance.

EXTENDBLOCKONMISSING=TRUE | FALSE
specifies whether a missing value in the BLOCK column starts a new block or reverts to the previous nonmissing value.

Default FALSE

Tip When EXTENDBLOCKONMISSING=TRUE, you can set up the input data for the BLOCK= column with nonmissing values where you expect the blocks to change and leave the remaining block values missing. For

an example, see "Example 1: BlockPlot Overlaid with SeriesPlot" on page 361.

See "boolean " on page xii for other Boolean values that you can use.

FILLATTRS=*style-element* | *style-element* (*fill-options*) | (*fill-options*)
specifies the appearance of the block fills. This option in conjunction with the ALTFILLATTRS= option controls fill appearance when FILLTYPE= ALTERNATE.

Default The GraphBlock style element.

Requirement FILLTYPE= ALTERNATE must set for this option to have any effect.

Interaction For this option to have any effect, the fill must be enabled by the ODS style or the DISPLAY= option.

Note If transparency is in effect with fill and the template includes a DISCRETELEGEND statement with the AUTOALIGN= option, the block plot bands might appear darker than normal. In that case, replace the AUTOALIGN= option in the DISCRETELEGEND statement with HALIGN= or VALIGN=.

Tips The ALTFILLATTRS= option controls the alternating fill color.

To make all block fill areas the same color, set the FILLATTRS= and ALTFILLATTRS= options to the same value.

The DATATRANSPARENCY= option sets the transparency for the block fills and the outlines. You can combine this option with TRANSPARENCY= in (*fill-options*) to set one transparency for the outlines and a different transparency for the block fills. For example:

```
datatransparency=0.2 fillattrs=(transparency=0.6)
```

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Fill Color Options" on page 1600 for available *fill-options*.

FILLTYPE=MULTICOLOR | ALTERNATE
specifies how the blocks are filled.

MULTICOLOR
fills the blocks with the color specified by the Color attribute of the style elements GraphData1–GraphDataN and GraphMissing (for missing BLOCK= values), or the style elements indicated by the BLOCKINDEX= column.

See "BLOCKINDEX=*positive-integer-column* | *expression* " on page 350

ALTERNATE
alternates the block fill between the colors specified by the FILLATTRS= and ALTFILLATTRS= options.

See "FILLATTRS=*style-element* | *style-element* (*fill-options*) | (*fill-options*) " on page 353 and "ALTFILLATTRS=*style-element* | *style-element* (*fill-options*) | (*fill-options*) " on page 350

Default MULTICOLOR

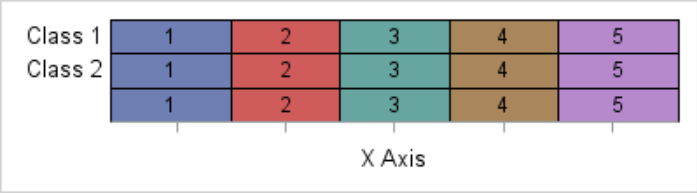
Interactions For this option to have any effect, the fill must be enabled by the ODS style or the DISPLAY= option.

When this option is set to ALTERNATE, the block plot does not support a DISCRETELEGEND entry.

INCLUDEMISSINGCLASS=TRUE | FALSE

specifies whether missing values in the class column are included in the plot. Missing class values are included by default. When the data contains missing class values, the label for those values is either blank for missing character values or a dot for missing numeric values.

The following figure shows block plots for classes Class 1, Class 2, and any missing class values.



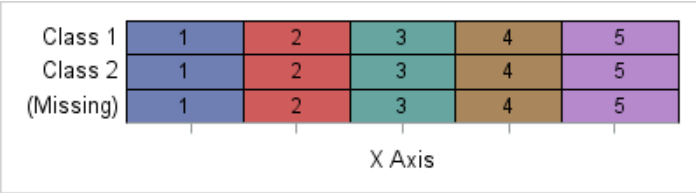
The following figure shows an X-axis axis table that displays values for classes Class 1, Class 2, and any missing class values.

Notice that the label for the missing class values is blank. You can use the INCLUDEMISSINGCLASS=FALSE option to exclude the missing class values. If you want to keep the missing class values, then you can create a format that specifies a more meaningful label for the missing class. For example, here is a format that specifies a label for missing character and numeric class values.

```
proc format;
  value $missingClass " " = "(Missing)";
  value missingClass . = "(Missing)";
run;
```

A single space enclosed in quotation marks specifies a missing character value and a dot specifies a missing numeric value. Although it might seem appropriate to use empty quotation marks (‘’ or ””) to specify a missing character value, doing so produces unexpected results. To specify a missing character value, enclose a single space in quotation marks (‘ ’ or " "). You can use this format for the class columns in the PROC SGRENDER statement. In that case, if the class columns contain missing values, then the labels specified in the format statement are used for the missing classes.

The following figure shows the previous example when format $missingClass is applied to the class variable.



Note: In SAS 9.4M2 and in earlier releases, ODS Graphics does not support Unicode values in user-defined formats. Starting with SAS 9.4M3, ODS Graphics supports Unicode values in user-defined formats only if they are preceded by the (*ESC*) escape sequence. Example: `"(*ESC*){unicode beta}"`. ODS Graphics does not support an escape character that is defined in an ODS ESCAPECHAR statement in user-defined formats.

Default TRUE

Interaction The CLASS= option must be specified for this option to have any effect.

See "boolean " on page xii for other Boolean values that you can use.

LABEL="*string*"
specifies an external label for a single block plot.

Defaults The label of the BLOCK= column.

The name of the BLOCK= column, if there is no column label.

Interactions If the CLASS= option is specified, then this option is ignored.

The DISPLAY= option must include LABEL for any external label(s) to appear.

Tip The font and color attributes for the external label are specified by the LABELATTRS= option.

LABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font attributes of the external block label(s).

Default The GraphLabelText style element.

Interaction If one or more text options are specified and they do not include all of the font properties such as color, family, size, weight, style, then the non-specified properties are derived from the GraphLabelText style element.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Text Options" on page 1606 for available *text-options*.

LABELPOSITION=LEFT | RIGHT | TOP | BOTTOM
specifies the alignment of BLOCK label.

LEFT
places the label to the left of the strip of block values.

RIGHT
places the label to the right of the strip of block values.

TOP
places the label above the strip of block values.

BOTTOM
places the label below the strip of block values.

Default LEFT

NAME="*string*"
assigns a name to this plot statement for reference in other template statements. This option is used mostly in the DISCRETELEGEND statement in order to coordinate the use of colors and line patterns between the plot and the legend.

Restrictions The *string* is case sensitive, cannot contain spaces, and must define a unique name within the template.

This option does not support variables that are created by the DYNAMIC, MVAR, and NMVAR template statements.

OUTLINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the appearance of the block outlines.

Default The GraphOutlines style element.

Interactions For this option to have any effect, the outlines must be enabled by the ODS style or the DISPLAY= option.

If labels are displayed in the TOP or BOTTOM position, then they are also outlined.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

REPEATEDVALUES=TRUE | FALSE
specifies whether contiguous block values that are identical create separate blocks.

FALSE
creates only one block when two or more identical block values appear consecutively.

TRUE
creates one block for each identical value when two or more identical values appear consecutively.

Default FALSE

See "boolean " on page xii for other Boolean values that you can use.

VALUEATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the appearance of the internal block text values or the alternative values that are specified by the BLOCKLABEL= option.

Default The GraphValueText style element.

Interaction If one or more text options are specified and they do not include all of the font properties such as color, family, size, weight, style, then the non-specified properties are derived from the GraphValueText style element.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Text Options" on page 1606 for available *text-options*.

VALUEFITPOLICY=NONE | SHRINK | SPLIT | SPLITALWAYS | TRUNCATE
specifies how text values are adjusted to fit within the containing block.

NONE
makes no attempt to fit values that collide.

SHRINK
reduces the font size of the values until they all fit.

SPLIT
splits a value that does not fit within the containing block at a split character in order to make the value fit the available space.

No split occurs at split characters that occur where a split is not needed. If the value does not contain any of the specified split characters, then a split does not occur.

Interaction The VALUESPLITCHAR= option specifies the split characters.

Tip Use the VALUEHALIGN= option to control the alignment of the split lines.

SPLITALWAYS
splits each value at every occurrence of a split character.

If the value does not contain any of the specified split characters, then a split does not occur.

Interaction The VALUESPLITCHAR= option specifies the split characters.

Tip Use the VALUEHALIGN= option to control the alignment of the split lines.

TRUNCATE
truncates any value that does not fit.

For a numeric column, an asterisk (*) is substituted for the entire value whenever truncation occurs. For a character column, the truncated portion of the text is replaced by an ellipsis (...).

Default TRUNCATE

Interaction The SPLIT and SPLITALWAYS policies are ignored when the BLOCKPLOT statement is placed in a DATALATTICE or DATAPANEL layout and the BLOCKPLOT CLASS= option is set. In that case, the TRUNCATE fit policy is used instead.

VALUEHALIGN=LEFT | CENTER | RIGHT | START
specifies the horizontal alignment of the value text within the blocks.

LEFT
left-aligned within the block

CENTER
center-aligned within the block

RIGHT
right-aligned within the block

START
center-aligned at the starting value of the block

Default LEFT

Restriction When the BLOCKPLOT statement is placed inside an INNERMARGIN block, only VALUEALIGN=CENTER is honored.

Requirement For this option to have any effect, the DISPLAY= option must include VALUE.

Interaction When REPEATEDVALUES= TRUE and X values are numeric, only CENTER and START can be used for a discrete axis. In addition, only LEFT and START can be used for a linear or log axis. For example, if REPEATEDVALUES=TRUE and the axis is discrete, then a setting of RIGHT for this option is ignored and LEFT is used instead.

VALUESPLITCHAR="*character-list*"
specifies one or more characters on which the values can be split, if needed. When multiple split characters are specified, each character in the list is treated as a separate split character unless the specified characters appear consecutively in the value. In that case, all of the specified split characters together are treated as a single split character.

When VALUESPLITPOLICY=SPLIT, if a value collision is detected, then the value is split at each occurrence of any of the specified split characters. When VALUESPLITPOLICY=SPLITALWAYS, the value is split unconditionally on each of the specified split characters. If the value does not contain any of the specified split characters, then the value is not split.

"character-list"
one or more characters with no delimiter between each character and enclosed in quotation marks.

Default A blank space

Requirements The list of characters must be enclosed in quotation marks.

Multiple characters must be specified with no delimiters. For example, to specify the split characters a, b, and c, use the following option:

```
valuesplitchar="abc"
```

The VALUEFITPOLICY= option must specify SPLIT or SPLITALWAYS.

Interactions

The VALUESPLITCHARDROP= option specifies whether the split characters are included in the displayed value or are dropped.

The VALUEFITPOLICY= option sets the policy that is used to manage the split behavior of the value.

Notes

When multiple characters are specified, the order of the characters in the list is not significant.

The split characters are case sensitive.

VALUESPLITCHARDROP=TRUE | FALSE

specifies whether the split characters are included in the displayed values.

TRUE

drops a split character from the value when a split occurs at that character.

Split characters at which a split does not occur are left in place. The VALUEFITPOLICY= option determines where the values are split. When VALUEFITPOLICY=SPLIT, each value is split at a split character only where a split is needed in order to make the value fit the available space. At each split point, the split character is dropped, and the characters that follow the split character, up to but not including the split character at the next split point, are wrapped to the following line.

When VALUEFITPOLICY=SPLITALWAYS, each value is split at every instance of a split character. All of the split characters are dropped. The characters that follow each split character, up to but not including the next split character, are wrapped to the next line.

The following figure shows how value Product*Group*1 is split when the VALUESPLITCHARDROP=TRUE, VALUESPLITCHAR="*", and VALUEHALIGN=CENTER options are specified with the SPLIT and SPLITALWAYS fit policies.

In this example, when VALUEFITPOLICY=SPLIT, the value is split at the first occurrence of the asterisk in order to make the value fit. No split is needed at the second asterisk. The first asterisk is dropped, and Group*1 wraps to the next line. Notice that the second asterisk is not dropped in this case. When

VALUEFITPOLICY=SPLITALWAYS, the value is split at every occurrence of the asterisk. In this case, both asterisks are dropped, and the characters that follow each asterisk wrap to the next line.

FALSE
includes the split characters in the value display.

The VALUEFITPOLICY= option determines how the split characters are displayed. When VALUEFITPOLICY=SPLIT, each value is split at a split character only where a split is needed in order to make the value fit the available space. A split might not occur at every split character in the value. At each split point, the split character remains as the last character in the current line. The characters that follow the split character, up to and including the split character at the next split point, are then wrapped to the following line. This process repeats until the entire value is displayed.

When VALUEFITPOLICY=SPLITALWAYS, each value is split at every instance of a split character in the value regardless of whether a split is actually needed. Each split character remains as the last character in the current line. The characters that follow each split character, up to and including the next split character, are then wrapped to the next line.

The following figure shows how value Product*Group*1 is split when the VALUESPLITCHARDROP=FALSE, VALUESPLITCHAR="*", and VALUEHALIGN=CENTER options are specified with the SPLIT and SPLITALWAYS fit policies.

In this example, when VALUEFITPOLICY=SPLIT, the label is split at the first occurrence of the asterisk to make the value fit. No split is needed at the second asterisk. The characters that follow the first asterisk wrap to the next line. When VALUEFITPOLICY=SPLITALWAYS, the value is split at every occurrence of the asterisk. Each asterisk remains as the last character in the current line, and the characters that follow are wrapped to the next line.

Default TRUE. A split character is dropped from the value display when a split occurs at that character.

Requirement The VALUEFITPOLICY= option must specify SPLIT or SPLITALWAYS.

Interaction The VALUESPLITCHAR= option specifies the split characters.

See “boolean ” on page xii for other Boolean values that you can use.

VALUEVALIGN=TOP | CENTER | BOTTOM
specifies the vertical alignment of the value text within the blocks.

Default CENTER

Interaction For this option to have any effect, the DISPLAY= option must include VALUE.

XAXIS=X | X2
specifies whether data are mapped to the primary X (bottom) axis or to the secondary X2 (top) axis.

Default X

Interaction The overall plot specification and the layout type determine the axis display. For more information, see "How Axis Features Are Determined" on page 1040.

Details

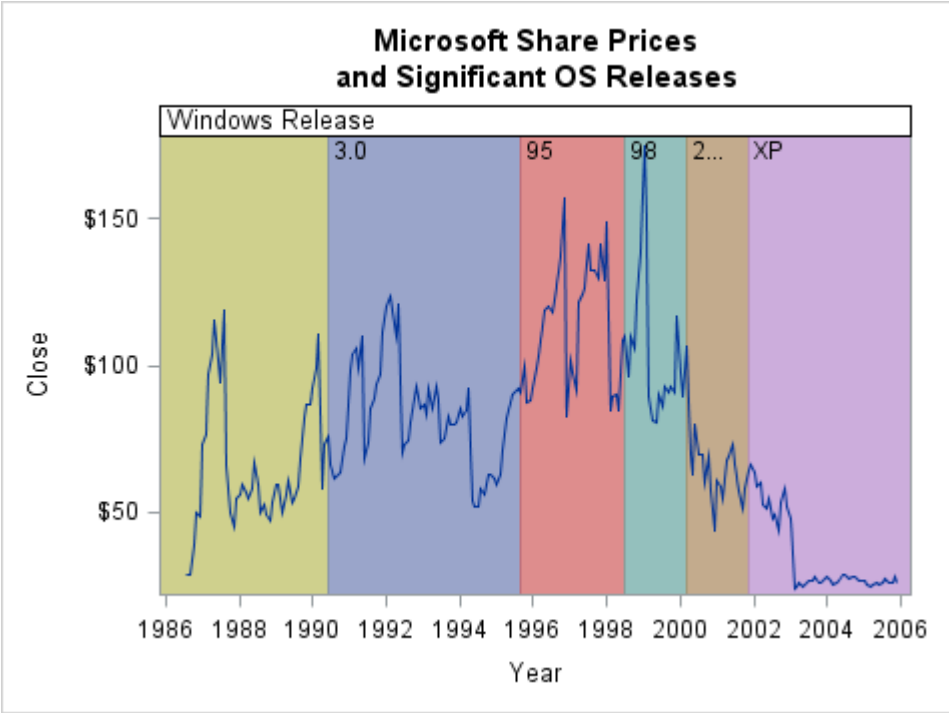
A block plot contains information about X locations and text values to be associated with corresponding intervals along the X axis. There is no Y-axis information in this plot.

Examples

Example 1: BlockPlot Overlaid with SeriesPlot

When overlaid with plots that have a Y axis (a series plot for example), a block plot expands vertically to fill the Y-axis range. In the BLOCKPLOT statement, the BLOCK= argument can be used to reference text values from a column. The resulting graph displays those values within the plot wall. This example shows how a block plot can be specified with a series plot within an OVERLAY layout. Here is the output for this example.

Example Output



Input Data

To prepare input data for the graph, “event” information must be added to the existing data for stock prices. Here is the SAS code that generates the data for this example. Notice that the first DATA step creates a Release column. That column is later specified on the BLOCK= argument to display text values on the wall of the block plot.

```
data MSevents;
  input Date date9. Release $5.;
  label Release="Windows Release";
datalines;
01jun1990 3.0
01sep1995 95
01jul1998 98
01mar2000 2000
01nov2001 XP
;

proc sort data=sashelp.stocks(keep=date stock close)
  out=MSstock;
  where stock="Microsoft";
  by date;
run;

data events;
```

```
  merge MSstock MSevents;
  by date;
run;
```

In the merged input data set, the Release column value is missing for each observation until the first event defined in the MSEvents data, 3.0, occurs in June of 1990. The Release column value is missing again for the subsequent observations until the next event defined in the MSEvents data, 95, occurs in September of 1995. Here is a sample of the merged data.

```
Obs      Stock       Date         Close    Release
...
 45    Microsoft    02APR90      $58.00
 46    Microsoft    01MAY90      $73.00
 47    Microsoft    01JUN90      $76.00      3.0
 48    Microsoft    02JUL90      $66.50
 49    Microsoft    01AUG90      $61.50
 50    Microsoft    04SEP90      $63.00
...
```

Example Program

Here is the code for this example.

```
proc template;
  define statgraph blockplot1;
    begingraph;
      entrytitle "Microsoft Share Prices";
      entrytitle "and Significant OS Releases";
       layout overlay;
         blockplot x=date block=release /
           datatransparency=0.3 valuevalign=top
           labelposition=top display=(fill values label)
           extendblockonmissing=true ;
        seriesplot x=date y=close;
      endlayout;
    endgraph;
  end;
run;

proc sgrender data=events template=blockplot1;
  format date year4.;
  label date="Year";
run;
```

Details

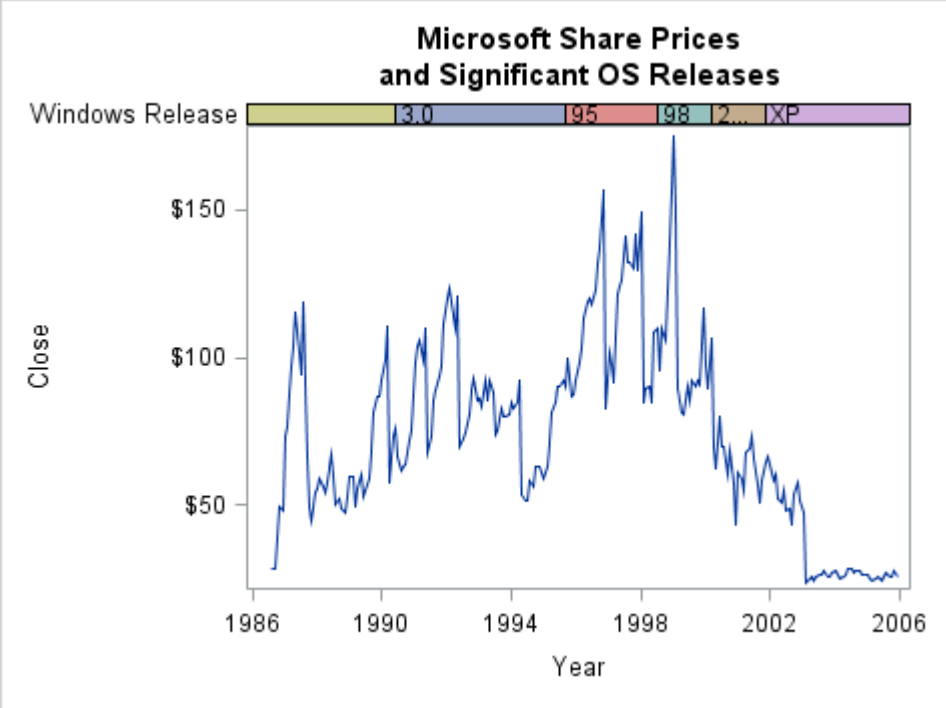
In the GTL template code for this example, BLOCK=RELEASE is specified in the BLOCKPLOT statement so that the RELEASE values are displayed on the wall of the resulting block plot. In this template, the BLOCKPLOT statement sets

EXTENDBLOCKONMISSING= TRUE so that missing values in the data revert to the previous nonmissing value in the block plot. Thus, in the block plot, values are missing until `01JUN90`, when the value changes from missing to `3.0`. The block plot retains that `3.0` value for subsequent observations until the next nonmissing value replaces it (in this case, the value`95` on `01SEP95`). In the example output shown in "Example Output" on page 362, the fill color for each of the nonmissing values is determined by the style elements GraphData1–GraphData5 in this case. The fill color for the missing values is determined by the next available GraphDataN style element, which is GraphData6 in this case.

Example 2: Standalone BlockPlot in Lattice Layout

When used as a standalone plot in a LATTICE layout, the block plot's height can be controlled. Using this technique, it is possible to include two or more "event" strips in a plot. This example demonstrates this technique by creating a series plot with an event strip as shown in the following figure.

Example Output



Example Program

In this example, the lattice ROWWEIGHTS=(0.04 0.96) option apportions 4% of the vertical space to the block plot. Here is the code for this example.

```
proc template;
```

```
  define statgraph blockplot2;
    begingraph;
      entrytitle "Microsoft Share Prices";
      entrytitle "and Significant OS Releases";
      layout lattice / rowweights=(0.04 0.96);
        blockplot x=date block=release / datatransparency=0.3
          valuefitpolicy=shrink  labelposition=left
          display=(fill label outline values)
          extendblockonmissing=true;
        seriesplot x=date y=close;
      endlayout;
    endgraph;
  end;
run;

proc sgrender data=events template=blockplot2;
  format date year4.;
  label date="Year";
run;
```

BOXPLOT Statement

Creates box plots that are computed from input data.

Tip: Starting with SAS 9.4M3, you can use subpixel rendering with this statement. It is enabled by default. To disable subpixel rendering, specify SUBPIXEL=OFF in the BEGINGRAPH statement or in an ODS GRAPHICS statement. For information about the BEGINGRAPH statement SUBPIXEL= option, see SUBPIXEL= on page 39. For information about the ODS GRAPHICS statement SUBPIXEL= option, see "ODS GRAPHICS Statement" on page 1561.

Syntax

BOXPLOT Y=*numeric-column* | *expression* < */options* >;

BOXPLOT X=*column* | *expression*
Y=*numeric-column* | *expression* < /option(s) >;

Summary of Optional Arguments

Appearance options

BOXWIDTH=*number*
: specifies the width of a box as a ratio of the maximum possible width.

CAPSCALE=*positive-number*
: specifies a positive number to use as a multiplier for determining the default width of the whisker caps.

CAPSHAPE=SERIF | LINE | BRACKET | NONE

specifies the shape at the ends of the whiskers.

CLUSTERWIDTH=*number*
specifies the width of the group clusters as a fraction of the midpoint spacing or bin width.

CONNECT=MEAN | MEDIAN | Q1 | Q3 | MIN | MAX
specifies that a connect line joins a statistic from box to box.

CONNECTATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the attributes of the lines connecting multiple boxes.

CONNECTBREAK=TRUE | FALSE
specifies whether the connect line is broken for values that have no observations.

DATASKIN=NONE | CRISP | GLOSS | MATTE | PRESSED | SHEEN
enhances the visual appearance of the filled boxes.

DATATRANSPARENCY=*number*
specifies the degree of the transparency of the box outlines, box fill, whiskers, mean, median, caps, connect lines, outliers, and data labels, if displayed.

DISPLAY=(*display-options*) | STANDARD | ALL
specifies which box-plot features to display.

EXTREME=TRUE | FALSE
specifies whether the whiskers can extend beyond the fences.

FILLATTRS=*style-element* | *style-element* (*fill-options*) | (*fill-options*)
specifies the appearance of the interior fill area of the boxes.

FILLPATTERNATTRS=*style-element* | (*fill-pattern-options*)
specifies the appearance of the pattern-filled areas.

INDEX=*positive-integer-column* | *expression*
specifies indices for mapping box attributes (fill and outline) to one of the GraphData1–GranphDataN style elements.

INTERVALBOXWIDTH=AUTO | *dimension*
specifies the box width when an interval category (X) column is specified.

MEANATTRS=*style-element* | *style-element* (*marker-options*) | (*marker-options*)
specifies the attributes of the marker representing the mean within the box.

MEDIANATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the appearance of the line representing the median within the box.

ORIENT=VERTICAL | HORIZONTAL
specifies the orientation of the Y axis and of the boxes.

OUTLIERATTRS=*style-element* | *style-element* (*marker-options*) | (*marker-options*)
specifies the attributes of the markers representing the outliers.

OUTLINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the appearance of the box outline.

SPREAD=TRUE | FALSE
specifies whether outliers with the same value are spread out to avoid overlap.

WHISKERATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)

specifies the line properties of the whiskers and caps.

Axes options

PRIMARY=TRUE | FALSE
: specifies that the data columns for this plot and the plot type be used for determining default axis features.

XAXIS=X | X2
: specifies whether data are mapped to the primary X (bottom) axis or to the secondary X2 (top) axis.

YAXIS=Y | Y2
: specifies whether data are mapped to the primary Y (left) axis or to the secondary Y2 (right) axis.

Data tip options

OUTLIERTIP=(*role-list*) | NONE
: specifies the information to display when the cursor is positioned over an outlier.

TIP=(*role-list*) | NONE
: specifies the information to display when the cursor is positioned over a box or whisker in the box plot.

TIPFORMAT=(*role-format-list*)
: specifies display formats for tip columns.

TIPLABEL=(*role-label-list*)
: specifies display labels for tip columns.

Label options

DATALABEL=*column*
: specifies the labels of the outliers. Either a numeric or a character column can be used.

DATALABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
: specifies the color and font attributes of the outlier labels.

DATALABELSPLIT=TRUE | FALSE
: specifies whether to split the data labels at the specified split characters.

DATALABELSPLITCHAR="*character-list*"
: specifies one or more characters on which the data labels can be split if needed.

DATALABELSPLITCHARDROP=TRUE | FALSE
: specifies whether the split characters are included in the data labels.

DATALABELSPLITJUSTIFY=AUTO | CENTER | LEFT | RIGHT
: specifies the justification of the strings that are inside the data label blocks.

LABELFAR=TRUE | FALSE
: specifies whether all outliers or only far outliers are labeled.

LEGENDLABEL="*string*"
: specifies a label to be used in a discrete legend for this plot.

Midpoint options

DISCRETEOFFSET=*number*

specifies an amount to offset all boxes from the discrete X ticks.

GROUP=*column* | *discrete-attr-var* | *expression*
: creates a box plot for each unique group value of the specified column.

GROUPDISPLAY=OVERLAY | CLUSTER
: specifies how to display the boxes that represent group values for the coordinate pairs.

GROUPORDER=DATA | REVERSEDATA | ASCENDING | DESCENDING
: specifies the ordering of the groups within a category.

INCLUDEMISSINGGROUP=TRUE | FALSE
: specifies whether missing values of the group variable are included in the plot.

Plot reference options

NAME="*string*"
: assigns a name to this plot statement for reference in other template statements.

Statistics options

DISPLAYSTATS=NONE | STANDARD | ALL | (*statistics-list*)
: specifies the statistics to be displayed for each box.

FREQ=*numeric-column* | *expression*
: specifies a numeric column that provides frequencies for each observation that is read.

PERCENTILE=1 | 2 | 3 | 4 | 5
: specifies one of five definitions used to calculate percentiles.

WEIGHT=*numeric-column* | *expression*
: specifies a column that contains a statistics calculation *a priori* weight for each observation of the input data object.

WHISKERPERCENTILE=*number*
: specifies the whisker length, in percentile units.

Required Arguments

Specifying only Y= creates a single box plot. Specifying both X= and Y= creates a box plot for each unique value of X.

Y=*numeric-column* | *expression*
specifies the column for the Y values. This argument is required.

X=*column* | *expression*
specifies the column for the X values. This argument is required if you want to create a box plot for each unique X value.

Note For interval X values, if a user-defined format is applied to the X column, the format should map each X value to only one unique formatted value. Otherwise, unexpected results might occur.

Optional Arguments

BOXWIDTH=*number*
specifies the width of a box as a ratio of the maximum possible width.

Defaults For a discrete category axis, 0.4 for a nongrouped box plot or 0.6 for a grouped box plot.

For an interval category axis, 85% of the smallest interval between any two boxes for the given plot.

Range 0–1, where 0 is the narrowest and 1 is the widest.

Interactions For a grouped box plot with a discrete category axis when GROUPDISPLAY=CLUSTER, the box width is a percentage of the cluster width. See CLUSTERWIDTH.

Prior to SAS 9.4M3, for an interval box plot, this option is ignored, and the box width is controlled by the INTERVALBOXWIDTH= option. Starting with SAS 9.4M3, for an interval box plot, this option is ignored when the INTERVALBOXWIDTH= option is specified. Otherwise, the BOXWIDTH= option is honored.

CAPSCALE=*positive-number*
specifies a positive number to use as a multiplier for determining the default width of the whisker caps.

Note: This feature applies to SAS 9.4M5 and to later releases.

Default 1

Interaction This option is ignored when CAPSHAPE=NONE is in effect.

Tips Use the CAPSHAPE= option to specify the cap shape.

The thickness (height) of the SERIF, LINE, and BRACKET is determined by the thickness specified in the WHISKERATTRS= option. The cap line pattern is always solid.

Examples Double the size of the caps:

```
capscale=2
```

Reduce the size of the caps by 50%:

```
capscale=0.5
```

CAPSHAPE=SERIF | LINE | BRACKET | NONE
specifies the shape at the ends of the whiskers.

SERIF
specifies a short line perpendicular to the whisker.

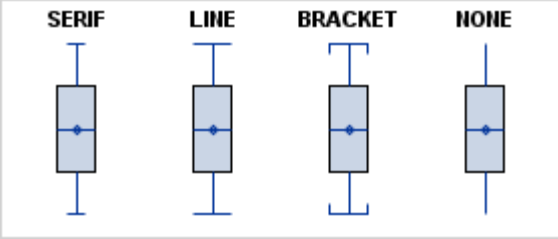
LINE
specifies a line perpendicular to the whisker that extends the width of the box.

BRACKET
specifies a line perpendicular to the whiskers that extends the width of the box and that has short extensions at each end.

The extensions are drawn in the direction of the box.

NONE
specifies that no shape appears at the ends of the whiskers.

The following figure shows each of the shapes.



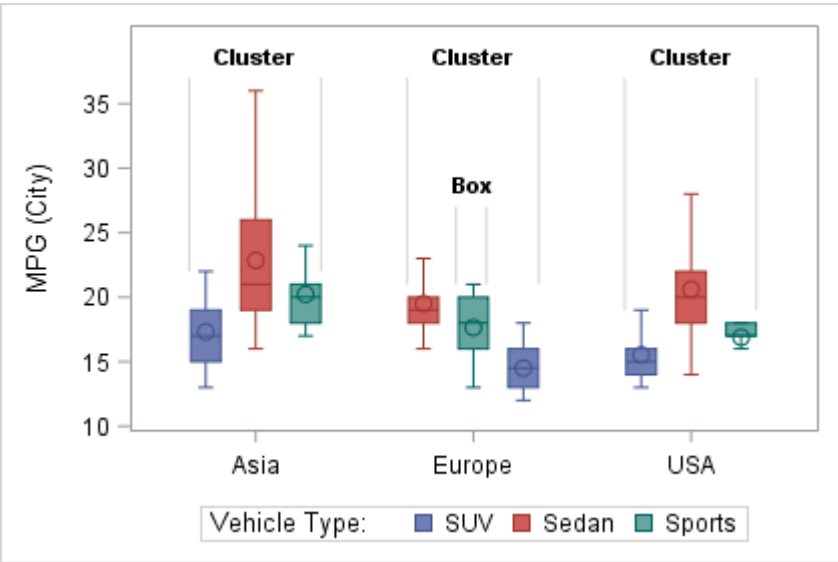
Default SERIF

Interactions The cap color and the thickness are specified by the WHISKERATTRS= option. The cap pattern is always solid.

The DISPLAY= option must include CAPS in order for cap lines to be shown.

Starting with SAS 9.4M5, when CAPSCALE= is in effect, the display width for the caps is the cap's default width multiplied by the value specified in CAPSCALE=.

CLUSTERWIDTH=*number*
specifies the width of the group clusters as a fraction of the midpoint spacing or bin width.



Default 0.7

Range 0–1, where 0 is the minimum width, which is one pixel wide, and 1 is the maximum possible width

Requirement For this option to take effect, the GROUP= option must also be specified, and the GROUPDISPLAY= option must be set to CLUSTER.

Note When the X axis is an interval axis, the cluster width is a fraction of the smallest data interval.

CONNECT=MEAN | MEDIAN | Q1 | Q3 | MIN | MAX
specifies that a connect line joins a statistic from box to box.

Default The GraphBox:Connect style reference.

Requirement The DISPLAY= option must contain the CONNECT *display-options* value in order for the connect line to be displayed.

Interaction This option applies only when the X= argument is used to generate multiple boxes.

Note Starting with SAS 9.4M3, the connect lines are drawn in axis order. In prior releases, they are drawn in data order.

CONNECTATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the attributes of the lines connecting multiple boxes.

Default The GraphConnectLine style element.

Interactions If there is only one box, then this option is ignored.

If the DISPLAY= option does not include CONNECT, or if the GROUP= option is used, then this option is ignored.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

CONNECTBREAK=TRUE | FALSE
specifies whether the connect line is broken for values that have no observations.

Note: This feature applies to SAS 9.4M5 and to later releases.

Default FALSE

Requirement DISPLAY= must include CONNECT for this option to have any effect.

Interaction This option is ignored when the GROUP= option is in effect.

DATALABEL=*column*
specifies the labels of the outliers. Either a numeric or a character column can be used.

Default No data labels are displayed

Interaction This option is ignored if EXTREME= TRUE or the DISPLAY= option does not display the outliers.

See LABELFAR= option

DATALABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font attributes of the outlier labels.

Default The GraphDataText style element.

Interactions This option is ignored if EXTREME= TRUE or the DISPLAY= option does not display the outliers.

If one or more label options are specified and they do not include all the font properties (color, family, size, weight, style), then the non-specified properties are derived from the GraphDataText style element.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Text Options" on page 1606 for available *text-options*.

DATALABELSPLIT=TRUE | FALSE
specifies whether to split the data labels at the specified split characters. When set to TRUE, the data label is split unconditionally at each occurrence of any of the specified split characters.

Default FALSE. The data labels are not split.

Requirement The DATALABEL= option must also be specified.

Interaction The DATALABELSPLITCHAR= option specifies one or more characters on which splits can occur.

See "boolean " on page xii for other Boolean values that you can use.

DATALABELSPLITCHAR="*character-list*"
specifies one or more characters on which the data labels can be split if needed. When multiple split characters are specified, each character in the list is treated as a separate split character unless the specified characters appear consecutively in the data label. In that case, all of the specified split characters together are treated as a single split character.

When DATALABEL= is specified and DATALABELSPLIT=TRUE, the data label is split unconditionally at each occurrence of any of the specified split characters. If the data label does not contain any of the specified characters, then the label is not split.

"character-list"
one or more characters with no space between each character and enclosed in quotation marks.

Default A blank space

Requirements The list of characters must be enclosed in quotation marks.

Multiple characters must be specified with no space between them. For example, to specify the split characters a, b, and c, use the following option:

```
datalabelsplitchar="abc"
```

The DATALABEL= option and the DATALABELSPLIT=TRUE option must also be specified.

Interaction The DATALABELSPLITCHARDROP= option specifies whether the split characters are included in the data label or are dropped.

Notes When multiple characters are specified, the order of the characters in the list is not significant.

The split characters are case sensitive.

Tip Use the DATALABELSPLITJUSTIFY= option to specify the justification of the strings in the data label block.

DATALABELSPLITCHARDROP=TRUE | FALSE

specifies whether the split characters are included in the data labels.

TRUE

drops the split characters from the data label.

FALSE

includes the split characters in the data label.

When DATALABELSPLIT=TRUE and DATALABELSPLITCHARDROP=FALSE, each split character remains as the last character in the current line. The characters that follow the split character, up to and including the next split character, are then wrapped to the next line.

The following figure shows an example of a data label with the following specifications:

- the data label text for this label is Product*Group*A
- DATALABELSPLIT=TRUE
- DATALABELSPLITCHARDROP=TRUE | FALSE
- DATALABELSPLITCHAR="*"

When DATALABELSPLITCHARDROP=TRUE, the asterisks are removed from the label. When DATALABELSPLITCHARDROP=FALSE, each asterisk remains as the last character in the line prior to the new line.

Default TRUE. The split characters are dropped from the data label.

Requirement The DATALABEL= option and the DATALABELSPLIT=TRUE option must also be specified.

Interaction The DATALABELSPLITCHAR= option specifies the split characters.

See "boolean " on page xii for other Boolean values that you can use.

DATALABELSPLITJUSTIFY=AUTO | CENTER | LEFT | RIGHT
specifies the justification of the strings that are inside the data label blocks.

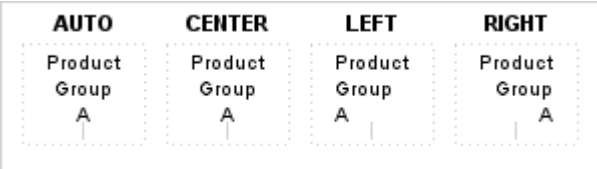
AUTO
justifies the labels based on the DATALABELPOSITION= option.

DATALABELPOSITION= Value	Justification
TOPLEFT, LEFT, or BOTTOMLEFT	RIGHT
TOPRIGHT, RIGHT, or BOTTOMRIGHT	LEFT
TOP, CENTER, or BOTTOM	CENTER

CENTER
LEFT
RIGHT
justifies the labels center, left, or right, as specified.

The following figure shows an example in which DATALABELPOSITION=TOP.

Note: The gray vertical line at the bottom of each label represents the horizontal center of the text box for reference.



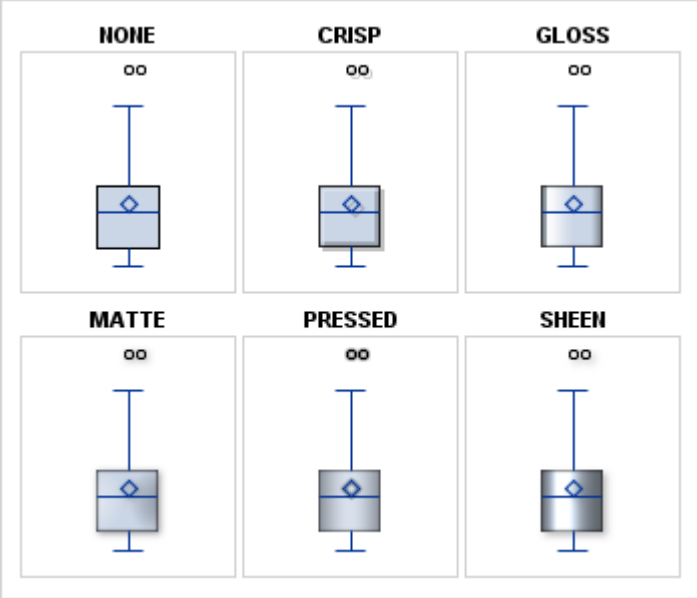
In this case, because DATALABELPOSITION=TOP, AUTO centers the lines of text. The text box is anchored the same way that the unsplit text is anchored. For example, if DATALABELPOSITION=TOP, then the bottom center of the text box is positioned at the top of the marker.

Default AUTO

Requirement The DATALABEL= option and the DATALABELSPLIT=TRUE option must also be specified.

Interaction This option has no effect if DATALABELPOSITION=AUTO.

DATASKIN=NONE | CRISP | GLOSS | MATTE | PRESSED | SHEEN
enhances the visual appearance of the filled boxes. The following figure shows boxes with each of the skins applied.



Default The DATASKIN= option value that is specified in the BEGINGRAPH statement. If that value is not specified, then the GraphSkins:DataSkin style element value is used.

Restriction Starting with SAS 9.4M1, the maximum number of skinned graphical elements is limited to 200 per plot in an OVERLAY or PROTOTYPE layout. When this limit is exceeded for a plot, the specified data skin is not applied to that plot. In that case, use the DATASKINMAX= option in your ODS GRAPHICS statement to increase the maximum limit.

Requirement For this option to have any effect, the fill must be enabled by the ODS style or the DISPLAY= option.

Interactions This option overrides the BEGINGRAPH statement DATASKIN= option.

The data skin appearance is based on the FILLATTRS= color.

When a data skin is applied, all bar outlines are set by the skin, and the OUTLINEATTRS= option is ignored.

DATATRANSPARENCY=*number*
specifies the degree of the transparency of the box outlines, box fill, whiskers, mean, median, caps, connect lines, outliers, and data labels, if displayed.

Default 0

Range 0–1, where 0 is opaque and 1 is entirely transparent

Tip The FILLATTRS= option can be used to set transparency for just the interior fill area of the boxes. You can combine this option with

FILLATTRS= to set one transparency for the box outlines and the whiskers, mean, median, caps, and connect lines, but a different transparency for the box fills. Example:

```
datatransparency=0.2 fillattrs=(transparency=0.6)
```

DISCRETEOFFSET=*number*
specifies an amount to offset all boxes from the discrete X ticks.

Default 0 (no offset, all boxes are centered on the discrete ticks)

Range -0.5 to +0.5, where 0.5 represents half the distance between discrete ticks. A positive offset is to the right when ORIENT=VERTICAL, and up when ORIENT=HORIZONTAL. (If the layout's axis options set REVERSE=TRUE, then the offset direction is also reversed.)

Restriction This option applies to discrete axes only. For nondiscrete axes, this option is ignored.

Tip Setting the discrete offset for the plots does not affect the axis minimum and maximum offsets. In some cases, setting a discrete offset can cause clipping at each end of the axis. In those cases, use the OFFSETMIN= and OFFSETMAX= axis options to increase the axis minimum and maximum offsets to accommodate the discrete offset.

See "About the DISCRETEOFFSET= Option" on page 393

DISPLAY=(*display-options*) | STANDARD | ALL
specifies which box-plot features to display.

(*display-options*)
specifies a space-separated list of one or more display options, enclosed in parentheses.

The list can contain one or more of the following options:

CAPS
displays caps at the ends of the whiskers

CONNECT
displays the line connecting multiple boxes

FILL
displays the box fill color

FILLPATTERN
displays the box fill pattern

Note This feature applies to SAS 9.4M5 and to later releases.

Tip By default, this option has no effect if the active ODS style does not specify a fill pattern. To display a fill pattern in that case, select an ODS style that supports fill patterns or use the FILLPATTERNATTRS= option to specify a fill pattern for the boxes.

MEAN
displays the mean symbol within the box

MEDIAN
displays the median line within the box

NOTCHES
displays notched boxes

OUTLIERS
displays markers for the outliers

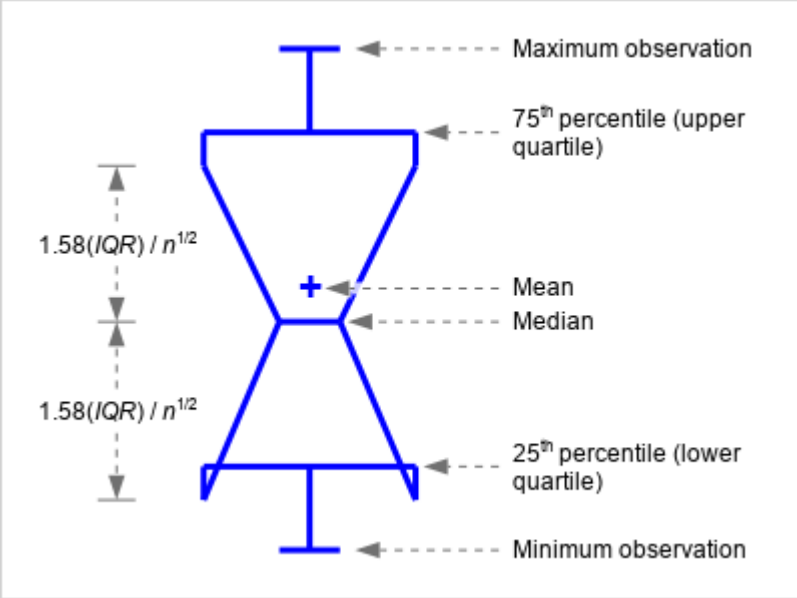
STANDARD
specifies CAPS, FILL, MEAN, MEDIAN, and OUTLIERS

ALL
specifies all features: CAPS, CONNECT, FILL, FILLPATTERN, MEAN, MEDIAN, NOTCHES, and OUTLIERS

The endpoints of the notches are at the following computed locations:

$$median \pm \frac{1.58\ IQR}{\sqrt{n}}$$

In the equation, IQR (IQR=Q3-Q1) is the interquartile range and *n* is the sample size. The medians (central lines) of the two boxes are significantly different at approximately the 0.05 level if the corresponding notches do not overlap.



Default The GraphBox:DisplayOpts style reference. If this style element does not exist, then the default is STANDARD.

Interaction If EXTREME= TRUE, then the OUTLIERS feature is ignored

Notes Starting with SAS 9.4M3, connect lines are drawn in axis order. They are drawn in data order in prior releases.

Starting with SAS 9.4M3, when DISPLAY= includes MEAN, the BOXPLOT statement contributes its mean markers to a discrete

legend when TYPE=MARKER is in effect in the DISCRETELEGEND statement.

Tips

To control the appearance of these features, use the CONNECTATTRS= , FILLATTRS= , MEANATTRS= , MEDIANATTRS= , OUTLIERATTRS= , and WHISKERATTRS= options. The WHISKERATTRS= option controls affects both CAPS and WHISKERS. Starting with SAS 9.4M5, use the FILLPATTERNATTRS= on page 380 option to control the appearance of the box fill pattern.

Regardless of which display options are being displayed, this option does not affect the axis range.

DISPLAYSTATS=NONE | STANDARD | ALL | (*statistics-list*)

specifies the statistics to be displayed for each box.

NONE

does not display any statistics.

STANDARD

displays N, MEAN, and STD.

ALL

displays all available statistics.

(*statistics-list*)

specifies a space-separated list of one or more statistics, enclosed in parentheses.

The list can include one or more of the following:

DATAMAX

maximum data value that includes not only the maximum whisker values but also the maximum outlier values.

This option is valid in SAS 9.4M1 and later releases. The DATAMAX value is greater than or equal to the MAX value and is always represented in the axis range.

DATAMIN

minimum data value that includes not only the minimum whisker values but also the minimum outlier values.

This option is valid in SAS 9.4M1 and later releases. The DATAMIN value is less than or equal to the MIN value and is always represented in the axis range.

IQR

interquartile range (Q3–Q1).

MAX

maximum data value below the box upper fence.

MEAN

mean data value for the box.

MEDIAN

median data value for the box.

MIN
minimum data value above the box lower fence.

N
number of observations for the box.

Q1
lower quartile (25th percentile) for the box.

Q3
upper quartile (75th percentile) for the box.

RANGE
range of the data (MAX–MIN).

STD
standard deviation of the data for the box.

SUMWGT
sum of the weights for the box.

This option is valid in SAS 9.4M1 and later releases.

Default NONE

Restrictions Prior to SAS 9.4M5, this option is ignored if ORIENT=HORIZONTAL. Starting with SAS 9.4M5, statistics can be displayed for both vertical and horizontal box plots.

This option is ignored if the GROUP= option is also specified.

Note The notches in the box plot can extend beyond DATAMIN and DATAMAX in some cases.

EXTREME=TRUE | FALSE
specifies whether the whiskers can extend beyond the fences. Fences are locations above and below the box. The upper and lower fences are located at a distance 1.5 times the Interquartile Range (IQR) (IQR = Q3 - Q1). The upper and lower far fences are located at a distance 3 times the IQR .

FALSE
specifies that whiskers be drawn from the upper edge of the box to the largest value within the upper fence, and from the lower edge of the box to the smallest value within the lower fence.

This representation is sometime called a schematic box plot or a Tukey box plot.

TRUE
specifies that whiskers be drawn to the largest and smallest data values, whether these values are inside or outside the fences.

The outliers and far outliers are not displayed and are not labeled. This representation is sometime called a *skeletal box and whisker plot*.

Default FALSE

Interaction This option overrides the DATALABEL= , DATALABELATTRS= , LABELFAR= , OUTLIERATTRS= , and SPREAD= options.

See "Statement Summary" on page 392

"boolean " on page xii for other Boolean values that you can use.

FILLATTRS=*style-element* | *style-element* (*fill-options*) | (*fill-options*)
specifies the appearance of the interior fill area of the boxes.

Defaults For non-grouped data, the GraphDataDefault:Color style reference.

For grouped data, the Color attribute of the GraphData1–GraphDataN style elements.

Interaction For this option to have any effect, the fill must be enabled by the ODS style or the DISPLAY= option.

Tip The DATATRANSPARENCY option sets the transparency for the box outlines, box fill, whiskers, mean, median, caps, connect lines, and outliers. You can combine this option with DATATRANSPARENCY= to set one transparency for the box outlines and the whiskers, mean, median, caps, and connect lines, but a different transparency for the box fills. Example:

```
datatransparency=0.2 fillattrs=(transparency=0.6)
```

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Fill Color Options" on page 1600 for available *fill-options*.

FILLPATTERNATTRS=*style-element* | (*fill-pattern-options*)
specifies the appearance of the pattern-filled areas.

Note: This feature applies to SAS 9.4M5 and to later releases.

Defaults For non-grouped data, the ContrastColor and FillPattern attributes of GraphDataDefault.

For grouped data, the ContrastColor and FillPattern attributes of GraphData1–GraphDataN.

Interaction For this option to take effect, the DISPLAY= option must include FILLPATTERN among the display options.

Tip In order to change the fill pattern for each group value in ODS styles such as HTMLBlue that use color-priority attribute rotation, specify ATTRPRIORITY=NONE in an ODS GRAPHICS statement or in the BEGINGRAPH statement in your graph template. For more information, see "Attribute Rotation Patterns" in *SAS Graph Template Language: User's Guide*.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Fill Pattern Options" on page 1601 for available *fill-pattern-options*.

FREQ=*numeric-column* | *expression*
specifies a numeric column that provides frequencies for each observation that is read.

Default All observations have a frequency count of 1.

Restriction If the value of *numeric-column* is missing or is less than 1 for an observation, then that observation is not used in the analysis. If the value is not an integer, then only the integer portion is used.

Note If *n* is the value of the numeric column for a given observation, then that observation is used *n* times for the purposes of any statistical computation. The marker for that observation is drawn *n* times, which increases the marker weight slightly with frequency.

GROUP=*column* | *discrete-attr-var* | *expression*
creates a box plot for each unique group value of the specified column.

discrete-attr-var
specifies a discrete attribute map variable.

The discrete attribute map variable is created by a DISCRETEATTRVAR statement.

Restriction A discrete attribute map variable specification must be a direct reference to the attribute map variable. It cannot be set by a dynamic variable.

A distinct box is created for each group value by varying the visual attributes of the box display features. The display features are controlled by the current ODS style or by the DISPLAY= option. The default group appearance for each display feature is shown in the following table.

Display Feature [1]	Style Attributes That Control Default Group Appearance
Fill color	Color and ContrastColor attributes of a GraphData1–GraphDataN style element or the GraphMissing style element. The Color attribute controls the fill color, and the ContrastColor attribute controls the outline color. The box outline line style is solid.
Fill pattern [2]	FillPattern and ContrastColor attributes of a GraphData1–GraphDataN style element or the GraphMissing style element. The ContrastColor attribute controls the color of the fill pattern and box outline. The box outline line style is solid. If the active ODS style does not specify FillPattern, fill patterns are not displayed by default.

Display Feature [1]	Style Attributes That Control Default Group Appearance
Median, caps, and notches	ContrastColor attribute of a GraphData1–GraphDataN style element or the GraphMissing style element with a solid line style.
Mean and outliers	MarkerSymbol and ContrastColor attributes of a GraphData1–GraphDataN style element or the GraphMissing style element.

1 The default display features are determined by the DisplayOpts attribute of the GraphBox style element.
2 Fill patterns are valid for box plots starting with SAS 9.4M5.

Interactions Connect lines are not drawn for grouped data.

The box plot display depends on the setting for the GROUPDISPLAY= option.

By default, the group values are mapped in the order of the data. The GROUPORDER= option can be used to control the sorting order of the group values. The INDEX= option can be used to alter the default sequence of colors and markers.

The INCLUDEMISSINGGROUP option controls whether missing group values are considered a distinct group value.

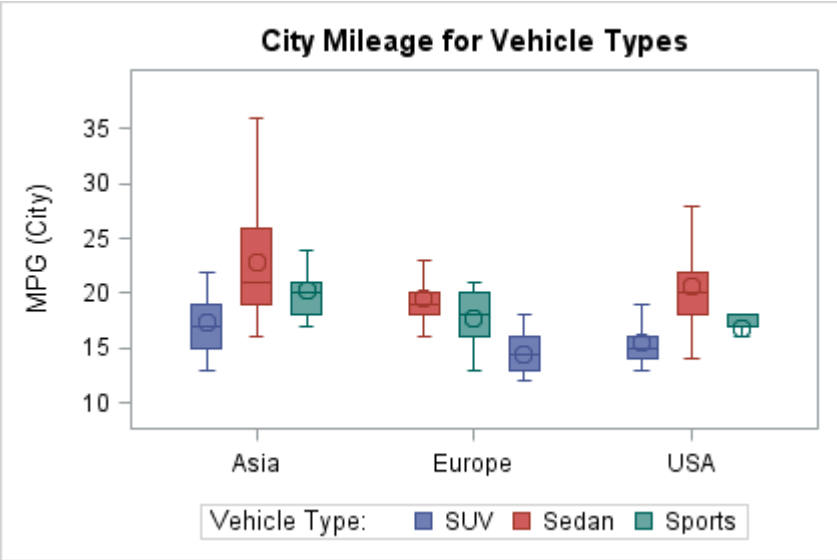
Tips The representations that are used to identify the groups can be overridden individually. For example, each distinct group value is represented by a different line pattern for the box outlines, but the PATTERN= setting in the OUTLIERATTRS= option could be used to assign the same line pattern to all box outlines and connect lines.

By default, ODS Graphics limits the number of groups to 1000. When this limit is exceeded, the GROUP= option is ignored. Use the GROUPMAX= option in the ODS GRAPHICS statement to change the maximum number of groups that can be processed.

See “Example 2: Box Plot of City MPG and Vehicle Type Grouped by Origin” on page 402

“DISCRETEATTRVAR Statement” on page 1516

GROUPDISPLAY=OVERLAY | CLUSTER
specifies how to display the boxes that represent group values for the coordinate pairs. The following example shows a box plot with GROUPDISPLAY=CLUSTER:



OVERLAY
draws boxes for a given group value at the exact coordinate.

Depending on the data, boxes at a given coordinate might overlap.

CLUSTER
draws boxes for a given group value adjacent to each other.

Default OVERLAY

Interaction This option is ignored unless GROUP= is specified.

Tip Use the CLUSTERWIDTH= option to control the width of the clusters when CLUSTER is in effect.

GROUPORDER=DATA | REVERSEDATA | ASCENDING | DESCENDING
specifies the ordering of the groups within a category.

DATA
orders the groups within a category in the group-column data order.

REVERSEDATA
orders the groups within a category in the reverse group-column data order.

Note: This feature applies to SAS 9.4M2 and to later releases.

Tip This option is useful when you want to reverse the category axis.

ASCENDING
orders the groups within a category in ascending order.

DESCENDING
orders the groups within a category in descending order.

Defaults DATA if the data is a SAS data set.

ASCENDING if the data is a CAS in-memory table. Sorting is based on nonformatted values for numeric group values or on formatted values for character group values.

Interactions This option is ignored if the GROUP= option is not also specified.

By default, the groups in the legend are shown in the order that is specified in GROUPORDER.

Notes When plotting a SAS data set, attributes such as color, symbol, and pattern are assigned to each group in DATA order by default. When plotting a CAS in-memory table, attributes are assigned in ascending order of the group column character values or unformatted numeric values by default.

The ASCENDING and DESCENDING settings linguistically sort the group values within each category (or X value) for display position purposes only. For numeric data, the order is based on the unformatted values. For character data, the order is based on the formatted values. The data order of the observations and the visual attributes that are assigned to the group values remain unchanged.

In SAS 9.4M6 and earlier releases, when data stored in a CAS in-memory table is used and DATA or REVERSEDATA is specified, unpredictable results might occur. To generate consistent graphs in that case, specify ASCENDING or DESCENDING. Starting with SAS Viya 3.5 and SAS Studio 5.2, when data stored in a CAS in-memory table is used and DATA or REVERSEDATA is specified, it is ignored, and ASCENDING is used instead.

INCLUDEMISSINGGROUP=TRUE | FALSE
specifies whether missing values of the group variable are included in the plot.

Default TRUE

Interaction For this option to take effect, the GROUP= option must also be specified.

Tip The attributes of the missing group value are determined by the GraphMissing style element unless a discrete attribute map is in effect, the INDEX= option is used, the MISSING= system option changes the default missing character, or a user-defined format is applied to the group value. In those cases, the attributes of the missing group value are determined by a GraphData1–GraphDataN style element instead of by the GraphMissing style element.

See “boolean ” on page xii for other Boolean values that you can use.

INDEX=*positive-integer-column* | *expression*
specifies indices for mapping box attributes (fill and outline) to one of the GraphData1–GranphDataN style elements.

Requirements The column or expression value must be an integer value of 1 or greater. Otherwise, this option is ignored.

The positive-integer column must not contain missing values. Otherwise, the entire column is invalidated and this option is ignored.

All of the indexes for a specific group value must be the same. Otherwise, the results are unpredictable.

Interaction For this option to take effect, the GROUP= option must also be specified.

Notes The index values are 1-based indices. For the style attributes in GraphData1–GraphDataN, if the index value is greater than N, then a modulo operation remaps that index value to a number less than N to determine which style to use.

If you do not use this option, then the group values are mapped in the order of the data.

Tip You can use indexing to collapse the number of groups that are represented in a graph. For more information, see "Remapping Groups for Grouped Data" on page 211.

INTERVALBOXWIDTH=AUTO | *dimension*

specifies the box width when an interval category (X) column is specified.

AUTO

the system determines the box width.

Prior to SAS 9.4M3, AUTO uses 85% of the smallest interval between any two boxes for the given plot. Starting with SAS 9.4M3, if the BOXWIDTH= option is specified, AUTO uses the BOXWIDTH= option value. Otherwise, it uses 85% of the smallest interval between any two boxes for the given plot.

uses one of the following box-width values listed in the order of precedence:

dimension

sets the box width to the specified value.

Default AUTO

Requirement The category axis (X by default) must be an interval axis for the INTERVALBOXWIDTH= option to have any effect.

Interaction Prior to SAS 9.4M3, this option controls the box width for an interval box plot. Starting with SAS 9.4M3, this option overrides the BOXWIDTH= option for an interval box plot.

Tip The box width that you specify with this option is honored even if the boxes overlap. If the boxes overlap, reduce the interval box width or use the BOXWIDTH= option instead.

See "dimension" on page xiii

LABELFAR=TRUE | FALSE

specifies whether all outliers or only far outliers are labeled.

FALSE
applies the labels specified by the DATALABEL= option to both the outliers and the far outliers.

TRUE
applies the labels specified by the DATALABEL= option to the far outliers.

Default FALSE

Interaction This option is ignored if EXTREME= TRUE or the DISPLAY= option does not display the outliers.

See "DATALABEL=*column* " on page 412

"Statement Summary" on page 392 for information about outliers.

"boolean " on page xii for other Boolean values that you can use.

LEGENDLABEL="*string*"
specifies a label to be used in a discrete legend for this plot.

Default The Y= column label. If a label is not defined, then the Y= column name is used.

Restriction This option applies only to an associated DISCRETELEGEND statement.

Interaction If the GROUP= option is specified, then this option is ignored.

MEANATTRS=*style-element* | *style-element* (*marker-options*) | (*marker-options*)
specifies the attributes of the marker representing the mean within the box.

Defaults For non-grouped data, GraphBoxMean style element.

For grouped data, the MarkerSymbol, Markersize, and ContrastColor attributes of the GraphData1–GraphDataN style elements.

Interaction This option is ignored if the DISPLAY= option does not display the mean.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Marker Options" on page 1604 for available *marker-options*.

MEDIANATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the appearance of the line representing the median within the box.

Defaults For non-grouped data, the GraphBoxMedian style element.

For grouped data, the LineStyle and LineThickness attritubes of the GraphBoxMedian style element, and the ContrastColor attribute of the GraphData1–GraphDataN style elements.

Interaction This option is ignored if the DISPLAY= option does not display the median.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

NAME="*string*"
assigns a name to this plot statement for reference in other template statements. The specified name is used primarily in legend statements to coordinate the use of colors and line patterns between the plot and the legend.

Restrictions The *string* is case sensitive, cannot contain spaces, and must define a unique name within the template.

This option does not support variables that are created by the DYNAMIC, MVAR, and NMVAR template statements.

Interaction The *string* is used as the default legend label if the LEGENDLABEL= option is not used.

ORIENT=VERTICAL | HORIZONTAL
specifies the orientation of the Y axis and of the boxes.

Default VERTICAL

OUTLIERATTRS=*style-element* | *style-element* (*marker-options*) | (*marker-options*)
specifies the attributes of the markers representing the outliers.

Defaults For non-grouped data, GraphOutlier style element.

For grouped data, the MarkerSymbol, Markersize, and ContrastColor attributes of the GraphData1–GraphDataN style elements.

Interaction This option is ignored if EXTREME= TRUE or the DISPLAY= option does not display the outliers.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Marker Options" on page 1604 for available *marker-options*.

OUTLIERTIP=(*role-list*) | NONE
specifies the information to display when the cursor is positioned over an outlier. If this option is used, then it replaces all of the information that is displayed by default. Roles for columns that do not contribute to the box plot can be specified along with roles that do contribute.

(*role-list*)
an ordered, space-separated list of unique BOXPLOT roles. BOXPLOT roles for OUTLIERTIP include X, Y, STAT, and DATALABEL.

Note In the data tip, the STAT role displays the text "outlier" or "far outlier" as applicable.

Example The following example displays data tips only for the column that is assigned to the X role:
```
OUTLIERTIP=(X)
```

Default The columns assigned to these roles are automatically included in the data tip information: X and Y .

Requirement To generate data tips, you must include an ODS GRAPHICS ON statement that specifies the IMAGEMAP option, and write the graphs to the ODS HTML destination.

Interaction The labels and formats for the OUTLIERTIP variables can be controlled with the TIPLABEL= and TIPFORMAT= options.

See the TIP= option for specifying the information to display when the cursor is positioned over a box or whisker in the box plot.

OUTLINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the appearance of the box outline.

Defaults For non-grouped data, the ContrastColor, LineThickness, and LineStyle attributes of the GraphOutlines style element.

For grouped data and filled boxes, the LineStyle and LineThickness attributes of the GraphOutlines style element, and the ContrastColor attribute of the GraphData1–GraphDataN style elements.

For grouped data and unfilled boxes, the LineThickness attribute of the GraphOutlines style element, and the ContrastColor and LineStyle attributes of the GraphData1–GraphDataN style elements.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

PERCENTILE=1 | 2 | 3 | 4 | 5
specifies one of five definitions used to calculate percentiles.

Default 5 (empirical distribution function with averaging)

Note The percentile definition and default are the same as those that are used by the PCTLDEF= option of the UNIVARIATE procedure and the QNTLDEF= option of the SUMMARY procedure.

See "Calculating Percentiles" on page 394

PRIMARY=TRUE | FALSE
specifies that the data columns for this plot and the plot type be used for determining default axis features. This option is needed only when two or more plots within an overlay-type layout contribute to a common axis.

Default FALSE

Restriction This option is ignored if the plot is placed under a GRIDDED or LATTICE layout block.

Note In an OVERLAY layout, only one plot in an overlay can be the primary plot on a per-axis basis. When no plot is designated as the primary plot, the first plot that can be a primary plot is considered the primary plot. If multiple plots specify PRIMARY=TRUE for the same axis, then the last such plot encountered is considered the primary plot.

See "When Plots Share Data and a Common Axis" on page 1046

"boolean " on page xii for other Boolean values that you can use.

SPREAD=TRUE | FALSE

specifies whether outliers with the same value are spread out to avoid overlap. For vertical box plots this means offsetting the outliers horizontally. If this option is false, then outliers with the same value are plotted in the same position, which means only one is visible.

Default FALSE

Interaction This option is ignored if EXTREME= TRUE or the DISPLAY= option does not display the outliers.

See "boolean " on page xii for other Boolean values that you can use.

TIP=(*role-list*) | NONE

specifies the information to display when the cursor is positioned over a box or whisker in the box plot. If this option is used, then it replaces all of the information that is displayed by default.

(*role-list*)

an ordered, space-separated list of unique BOXPLOT roles.

BOXPLOT roles for TIP include DATAMAX, DATAMIN, MAX, MIN, MEAN, MEDIAN, N, Q1, Q2, STD, SUMWGT, and X.

Note The roles DATAMAX, DATAMIN, and SUMWGT apply to SAS 9.4M1 and later releases.

Tip Statistics such as N, MIN, and MAX are special roles, They are not column-based like the X role.

Example The following example displays data tips only for the columns that are assigned to the roles X (CATEGORY) and the statistic MEAN:

```
TIP=(X MEAN)
```

NONE

suppresses data tips from the plot.

Default The columns assigned to these roles are automatically included in the data tip information: X, N, STD, MIN, MAX, Q1, Q3, MEAN, and MEDIAN.

Requirement To generate data tips in the output, you must include an ODS GRAPHICS ON statement that specifies the IMAGEMAP option, and you must write the output to the ODS HTML destination.

Interaction This option is ignored when the plot statement is in an OVERLAY or PROTOTYPE layout and the INCLUDERANGES= option is specified in the LINEAROPTS= or TIMEOPTS= option for either axis.

Tip The labels and formats for the TIP roles can be controlled with the TIPLABEL= and TIPFORMAT= options.

See the OUTLIERTIP= option for specifying the information to display when the cursor is positioned over an outlier.

TIPFORMAT=(*role-format-list*)
specifies display formats for tip columns. This option provides a way to control the formats of columns that appear in data tips.

(role-format-list)
a space-separated list of *role-name* = *format* pairs.

Example
```
TIP=(X Y)
TIPFORMAT=(X=4. Y=4.)
```

Default The column format of the column assigned to the role or BEST6 if no format is assigned to a numeric column.

Restriction Only the roles that appear in the OUTLIERTIP= or TIP= options are used.

Requirement A column must be assigned to each of the specified roles.

TIPLABEL=(*role-label-list*)
specifies display labels for tip columns. This option provides a way to control the labels of columns that appear in data tips.

role-label-list
a space-separated list of *rolename* ="*string*" pairs.

Example
```
TIP=(X)
TIPLABEL=(X="Type")
```

Default The column label or column name of the column assigned to the role.

Restriction Only the roles that appear in the OUTLIERTIP= or TIP= options are used.

Requirement A column must be assigned to each of the specified roles.

WEIGHT=*numeric-column* | *expression*
specifies a column that contains a statistics calculation *a priori* weight for each observation of the input data object.

Requirement The value must be nonnegative.

Note The values of the weight variable must be greater than zero. If the weight value for an observation is zero, negative, or missing, that observation is deleted from the analysis.

WHISKERATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the line properties of the whiskers and caps.

Defaults For non-grouped data, the GraphBoxWhisker style element.

For grouped data, the LineStyle and LineThickness attritubes of the GraphBoxWhisker style element, and the ContrastColor attribute of the GraphData1–GraphDataN style elements.

Restriction The caps are always drawn with a solid line.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

WHISKERPERCENTILE=*number*
specifies the whisker length, in percentile units. When this option is specified, *number* is used as the low percentile, and 100–*number* is used as the high percentile.

Here are some examples of values and their effect:

0 specifies the high and low extremes

10 specifies the 10th percentile low and the 90th percentile high

25 specifies the 25th percentile low and the 75th percentile high

Default The whiskers are drawn from the box to the most extreme point that is less than or equal to 1.5 times the IQR

Range 0–25

Notes When this option is specified, fences and far outliers are not drawn.

When this option is set to 25, no whiskers are drawn because the box extends from the 25th to the 75th percentile.

XAXIS=X | X2
specifies whether data are mapped to the primary X (bottom) axis or to the secondary X2 (top) axis.

Default X

Interactions This option is ignored if the X= argument is not specified.

The overall plot specification and the layout type determine the axis display. For more information, see "How Axis Features Are Determined" on page 1040.

YAXIS=Y | Y2
specifies whether data are mapped to the primary Y (left) axis or to the secondary Y2 (right) axis.

Default Y

Interaction The overall plot specification and the layout type determine the axis display. For more information, see "How Axis Features Are Determined" on page 1040.

Details

Statement Summary

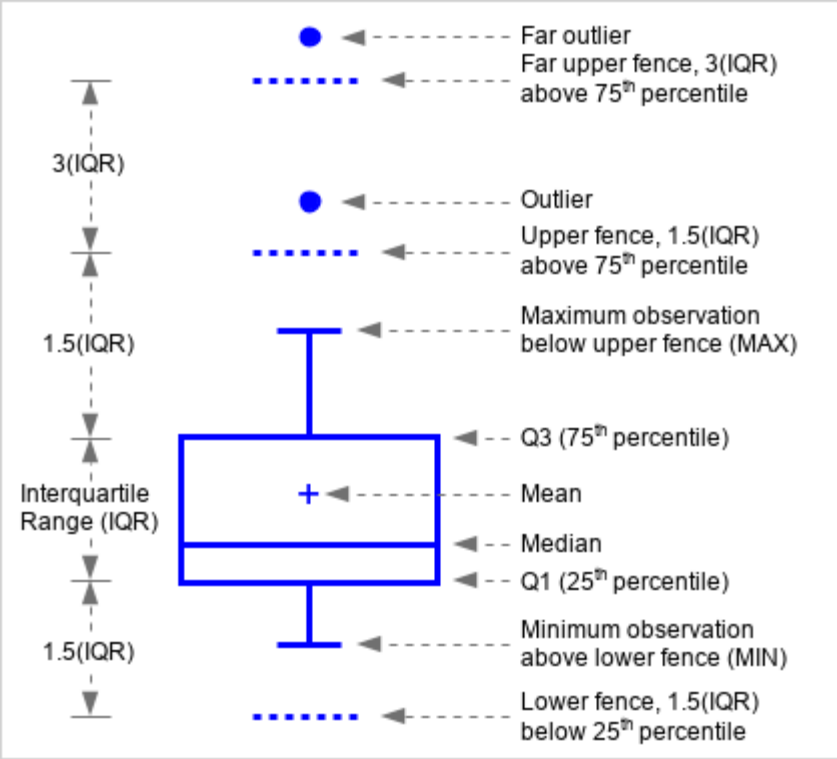
The BOXPLOT statement displays a single box if given just a Y argument. It displays multiple boxes if given both Y and X arguments and X has more than one unique value.

By default for numeric or character columns, the category (X) axis is TYPE=DISCRETE. You can override the default and set the TYPE= to LINEAR or TIME in the parent layout, provided that the X column is numeric. The axis for the analysis (Y) column is always LINEAR. When the X axis is LINEAR, you must use the INTERVALBOXWIDTH= option to specify the box width.

When ORIENT= VERTICAL, the X (or X2) axis is used for the X column and the Y (or Y2) axis is used for the Y column. When ORIENT=HORIZONTAL, the X (or X2) axis is used for the Y column and the Y (or Y2) axis is used for the X column.

Two basic box plot representations can be drawn with the BOXPLOT statement: a *schematic (Tukey) box plot* and a *skeletal box plot*. See the EXTREME= option for details.

The following figure illustrates the box plot elements:



As shown in the figure, the bottom and top edges of the box are located at the 25th and 75th percentiles of the sample. Within the box, you can display the median (50th percentile) as a line and the mean as a marker (see DISPLAY= option).

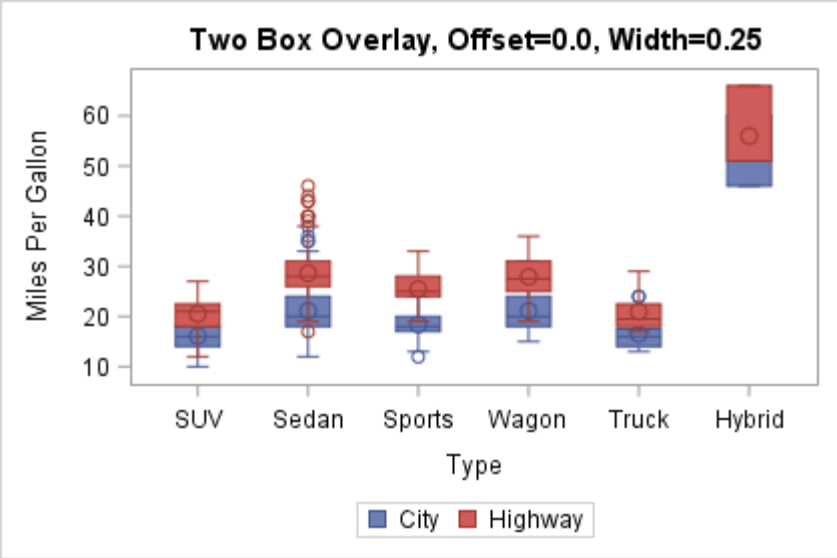
You can also display markers and data labels for outliers. Outliers are observations that are more extreme than the upper and lower fences ($\pm$ 1.5 IQR). Outliers that are beyond upper and lower far fences ($\pm$ 3 IQR) are called FAR OUTLIERS and can also be identified and labeled. From a graphical perspective, the locations of fences along the axis are known, but there is no line or marker that displays a fence. (See DISPLAY= , LABELFAR= , and DATALABEL= options).

Finally, you can control the range represented by the whiskers. By default, the whiskers are drawn from the upper edge of the box to the MAX value, and from the lower edge of the box to the MIN value. (See the EXTREME= option.)

About the DISCRETEOFFSET= Option

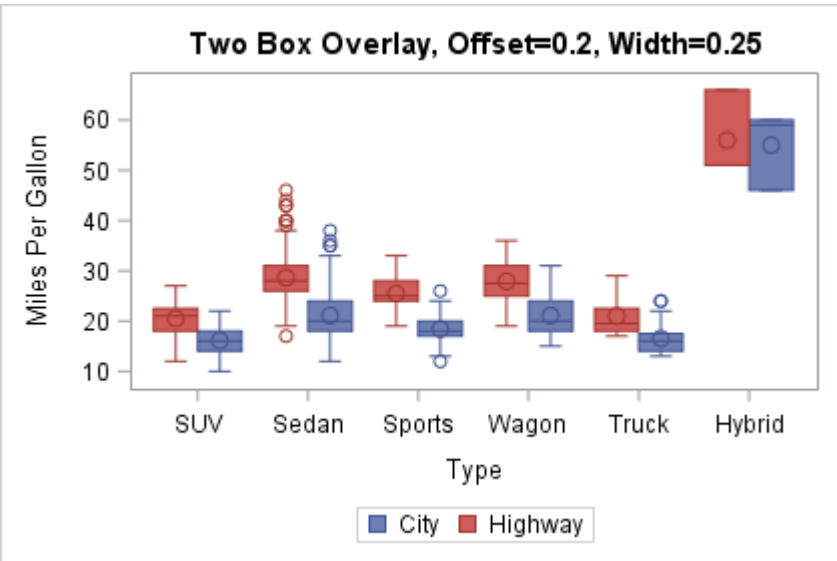
This feature is useful for graphing multiple response variables side by side on a common axis. By default within an overlay-type layout, if multiple BOXPLOT statements are used with different analysis variables, then the boxes for matching X values are centered on the ticks. Depending on the data, the boxes might be superimposed. The following code fragment shows the default box positioning:

```
layout overlay / cycleattrs=true
   yaxisopts=(label="Miles Per Gallon");
   boxplot x=type y=mpg_city / name="City"
      legendlabel="City";
   boxplot x=type y=mpg_highway / name="Highway"
      legendlabel="Highway";
   discretelegend "City" "Highway";
endlayout;
```



To place the different response values side by side, you can assign a different offset to each BOXPLOT statement. The BOXWIDTH= option can be used in conjunction with the DISCRETEOFFSET= option to create narrower boxes when desired.

```
layout overlay / cycleattrs=true
   yaxisopts=(label="Miles Per Gallon");
   boxplot x=type y=mpg_city / name="City"
      discreteoffset=0.2 legendlabel="City";
   boxplot x=type y=mpg_highway / name="Highway"
      discreteoffset=-0.2 legendlabel="Highway";
   discretelegend "City" "Highway";
endlayout;
```



Calculating Percentiles

You can specify one of five definitions for computing the percentiles with the PERCENTILE= option. Let n be the number of nonmissing values for a variable, and let $X_1, X_2, ..., X_n$ represent the ordered values of the variable. X_1 is the smallest

value, X_2 is the next smallest, and X_n is the largest value. Let the tth percentile be y, set:

$$p = \frac{t}{100}$$

and let:

$$np = j + g$$

when PERCENTILE=1, 2, 3, or 5, or let:

$$(n+1)p = j + g$$

when PERCENTILE=4, where j is the integer part of np, and g is the fractional part of np. Then the PERCENTILE= option defines the tth percentile, y, as described in the following table:

Percentile	Description	Equation	Notes
1	Weighted average at X_{np}	$y = (1-g)x_j + gx_{j+1}$	x_0 is taken to be x_1
2	Observation numbered closest to *np*	$y = x_j$	Used when $g < \frac{1}{2}$ or when $g = \frac{1}{2}$ and *j* is even
		$y = x_{j+1}$	Used when $g = \frac{1}{2}$ and *j* is odd or when $g > \frac{1}{2}$
3	Empirical distribution function	$y = x_j$	Used when $g = 0$
		$y = x_{j+1}$	Used when $g > 0$
4	Weighted average aimed at $x_{(n+1)p}$	$y = (1-g)x_j + gx_{j+1}$	x_{n+1} is taken to be x_n
5	Empirical distribution function with averaging	$y = \frac{1}{2}(x_j + x_{j+1})$	Used when $g = 0$
		$y = x_{j+1}$	Used when $g > 0$

Changing Box Plot Display

SAS defines graphical style elements that control the display of box plots generated with the BOXLOT or BOXPLOTPARM statement. Using these style elements as a starting point, you can change the style attribute values to achieve a very different appearance for your box plots. Using the DEFAULT style for an

example, here is a portion of the style template for elements that are related to box plots:

```
proc template;
  define style Default;
  ...
  style GraphBox /
    capstyle = "serif"
    connect = "mean"
    displayopts = "fill caps median mean outliers";
  style GraphBoxMean / ...;
  style GraphBoxMedian / ...;
  style GraphBoxOutlier / ...;
  style GraphBoxWhisker / ...;
  ...
  end;
run;
```

Table 6.1 *Style Elements and Their Purpose*

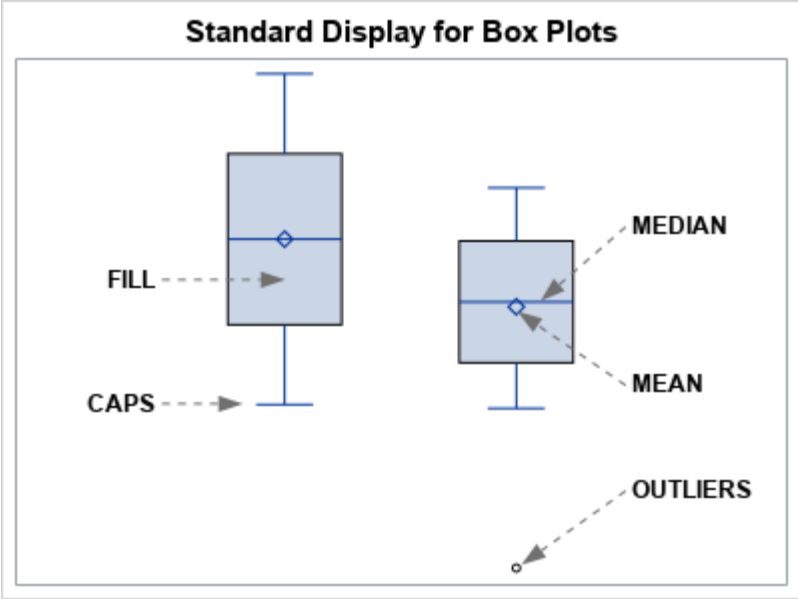
Style Element	Purpose
GraphBox	general box plot properties (see the next table)
GraphBoxMean	marker properties of mean marker (MARKERSYMBOL= , MARKERSIZE=, CONTRASTCOLOR=)
GraphBoxMedian	line properties of the median line (LINESTYLE=, LINETHICKNESS=, CONTRASTCOLOR=)
GraphBoxOutlier	marker properties of outliers (MARKERSYMBOL=, MARKERSIZE=, CONTRASTCOLOR=)
GraphBoxWhisker	line properties of whiskers and caps (LINESTYLE=, LINETHICKNESS=, CONTRASTCOLOR=)

Table 6.2 *Attributes and Values for the GraphBox Style Element*

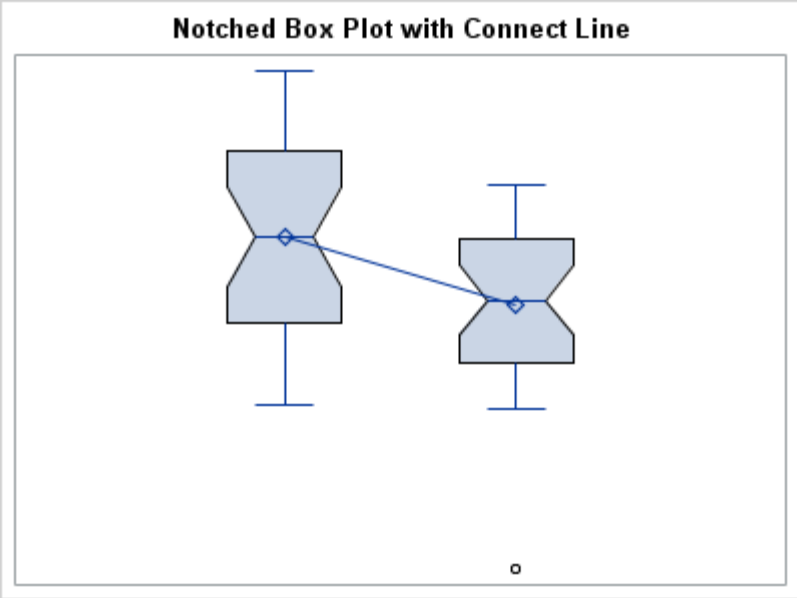
Attribute	Value(s)	Description
CONNECT=	"MEAN" | "MEDIAN" | "Q1" | "Q3" | "MIN" | "MAX"	statistic to connect with line
CAPSTYLE=	"SERIF" | "LINE" | "BRACKET"	shape at ends of whiskers
DISPLAYOPTS=	"<CAPS>	show caps at end of whiskers
	<FILL>	show filled boxes

Attribute	Value(s)	Description
	<MEAN>	show a marker for the mean
	<MEDIAN>	show a line for the median
	<OUTLIERS>	show markers for the outliers
	<CONNECT>	show line connecting same statistic on multiple boxes
	<NOTCHES>"	show notched boxes

The DisplayOpts attribute of GraphBox lists the general features to be displayed. The following diagram shows the standard display for box plots, as defined by the DEFAULT style. The keywords that are related to the appearance features are annotated:



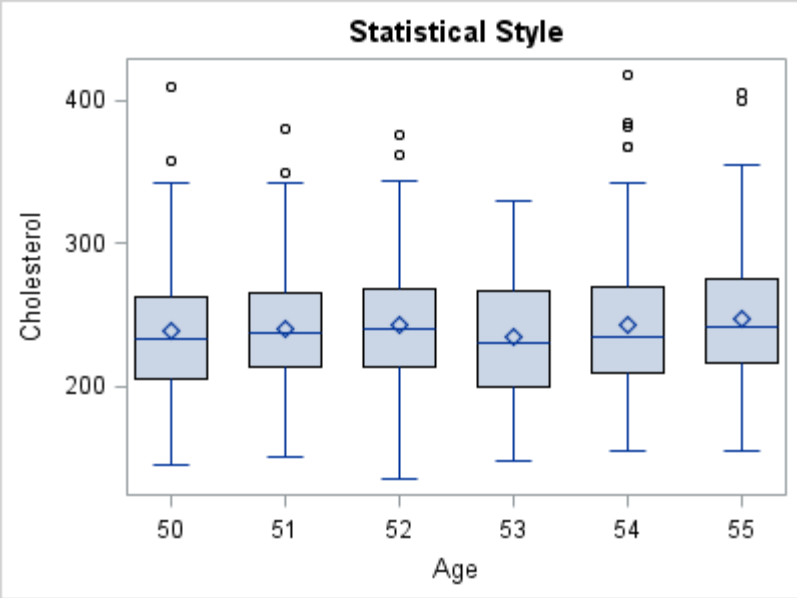
The two display options that are not the default are CONNECT (show connect lines) and NOTCHES.



The STATISTICAL style is derived from the DEFAULT style and inherits the GraphBox element from the parent DEFAULT style. The following code generates a box plot for the STATISTICAL style:

```
/* Specify a path for the ODS output */
filename odsout "output-path";

proc template;
  define statgraph boxplotdef;
  begingraph;
    entrytitle "Statistical Style";
    layout overlay / xaxisopts=(label="Age" type=linear);
      boxplot x=ageatstart y=cholesterol / intervalboxwidth=40;
    endlayout;
  endgraph;
end;

ods graphics / outputfmt=static;
ods _all_ close;
ods html path=odsout file="boxplot.html" style=statistical;

proc sgrender data=sashelp.heart template=boxplotdef;
  where ageatstart between 50 and 55;
run;

ods html close;
ods html; /* Not required in SAS Studio */
```

Here is the output.



For this example, the following attributes on the default box plot are changed:

- By default, serif caps are displayed at the end of the fences. Those caps are removed from the fence lines.
- By default, the boxes are filled. Empty, notched boxes are displayed.
- By default, the mean values are represented by hollow diamonds. Filled diamonds with a slightly reduced size are displayed.
- By default, the marker symbols for the outliers are hollow black circles. The size and shape of the marker symbols are changed, and the marker size is reduced.

To make these changes, you can derive a new style from the STATISTICAL style and set the attributes that you want to change. Any attribute settings that you do not change are inherited from the parent STATISTICAL style. The following style template effects the desired changes:

```
proc template;
  define style Boxplot;
  parent = styles.statistical;
    style GraphBox from GraphBox /
      capstyle = "line"
      displayopts = "caps median mean outliers notches";
    style GraphBoxMean from GraphBoxMean /
      markersymbol="diamondfilled"
      contrastcolor=GraphColors("gcdata1")
      markersize = 5px;
    style GraphOutlier from GraphOutlier /
      markersize = 5px
      markersymbol = "x"
      contrastcolor = GraphColors("gcdata2");
    end;
run;
```

Note the following:

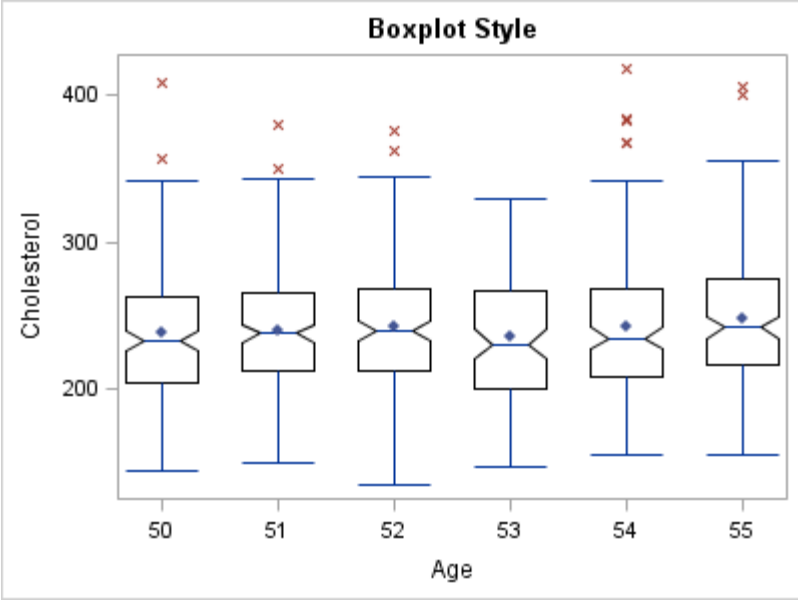
- The DEFINE STYLE statement assigns the name BOXPLOT to our new style, and sets the STATISTICAL style as the parent style.

- On the GraphBox style element, the CapStyle attribute is set to LINE, which removes the serif caps from the end of the fences. The DisplayOpts attribute drops the FILL value from the display list and adds the NOTCHES value; these changes determine that the graph displays empty, notched boxes.
- On the GraphBoxMean style element, the marker symbol is changed to a filled diamond and the marker size is reduced to 5 pixels (the default is 9 pixels). The ContrastColor attribute is set to GCDATA1 (the default is GCDATA).
- On the GraphBoxOutlier style element, the marker symbol is changed to an X and the marker size is reduced to 5 pixels (the default is 7 pixels). The CONTRASTCOLOR= attribute is set to GCDATA2 (the default is GCOUTLIER).

The following code generates a box plot for the BOXPLOT style:

```
/* Specify a path for the ODS output */
filename odsout "output-path";

proc template;
  define statgraph boxplotdef;
  begingraph;
    entrytitle "Boxplot Style";
    layout overlay / xaxisopts=(label="Age" type=linear);
      boxplot x=ageatstart y=cholesterol / intervalboxwidth=40;
    endlayout;
  endgraph;
end;

ods graphics / outputfmt=static;
ods _all_ close;
ods html path=odsout file="notchedboxplot.html" style=Boxplot;

proc sgrender data=sashelp.heart template=boxplotdef;
  where ageatstart between 50 and 55;
run;

ods html close;
ods html; /* Not required in SAS Studio */
```

Here is the output.



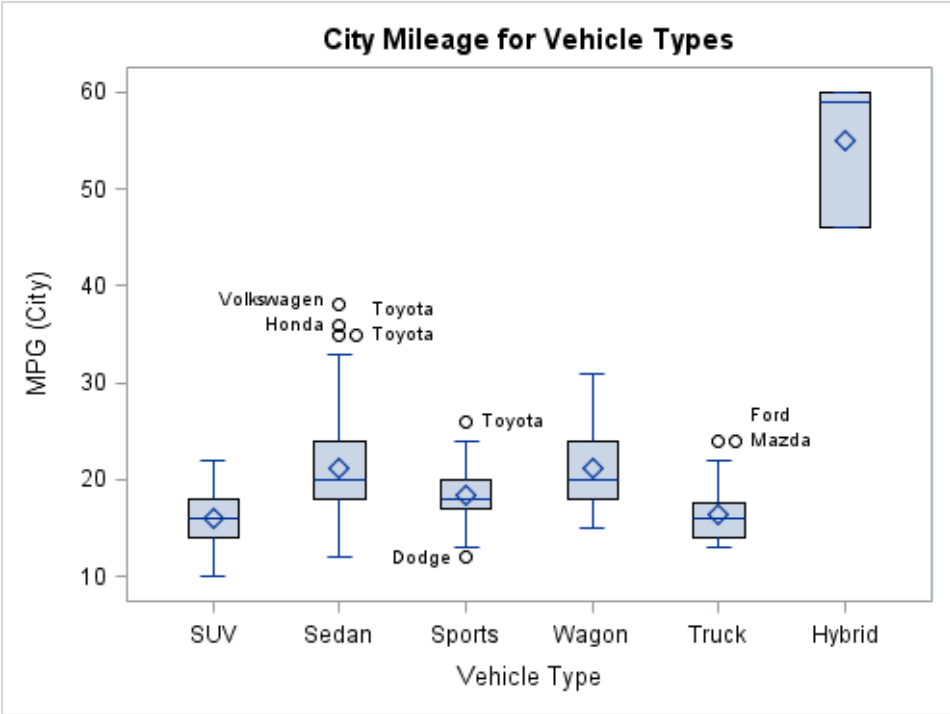
When making such style changes, remember that you are affecting all box plot displays for all procedures that produce box plots when this style is in effect. It is possible to change the box plot appearance for specific procedures, but to do this, a specific graph template must be modified, not a style template.

For a comprehensive description of the style elements affecting ODS graphics, see "Graph Style Elements Used by ODS Graphics" in *SAS Graph Template Language: User's Guide*.

Examples

Example 1: Box Plot of City MPG and Vehicle Type

The following graph was generated by the "Example Program" on page 402:

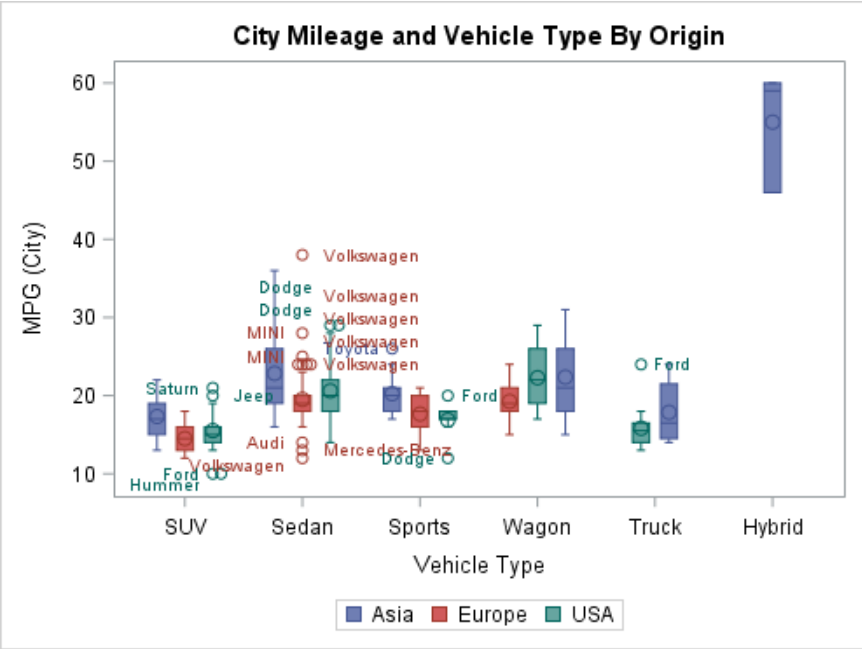


Example Program

```
proc template;
  define statgraph boxplot;
    begingraph;
      entrytitle "City Mileage for Vehicle Types";
      layout overlay /
        xaxisopts=(offsetmin=0.1 offsetmax=0.1);
        boxplot y=mpg_city x=type /
          datalabel=make spread=true;
      endlayout;
    endgraph;
  end;
run;

proc sgrender data=sashelp.cars template=boxplot;
  label type="Vehicle Type";
run;
```

Example 2: Box Plot of City MPG and Vehicle Type Grouped by Origin

The following graph was generated by the "Example Program" on page 403:



Example Program

```
proc template;
  define statgraph boxplot;
    begingraph;
      entrytitle "City Mileage and Vehicle Type By Origin";
      layout overlay /
        xaxisopts=(offsetmin=0.1 offsetmax=0.1);
        boxplot y=mpg_city x=type / name="box"
           group=origin groupdisplay=cluster
           spread=true datalabel=make;
        discretelegend "box";
      endlayout;
    endgraph;
  end;
run;
proc sgrender data=sashelp.cars template=boxplot;
  label type="Vehicle Type";
run;
```

BOXPLOTPARM Statement

Creates side-by-side box plots specified by parameters.

Requirements: The input data must be precomputed. See "Input Data Requirements for the BOXPLOTPARM Statement" on page 435.

Nonmissing Y values for statistical observations of Q1 and Q3 are required in order for a box to be drawn.

The statistical values, if present, must conform to the following rules in order for a box to be displayed:

```
Q1 <= MEDIAN <= Q3
MIN <= MAX
STD >= 0
N > 0
```

Tip: Starting with SAS 9.4M3, you can use subpixel rendering with this statement. It is enabled by default. To disable subpixel rendering, specify SUBPIXEL=OFF in the BEGINGRAPH statement or in an ODS GRAPHICS statement. For information about the BEGINGRAPH statement SUBPIXEL= option, see SUBPIXEL= on page 39. For information about the ODS GRAPHICS statement SUBPIXEL= option, see "ODS GRAPHICS Statement" on page 1561.

Syntax

BOXPLOTPARM Y=*numeric-column* | *expression*
STAT=*string-column* < /option(s) >;

BOXPLOTPARM X=*column* | *expression*
Y=*numeric-column* | *expression*
STAT=*string-column* < /*options* >;

Summary of Optional Arguments

Appearance options

BOXWIDTH=*number*
: specifies the width of a box as a ratio of the maximum possible width.

CAPSCALE=*positive-number*
: specifies a positive number to use as a multiplier for determining the default width of the whisker caps.

CAPSHAPE=SERIF | LINE | BRACKET | NONE
: specifies the shape at the ends of the whiskers.

CLUSTERWIDTH=*number*
: specifies the width of the group clusters as a fraction of the midpoint spacing or bin width.

CONNECT=MEAN | MEDIAN | Q1 | Q3 | MIN | MAX
: specifies that a connect line joins a statistic from box to box.

CONNECTATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
: specifies the attributes of the lines connecting multiple boxes.

CONNECTBREAK=TRUE | FALSE
: specifies whether the connect line is broken for values that have no observations.

DATASKIN=NONE | CRISP | GLOSS | MATTE | PRESSED | SHEEN
: enhances the visual appearance of the filled boxes.

DATATRANSPARENCY=*number*

specifies the degree of the transparency of the box outlines, box fill, whiskers, mean, median, caps, connect lines, outliers, and data labels, if displayed.

DISPLAY=(*display-options*) | STANDARD | ALL
specifies which box-plot features to display.

EXTREME=TRUE | FALSE
specifies whether the whiskers can extend beyond the fences.

FILLATTRS=*style-element* | *style-element* (*fill-options*) | (*fill-options*)
specifies the appearance of the interior fill area of the boxes.

FILLPATTERNATTRS=*style-element* | (*fill-pattern-options*)
specifies the appearance of the pattern-filled areas.

INDEX=*positive-integer-column* | *expression*
specifies indices for mapping box attributes (fill and outline) to one of the GraphData1–GranphDataN style elements.

INTERVALBOXWIDTH=AUTO | *dimension*
specifies the box width when an interval category (X) column is specified.

MEANATTRS=*style-element* | *style-element* (*marker-options*) | (*marker-options*)
specifies the attributes of the marker representing the mean within the box.

MEDIANATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the appearance of the line representing the median within the box.

ORIENT=VERTICAL | HORIZONTAL
specifies the orientation of the Y axis and of the boxes.

OUTLIERATTRS=*style-element* | *style-element* (*marker-options*) | (*marker-options*)
specifies the attributes of the markers representing the outliers.

OUTLINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the appearance of the box outline.

SPREAD=TRUE | FALSE
specifies whether outliers with the same value are spread out to avoid overlap.

WHISKERATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the line properties of the whiskers and caps.

Axes options

PRIMARY=TRUE | FALSE
specifies that the data columns for this plot and the plot type be used for determining default axis features.

XAXIS=X | X2
specifies whether data are mapped to the primary X (bottom) axis or to the secondary X2 (top) axis.

YAXIS=Y | Y2
specifies whether data are mapped to the primary Y (left) axis or to the secondary Y2 (right) axis.

Data tip options

OUTLIERTIP=(*role-list*) | NONE
: specifies the information to display when the cursor is positioned over an outlier.

ROLENAME=(*role-name-list*)
: specifies user-defined roles that can be used to display information in the data tips.

TIP=(*role-list*) | NONE
: specifies the information to display when the cursor is positioned over a box or whisker in the box plot.

TIPFORMAT=(*role-format-list*)
: specifies display formats for tip columns.

TIPLABEL=(*role-label-list*)
: specifies display labels for tip columns.

Label options

DATALABEL=*column*
: specifies the labels of the values that are identified as outlier or far outlier by the STAT= column.

DATALABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
: specifies the color and font attributes of the outlier labels.

DATALABELSPLIT=TRUE | FALSE
: specifies whether to split the data labels at the specified split characters.

DATALABELSPLITCHAR="*character-list*"
: specifies one or more characters on which the data labels can be split if needed.

DATALABELSPLITCHARDROP=TRUE | FALSE
: specifies whether the split characters are included in the data labels.

DATALABELSPLITJUSTIFY=AUTO | CENTER | LEFT | RIGHT
: specifies the justification of the strings that are inside the data label blocks.

LABELFAR=TRUE | FALSE
: specifies whether all outliers or only far outliers are labeled.

LEGENDLABEL="*string*"
: specifies a label to be used in a discrete legend for this plot.

Midpoint options

DISCRETEOFFSET=*number*
: specifies an amount to offset all boxes from the discrete X ticks.

GROUP=*column* | *discrete-attr-var* | *expression*
: creates a box plot for each unique group value of the specified column.

GROUPDISPLAY=OVERLAY | CLUSTER
: specifies how to display the boxes that represent group values for the coordinate pairs.

GROUPORDER=DATA | REVERSEDATA | ASCENDING | DESCENDING
: specifies the ordering of the groups within a category.

INCLUDEMISSINGGROUP=TRUE | FALSE

specifies whether missing values of the group variable are included in the plot.

ODS options

URL=*string-column*
specifies an HTML page that is displayed when a box or an outlier marker is selected.

Plot reference options

NAME="*string*"
assigns a name to this plot statement for reference in other template statements.

Statistics options

DISPLAYSTATS=NONE | STANDARD | ALL | (*statistics-list*)
specifies the statistics to be displayed for each box.

Required Arguments

Specifying only Y= creates a single box plot. Specifying both X= and Y= creates a box plot for each unique value of X.

Y=*numeric-column* | *expression*
specifies the column for the Y values. The Y values must be the statistical values needed for the box plot. At a minimum, there must be nonmissing values for the 25th and 75th percentiles.

X=*column* | *expression*
specifies the column for the X values. The X values must qualify or classify the values in the Y column. This optional argument is used to create a plot box for each classifier.

Restriction When you specify a numeric column for the X= argument and the category axis is an interval axis, you should not change the column value format. Doing so might result in incorrect output.

STAT=*string-column*
specifies the name of a column that contains the statistic represented by the value in the Y column. Valid STAT= column values include the following (see the requirements listed at the end of this description):

BOXWIDTH
specifies the width of the boxes as a ratio of the maximum possible width.

The range of values is 0 (narrowest) to 1 (widest). The default is 0.4. If the Y value corresponding to BOXWIDTH is in range, then it overrides the setting that is specified in the BOXWIDTH= option.

DATAMAX
specifies the maximum data value that includes not only the maximum whisker values but the maximum outlier values as well.

The DATAMAX value is greater than or equal to the MAX value and is always represented in the axis range.

Note This statistic is valid in SAS 9.4M1 and later releases.

DATAMIN
specifies the minimum data value that includes not only the minimum whisker values but the minimum outlier values as well.

The DATAMIN value is less than or equal to the MIN value and is always represented in the axis range.

Note This statistic is valid in SAS 9.4M1 and later releases.

FAROUTLIER
specifies the observations that are outside the lower and upper far fences.

The far fences are located at a distance 3 times the Interquartile Range (IQR = Q3–Q1) above and below the box. The far outliers are labeled when the DATALABEL= option is used. Specify that LABELFAR= TRUE to label only the far outliers but not the outliers.

MAX
specifies the maximum data value less than or equal to the upper fence.

MEAN
specifies the data mean.

MEDIAN
specifies the data median.

MIN
specifies the minimum data value greater than or equal to the lower fence.

N
specifies the subgroup sample size.

The N value is not shown in the plot but is used to calculate notch locations when the DISPLAY= option displays notches.

OUTLIER
specifies the observations that are outside the lower and upper fences.

The fences are located at a distance 1.5 times the Interquartile Range (IQR = Q3–Q1) above and below the box. The outliers are labeled when the DATALABEL= option is used.

Q1
specifies the 1st quartile (25th percentile).

The data must contain a nonmissing value for this quartile.

Q3
specifies the 3rd quartile (75th percentile).

The data must contain a nonmissing value for this quartile.

STD
specifies the data standard deviation.

SUMWGT
specifies the sum of the weights for the box.

Note This statistic is valid in SAS 9.4M1 and later releases.

Requirements Nonmissing Y values for STAT observations of Q1 and Q3 are required in order for a box to be drawn. Other STAT values can be omitted or have missing Y values.

The STAT values, if present, must conform to the following rules in order for a box to be displayed:

```
Q1 <= MEDIAN <= Q3
MIN <= MAX
STD >= 0
N > 0
```

Optional Arguments

BOXWIDTH=*number*
specifies the width of a box as a ratio of the maximum possible width.

Defaults For a discrete category axis, 0.4 for a nongrouped box plot or 0.6 for a grouped box plot.

For an interval category axis, 85% of the smallest interval between any two boxes for the given plot.

Range 0–1, where 0 is the narrowest and 1 is the widest.

Interactions For a grouped box plot with a discrete category axis when GROUPDISPLAY=CLUSTER, the box width is a percentage of the cluster width. See CLUSTERWIDTH.

This option is overridden by the Y value when the STAT= column value is BOXWIDTH and the corresponding Y value is within the range of 0–1.

Prior to SAS 9.4M3, for an interval box plot, this option is ignored, and the box width is controlled by the INTERVALBOXWIDTH= option. Starting with SAS 9.4M3, for an interval box plot, this option is ignored when the INTERVALBOXWIDTH= option is specified. Otherwise, the BOXWIDTH= option is honored.

CAPSCALE=*positive-number*
specifies a positive number to use as a multiplier for determining the default width of the whisker caps.

Note: This feature applies to SAS 9.4M5 and to later releases.

Default 1

Interaction This option is ignored when CAPSHAPE=NONE is in effect.

Tips Use the CAPSHAPE= option to specify the cap shape.

The thickness (height) of the SERIF, LINE, and BRACKET is determined by the thickness specified in the WHISKERATTRS= option. The cap line pattern is always solid.

Examples Double the size of the caps:

```
capscale=2
```

Reduce the size of the caps by 50%:

```
capscale=0.5
```

CAPSHAPE=SERIF | LINE | BRACKET | NONE
specifies the shape at the ends of the whiskers.

SERIF
specifies a short line perpendicular to the whisker.

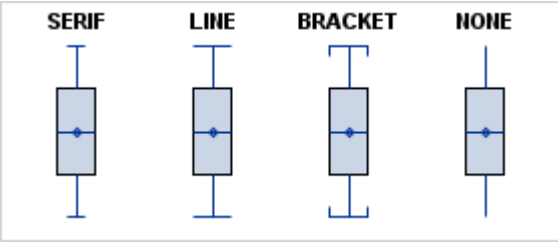
LINE
specifies a line perpendicular to the whisker that extends the width of the box.

BRACKET
specifies a line perpendicular to the whiskers that extends the width of the box and that has short extensions at each end.

The extensions are drawn in the direction of the box.

NONE
specifies that no shape appears at the ends of the whiskers.

The following figure shows each of the shapes.



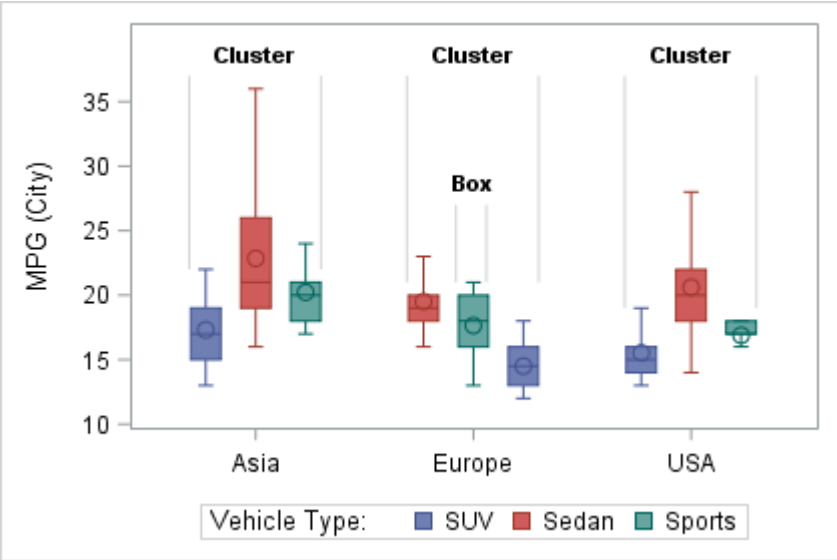
Default SERIF

Interactions The cap color and the thickness are specified by the WHISKERATTRS= option. The cap pattern is always solid.

The DISPLAY= option must include CAPS in order for cap lines to be shown.

Starting with SAS 9.4M5, when CAPSCALE= is in effect, the display width for the caps is the cap's default width multiplied by the value specified in CAPSCALE=.

CLUSTERWIDTH=*number*
specifies the width of the group clusters as a fraction of the midpoint spacing or bin width.



Default 0.7

Range 0–1, where 0 is the minimum width, which is one pixel wide, and 1 is the maximum possible width

Requirement For this option to take effect, the GROUP= option must also be specified, and the GROUPDISPLAY= option must be set to CLUSTER.

CONNECT=MEAN | MEDIAN | Q1 | Q3 | MIN | MAX
specifies that a connect line joins a statistic from box to box.

Default The GraphBox:Connect style reference.

Requirement The DISPLAY= option must contain the CONNECT *display-options* value in order for the connect line to be displayed.

Interaction This option applies only when the X= argument is used to generate multiple boxes.

Note Starting with SAS 9.4M3, the connect lines are drawn in axis order. In prior releases, they are drawn in data order.

CONNECTATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the attributes of the lines connecting multiple boxes.

Default The GraphConnectLine style element.

Interactions If there is only one box, then this option is ignored.

If the DISPLAY= option does not include CONNECT, or if the GROUP= option is used, then this option is ignored.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

CONNECTBREAK=TRUE | FALSE
specifies whether the connect line is broken for values that have no observations.

Note: This feature applies to SAS 9.4M5 and to later releases.

Default FALSE

Requirement DISPLAY= must include CONNECT for this option to have any effect.

Interaction This option is ignored when the GROUP= option is in effect.

DATALABEL=*column*
specifies the labels of the values that are identified as outlier or far outlier by the STAT= column. Either a numeric or a character column can be used.

Default No data labels are displayed

Interaction This option is ignored if EXTREME= TRUE or the DISPLAY= option does not display the outliers.

See the LABELFAR= option

DATALABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font attributes of the outlier labels.

Default The GraphDataText style element.

Interaction This option is ignored if EXTREME= TRUE or the DISPLAY= option does not display the outliers.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Text Options" on page 1606 for available *text-options*.

DATALABELSPLIT=TRUE | FALSE
specifies whether to split the data labels at the specified split characters. When set to TRUE, the data label is split unconditionally at each occurrence of any of the specified split characters.

Default FALSE. The data labels are not split.

Requirement The DATALABEL= option must also be specified.

Interaction The DATALABELSPLITCHAR= option specifies one or more characters on which splits can occur.

See "boolean " on page xii for other Boolean values that you can use.

DATALABELSPLITCHAR="*character-list*"
specifies one or more characters on which the data labels can be split if needed. When multiple split characters are specified, each character in the list is treated

as a separate split character unless the specified characters appear consecutively in the data label. In that case, all of the specified split characters together are treated as a single split character.

When DATALABEL= is specified and DATALABELSPLIT=TRUE, the data label is split unconditionally at each occurrence of any of the specified split characters. If the data label does not contain any of the specified characters, then the label is not split.

"character-list"
one or more characters with no space between each character and enclosed in quotation marks.

Default A blank space

Requirements The list of characters must be enclosed in quotation marks.

Multiple characters must be specified with no space between them. For example, to specify the split characters a, b, and c, use the following option:

```
datalabelsplitchar="abc"
```

The DATALABEL= option and the DATALABELSPLIT=TRUE option must also be specified.

Interaction The DATALABELSPLITCHARDROP= option specifies whether the split characters are included in the data label or are dropped.

Notes When multiple characters are specified, the order of the characters in the list is not significant.

The split characters are case sensitive.

Tip Use the DATALABELSPLITJUSTIFY= option to specify the justification of the strings in the data label block.

DATALABELSPLITCHARDROP=TRUE | FALSE
specifies whether the split characters are included in the data labels.

TRUE
drops the split characters from the data label.

FALSE
includes the split characters in the data label.

When DATALABELSPLIT=TRUE and DATALABELSPLITCHARDROP=FALSE, each split character remains as the last character in the current line. The characters that follow the split character, up to and including the next split character, are then wrapped to the next line.

The following figure shows an example of a data label with the following specifications:

- the data label text for this label is Product*Group*A
- DATALABELSPLIT=TRUE
- DATALABELSPLITCHARDROP=TRUE | FALSE

- DATALABELSPLITCHAR="*"

When DATALABELSPLITCHARDROP=TRUE, the asterisks are removed from the label. When DATALABELSPLITCHARDROP=FALSE, each asterisk remains as the last character in the line prior to the new line.

Default TRUE. The split characters are dropped from the data label.

Requirement The DATALABEL= option and the DATALABELSPLIT=TRUE option must also be specified.

Interaction The DATALABELSPLITCHAR= option specifies the split characters.

See "boolean " on page xii for other Boolean values that you can use.

DATALABELSPLITJUSTIFY=AUTO | CENTER | LEFT | RIGHT
specifies the justification of the strings that are inside the data label blocks.

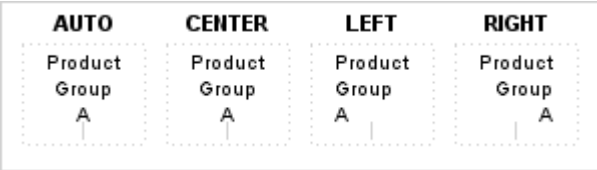
AUTO
justifies the labels based on the DATALABELPOSITION= option.

DATALABELPOSITION= Value	Justification
TOPLEFT, LEFT, or BOTTOMLEFT	RIGHT
TOPRIGHT, RIGHT, or BOTTOMRIGHT	LEFT
TOP, CENTER, or BOTTOM	CENTER

CENTER
LEFT
RIGHT
justifies the labels center, left, or right, as specified.

The following figure shows an example in which DATALABELPOSITION=TOP.

Note: The gray vertical line at the bottom of each label represents the horizontal center of the text box for reference.



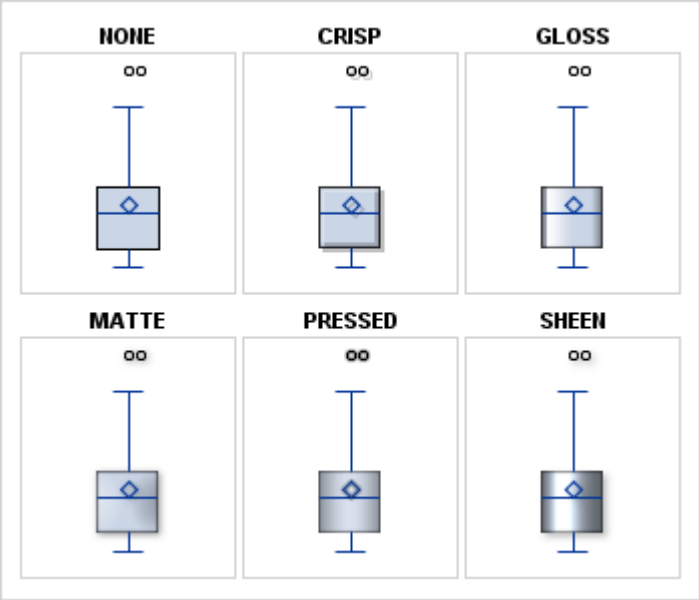
In this case, because DATALABELPOSITION=TOP, AUTO centers the lines of text. The text box is anchored the same way that the unsplit text is anchored. For example, if DATALABELPOSITION=TOP, then the bottom center of the text box is positioned at the top of the marker.

Default AUTO

Requirement The DATALABEL= option and the DATALABELSPLIT=TRUE option must also be specified.

Interaction This option has no effect if DATALABELPOSITION=AUTO.

DATASKIN=NONE | CRISP | GLOSS | MATTE | PRESSED | SHEEN
enhances the visual appearance of the filled boxes. The following figure shows boxes with each of the skins applied.



Default The DATASKIN= option value that is specified in the BEGINGRAPH statement. If that value is not specified, then the GraphSkins:DataSkin style element value is used.

Restriction Starting with SAS 9.4M1, the maximum number of skinned graphical elements is limited to 200 per plot in an OVERLAY or PROTOTYPE layout. When this limit is exceeded for a plot, the specified data skin is not applied to that plot. In that case, use the DATASKINMAX= option in your ODS GRAPHICS statement to increase the maximum limit.

Requirement For this option to have any effect, the fill must be enabled by the ODS style or the DISPLAY= option.

Interactions This option overrides the BEGINGRAPH statement DATASKIN= option.

The data skin appearance is based on the FILLATTRS= color.

When a data skin is applied, all bar outlines are set by the skin, and the OUTLINEATTRS= option is ignored.

DATATRANSPARENCY=*number*
specifies the degree of the transparency of the box outlines, box fill, whiskers, mean, median, caps, connect lines, outliers, and data labels, if displayed.

Default 0

Range 0–1, where 0 is opaque and 1 is entirely transparent

Tip The FILLATTRS= option can be used to set transparency for just the interior fill area of the boxes. You can combine this option with FILLATTRS= to set one transparency for the box outlines and the whiskers, mean, median, caps, and connect lines, but a different transparency for the box fills. Example:

```
datatransparency=0.2 fillattrs=(transparency=0.6)
```

DISCRETEOFFSET=*number*
specifies an amount to offset all boxes from the discrete X ticks.

Default 0 (no offset, all boxes are centered on the discrete ticks)

Range -0.5 to +0.5, where 0.5 represents half the distance between discrete ticks. A positive offset is to the right when ORIENT=VERTICAL, and up when ORIENT=HORIZONTAL. (If the layout's axis options set REVERSE=TRUE, then the offset direction is also reversed.)

Restriction This option applies to discrete axes only. For nondiscrete axes, this option is ignored.

Tip Setting the discrete offset for the plots does not affect the axis minimum and maximum offsets. In some cases, setting a discrete offset can cause clipping at each end of the axis. In those cases, use the OFFSETMIN= and OFFSETMAX= axis options to increase the axis minimum and maximum offsets to accommodate the discrete offset.

See "About the DISCRETEOFFSET= Option" on page 438

DISPLAY=(*display-options*) | STANDARD | ALL
specifies which box-plot features to display.

(*display-options*)
specifies a space-separated list of one or more display options, enclosed in parentheses.

The list can contain one or more of the following options:

CAPS
displays caps at the ends of the whiskers

CONNECT
displays the line connecting multiple boxes

FILL
displays the box fill color

FILLPATTERN
displays the box fill pattern

Note This feature applies to SAS 9.4M5 and to later releases.

Tip By default, this option has no effect if the active ODS style does not specify a fill pattern. To display a fill pattern in that case, select an ODS style that supports fill patterns or use the FILLPATTERNATTRS= option to specify a fill pattern for the boxes.

MEAN
displays the mean symbol within the box

MEDIAN
displays the median line within the box

NOTCHES
displays notched boxes

OUTLIERS
displays markers for the outliers

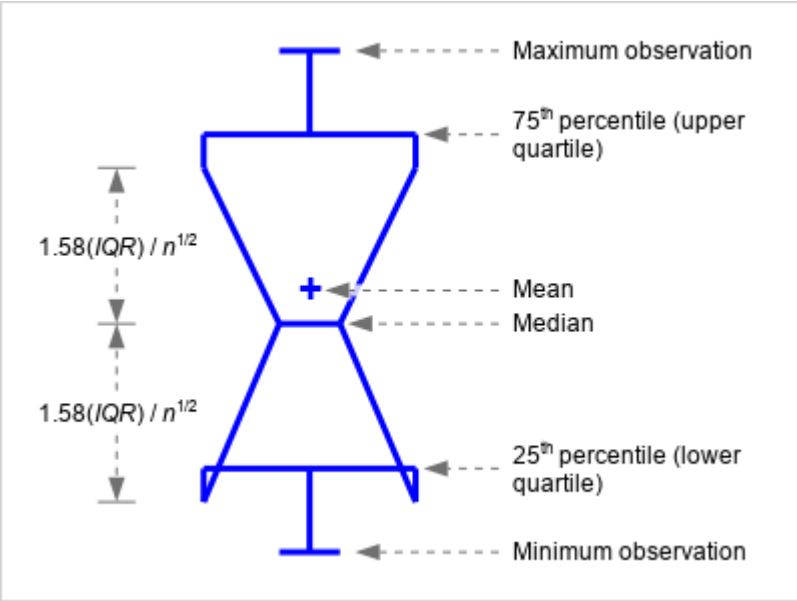
STANDARD
specifies CAPS FILL MEAN MEDIAN, and OUTLIERS

ALL
specifies all features: CAPS, CONNECT, FILL, FILLPATTERN, MEAN, MEDIAN, NOTCHES, and OUTLIERS

The endpoints of the notches are at the following computed locations:

$$median \pm \frac{1.58\ IQR}{\sqrt{n}}$$

In the equation, IQR is the interquartile range and *n* is the sample size.



Default The GraphBox:DisplayOpts style reference. If this style element does not exist, then the default is STANDARD.

Restriction The display features requested can be displayed only if the input data includes this information.

Interaction If EXTREME= TRUE, then the OUTLIERS feature is ignored

Notes Starting with SAS 9.4M3, the connect lines are drawn in axis order. They are drawn in data order in prior releases.

Starting with SAS 9.4M3, when DISPLAY= includes MEAN, the BOXPLOTPARM statement contributes its mean markers to a discrete legend when TYPE=MARKER is in effect in the DISCRETELEGEND statement.

Tips To control the appearance of these features, use the CONNECTATTRS= , FILLATTRS= , MEANATTRS= , MEDIANATTRS= , OUTLIERATTRS= , and WHISKERATTRS= options. The WHISKERATTRS= option controls affects both CAPS and WHISKERS. Starting with SAS 9.4M5, use the FILLPATTERNATTRS= on page 421 option to control the appearance of the box fill pattern.

Regardless of which display options are being displayed, this option does not affect the axis range.

DISPLAYSTATS=NONE | STANDARD | ALL | (*statistics-list*)
specifies the statistics to be displayed for each box.

NONE
does not display any statistics.

STANDARD
displays N, MEAN, and STD.

ALL
displays all available statistics.

(*statistics-list*)
specifies a space-separated list of one or more statistics, enclosed in parentheses.

The list can include one or more of the following:

DATAMAX
maximum data value that includes not only the maximum whisker values but also the maximum outlier values.

This option is valid in SAS 9.4M1 and later releases. The DATAMAX value is greater than or equal to the MAX value and is always represented in the axis range.

DATAMIN
minimum data value that includes not only the minimum whisker values but also the minimum outlier values.

This option is valid in SAS 9.4M1 and later releases. The DATAMIN value is less than or equal to the MIN value and is always represented in the axis range.

IQR
interquartile range (Q3–Q1).

MAX
maximum data value below the box upper fence.

MEAN
mean data value for the box.

MEDIAN
median data value for the box.

MIN
minimum data value above the box lower fence.

N
number of observations for the box.

Q1
lower quartile (25th percentile) for the box.

Q3
upper quartile (75th percentile) for the box.

RANGE
range of the data (MAX–MIN).

STD
standard deviation of the data for the box.

SUMWGT
sum of the weights for the box.

This option is valid in SAS 9.4M1 and later releases.

Default NONE

Restrictions Prior to SAS 9.4M5, this option is ignored if ORIENT=HORIZONTAL. Starting with SAS 9.4M5, statistics can be displayed for both vertical and horizontal box plots.

This option is ignored if the GROUP= option is also specified.

Only those statistics that are included in the STAT= column can be displayed. RANGE requires both MAX and MIN to be included. IQR requires both Q1 and Q3 to be included.

Note The notches in the box plot can extend beyond DATAMIN and DATAMAX in some cases.

EXTREME=TRUE | FALSE
specifies whether the whiskers can extend beyond the fences. Fences are locations above and below the box. The upper and lower fences are located at a distance 1.5 times the Interquartile Range (IQR) (IQR = Q3 - Q1). The upper and lower far fences are located at a distance 3 times the IQR .

FALSE
specifies that whiskers be drawn from the upper edge of the box to the largest value within the upper fence, and from the lower edge of the box to the smallest value within the lower fence.

This representation is sometime called a schematic box plot or a Tukey box plot.

TRUE
specifies that whiskers be drawn to the largest and smallest data values, whether these values are inside or outside the fences.

The outliers and far outliers are not displayed and are not labeled. This representation is sometime called a *skeletal box and whisker plot*.

Default FALSE

Interaction This option overrides the DATALABEL= , DATALABELATTRS= , LABELFAR= , OUTLIERATTRS= , and SPREAD= options.

See “Statement Summary” on page 434

“boolean ” on page xii for other Boolean values that you can use.

FILLATTRS=*style-element* | *style-element* (*fill-options*) | (*fill-options*)
specifies the appearance of the interior fill area of the boxes.

Defaults For non-grouped data, the Color attribute of GraphDataDefault style element.

For grouped data, the Color attribute of GraphData1–GraphDataN style elements.

Interaction For this option to have any effect, the fill must be enabled by the ODS style or the DISPLAY= option.

Tip The DATATRANSPARENCY= option sets the transparency for the box outlines, box fill, whiskers, mean, median, caps, connect lines, and outliers. You can combine this option with DATATRANSPARENCY= to set one transparency for the box outlines and the whiskers, mean, median, caps, and connect lines, but a different transparency for the box fills. Example:

```
datatransparency=0.2 fillattrs=(transparency=0.6)
```

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Fill Color Options" on page 1600 for available *fill-options*.

FILLPATTERNATTRS=*style-element* | (*fill-pattern-options*)
specifies the appearance of the pattern-filled areas.

Note: This feature applies to SAS 9.4M5 and to later releases.

Defaults For non-grouped data, the ContrastColor and FillPattern attributes of GraphDataDefault.

For grouped data, the ContrastColor and FillPattern attributes of GraphData1–GraphDataN.

Interaction For this option to take effect, the DISPLAY= option must include FILLPATTERN among the display options.

Tip In order to change the fill pattern for each group value in ODS styles such as HTMLBlue that use color-priority attribute rotation, specify ATTRPRIORITY=NONE in an ODS GRAPHICS statement or in the BEGINGRAPH statement in your graph template. For more information, see "Attribute Rotation Patterns" in *SAS Graph Template Language: User's Guide*.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Fill Pattern Options" on page 1601 for available *fill-pattern-options*.

GROUP=*column* | *discrete-attr-var* | *expression*
creates a box plot for each unique group value of the specified column.

discrete-attr-var
specifies a discrete attribute map variable.

The discrete attribute map variable is created by a DISCRETEATTRVAR statement.

Restriction A discrete attribute map variable specification must be a direct reference to the attribute map variable. It cannot be set by a dynamic variable.

The box plot display depends on the setting for the GROUPDISPLAY= option. This option can be used to group the box plots in the display.

A distinct box is created for each group value by varying the visual attributes of the box display features. The display features are controlled by the current ODS style or by the DISPLAY= option. The default group appearance for each display feature is shown in the following table.

Display Feature [1]	Style Attributes That Control Default Group Appearance
Fill color	Color and ContrastColor attributes of a GraphData1–GraphDataN style element or the GraphMissing style element. The Color attribute controls the fill color, and the ContrastColor attribute controls the outline color. The box outline line style is solid.
Fill pattern [2]	FillPattern and ContrastColor attributes of a GraphData1–GraphDataN style element or the GraphMissing style element. The ContrastColor attribute controls the color of the fill pattern and box outline. The box outline line style is solid. If the active ODS style does not specify FillPattern, fill patterns are not displayed by default.
Median, caps, and notches	ContrastColor attribute of a GraphData1–GraphDataN style element or the GraphMissing style element with a solid line style.
Mean and outliers	MarkerSymbol and ContrastColor attributes of a GraphData1–GraphDataN style element or the GraphMissing style element.

1 The default display features are determined by the DisplayOpts attribute of the GraphBox style element.

2 Fill patterns are valid for box plots starting with SAS 9.4M5.

Defaults

If box fills are enabled by the ODS style or by the DISPLAY= option, then each distinct group value is represented in the plot by a different fill color. Starting with SAS 9.4M5, each distinct group value can be represented by a different fill pattern, with or without a different fill color. The fill color and fill pattern are defined by the Color and FillPattern attributes of the GraphData1–GraphDataN and GraphMissing style elements.

If only box outlines are enabled by the ODS style or by the DISPLAY= option, then each distinct group value is represented in the plot by a different box outline color and line style. The outline colors and line styles are defined by the ContrastColor and LineStyle attributes of the GraphData1–GraphDataN style elements.

Each distinct group value is represented in the plot by a different box outline color. The outline colors are defined by the

ContrastColor attribute of the GraphData1–GraphDataN and GraphMissing style elements.

If the MEDIAN, CAPS, or NOTCHES are enabled by the DISPLAY= option, then each of these features uses the same color as the box outline. Line styles do not change by group value.

If the MEAN or OUTLIERS are enabled by the DISPLAY= option, then each distinct group value is represented by a different marker. The markers are defined by the MarkerSymbol and ContrastColor attributes of the GraphData1–GraphDataN and GraphMissing style elements. A marker is used for both MEAN and OUTLIERS, if displayed.

Interactions Connect lines are not drawn for grouped data.

This option causes the DISPLAY=(CONNECT) and the CONNECT= options to be ignored.

Tips By default, the group values are mapped in the order of the data. The GROUPORDER= option can be used to control the sorting order of the group values. The INDEX= option can be used to alter the default sequence of colors and markers.

The INCLUDEMISSINGGROUP option controls whether missing group values are considered a distinct group value.

The representations that are used to identify the groups can be overridden individually. For example, each distinct group value is represented by a different line pattern for the box outlines, but the PATTERN= setting on the OUTLIERATTRS= option could be used to assign the same line pattern to all box outlines and connect lines.

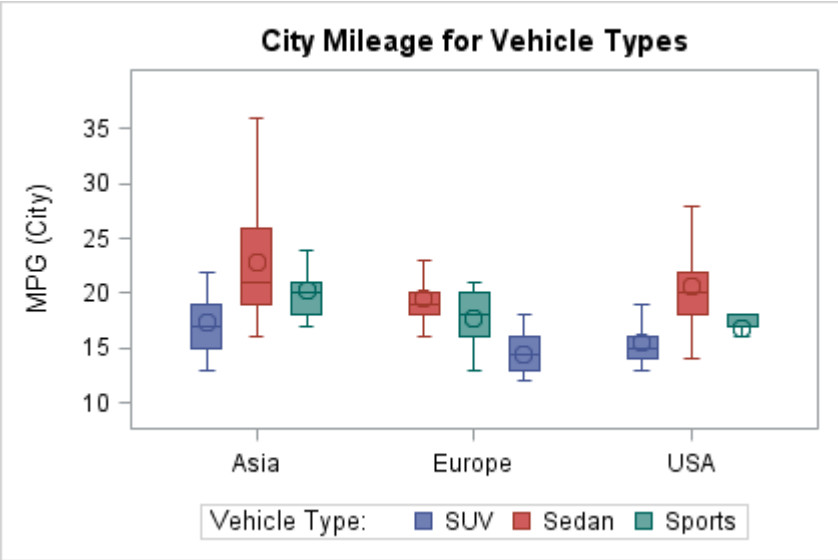
By default, ODS Graphics limits the number of groups to 1000. When this limit is exceeded, the GROUP= option is ignored. Use the GROUPMAX= option in the ODS GRAPHICS statement to change the maximum number of groups that can be processed.

See the GROUPDISPLAY= option to see the output for the grouped boxes

"DISCRETEATTRVAR Statement" on page 1516

GROUPDISPLAY=OVERLAY | CLUSTER

specifies how to display the boxes that represent group values for the coordinate pairs. The following example shows a box plot with GROUPDISPLAY=CLUSTER:



OVERLAY
draws boxes for a given group value at the exact coordinate.

Depending on the data, boxes at a given coordinate might overlap.

CLUSTER
draws boxes for a given group value adjacent to each other.

This option is available only when the category (X) column is discrete.

Default OVERLAY

Interactions This option is ignored unless GROUP= is specified.

The groups in the legend are shown in the order that is specified in GROUPORDER by default.

Attributes such as color, symbol, and pattern are assigned to each group in DATA order by default.

Tip Use the CLUSTERWIDTH= option to control the width of the clusters when CLUSTER is in effect.

GROUPORDER=DATA | REVERSEDATA | ASCENDING | DESCENDING
specifies the ordering of the groups within a category.

DATA
orders the groups within a category in the group-column data order.

REVERSEDATA
orders the groups within a category in the reverse group-column data order.

Note: This feature applies to SAS 9.4M2 and to later releases.

Tip This option is useful when you want to reverse the category axis.

ASCENDING
orders the groups within a category in ascending order.

DESCENDING
orders the groups within a category in descending order.

Defaults DATA if the data is a SAS data set.

ASCENDING if the data is a CAS in-memory table. Sorting is based on nonformatted values for numeric group values or on formatted values for character group values.

Interactions This option is ignored if the GROUP= option is not also specified.

By default, the groups in the legend are shown in the order that is specified in GROUPORDER.

Notes When plotting a SAS data set, attributes such as color, symbol, and pattern are assigned to each group in DATA order by default. When plotting a CAS in-memory table, attributes are assigned in ascending order of the group column character values or unformatted numeric values by default.

The ASCENDING and DESCENDING settings linguistically sort the group values within each category (or X value) for display position purposes only. For numeric data, the order is based on the unformatted values. For character data, the order is based on the formatted values. The data order of the observations and the visual attributes that are assigned to the group values remain unchanged.

In SAS 9.4M6 and earlier releases, when data stored in a CAS in-memory table is used and DATA or REVERSEDATA is specified, unpredictable results might occur. To generate consistent graphs in that case, specify ASCENDING or DESCENDING. Starting with SAS Viya 3.5 and SAS Studio 5.2, when data stored in a CAS in-memory table is used and DATA or REVERSEDATA is specified, it is ignored, and ASCENDING is used instead.

INCLUDEMISSINGGROUP=TRUE | FALSE
specifies whether missing values of the group variable are included in the plot.

Default TRUE

Interaction For this option to take effect, the GROUP= option must also be specified.

Tip The attributes of the missing group value are determined by the GraphMissing style element unless a discrete attribute map is in effect, the INDEX= option is used, the MISSING= system option changes the default missing character, or a user-defined format is applied to the group value. In those cases, the attributes of the missing group value are determined by a GraphData1–GraphDataN style element instead of by the GraphMissing style element.

See “boolean ” on page xii for other Boolean values that you can use.

INDEX=*positive-integer-column* | *expression*
specifies indices for mapping box attributes (fill and outline) to one of the GraphData1–GranphDataN style elements.

Requirements The column or expression value must be an integer value of 1 or greater. Otherwise, this option is ignored.

The positive-integer column must not contain missing values. Otherwise, the entire column is invalidated and this option is ignored.

All of the indexes for a specific group value must be the same. Otherwise, the results are unpredictable.

Interaction For this option to take effect, the GROUP= option must also be specified.

Notes The index values are 1-based indices. For the style attributes in GraphData1–GraphDataN, if the index value is greater than N, then a modulo operation remaps that index value to a number less than N to determine which style to use.

If you do not use this option, then the group values are mapped in the order of the data.

Tip You can use indexing to collapse the number of groups that are represented in a graph. For more information, see "Remapping Groups for Grouped Data" on page 211.

INTERVALBOXWIDTH=AUTO | *dimension*
specifies the box width when an interval category (X) column is specified.

AUTO
the system determines the box width.

uses one of the following box-width values listed in the order of precedence:

- the BOXWIDTH statistic, if it is included in the Stat column and if the Y value is within the range of 0–1
- starting with SAS 9.4M3, the BOXWIDTH= option value, if it is specified
- otherwise, 85% of the smallest interval between any two boxes for the given plot

dimension
sets the box width to the specified value.

Default AUTO

Requirement The category axis (X by default) must be an interval axis for the INTERVALBOXWIDTH= option to have any effect.

Interactions Starting with SAS 9.4M3, this option is overridden by the Y value when the STAT= column value is BOXWIDTH and the corresponding Y value is within the range of 0–1.

Prior to SAS 9.4M3, this option controls the box width for an interval box plot. Starting with SAS 9.4M3, this option overrides the BOXWIDTH= option for an interval box plot.

Tip The box width that you specify with this option is honored even if the boxes overlap. If the boxes overlap, reduce the interval box width or use the BOXWIDTH= option instead.

See "dimension" on page xiii

LABELFAR=TRUE | FALSE
specifies whether all outliers or only far outliers are labeled.

FALSE
applies the labels specified by the DATALABEL= option to both the outliers and the far outliers.

TRUE
applies the labels specified by the DATALABEL= option to the far outliers.

Default FALSE

Interaction This option is ignored if EXTREME= TRUE or the DISPLAY= option does not display the outliers.

See "DATALABEL=*column* " on page 412

"Statement Summary" on page 392 for information about outliers.

"boolean " on page xii for other Boolean values that you can use.

LEGENDLABEL="*string*"
specifies a label to be used in a discrete legend for this plot.

Default The Y= column label. If a label is not defined, then the Y= column name is used.

Restriction This option applies only to an associated DISCRETELEGEND statement.

Interaction If the GROUP= option is specified, then this option is ignored.

MEANATTRS=*style-element* | *style-element* (*marker-options*) | (*marker-options*)
specifies the attributes of the marker representing the mean within the box.

Defaults For non-grouped data, GraphBoxMean style element.

For grouped data, the MarkerSymbol, Markersize, and ContrastColor attributes of the GraphData1–GraphDataN style elements.

Interaction This option is ignored if the DISPLAY= option does not display the mean.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Marker Options" on page 1604 for available *marker-options*.

MEDIANATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the appearance of the line representing the median within the box.

Defaults For non-grouped data, the GraphBoxMedian style element.

For grouped data, the LineStyle and LineThickness attritubes of the GraphBoxMedian style element, and the ContrastColor attribute of the GraphData1–GraphDataN style elements.

Interaction This option is ignored if the DISPLAY= option does not display the median.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

NAME="*string*"
assigns a name to this plot statement for reference in other template statements. The specified name is used primarily in legend statements to coordinate the use of colors and line patterns between the plot and the legend.

Restrictions The *string* is case sensitive, cannot contain spaces, and must define a unique name within the template.

This option does not support variables that are created by the DYNAMIC, MVAR, and NMVAR template statements.

Interaction The *string* is used as the default legend label if the LEGENDLABEL= option is not used.

ORIENT=VERTICAL | HORIZONTAL
specifies the orientation of the Y axis and of the boxes.

Default VERTICAL

OUTLIERATTRS=*style-element* | *style-element* (*marker-options*) | (*marker-options*)
specifies the attributes of the markers representing the outliers.

Defaults For non-grouped data, GraphOutlier style element.

For grouped data, the MarkerSymbol, Markersize, and ContrastColor attributes of the GraphData1–GraphDataN style elements.

Interaction This option is ignored if EXTREME= TRUE or the DISPLAY= option does not display the outliers.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Marker Options" on page 1604 for available *marker-options*.

OUTLIERTIP=(*role-list*) | NONE
specifies the information to display when the cursor is positioned over an outlier. If this option is used, then it replaces all of the information that is displayed by default.

(*role-list*)
an ordered, space-separated list of unique BOXPLOTPARM roles and user-defined roles. BOXPLOTPARM roles for OUTLIERTIP include X, Y, STAT, and DATALABEL.

Note In the data tip, the STAT role displays the text “outlier” or “far outlier” as applicable.

Tip User-defined roles are defined with the ROLENAME= option.

Example The following example displays data tips for the columns that are assigned to the X and Y roles, and also the data column Obs, which is not assigned to any pre-defined BOXPLOTPARM role. The Obs column must first be assigned a role:

```
ROLENAME=(TIP1=OBS)
OUTLIERTIP=(X Y TIP1)
```

Default The columns assigned to these roles are automatically included in the data tip information: X and Y .

Requirement To generate data tips, you must include an ODS GRAPHICS ON statement that specifies the IMAGEMAP option, and write the graphs to the ODS HTML destination.

Interaction The labels and formats for the OUTLIERTIP variables can be controlled with the TIPLABEL= and TIPFORMAT= options.

See the ROLENAME= option for specifying user-defined roles.

the TIP= option for specifying the information to display when the cursor is positioned over a box or whisker in the box plot.

OUTLINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the appearance of the box outline.

Defaults For non-grouped data, the ContrastColor, LineThickness, and LineStyle attributes of the GraphOutlines style element.

For grouped data and filled boxes, the LineStyle and LineThickness attributes of the GraphOutlines style element, and the ContrastColor attribute of the GraphData1–GraphDataN style elements.

For grouped data and unfilled boxes, the LineThickness attribute of the GraphOutlines style element, and the ContrastColor and LineStyle attributes of the GraphData1–GraphDataN style elements.

See “General Syntax for Attribute Options” on page 1599 for the syntax on using a *style-element*.

“Line Options” on page 1602 for available *line-options*.

PRIMARY=TRUE | FALSE
specifies that the data columns for this plot and the plot type be used for determining default axis features. This option is needed only when two or more plots within an overlay-type layout contribute to a common axis.

Default FALSE

Restriction This option is ignored if the plot is placed under a GRIDDED or LATTICE layout block.

Note In an OVERLAY layout, only one plot in an overlay can be the primary plot on a per-axis basis. When no plot is designated as the primary plot, the first plot that can be a primary plot is considered the primary plot. If multiple plots specify PRIMARY=TRUE for the same axis, then the last such plot encountered is considered the primary plot.

See "When Plots Share Data and a Common Axis" on page 1046

"boolean " on page xii for other Boolean values that you can use.

ROLENAME=(*role-name-list*)
specifies user-defined roles that can be used to display information in the data tips. This option provides a way to add to the data columns that appear in data tips that are specified by the OUTLIERTIP= option.

(*role-name-list*)
a space-separated list of *role-name = column* pairs.

Example The following example assigns the column Obs to the user-defined role TIP:

```
ROLENAME=(TIP1=OBS)
```

Default No user-defined roles

Requirement The role names that you choose must be unique and different from the predefined roles DATAMAX, DATAMIN, MAX, MIN, MEAN, MEDIAN, N, Q1, Q2, STD, SUMWGT, and X.

Note The roles DATAMAX, DATAMIN, and SUMWGT are valid in SAS 9.4M1 and in later releases.

SPREAD=TRUE | FALSE
specifies whether outliers with the same value are spread out to avoid overlap. For vertical box plots this means offsetting the outliers horizontally. If this option is false, then outliers with the same value are plotted in the same position, which means only one is visible.

Default FALSE

Interaction This option is ignored if EXTREME= TRUE or the DISPLAY= option does not display the outliers.

See "boolean " on page xii for other Boolean values that you can use.

TIP=(*role-list*) | NONE

specifies the information to display when the cursor is positioned over a box or whisker in the box plot. If this option is used, then it replaces all of the information that is displayed by default. Roles for columns that do not contribute to the box plot can be specified along with roles that do contribute.

(*role-list*)

an ordered, space-separated list of unique BOXPLOTPARM roles.

BOXPLOTPARM roles for TIP include DATAMAX, DATAMIN, MAX, MIN, MEAN, MEDIAN, N, Q1, Q2, STD, SUMWGT, and X.

Note The roles DATAMAX, DATAMIN, and SUMWGT are valid in SAS 9.4M1 and later releases.

Tip Statistics such as N, MIN, and MAX are special roles, They are not column-based like the X role.

Example The following example displays data tips only for the columns that are assigned to the roles X (CATEGORY) and the statistic MEAN:

```
TIP=(X MEAN)
```

NONE

suppresses data tips from the plot.

Default The columns assigned to these roles are automatically included in the data tip information: DATAMAX, DATAMIN, MAX, MIN, MEAN, MEDIAN, N, Q1, Q2, STD, SUMWGT, and X.

Requirement To generate data tips in the output, you must include an ODS GRAPHICS ON statement that specifies the IMAGEMAP option, and you must write the output to the ODS HTML destination.

Interaction This option is ignored when the plot statement is in an OVERLAY or PROTOTYPE layout and the INCLUDERANGES= option is specified in the LINEAROPTS= or TIMEOPTS= option for either axis.

Tip The labels and formats for the TIP roles can be controlled with the TIPLABEL= and TIPFORMAT= options.

See the OUTLIERTIP= option for specifying the information to display when the cursor is positioned over an outlier.

TIPFORMAT=(*role-format-list*)

specifies display formats for tip columns. This option provides a way to control the formats of columns that appear in data tips.

(*role-format-list*)

a space-separated list of *role-name* = *format* pairs.

Example

```
ROLENAME=(TIP1=SALARY)
TIP=(TIP1)
TIPFORMAT=(TIP1=DOLLAR12.)
```

Default The column format of the column assigned to the role or BEST6 if no format is assigned to a numeric column.

Restriction Only the roles that appear in the OUTLIERTIP= or TIP= options are used.

Requirement A column must be assigned to each of the specified roles. (See the ROLENAME= option.)

TIPLABEL=(*role-label-list*)
specifies display labels for tip columns. This option provides a way to control the labels of columns that appear in data tips.

role-label-list
a space-separated list of *rolename* ="*string*" pairs.

Example
```
ROLENAME=(TIP1=PCT)
TIP=(TIP1)
TIPLABEL=(TIP1="Percent")
```

Default The column label or column name of the column assigned to the role.

Restriction Only the roles that appear in the OUTLIERTIP= or TIP= options are used.

Requirement A column must be assigned to each of the specified roles. (See the ROLENAME= option.)

URL=*string-column*
specifies an HTML page that is displayed when a box or an outlier marker is selected.

Note: This option is valid starting in SAS 9.4M1.

string-column
specifies a column that contains a valid HTML page reference (HREF) for each box or outlier marker that is to have an active link.

Example **`http://www.sas.com`**

The character column can specify different target URLs for each box and outlier marker.

Requirements The target URLs for the boxes must be specified in the Q1 statistic observations, and the target URLs for the outlier markers must be specified in the OUTLIER statistic observations. URLs that are specified in observations other than Q1 and OUTLIER are ignored.

To generate selectable boxes and outlier markers, you must include an ODS GRAPHICS ON statement that specifies the IMAGEMAP option, and you must write the output to the ODS HTML destination.

Interaction This option is ignored when the plot statement is in an OVERLAY or PROTOTYPE layout and the INCLUDERANGES= option is specified in the LINEAROPTS= or TIMEOPTS= option for either axis.

Tips The URL value can be blank for a box or outlier, meaning that no action is taken when that box or outlier marker is selected.

By default, drill-down links open in a new browser window (link target _blank). To specify a different target for your drill-down links, such as _self or _parent, add the DRILLTARGET="*target*" option to your ODS GRAPHICS statement. See DRILLTARGET= on page 1568.

Example The following vehicle mileage data sample shows box and outlier URLs specified in column URL for Sedan.

```
STAT       X     VALUE DATALABEL          URL
  ...
N        Sedan   262.0
MEAN     Sedan   08
MEDIAN   Sedan   20.00
Q1       Sedan   18.00             ./mileageSedan.html
Q3       Sedan   24.00
STD      Sedan    4.23
OUTLIER  Sedan   36.00 Honda       ./mileageHonda.html
OUTLIER  Sedan   35.00 Toyota      ./mileageToyota.html
OUTLIER  Sedan   35.00 Toyota      ./mileageToyota.html
OUTLIER  Sedan   38.00 Volkswagen  ./mileageVolkswagen.html
MIN      Sedan   12.00 Volvo
MAX      Sedan   33.00 Volvo
  ...
```

WHISKERATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the line properties of the whiskers and caps.

Defaults For non-grouped data, the GraphBoxWhisker style element.

For grouped data, the LineStyle and LineThickness attritubes of the GraphBoxWhisker style element, and the ContrastColor attribute of the GraphData1–GraphDataN style elements.

Restriction The caps are always drawn with a solid line.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

XAXIS=X | X2
specifies whether data are mapped to the primary X (bottom) axis or to the secondary X2 (top) axis.

Default X

Interactions This option is ignored if the X= argument is not specified.

The overall plot specification and the layout type determine the axis display. For more information, see "How Axis Features Are Determined" on page 1040.

YAXIS=Y | Y2
specifies whether data are mapped to the primary Y (left) axis or to the secondary Y2 (right) axis.

Default Y

Interaction The overall plot specification and the layout type determine the axis display. For more information, see "How Axis Features Are Determined" on page 1040.

Details

Statement Summary

The BOXPLOTPARM statement requires precomputed input data. One reason to choose this statement over the BOXPLOT statement is that you can control the computational technique used to compute various statistics for the box plot, such as the mean, quartiles, location of fences, outlier definition, and so on. See Appendix 5, "Generalized Macro for BOXPLOTPARM Data," on page 1627 for examples of such computations using PROC SUMMARY and multiple DATA steps.

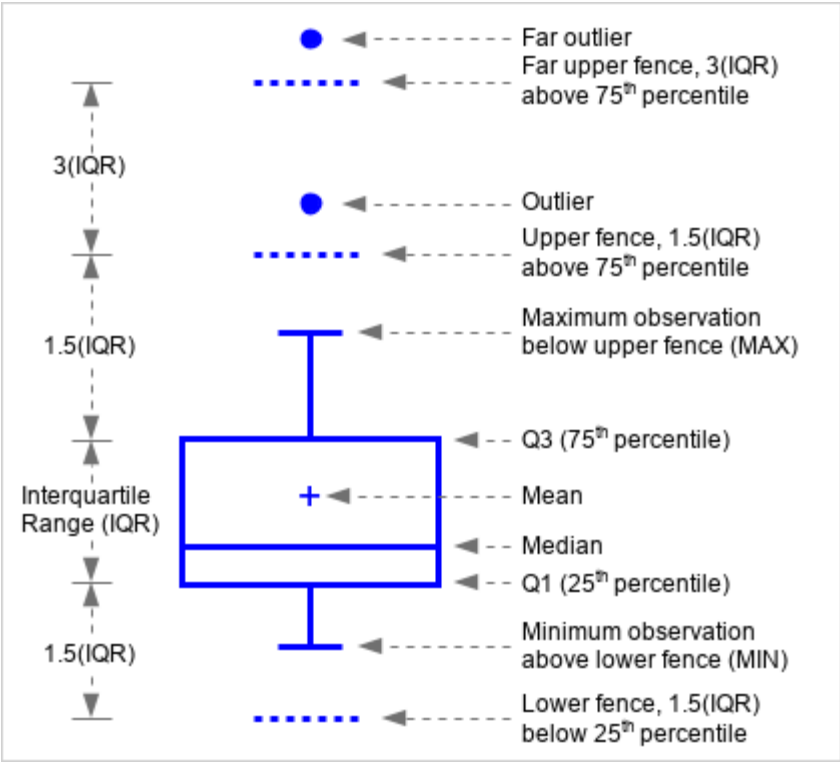
The BOXPLOTPARM statement displays a single box if given just Y and a STAT argument. It displays multiple boxes if given both Y and X and a STAT argument and X has more than one unique value.

By default for numeric or character columns, the category (X) axis is TYPE=DISCRETE. You can override the default and specify TYPE=LINEAR in the parent layout, provided that the X column is numeric. The axis for the analysis (Y) column is always LINEAR. When the X axis is LINEAR, you can use the INTERVALBOXWIDTH= option to specify the box width.

When ORIENT= VERTICAL, the X (or X2) axis is used for the X column and the Y (or Y2) axis is used for the Y column. When ORIENT=HORIZONTAL, the X (or X2) axis is used for the Y column and the Y (or Y2) axis is used for the X column.

Two basic box plot representations can be drawn with the BOXPLOTPARM statement: a *schematic (Tukey) box plot* and a *skeletal box plot*. See the EXTREME= option for details.

The following figure illustrates the box plot elements:



As shown in the figure, the bottom and top edges of the box are located at the 1st quartile (25th percentile) and 3rd quartile (75th percentile) of the sample. Within the box, you can display the median (50th percentile) as a line and the mean as a marker (see the DISPLAY= option).

You can also display markers and data labels for outliers. Outliers are observations that are more extreme than the upper and lower fences ($\pm$ 1.5 IQR). Outliers that are beyond upper and lower far fences (± 3 IQR) are called FAR OUTLIERS and can also be identified and labeled. From a graphical perspective, the locations of fences along the axis are known, but there is no line or marker that displays a fence. (See DISPLAY= , LABELFAR= , and DATALABEL= options).

Finally, you can control the range represented by the whiskers. By default, the whiskers are drawn from the upper edge of the box to the MAX value, and from the lower edge of the box to the MIN value. (See the EXTREME= option.)

Input Data Requirements for the BOXPLOTPARM Statement

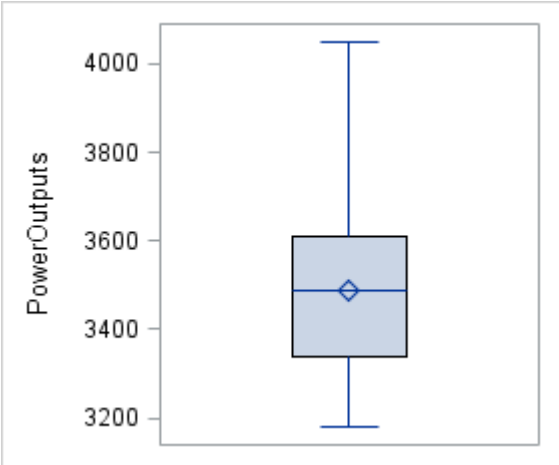
At a minimum, valid data for the BOXPLOTPARM statement must provide a numeric column (Y=) that contains calculated statistics for an analysis, and a string column (STAT=) that identifies each statistic. The Y column must contain nonmissing values for the Q1 (25th percentile) and Q3 (75th percentile) statistics. If Y values are missing or not supplied for other statistic values, then those statistics are not displayed in the plot, regardless of syntax requests to display them.

For example, a petroleum company uses a turbine to heat water into steam that is pumped into the ground to make oil more viscous and easier to extract. This process occurs 20 times daily, and the amount of power (in kilowatts) used to heat the water to the desired temperature is recorded. The following data show the statistics that are calculated for one day of this process:

PowerOutputs	Statistic
3180.00	MIN
3340.00	Q1
3487.40	MEAN
3490.00	MEDIAN
3610.00	Q3
4050.00	MAX
20.00	N

To plot the data from the preceding table, the following BOXPLOTPARM statement uses the Y= and STAT= arguments to generate a single box plot for the recorded statistics:

```
BOXPLOTPARM Y=PowerOutputs STAT=Statistic;
```



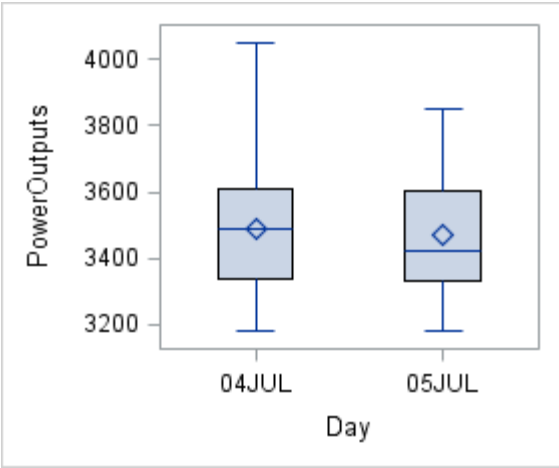
If the data contain statistics for multiple days of the process, then a third column in the data must be present to identify the days that the statistics were recorded. For example, the following data show the statistics that are calculated for two days of this process:

Day	PowerOutputs	Statistic
04JUL	3180.00	MIN
04JUL	3340.00	Q1
04JUL	3487.40	MEAN

Day	PowerOutputs	Statistic
04JUL	3490.00	MEDIAN
04JUL	3610.00	Q3
04JUL	4050.00	MAX
04JUL	20.00	N
05JUL	3179.00	MIN
05JUL	3333.50	Q1
05JUL	3471.65	MEAN
05JUL	3419.50	MEDIAN
05JUL	3605.00	Q3
05JUL	3849.00	MAX
05JUL	20.00	N

To plot the data from the preceding table, the BOXPLOTPARM statement needs the Y=, STAT=, and X= arguments to generate a separate box plot for each day that the statistics were recorded:

```
BOXPLOTPARM Y=PowerOutputs STAT=Statistic X=Day;
```

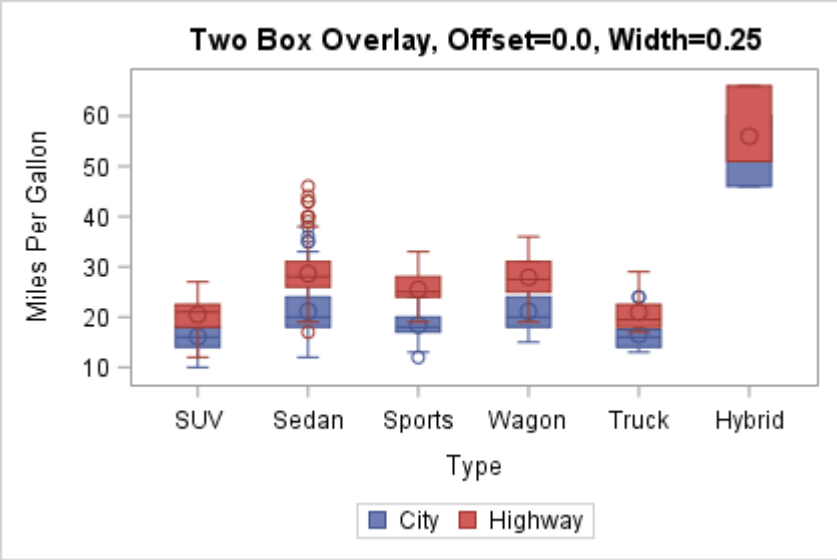


See Appendix 5, “Generalized Macro for BOXPLOTPARM Data,” on page 1627 for a more complete example of providing input data for BOXPLOTPARM.

About the DISCRETEOFFSET= Option

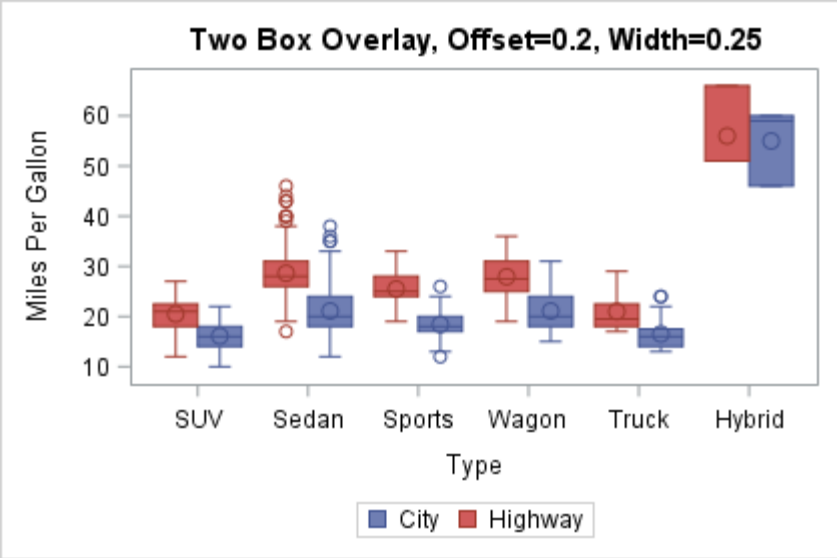
The DISCRETEOFFSET= option is useful for graphing multiple response variables side by side on a common axis. By default within an overlay-type layout, if multiple BOXPLOTPARM statements are used with different analysis variables, then the boxes for matching X values are centered on the ticks. Depending on the data, the boxes might be superimposed. The following code fragment shows the default box positioning:

```
layout overlay / cycleattrs=true
    yaxisopts=(label="Miles Per Gallon");

  boxplotparm x=type y=mpg_city stat=y_stat    / name="City" ;
  boxplotparm x=type y=mpg_highway stat=y_stat / name="Highway" ;

  discretelegend "City" "Highway";
endlayout;
```



To place the different response values side by side, you can assign a different offset to each BOXPLOTPARM statement. The BOXWIDTH= option can be used in conjunction with the DISCRETEOFFSET= option to create narrower boxes when desired.

```
layout overlay / cycleattrs=true
    yaxisopts=(label="Miles Per Gallon");

  boxplotparm x=type y=mpg_city stat=y_stat    / name="City"
    discreteoffset=0.2 ;
  boxplotparm x=type y=mpg_highway stat=y_stat / name="Highway"
    discreteoffset=-0.2 ;

  discretelegend "City" "Highway";
endlayout;
```

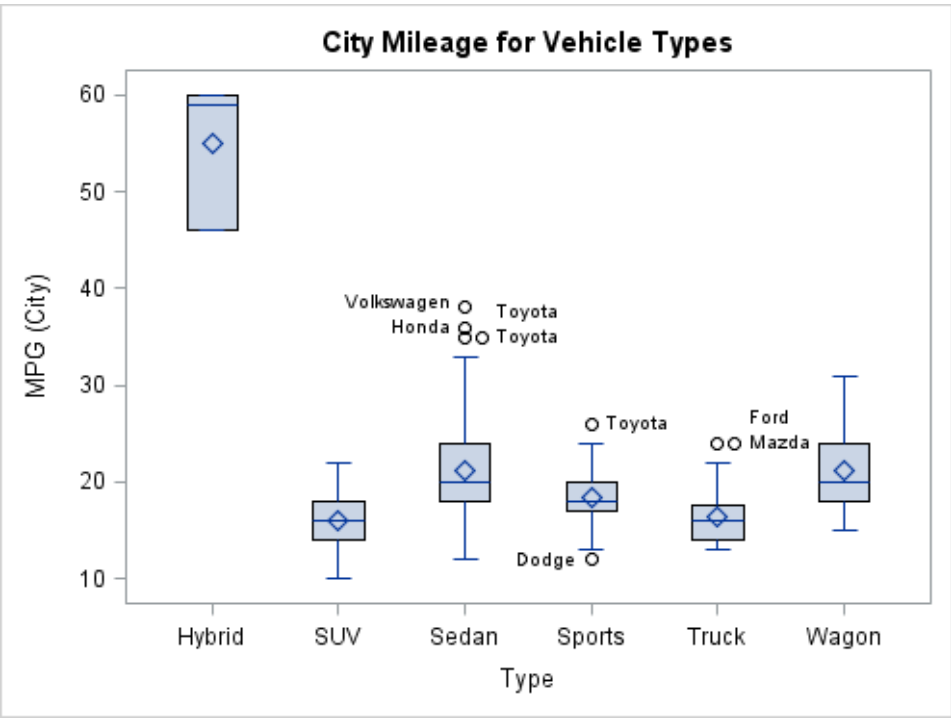


Changing Box Plot Display

SAS defines graphical style elements that control the display of box plots. Using these style elements as a starting point, you can change the style attribute values to achieve a very different appearance for your box plots. For more information, see "Changing Box Plot Display" on page 395.

Example: BOXPLOTPARM Statement

The following graph was generated by the "Example Program" on page 440:



Use the %BOXCOMPUTE macro to generate the data for this example. See Appendix 5, “Generalized Macro for BOXPLOTPARM Data,” on page 1627 to see the code for creating all of the data.

```
%boxcompute(indsn=sashelp.cars,x=type,y=mpg_city,datalabel=make);
```

Example Program

Here is the code for this example.

```
/* Define the template for the plot. */
proc template;
  define statgraph boxplotparm1;
    begingraph;
      entrytitle "City Mileage for Vehicle Types";
      layout overlay;
       boxplotparm y=value x=x stat=stat /
         datalabel=datalabel spread=true ;
      endlayout;
    endgraph;
  end;
run;

/* Generate the plot. */
proc sgrender data=boxdata template=boxplotparm1;
run;
```

BUBBLEPLOT Statement

Creates a bubble plot of the input data. The locations of the bubble centers correspond to the values of X and Y columns in the data, and the bubble radii correspond to the values of a SIZE column.

Tip: Starting with SAS 9.4M3, you can use subpixel rendering with this statement. It is enabled by default. To disable subpixel rendering, specify SUBPIXEL=OFF in the BEGINGRAPH statement or in an ODS GRAPHICS statement. For information about the BEGINGRAPH statement SUBPIXEL= option, see SUBPIXEL= on page 39. For information about the ODS GRAPHICS statement SUBPIXEL= option, see “ODS GRAPHICS Statement” on page 1561.

Syntax

BUBBLEPLOT X=*column* | *expression*
Y=*column* | *expression*
SIZE=*numeric-column* | *expression* </*options*>;

Summary of Optional Arguments

Appearance options

BUBBLERADIUSMAX=*dimension*
: specifies the drawing size of the largest bubble.

BUBBLERADIUSMIN=*dimension*
: specifies the drawing size of the smallest bubble.

COLORMODEL=*color-ramp-style-element* | (*color-list*)
: specifies a color ramp to use with the COLORRESPONSE= option.

COLORRESPONSE=*numeric-column* | *range-attr-var* | *expression*
: specifies the numeric column or range attribute map variable to use to determine the bubble colors.

DATASKIN=NONE | CRISP | GLOSS | MATTE | PRESSED | SHEEN
: enhances the visual appearance of the filled bubbles.

DATATRANSPARENCY=*number*
: specifies the degree of the transparency of the bubble fills and bubble outlines

DISPLAY=(*display-options*) | STANDARD | ALL
: specifies which bubble features to display.

DRAWORDER=SIZE | DATA
: specifies whether the bubbles are drawn according to bubble size or according to data order.

FILLATTRS=*style-element* | *style-element* (*fill-options*) | (*fill-options*)
: specifies the appearance of the filled bubble areas.

FILLPATTERNATTRS=*style-element* | (*fill-pattern-options*)
: specifies the appearance of the pattern-filled areas.

INDEX=*positive-integer-column* | *expression*
: specifies indices for mapping bubble attributes (fill and outline) to one of the GraphData1–GraphDataN style elements.

OUTLINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
: specifies the appearance of the bubble outlines.

RELATIVESCALE=TRUE | FALSE
: specifies whether the SIZE= column values are interpreted as relative values.

RELATIVESCALETYPE=LINEAR | PROPORTIONAL
: specifies the type of scaling that is to be applied to the SIZE= column values.

REVERSECOLORMODEL=TRUE | FALSE
: specifies whether to reverse the gradient (color ramp) that is defined by either the ODS style that is in effect or by the COLORMODEL= option.

SIZETHRESHOLDMAX=*numeric-value*
: specifies a SIZE= column value threshold at which bubble size is clamped to the BUBBLERADIUSMAX= option value.

Axes options

PRIMARY=TRUE | FALSE
: specifies that the data columns for this plot and the plot type be used for determining default axis features.

XAXIS=X | X2
: specifies whether data are mapped to the primary X (bottom) axis or to the secondary X2 (top) axis.

YAXIS=Y | Y2
: specifies whether data are mapped to the primary Y (left) axis or to the secondary Y2 (right) axis.

Data tip options

ROLENAME=(*role-name-list*)
: specifies user-defined roles that can be used to display information in the data tips.

TIP=(*role-list*) | NONE
: specifies the information to display when the cursor is positioned over the bubbles.

TIPFORMAT=(*role-format-list*)
: specifies display formats for tip columns.

TIPLABEL=(*role-label-list*)
: specifies display labels for tip columns.

Label options

DATALABEL=*column* | *expression*
: specifies a column for bubble labels.

DATALABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
: specifies the color and font attributes of the bubble labels.

DATALABELPOSITION=TOPRIGHT | TOP | TOPLEFT | LEFT | CENTER | RIGHT | BOTTOMLEFT | BOTTOM | BOTTOMRIGHT
: specifies the location of the bubble labels relative to the bubble.

DATALABELSPLIT=TRUE | FALSE
: specifies whether to split the data labels at the specified split characters.

DATALABELSPLITCHAR="*character-list*"
: specifies one or more characters on which the data labels can be split if needed.

DATALABELSPLITCHARDROP=TRUE | FALSE
: specifies whether the split characters are included in the data labels.

DATALABELSPLITJUSTIFY=AUTO | CENTER | LEFT | RIGHT
: specifies the justification of the strings that are inside the data label blocks.

LEGENDLABEL="*string*"
: specifies a label to be used in a discrete legend for this plot.

Midpoint options

GROUP=*column* | *discrete-attr-var* | *expression*
: creates a separate bubble color for each unique grouping that is specified.

INCLUDEMISSINGGROUP=TRUE | FALSE
: specifies whether missing values of the group variable are included in the plot.

ODS options

URL=*string-column*
: specifies an HTML page to display when a bubble is selected.

Plot reference options

NAME=*"string"*
: assigns a name to this plot statement for reference in other template statements.

Required Arguments

X=*column* | *expression*
specifies the column for the X values of the bubble centers.

Y=*column* | *expression*
specifies the column for the Y values of the bubble centers.

SIZE=*numeric-column* | *expression*
specifies the bubble SIZE values.

Optional Arguments

BUBBLERADIUSMAX=*dimension*
specifies the drawing size of the largest bubble.

Default
: Three times as large as the size set by GraphDataDefault:markerSize

Restriction
: The *dimension* value must be greater than the BUBBLERADIUSMIN=*dimension* value.

Interaction
: This option is ignored when RELATIVESCALE= FALSE.

Tip
: A maximum size that is specified as a percent is interpreted as a percent of the graph's height. The height can be adjusted with the DESIGNHEIGHT= option in the BEGINGRAPH statement or the HEIGHT= option in the ODS GRAPHICS statement.

See
: "dimension" on page xiii

BUBBLERADIUSMIN=*dimension*
specifies the drawing size of the smallest bubble.

Default
: GraphDataDefault:markerSize

Restriction
: The BUBBLERADIUSMIN= value must be less than the BUBBLERADIUSMAX= value.

Interaction
: This option is ignored when RELATIVESCALE= FALSE.

Tip
: A maximum size that is specified as a percent is interpreted as a percent of the graph's height. The height can be adjusted with the DESIGNHEIGHT= option in the BEGINGRAPH statement or the HEIGHT= option in the ODS GRAPHICS statement.

See
: "dimension" on page xiii

COLORMODEL=*color-ramp-style-element* | (*color-list*)
specifies a color ramp to use with the COLORRESPONSE= option.

color-ramp-style-element
specifies the name of a color-ramp style element.

The style element should contain these style attributes:

STARTCOLOR
specifies the color for the smallest data value of the COLORRESPONSE= column.

NEUTRALCOLOR
specifies the color for the midpoint of the range of the COLORRESPONSE= column.

ENDCOLOR
specifies the color for the highest data value of the COLORRESPONSE= column.

(*color-list*)
specifies a space-separated list of colors to use in the color ramp. You can use style attribute references such as GraphData3:Color, color names, or RGB, CMYK, HLS, and HSV (HSB) color codes to specify a color. The list can contain a mix of style attribute references, color names, and color codes.

Requirement The list of colors must be enclosed in parentheses.

See "color " on page xii

Default The ThreeColorRamp style element for filled bubbles and ThreeColorAltRamp for unfilled bubbles

Interaction For this option to take effect, the COLORRESPONSE= option must also be specified.

Tip To reverse the start and end colors of the ramp that is assigned to the color model, use the REVERSECOLORMODEL= option.

COLORRESPONSE=*numeric-column* | *range-attr-var* | *expression*
specifies the numeric column or range attribute map variable to use to determine the bubble colors.

range-attr-var
specifies a range attribute map variable that is defined in a RANGEATTRVAR statement.

"RANGEATTRVAR Statement"

Restriction A range attribute map variable specification must be a direct reference to the attribute map variable. It cannot be set as a dynamic variable.

See "RANGEATTRVAR Statement" on page 1531

When a numeric column or expression is specified, the range of column or expression values are linearly mapped to the color ramp that is specified by the

COLORMODEL= option. When a range attribute map variable is specified, the colors that are defined in the associated range attribute map are used instead.

Interactions Prior to SAS 9.4M5, when the GROUP= option is specified with the COLORRESPONSE= option, the GROUP= option is ignored. Starting with SAS 9.4M5, the COLORRESPONSE= option controls the color of the group fill patterns when the fill patterns are displayed.

When fill is displayed, this option overrides suboption COLOR= in the FILLATTRS= option and varies the fill color according to the color gradient or the attribute map.

When only the outlines are displayed, this option overrides suboption COLOR= in the OUTLINEATTRS= option and varies the outline color according to the color gradient or the attribute map.

Notes When both the fill and outline are displayed, the bubble fill color varies according to the color gradient or attribute map but the bubble outline color remains fixed on the color specified in option OUTLINEATTRS=.

The mapped color used for the bubbles is also used for the data labels.

Tip To display a legend with this option in effect, use a CONTINUOUSLEGEND statement.

DATALABEL=*column* | *expression*
specifies a column for bubble labels. The label positions are adjusted to prevent them from overlapping.

Default No labels are displayed.

Note The BUBBLEPLOT statement does not use a data-label collision avoidance algorithm. Data labels in bubble plots might overlap.

DATALABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font attributes of the bubble labels.

Defaults For non-grouped data, the GraphDataText style element.

For grouped data, the text color is derived from the GraphData1–GraphDataN style elements. The data label color changes to match the group color derived from the ContrastColor attribute of the style element that is in effect.

Interaction The default attributes are overridden if the COLORRESPONSE= option is used.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Text Options" on page 1606 for available *text-options*.

DATALABELPOSITION=TOPRIGHT | TOP | TOPLEFT | LEFT | CENTER | RIGHT | BOTTOMLEFT | BOTTOM | BOTTOMRIGHT

specifies the location of the bubble labels relative to the bubble.

Default TOPRIGHT

DATALABELSPLIT=TRUE | FALSE

specifies whether to split the data labels at the specified split characters. When set to TRUE, the data label is split unconditionally at each occurrence of any of the specified split characters.

Default FALSE. The data labels are not split.

Requirement The DATALABEL= option must also be specified.

Interaction The DATALABELSPLITCHAR= option specifies one or more characters on which splits can occur.

See “boolean ” on page xii for other Boolean values that you can use.

DATALABELSPLITCHAR="*character-list*"

specifies one or more characters on which the data labels can be split if needed. When multiple split characters are specified, each character in the list is treated as a separate split character unless the specified characters appear consecutively in the data label. In that case, all of the specified split characters together are treated as a single split character.

When DATALABEL= is specified and DATALABELSPLIT=TRUE, the data label is split unconditionally at each occurrence of any of the specified split characters. If the data label does not contain any of the specified characters, then the label is not split.

"character-list"

one or more characters with no space between each character and enclosed in quotation marks.

Default A blank space

Requirements The list of characters must be enclosed in quotation marks.

Multiple characters must be specified with no space between them. For example, to specify the split characters a, b, and c, use the following option:

```
datalabelsplitchar="abc"
```

The DATALABEL= option and the DATALABELSPLIT=TRUE option must also be specified.

Interaction The DATALABELSPLITCHARDROP= option specifies whether the split characters are included in the data label or are dropped.

Notes When multiple characters are specified, the order of the characters in the list is not significant.

The split characters are case sensitive.

Tip Use the DATALABELSPLITJUSTIFY= option to specify the justification of the strings in the data label block.

DATALABELSPLITCHARDROP=TRUE | FALSE
specifies whether the split characters are included in the data labels.

TRUE
drops the split characters from the data label.

FALSE
includes the split characters in the data label.

When DATALABELSPLIT=TRUE and DATALABELSPLITCHARDROP=FALSE, each split character remains as the last character in the current line. The characters that follow the split character, up to and including the next split character, are then wrapped to the next line.

The following figure shows an example of a data label with the following specifications:

- the data label text for this label is Product*Group*A
- DATALABELSPLIT=TRUE
- DATALABELSPLITCHARDROP=TRUE | FALSE
- DATALABELSPLITCHAR="*"

When DATALABELSPLITCHARDROP=TRUE, the asterisks are removed from the label. When DATALABELSPLITCHARDROP=FALSE, each asterisk remains as the last character in the line prior to the new line.

Default TRUE. The split characters are dropped from the data label.

Requirement The DATALABEL= option and the DATALABELSPLIT=TRUE option must also be specified.

Interaction The DATALABELSPLITCHAR= option specifies the split characters.

See "boolean " on page xii for other Boolean values that you can use.

DATALABELSPLITJUSTIFY=AUTO | CENTER | LEFT | RIGHT
specifies the justification of the strings that are inside the data label blocks.

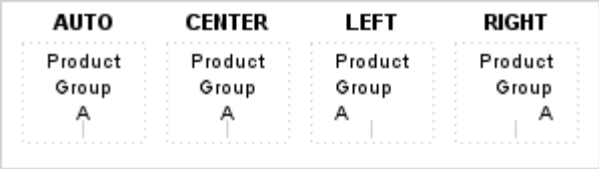
AUTO
justifies the labels based on the DATALABELPOSITION= option.

DATALABELPOSITION= Value	Justification
TOPLEFT, LEFT, or BOTTOMLEFT	RIGHT
TOPRIGHT, RIGHT, or BOTTOMRIGHT	LEFT
TOP, CENTER, or BOTTOM	CENTER

CENTER
LEFT
RIGHT
justifies the labels center, left, or right, as specified.

The following figure shows an example in which DATALABELPOSITION=TOP.

Note: The gray vertical line at the bottom of each label represents the horizontal center of the text box for reference.

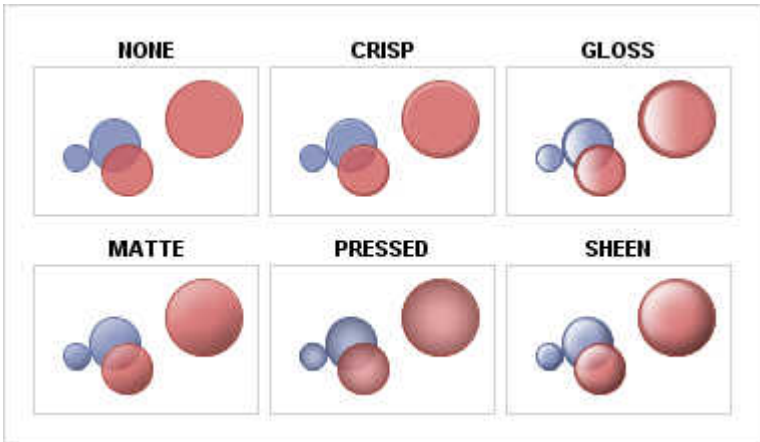


In this case, because DATALABELPOSITION=TOP, AUTO centers the lines of text. The text box is anchored the same way that the unsplit text is anchored. For example, if DATALABELPOSITION=TOP, then the bottom center of the text box is positioned at the top of the marker.

Default AUTO

Requirement The DATALABEL= option and the DATALABELSPLIT=TRUE option must also be specified.

DATASKIN=NONE | CRISP | GLOSS | MATTE | PRESSED | SHEEN
enhances the visual appearance of the filled bubbles. The following figure shows bubbles with each of the skins applied.



Default The DATASKIN= option value that is specified in the BEGINGRAPH statement. If not specified, then the GraphSkins:DataSkin style element value is used.

Restriction Starting with SAS 9.4M1, the maximum number of skinned graphical elements is limited to 200 per plot in an OVERLAY or PROTOTYPE layout. When this limit is exceeded for a plot, the specified data skin is not applied to that plot. In that case, use the DATASKINMAX= option in your ODS GRAPHICS statement to increase the maximum limit.

Requirement For this option to have any effect, DISPLAY= FILL must be in effect. Otherwise, this option is ignored.

Interactions This option overrides the BEGINGRAPH statement DATASKIN= option.

The appearance of the data skin is based on the FILLATTRS= color.

This option is ignored if the RELATIVESCALE= option is set to FALSE.

When a data skin is applied, all bubble outlines are set by the skin, and the OUTLINEATTRS= option is ignored.

DATATRANSPARENCY=*number*
specifies the degree of the transparency of the bubble fills and bubble outlines

Default 0

Range 0–1, where 0 is opaque and 1 is entirely transparent

Restriction The specified transparency is not applied to missing values. Missing values are always opaque.

Note This option does not affect the data labels.

Tip The FILLATTRS= option can be used to set transparency for just the filled bubble areas. You can combine this option with FILLATTRS= to set one transparency for the bubble outlines but a different transparency for the bubble fills. Example:

```
datatransparency=0.2 fillattrs=(transparency=0.6)
```

DISPLAY=(*display-options*) | STANDARD | ALL
specifies which bubble features to display.

(*display-options*)
specifies a space-separated list of one or more display options, enclosed in parentheses.

The list can contain one or more of the following options:

OUTLINE
displays the bubble outline

FILL
displays the bubble fill color

FILLPATTERN
displays the bubble fill pattern

Note This feature applies to SAS 9.4M5 and to later releases.

Tip By default, this option has no effect if the active ODS style does not specify a fill pattern. To display a fill pattern in that case, select an ODS style that supports fill patterns or use the FILLPATTERNATTRS= option to specify a fill pattern for the bubbles.

STANDARD
specifies FILL and OUTLINE

ALL
specifies all features: FILL, FILLPATTERNATTRS, and OUTLINE

Default STANDARD

Tip Use the DATASKIN= , OUTLINEATTRS= , and FILLATTRS= options to control the appearance of the bubble outline and fill color. Starting with SAS 9.4M5, use the FILLPATTERNATTRS= on page 451 option to control the appearance of the bubble fill pattern.

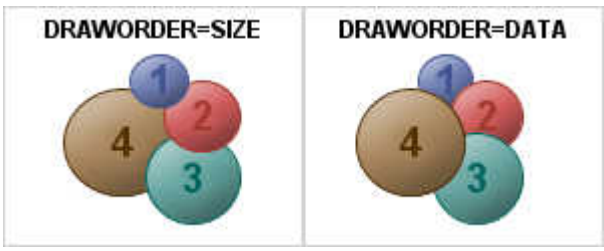
DRAWORDER=SIZE | DATA
specifies whether the bubbles are drawn according to bubble size or according to data order.

Note: This feature applies to SAS 9.4M3 and to later releases.

SIZE
draws the bubbles according to bubble size, from the largest to the smallest

DATA
draws the bubbles according to data order

The following figure shows the effect of SIZE and DATA on four bubbles. The bubble labels indicate the data order, and the bubble sizes increase linearly starting with 1.



Default SIZE

FILLATTRS=*style-element* | *style-element* (*fill-options*) | (*fill-options*)
specifies the appearance of the filled bubble areas.

Defaults For non-grouped data, the GraphDataDefault:Color style reference.

For grouped data, the Color attribute of GraphData1–GraphDataN style elements.

Interactions For this option to have any effect, the fill must be enabled by the ODS style or the DISPLAY= option.

When COLORRESPONSE= is in effect and the DISPLAY= option enables FILL display, the FILLATTRS= suboption COLOR= is ignored, and the bubble fill colors vary according to the gradient.

Tip The DATATRANSPARENCY= option sets the transparency for the bubble fills and the bubble outlines. You can combine this option with DATATRANSPARENCY= to set one transparency for the outlines but a different transparency for the fills. Example:

```
datatransparency=0.2 fillattrs=(transparency=0.6)
```

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Fill Color Options" on page 1600 for available *fill-options*.

FILLPATTERNATTRS=*style-element* | (*fill-pattern-options*)
specifies the appearance of the pattern-filled areas.

Note: This feature applies to SAS 9.4M5 and to later releases.

Defaults For non-grouped data, the ContrastColor and FillPattern attributes of GraphDataDefault.

For grouped data, the ContrastColor and FillPattern attributes of GraphData1–GraphDataN.

Interactions For this option to take effect, the DISPLAY= option must include FILLPATTERN among the display options.

Starting with SAS 9.4M5, when COLORRESPONSE= is in effect and the DISPLAY= option enables FILLPATTERN display, the FILLPATTERNATTRS= suboption COLOR= is ignored, and the fill-pattern colors vary according to the gradient.

Tip In order to change the fill pattern for each group value in ODS styles such as HTMLBlue that use color-priority attribute rotation, specify ATTRPRIORITY=NONE in an ODS GRAPHICS statement or in the BEGINGRAPH statement in your graph template. For more information, see "Attribute Rotation Patterns" in *SAS Graph Template Language: User's Guide*.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Fill Pattern Options" on page 1601 for available *fill-pattern-options*.

GROUP=*column* | *discrete-attr-var* | *expression*
creates a separate bubble color for each unique grouping that is specified.

discrete-attr-var
specifies a discrete attribute map variable.

The discrete attribute map variable is created by a DISCRETEATTRVAR statement.

Restriction A discrete attribute map variable specification must be a direct reference to the attribute map variable. It cannot be set by a dynamic variable.

A distinct bubble is created for each group value by varying the visual attributes of the bubble display features. The display features are controlled by the current ODS style or by the DISPLAY= option. The default group appearance for each display feature is shown in the following table.

Display Feature[1]	Style Attributes That Control Default Group Appearance
Fill color	Color attribute of a GraphData1–GraphDataN style element or the GraphMissing style element.
Fill pattern [2]	FillPattern and ContrastColor attributes of a GraphData1–GraphDataN style element or the GraphMissing style element. The ContrastColor attribute controls the color of the fill pattern.
Outline	■ if the outline is enabled with fill color, fill pattern, or both, ContrastColor attribute of a GraphData1–GraphDataN style element or the GraphMissing style element with a solid line style ■ if the outline is the only display feature enabled, ContrastColor and LineStyle attributes of a GraphData1–GraphDataN style element or the GraphMissing style element

1 Fill color and the outline are displayed by default.
2 Fill patterns are valid for bubble plots starting with SAS 9.4M5.

Interactions If a discrete attribute map variable is specified, then the color mapping for the bubbles is defined by the associated DISCRETEATTRMAP statement. See "DISCRETEATTRMAP Statement" on page 1505.

The mapped color that is used for outlines is also used as the color of the data labels.

This option is ignored if the COLORRESPONSE= option is also used.

The INCLUDEMISSINGGROUP option controls whether missing group values are considered a distinct group value.

Notes All bubbles have only one fill and one outline color as specified by the FILLATTRS= and OUTLINEATTRS options.

If you specify a column in a SAS data set, the visual attributes for each group value are assigned in data order. If you specify a column in a CAS in-memory table, the visual attributes for each group value are assigned in ascending order of the group column character values or of unformatted numeric values.

Tip By default, ODS Graphics limits the number of groups to 1000. When this limit is exceeded, the GROUP= option is ignored. Use the GROUPMAX= option in the ODS GRAPHICS statement to change the maximum number of groups that can be processed.

See “DISCRETEATTRVAR Statement” on page 1516

INCLUDEMISSINGGROUP=TRUE | FALSE

specifies whether missing values of the group variable are included in the plot.

Default TRUE

Interaction For this option to take effect, the GROUP= option must also be specified.

Tip The attributes of the missing group value are determined by the GraphMissing style element unless a discrete attribute map is in effect, the INDEX= option is used, the MISSING= system option changes the default missing character, or a user-defined format is applied to the group value. In those cases, the attributes of the missing group value are determined by a GraphData1–GraphDataN style element instead of by the GraphMissing style element.

See “boolean ” on page xii for other Boolean values that you can use.

INDEX=*positive-integer-column* | *expression*

specifies indices for mapping bubble attributes (fill and outline) to one of the GraphData1–GraphDataN style elements.

Requirements The column or expression value must be an integer value of 1 or greater. Otherwise, this option is ignored.

The positive-integer column must not contain missing values. Otherwise, the entire column is invalidated and this option is ignored.

All of the indexes for a specific group value must be the same. Otherwise, the results are unpredictable.

Interaction For this option to take effect, the GROUP= option must also be specified.

Notes The index values are 1-based indices. For the style attributes in GraphData1–GraphDataN, if the index value is greater than N, then a modulo operation remaps that index value to a number less than N to determine which style to use.

If you do not use this option, then the group values are mapped in the order of the data.

Tip You can use indexing to collapse the number of groups that are represented in a graph. For more information, see "Remapping Groups for Grouped Data" on page 211.

LEGENDLABEL="*string*"
specifies a label to be used in a discrete legend for this plot.

Default The SIZE= column label. If a label is not defined, then the SIZE= column name is used.

Restriction This option applies only to an associated DISCRETELEGEND statement.

Interaction If the GROUP= option is specified, then this option is ignored.

NAME="*string*"
assigns a name to this plot statement for reference in other template statements. The specified name is used primarily in legend statements to coordinate the use of colors and line patterns between the plot and the legend.

Restrictions The *string* is case sensitive, cannot contain spaces, and must define a unique name within the template.

This option does not support variables that are created by the DYNAMIC, MVAR, and NMVAR template statements.

Interaction The *string* is used as the default legend label if the LEGENDLABEL= option is not used.

OUTLINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the appearance of the bubble outlines.

Defaults For non-grouped data, the ContrastColor and LineStyle attributes of the GraphOutlines style element.

For grouped data and filled bubbles, the ContrastColor attribute of the GraphData1–GraphDataN style elements and a solid line style. If the COLORRESPONSE= option is specified, then the bubble outline attributes are derived from the GraphDataDefault style element.

For grouped data and unfilled bubbles, the ContrastColor and LineStyle attributes of the GraphData1–GraphDataN style elements.

Interactions For this option to have any effect, outlines must be enabled by the ODS style or the DISPLAY= option.

If the DATASKIN= option applies a data skin, then this option is ignored.

When the COLORRESPONSE= and DISPLAY=(OUTLINE) options are in effect, the OUTLINEATTRS= suboption COLOR= is ignored, and the bubble outline colors vary according to the gradient.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

PRIMARY=TRUE | FALSE

specifies that the data columns for this plot and the plot type be used for determining default axis features. This option is needed only when two or more plots within an overlay-type layout contribute to a common axis.

Default FALSE

Restriction This option is ignored if the plot is placed under a GRIDDED or LATTICE layout block.

Note In an OVERLAY layout, only one plot in an overlay can be the primary plot on a per-axis basis. When no plot is designated as the primary plot, the first plot that can be a primary plot is considered the primary plot. If multiple plots specify PRIMARY=TRUE for the same axis, then the last such plot encountered is considered the primary plot.

See "When Plots Share Data and a Common Axis" on page 1046

"boolean " on page xii for other Boolean values that you can use.

RELATIVESCALE=TRUE | FALSE

specifies whether the SIZE= column values are interpreted as relative values. Relative means that the size values do not translate directly into bubble radii. Rather, the bubble sizes are scaled to represent the value range of the SIZE= column.

For example, when RELATIVESCALE=TRUE, if only two bubbles are drawn with sizes of 2 and 4, then they appear the same as only two bubbles with sizes of 4000 and 8000. By contrast, when RELATIVESCALE=FALSE, the size values are interpreted in the same units as the axes.

If you set this option to FALSE, then it is recommended that you also place the BUBBLEPLOT statement in a LAYOUT OVERLAYEQUATED container. This ensures that the X axis and Y-axis units are the same. For more information, see "Details" on page 460.

Default TRUE

Interactions When this option is set to TRUE, the BUBBLERADIUSMAX= and BUBBLERADIUSMIN= options can be used to fix the drawing size of the smallest bubble and largest bubble. If RELATIVESCALE=FALSE, then the BUBBLERADIUSMAX= and BUBBLERADIUSMIN= options are ignored.

If this option is set to FALSE, then the DATASKIN= option is ignored.

If one or both axes are discrete, then RELATIVESCALE=FALSE is ignored.

Tip If you specify RELATIVESCALE=FALSE, then it is recommended that you also place the BUBBLEPLOT statement in a LAYOUT OVERLAYEQUATED container to ensure that the X axis and Y-axis units are the same. If you place the BUBBLEPLOT statement in a LAYOUT OVERLAY container instead, then the bubbles might be drawn as ellipses because the X axis and Y-axis units are different.

See “boolean ” on page xii for other Boolean values that you can use.

RELATIVESCALETYPE=LINEAR | PROPORTIONAL

specifies the type of scaling that is to be applied to the SIZE= column values.

LINEAR

increases the size of the bubbles in linear proportion to the range of the SIZE= column values.

For example, if only two bubbles are drawn with sizes of 2 and 4, then they appear the same as only two bubbles with sizes of 4000 and 8000.

PROPORTIONAL

increases the size of each bubble in direct proportion to its corresponding SIZE= column value.

For example, if only two bubbles are drawn with sizes of 50 and 100, then the bubble for SIZE=50 is drawn to half the size of the bubble for SIZE=100.

Default LINEAR

Interactions This option is ignored when RELATIVESCALE=FALSE.

When theSIZETHRESHOLDMAX= option is specified, for any SIZE= column value that is greater than the SIZETHRESHOLDMAX= value, the proportional scale is adjusted so that the size of the bubble for that value is clamped to theBUBBLERADIUSMAX= value.

If all the values for the SIZE= column are negative, then RELATIVESCALETYPE=PROPORTIONAL is ignored, and the default value is used.

When RELATIVESCALETYPE=PROPORTIONAL is specified, the BUBBLERADIUSMIN= option specifies the minimum bubble size. In

that case, when a SIZE= column value results in a bubble of a size that is less than the BUBBLERADIUSMIN= value, the bubble size for that value is changed to the BUBBLERADIUSMIN= value.

REVERSECOLORMODEL=TRUE | FALSE
specifies whether to reverse the gradient (color ramp) that is defined by either the ODS style that is in effect or by the COLORMODEL= option.

Default FALSE

See COLORMODEL=

"boolean " on page xii for other Boolean values that you can use.

ROLENAME=(*role-name-list*)
specifies user-defined roles that can be used to display information in the data tips. This option provides a way to add to the data columns that appear in data tips that are specified by the TIP= option.

(*role-name-list*)
a space-separated list of *role-name = column* pairs.

Example The following example assigns the column Obs to the user-defined role TIP:

```
ROLENAME=(TIP1=OBS)
```

Default No user-defined roles

Requirement The role names that you choose must be unique and different from the predefined roles X, Y , SIZE, GROUP, DATALABEL, and COLORRESPONSE.

SIZETHRESHOLDMAX=*numeric-value*
specifies a SIZE= column value threshold at which bubble size is clamped to the BUBBLERADIUSMAX= option value. The size of the bubbles for all SIZE= column values that equal or exceed the specified threshold value is set to the BUBBLERADIUSMAX= value.

Default The maximum SIZE= column value is mapped to the BUBBLERADIUSMAX= option value.

TIP=(*role-list*) | NONE
specifies the information to display when the cursor is positioned over the bubbles. If this option is used, then it replaces all of the information that is displayed by default. Roles for columns that do not contribute to the bubble plot can be specified along with roles that do.

(*role-list*)
an ordered, space-separated list of unique BUBBLEPLOT and user-defined roles.

BUBBLEPLOT roles include X, Y, SIZE, GROUP, DATALABEL, and COLORRESPONSE.

Tip User-defined roles are defined with the ROLENAME= option.

Example The following example displays data tips for the columns assigned to the roles X, Y, and SIZE, as well as the column Pop_2009. The POP_2009 column is not assigned to any pre-defined BUBBLEPLOT role, so it must first be assigned a role:

```
ROLENAME=(TIP1=POP_2009)
TIP=(TIP1 X Y SIZE)
```

NONE
suppresses data tips and URLs (if requested) from the plot.

Default The columns assigned to these roles are automatically included in the data tip information: X , Y , SIZE , GROUP , and COLORRESPONSE .

Requirement To generate data tips in the output, you must include an ODS GRAPHICS ON statement that specifies the IMAGEMAP option, and you must write the output to the ODS HTML destination.

Interaction This option is ignored when the plot statement is in an OVERLAY or PROTOTYPE layout and the INCLUDERANGES= option is specified in the LINEAROPTS= or TIMEOPTS= option for either axis.

Tip The labels and formats for the TIP roles can be controlled with the TIPLABEL= and TIPFORMAT= options.

TIPFORMAT=(*role-format-list*)
specifies display formats for tip columns. This option provides a way to control the formats of columns that appear in data tips.

(role-format-list)
a space-separated list of *role-name* = *format* pairs.

Example
```
ROLENAME=(TIP1=SALARY)
TIP=(TIP1)
TIPFORMAT=(TIP1=DOLLAR12.)
```

Default The column format of the column assigned to the role or BEST6 if no format is assigned to a numeric column.

Restriction Only the roles that appear in the TIP= option are used.

Requirement A column must be assigned to each of the specified roles. (See the ROLENAME= option.)

TIPLABEL=(*role-label-list*)
specifies display labels for tip columns. This option provides a way to control the labels of columns that appear in data tips.

role-label-list
a space-separated list of *rolename* ="*string*" pairs.

Example
```
ROLENAME=(TIP1=PCT)
TIP=(TIP1)
```

```
TIPLABEL=(TIP1="Percent")
```

Default The column label or column name of the column assigned to the role.

Restriction Only the roles that appear in the TIP= option are used.

Requirement A column must be assigned to each of the specified roles. (See the ROLENAME= option.)

URL=*string-column*
specifies an HTML page to display when a bubble is selected.

string-column
specifies a column that contains a valid HTML page reference (HREF) for each bubble that is to have an active link.

Example **`http://www.sas.com`**

Requirement To generate a plot with selectable bubbles, you must include an ODS GRAPHICS ON statement that specifies the IMAGEMAP option, and you must write the output to the ODS HTML destination.

Interactions This option has no effect when TIP=NONE.

This option is ignored when the plot statement is in an OVERLAY or PROTOTYPE layout and the INCLUDERANGES= option is specified in the LINEAROPTS= or TIMEOPTS= option for either axis.

Tips The URL value can be blank for some X and Y pairs, meaning that no action is taken when the corresponding point is selected.

The URL value can be the same for any X and Y pairs. In that case, the same action is taken when the bubbles for those X and Y pairs are selected.

By default, drill-down links open in a new browser window (link target _blank). To specify a different target for your drill-down links, such as _self or _parent, add the DRILLTARGET="*target*" option to your ODS GRAPHICS statement. See DRILLTARGET= on page 1568.

XAXIS=X | X2
specifies whether data are mapped to the primary X (bottom) axis or to the secondary X2 (top) axis.

Default X

Interaction The overall plot specification and the layout type determine the axis display. For more information, see "How Axis Features Are Determined" on page 1040.

YAXIS=Y | Y2
specifies whether data are mapped to the primary Y (left) axis or to the secondary Y2 (right) axis.

Default Y

Interaction The overall plot specification and the layout type determine the axis display. For more information, see "How Axis Features Are Determined" on page 1040.

Details

The BUBBLEPLOT statement displays one bubble for each row in the data, provided that row contains nonmissing values for X, Y, and SIZE. By default, the bubbles are displayed as filled, outlined circles. Regardless of the data order, the bubbles are always drawn from the largest size to the smallest size.

By default, the minimum and maximum values of the SIZE= column establish a range over which the bubble radii increase in linear proportion. The actual drawing size of the smallest and largest bubble is set automatically. You can adjust the smallest and largest bubble sizes with the BUBBLERADIUSMIN= and BUBBLERADIUSMAX= options. In these cases where the bubble sizes are proportional to each other, the default setting RELATIVESCALE=TRUE is appropriate.

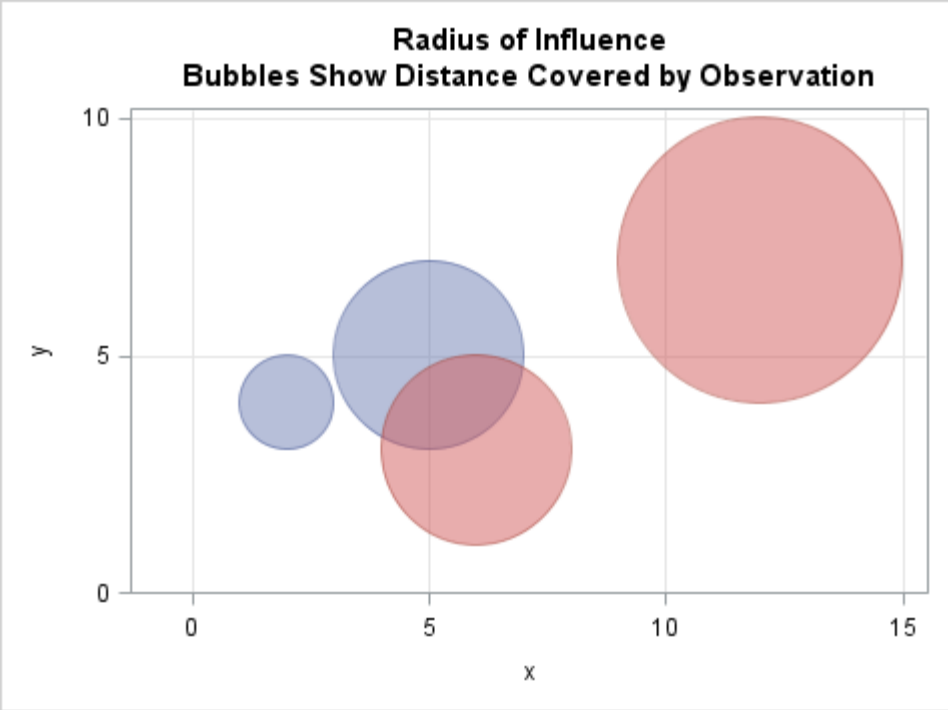
If the SIZE= values are in the same units as the X and Y values, and both X and Y are numeric, then you can generate a plot where the bubble-radius units match the axis-scale units. To do so, specify the BUBBLEPLOT statement within a LAYOUT OVERLAYEQUATED block, and in the BUBBLEPLOT statement, set RELATIVESCALE=FALSE.

By default, for character columns, the X and Y axes are always discrete. For numeric columns, the X and Y axes are linear. You can change axis type for numeric axes with the layout options XAXISOPTS= and YAXISOPTS=.

Note: Within a LAYOUT OVERLAY, the unit-interval of the X and Y axes are not necessarily the same and the bubbles might be distorted into ellipses when RELATIVESCALE=FALSE. The OVERLAYEQUATED container ensures that the bubbles are displayed as circles, assuming that both the X= and Y= arguments specify numeric columns.

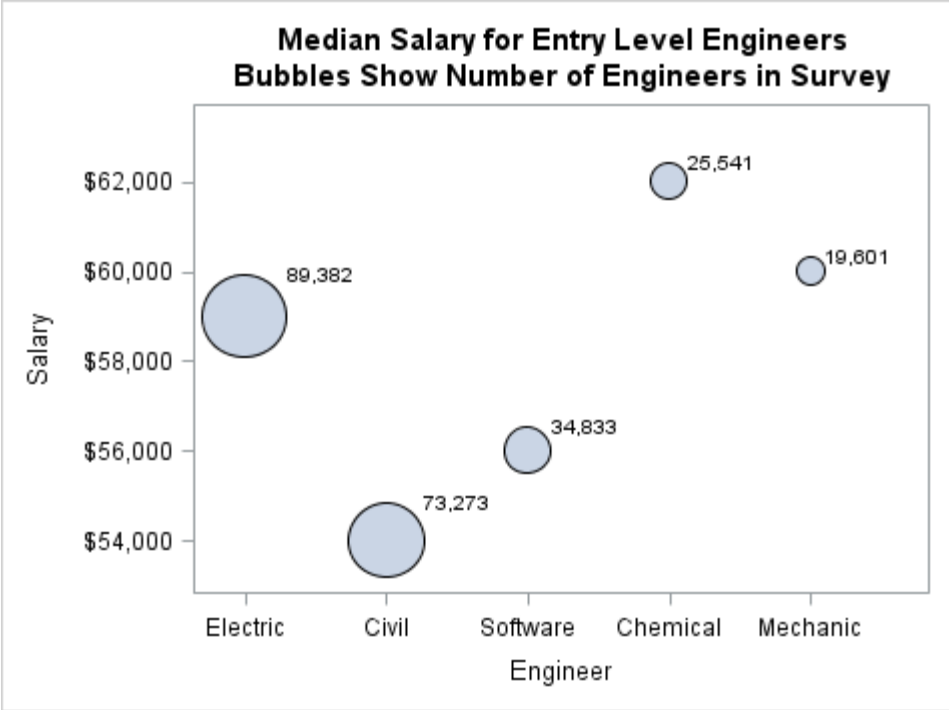
```
data influence;
input x y radius category;
datalines;
2  4 1 1
5  5 2 1
6  3 2 2
12 7 3 2
;
proc template;
  define statgraph equatedbubbles;
    begingraph;
```

```
      entrytitle 'Radius of Influence';
      entrytitle 'Bubbles Show Distance Covered by Observation';
      layout overlayequated /
          xaxisopts = (griddisplay=on)
          yaxisopts = (griddisplay=on);
        bubbleplot x=x y=y size=radius /
          group=category datatransparency=0.5
          relativescale=false ;
      endlayout;
    endgraph;
  end;

proc sgrender data=influence template=equatedbubbles;
run;
```



Example: BUBBLEPLOT Statement

The following graph was generated by the “Example Program” on page 462 :



Example Program

```
data bubbleintro;
input Engineer $ Salary number;
format Salary dollar7.0 number comma6.0;
datalines;
Electric 59000 89382
Civil 54000 73273
Software 56000 34833
Chemical 62000 25541
Mechanical 60000 19601
;
proc template;
  define statgraph engineer;
    begingraph;
      entrytitle 'Median Salary for Entry Level Engineers';
      entrytitle 'Bubbles Show Number of Engineers in Survey';
      layout overlay;
        bubbleplot x=engineer y=salary
          size=number / datalabel=number;
      endlayout;
    endgraph;
  end;

proc sgrender data=bubbleintro template=engineer;
run;
```

CONTOURPLOTPARM Statement

Creates a contour plot representing a response variable evaluated over a grid of X and Y values.

Restriction: Contour plots do not support data tips.

Tips: By default, the CONTOURPLOTPARM statement assumes that the X-Y grid is complete and does not contain any missing or irregular values. If the X-Y grid is not complete, specify GRIDDED=FALSE in the CONTOURPLOTPARM statement so that the values needed to complete the grid are calculated. Otherwise, unexpected results might occur.

You can use a legend to display the contour level values. For CONTOURTYPE=LINE and CONTOURTYPE=LABELEDLINE, use a DISCRETELEGEND statement to add a legend. For all other contour types, use a CONTINUOUSLEGEND statement to add a legend.

For filled contour types, there might be small, visible gaps between the axes and the contour boundaries. To eliminate the gaps, specify the following axis options in the layout statement for the plots parent layout:

```
XAXISOPTS=(OFFSETMIN=0 OFFSETMAX=0
  LINEAROPTS=(THRESHOLDMIN=0 THRESHOLDMAX=0))
YAXISOPTS=(OFFSETMIN=0 OFFSETMAX=0
  LINEAROPTS=(THRESHOLDMIN=0 THRESHOLDMAX=0))
```

Starting with SAS 9.4M3, you can use subpixel rendering with this statement. It is enabled by default. To disable subpixel rendering, specify SUBPIXEL=OFF in the BEGINGRAPH statement or in an ODS GRAPHICS statement. For information about the BEGINGRAPH statement SUBPIXEL= option, see SUBPIXEL= on page 39. For information about the ODS GRAPHICS statement SUBPIXEL= option, see "ODS GRAPHICS Statement" on page 1561.

Syntax

CONTOURPLOTPARM X=*numeric-column* | *expression*
Y=*numeric-column* | *expression*
Z=*numeric-column* | *expression* <*/options*>;

Summary of Optional Arguments

Appearance options

COLORMODEL=*style-element* | (*color-list*)
: specifies a color ramp that is to be used to determine the colors of filled or gradient contours.

CONTOURTYPE=LINE | FILL | GRADIENT | LINEFILL | LINEGRADIENT | LABELEDLINE | LABELEDLINEFILL | LABELEDLINEGRADIENT

specifies how the contour is displayed.

GRIDDED=TRUE | FALSE
specifies whether the X and Y values are equally spaced in a rectangular grid.

LEVELS=(*contour-value-list*)
specifies a list of contour level values.

LINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the attributes of the contour lines.

NHINT=*integer*
specifies the suggested number of contour levels for the Z column.

NLEVELS=*integer*
specifies the actual number of contour levels for the Z column.

REVERSECOLORMODEL=TRUE | FALSE
specifies whether to reverse the gradient (color ramp) that is defined by either the ODS style that is in effect or by the COLORMODEL= option.

Axes options

PRIMARY=TRUE | FALSE
specifies that the data columns for this plot and the plot type be used for determining default axis features.

XAXIS=X | X2
specifies whether data are mapped to the primary X (bottom) axis or to the secondary X2 (top) axis.

YAXIS=Y | Y2
specifies whether data are mapped to the primary Y (left) axis or to the secondary Y2 (right) axis.

Label options

LEGENDLABEL="*string*"
specifies a label to be used in a discrete legend for this plot.

LINELABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font attributes of the contour line labels.

LINELABELBASELINE=HORIZONTAL | TANGENT
specifies the text alignment of the contour line labels.

LINELABELFORMAT=*format*
specifies the format to use for the contour line labels.

LINELABELPOSITION=MIDDLE | BEGIN | END
specifies the position for the contour line labels.

Plot reference options

NAME="*string*"
assigns a name to this plot statement for reference in other template statements.

Required Arguments

X=*numeric-column* | *expression*
specifies the X coordinates for the grid.

Y=*numeric-column* | *expression*
specifies the Y coordinates for the grid.

Z=*numeric-column* | *expression*
specifies the contour response values.

Optional Arguments

COLORMODEL=*style-element* | (*color-list*)
specifies a color ramp that is to be used to determine the colors of filled or gradient contours.

style-element
specifies the name of a style element. The style element can contain these style attributes:

STARTCOLOR	specifies a color for the smallest data value of the Z= column.
NEUTRALCOLOR	specifies a color for the midpoint of the range of the Z= column.
ENDCOLOR	specifies a color for the highest data value of the Z= column.

(*color-list*)
specifies a space-separated list of colors to use in the color ramp.

You can use style attribute references such as GraphData2:Color, color names, or RGB, CMYK, HLS, and HSV (HSB) color codes to specify a color. The list can contain a mix of style attribute references, color names, and color codes.

Requirement The list of colors must be enclosed in parentheses.

See “color ” on page xii

Default The ThreeColorRamp style element.

Interactions The REVERSECOLORMODEL= option can be used to reverse the start and end colors of the ramp assigned to the color model.

The NeutralColor attribute is not used for two-color ramps.

Note For a contour plot of type FILL, LINEFILL, or LABELEDLINEFILL, the color that is chosen for the first segment is the color for the N+1 inflection point and not the starting color in the color model.

CONTOURTYPE=LINE | FILL | GRADIENT | LINEFILL | LINEGRADIENT | LABELEDLINE | LABELEDLINEFILL | LABELEDLINEGRADIENT
specifies how the contour is displayed.

LINE
displays contour levels as unlabeled lines.

FILL
displays the area between the contour levels as filled.

Each contour interval is filled with one color.

GRADIENT
displays a smooth gradient of color to represent contour levels.

LINEFILL
combines the LINE and FILL types.

Each contour interval is filled with one color. Displays contour levels as unlabeled lines.

LINEGRADIENT
combines the LINE and GRADIENT types.

Displays contour levels as unlabeled lines.

LABELEDLINE
adds labels to the LINE type, displaying contour levels as labeled lines.

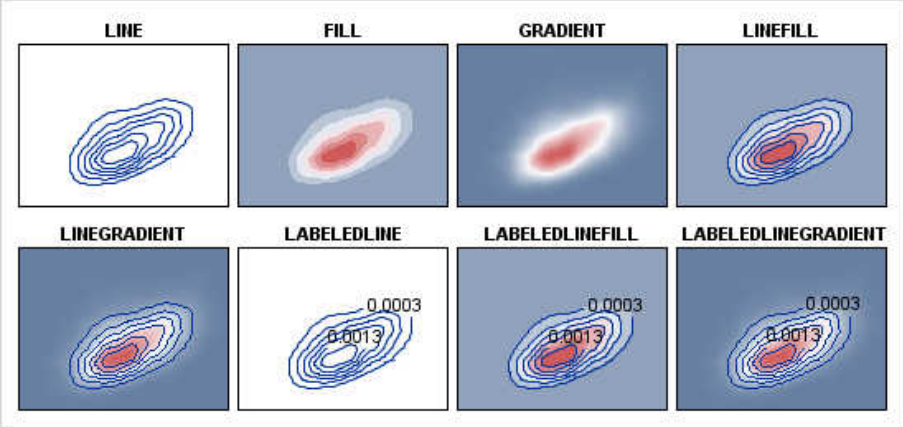
LABELEDLINEFILL
adds labels to the LINEFILL type.

Each contour interval is filled with one color. Displays contour levels as lines with labels showing contour level values.

LABELEDLINEGRADIENT
adds labels to the LINEGRADIENT type.

Displays contour levels as lines with labels showing contour level values.

The following figure shows the effect of each of the values.



Default The GraphContour:DisplayOpts style reference.

Interactions The fill colors of the types that enable FILL or GRADIENT are controlled by the COLORMODEL= option.

The line properties of the types that enable LINE or LABELEDLINE are controlled by the LINEATTRS= option.

The label properties of the types that enable LABELEDLINE are controlled by the LINELABELATTRS= and LINELABELBASELINE= options.

If a DISCRETELEGEND statement is associated with the contour, then the legend is NOT displayed if CONTOURTYPE= is set to FILL or GRADIENT.

If a CONTINUOUSLEGEND statement is associated with the contour, then the legend is NOT displayed if CONTOURTYPE is set to LINE or LABELEDLINE.

Note For a contour plot of type FILL, LINEFILL, or LABELEDLINEFILL, the color that is chosen for the first segment is the color for the N+1 inflection point and not the starting color in the color model.

GRIDDED=TRUE | FALSE

specifies whether the X and Y values are equally spaced in a rectangular grid. If set to FALSE, then additional calculations are performed in order to complete the grid.

For information about the algorithm used to calculate the grid, see "Mesoscale Objective Map Analysis Using Weighted Time-Series Observations."[1]

Default TRUE

Tip By default, the CONTOURPLOTPARM statement assumes that the X-Y grid is complete and does not contain any missing or irregular values. If the X-Y grid is not complete, then specify GRIDDED=FALSE so that the plot calculates the values needed to complete the grid. Otherwise, unexpected results might occur.

See "boolean " on page xii for other Boolean values that you can use.

LEGENDLABEL="*string*"

specifies a label to be used in a discrete legend for this plot.

Default The Z-column label. If a label is not defined, then the Z-column name is used.

Restrictions This option applies only to an associated DISCRETELEGEND statement.

This option applies to contour types LINE and LABELEDLINE only.

LEVELS=(*contour-value-list*)

specifies a list of contour level values.

(contour-value-list)

a space-separated list of numeric values, enclosed in parentheses.

Default The number of levels and the level values are determined internally using the NHINT= or NLEVELS= option value.

Interaction This option overrides the NHINT= and NLEVELS= options.

1. Barnes, Stanley L March 1973. "Mesoscale Objective Map Analysis Using Weighted Time-Series Observations." Technical Memorandum (NOAA TM ERLNSSL-62), United States National Oceanic and Atmospheric Administration, Environmental Research Labs, Norman, OK..

Notes Values that are outside of the data range are ignored.

When the LEVELS= option is not specified, the data range might be extended in order to accommodate the internally computed levels.

Example The following example specifies six levels for a contour plot:

```
levels=(0.0001 0.0004 0.0007 0.0010 0.0013 0.0016)
```

LINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the attributes of the contour lines.

Default The GraphAxisLines style element.

Interaction This option is honored only if the CONTOURTYPE= displays lines.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

LINELABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font attributes of the contour line labels.

Default The GraphValueText style element.

Interaction This option is honored only if the CONTOURTYPE= displays labels.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Text Options" on page 1606 for available *text-options*.

LINELABELBASELINE=HORIZONTAL | TANGENT
specifies the text alignment of the contour line labels. Each contour line has a precomputed label point.

HORIZONTAL
specifies that each label is parallel to the X axis.

The label intersects its contour line and is centered at the label point.

TANGENT
specifies that each label is drawn tangent to the contour line at the label point.

This reduces intersection with the contour line and causes labels to be tilted at various angles in relation to the X axis.

Default HORIZONTAL

Interaction This option is honored only if the CONTOURTYPE= displays labels.

LINELABELFORMAT=*format*
specifies the format to use for the contour line labels.

Default The format associated with the Z column or BEST6. if no format is assigned.

Interaction This option is honored only if the CONTOURTYPE= displays labels.

LINELABELPOSITION=MIDDLE | BEGIN | END
specifies the position for the contour line labels.

Default MIDDLE

Interaction This option is honored only if the CONTOURTYPE= option specifies labels.

NAME="*string*"
assigns a name to this plot statement for reference in other template statements. The specified name is used primarily in legend statements to indicate the colors associated with the Z values.

Restrictions The *string* is case sensitive, cannot contain spaces, and must define a unique name within the template.

This option does not support variables that are created by the DYNAMIC, MVAR, and NMVAR template statements.

Interaction The *string* is used as the default legend label if the LEGENDLABEL= option is not used.

NHINT=*integer*
specifies the suggested number of contour levels for the Z column.

Default 7

Interaction This option is ignored if the LEVELS= or NLEVELS= option is specified.

Note The actual number of levels is adjusted to provide an appropriate number of levels for the data.

NLEVELS=*integer*
specifies the actual number of contour levels for the Z column.

Default The number of levels is determined internally, using the NHINT= value.

Interactions This option overrides the NHINT= option.

This option is ignored if CONTOURTYPE= GRADIENT.

This option is ignored if the LEVELS= option is specified.

PRIMARY=TRUE | FALSE
specifies that the data columns for this plot and the plot type be used for determining default axis features. This option is needed only when two or more plots within an overlay-type layout contribute to a common axis.

Default FALSE

Restriction This option is ignored if the plot is placed under a GRIDDED or LATTICE layout block.

Note In an OVERLAY layout, only one plot in an overlay can be the primary plot on a per-axis basis. When no plot is designated as the primary plot, the first plot that can be a primary plot is considered the primary plot. If multiple plots specify PRIMARY=TRUE for the same axis, then the last such plot encountered is considered the primary plot.

See "When Plots Share Data and a Common Axis" on page 1046

"boolean " on page xii for other Boolean values that you can use.

REVERSECOLORMODEL=TRUE | FALSE
specifies whether to reverse the gradient (color ramp) that is defined by either the ODS style that is in effect or by the COLORMODEL= option.

Default FALSE

See COLORMODEL=

"boolean " on page xii for other Boolean values that you can use.

XAXIS=X | X2
specifies whether data are mapped to the primary X (bottom) axis or to the secondary X2 (top) axis.

Default X

Interaction The overall plot specification and the layout type determine the axis display. For more information, see "How Axis Features Are Determined" on page 1040.

YAXIS=Y | Y2
specifies whether data are mapped to the primary Y (left) axis or to the secondary Y2 (right) axis.

Default Y

Interaction The overall plot specification and the layout type determine the axis display. For more information, see "How Axis Features Are Determined" on page 1040.

Details

A CONTOURPLOTPARM statement uses the CONTOURTYPE= option to specify the type of contour plot to generate. Contour types that display fills or gradients but no contour lines can use only a CONTINUOUSLEGEND statement to represent the contour level values in a legend. Contour types that display lines can use either a CONTINUOUSLEGEND or DISCRETELEGEND statement to identify contour level values.

By default, the CONTOURPLOTPARM statement assumes that the X-Y grid is complete. If the grid is not complete, then set the GRIDDED= option to FALSE so that the plot calculates the values needed to complete into a grid with a bounding rectangle.

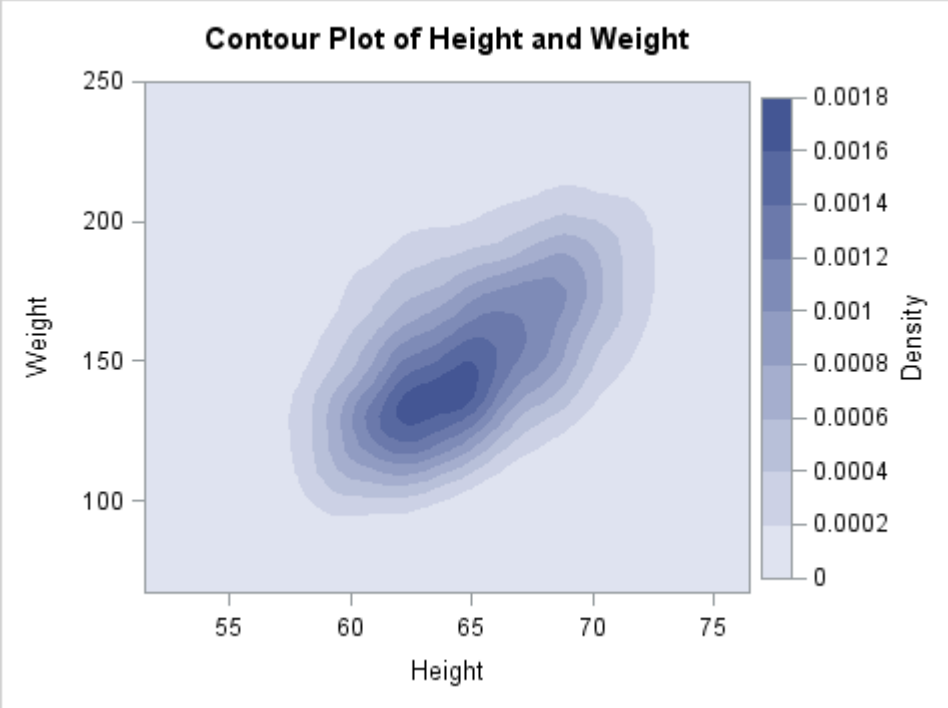
For filled or gradient contour types, small gaps might be visible between the axes and the bounding box of the contour data. To eliminate these gaps, set the axis options of the LAYOUT OVERLAY statement as follows:

```
XAXISOPTS=(OFFSETMIN=0  OFFSETMAX=0
           LINEAROPTS=(THRESHOLDMIN=0 THRESHOLDMAX=0))

YAXISOPTS=(OFFSETMIN=0  OFFSETMAX=0
           LINEAROPTS=(THRESHOLDMIN=0 THRESHOLDMAX=0))
```

Contour plots do not support the data tips that are enabled by the IMAGEMAP= option in the ODS GRAPHICS statement.

Example: CONTOURPLOTPARM Statement

The following graph was generated by the "Example Program" on page 471:



Example Program

```
proc template;
 define statgraph contourplotparm;
   begingraph;
```

```
      entrytitle "Contour Plot of Height and Weight";
      layout overlay /
          xaxisopts=(offsetmin=0 offsetmax=0
            linearopts=(thresholdmin=0 thresholdmax=0))
          yaxisopts=(offsetmin=0 offsetmax=0
            linearopts=(viewmax=250
                        thresholdmin=0 thresholdmax=0));
        contourplotparm x=height y=weight z=density /
          contourtype=fill nhint=12
            name="Contour" colormodel=twocolorramp;
        continuouslegend "Contour" / title="Density";
      endlayout;
    endgraph;
  end;
run;
proc sgrender data=sashelp.gridded template=contourplotparm;
run;
```

DENDROGRAM Statement

Creates a tree diagram that is typically used to display the results of a hierarchical clustering analysis.

Restriction: The DENDROGRAM statement does not support CAS in-memory tables. In SAS 9.4M6 and earlier releases, unexpected results might occur when data stored in a CAS in-memory table is used. Starting with SAS Viya 3.5 and SAS Studio 5.2, the dendrogram is dropped when data stored in a CAS in-memory table is used.

Syntax

DENDROGRAM NODEID=*column* | *expression*
PARENTID=*column* | *expression*
CLUSTERHEIGHT=*numeric-column* | *expression* </*options*>;

Summary of Optional Arguments

Appearance options

CLUSTERS=*numeric-column* | *expression*
: specifies a numeric column containing the resultant number of clusters at each node.

CUT=TRUE | FALSE
: specifies whether the tree is to be cut.

CUTOPTS=(*pruning-options*)
: specifies pruning options for cutting the dendrogram.

DATATRANSPARENCY=*number*
: specifies the degree of the transparency of the dendrogram lines.

LINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the attributes of the dendrogram lines.

ORIENT=VERTICAL | HORIZONTAL
specifies the orientation of the dendrogram leaf axis.

TREETYPE=RECTANGULAR | TRIANGULAR
specifies the type of tree structure to draw.

Axes options

PRIMARY=TRUE | FALSE
specifies that the data columns for this plot and the plot type be used for determining default axis features.

XAXIS=X | X2
specifies whether data are mapped to the primary X (bottom) axis or to the secondary X2 (top) axis.

YAXIS=Y | Y2
specifies whether data are mapped to the primary Y (left) axis or to the secondary Y2 (right) axis.

Data tip options

TIP=(*role-list*) | NONE
specifies the information to display when the cursor is positioned over a dendrogram line.

TIPFORMAT=(*role-format-list*)
specifies display formats for tip columns.

TIPLABEL=(*role-label-list*)
specifies display labels for tip columns.

Label options

LEGENDLABEL="*string*"
specifies a label to be used in a discrete legend for this plot.

Plot reference options

NAME="*string*"
assigns a name to this plot statement for reference in other template statements.

Required Arguments

NODEID=*column* | *expression*
specifies a column for the ID values of the nodes. Each node ID value must be unique. If duplicate NODEID values are found, then the dendrogram is not rendered . The column can be numeric or character, but it must be of the same type and have the same formatted length as the ParentID column.

The maximum number of nodes that are supported by the dendrogram is determined by the DISCRETEMAX= option in the ODS GRAPHICS statement. The default value is DISCRETEMAX=1000. If the graph data contains more than 1000 discrete values, then the dendrogram is not drawn and a warning is written to the SAS log. In that case, you can use the DISCRETEMAX= option to increase the maximum number of discrete values that are allowed.

Note If the data is a SAS data set, the nodes are displayed in data order. If the data is a CAS in-memory table, the nodes are displayed in ascending order of the NODEID values by default.

PARENTID=*column* | *expression*
specifies a column for the parent ID values of the nodes. The column can be numeric or character, but it must be of the same type and have the same formatted length as the NodeID column.

CLUSTERHEIGHT=*numeric-column* | *expression*
specifies the column for the height values for each node.

Optional Arguments

CLUSTERS=*numeric-column* | *expression*
specifies a numeric column containing the resultant number of clusters at each node.

Interaction For this option to take effect, the pruning options in the CUTOPTS= option must set TYPE=NCLUSTERS and specify a number for the NCLUSTERS= setting.

CUT=TRUE | FALSE
specifies whether the tree is to be cut.

Default FALSE

Tip To set the properties of the CUT, use the CUTOPTS= option.

See “boolean ” on page xii for other Boolean values that you can use.

CUTOPTS=(*pruning-options*)
specifies pruning options for cutting the dendrogram. The following *pruning-options* must be specified as a space-separated list of *option = value* pairs enclosed in parentheses.

CUTHEIGHT=*number*
specifies the height at which the tree is to be pruned.

Default The tree is not pruned.

Requirement You must include pruning option TYPE=CUTHEIGHT with this option.

Interaction This option is ignored when CUT=FALSE or when pruning option TYPE=CUTHEIGHT is not explicitly specified.

Example CUTOPTS=(TYPE=CUTHEIGHT CUTHEIGHT=0.75)

NCLUSTERS=*number*
specifies the number of clusters to use for pruning the tree.

Default The tree is not pruned.

Interaction For this setting to take effect, *pruning-option* TYPE=NCLUSTERS must also be set. In addition, the CLUSTERS= option must be used, and the CUT= option must be set to TRUE.

OUTLINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the attributes of the cut lines.

Default The GraphCutLine style element.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

TYPE=CUTHEIGHT | NCLUSTERS
specifies which rule to use to prune the tree.

Default CUTHEIGHT

DATATRANSPARENCY=*number*
specifies the degree of the transparency of the dendrogram lines.

Default 0

Range 0–1, where 0 is opaque and 1 is entirely transparent

LEGENDLABEL="*string*"
specifies a label to be used in a discrete legend for this plot.

Default The CLUSTERHEIGHT= column label. If a label is not defined, then the CLUSTERHEIGHT= column name is used.

Restriction This option applies only to an associated DISCRETELEGEND statement.

LINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the attributes of the dendrogram lines.

Default The GraphDataDefault style element.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

NAME="*string*"
assigns a name to this plot statement for reference in other template statements. The specified name is used primarily in legend statements to coordinate the use of colors and line patterns between the plot and the legend.

Restrictions The *string* is case sensitive, cannot contain spaces, and must define a unique name within the template.

This option does not support variables that are created by the DYNAMIC, MVAR, and NMVAR template statements.

Interaction The *string* is used as the default legend label if the LEGENDLABEL= option is not used.

ORIENT=VERTICAL | HORIZONTAL
specifies the orientation of the dendrogram leaf axis.

Default VERTICAL

PRIMARY=TRUE | FALSE
specifies that the data columns for this plot and the plot type be used for determining default axis features. This option is needed only when two or more plots within an overlay-type layout contribute to a common axis.

Default FALSE

Restriction This option is ignored if the plot is placed under a GRIDDED or LATTICE layout block.

Note In an OVERLAY layout, only one plot in an overlay can be the primary plot on a per-axis basis. When no plot is designated as the primary plot, the first plot that can be a primary plot is considered the primary plot. If multiple plots specify PRIMARY=TRUE for the same axis, then the last such plot encountered is considered the primary plot.

See "When Plots Share Data and a Common Axis" on page 1046

"boolean " on page xii for other Boolean values that you can use.

TIP=(*role-list*) | NONE
specifies the information to display when the cursor is positioned over a dendrogram line. If this option is used, then it replaces all of the information that is displayed by default.

(*role-list*)
an ordered, space-separated list of unique DENDROGRAM roles, which include NODEID , PARENTID , and CLUSTERHEIGHT .

Example The following example displays data tips for the columns assigned to the roles NODEID and PARENTID.

```
TIP=(NODEID PARENTID)
```

NONE
suppresses data tips from the plot.

Default The columns assigned to the following roles are automatically included in the data tip information: NODEID , PARENTID , and CLUSTERHEIGHT .

Requirement To generate data tips in the output, you must include an ODS GRAPHICS ON statement that specifies the IMAGEMAP option, and you must write the output to the ODS HTML destination.

Interaction This option is ignored when the plot statement is in an OVERLAY or PROTOTYPE layout and the INCLUDERANGES= option is

specified in the LINEAROPTS= or TIMEOPTS= option for either axis.

Tip The labels and formats for the TIP roles can be controlled with the TIPLABEL= and TIPFORMAT= options.

TIPFORMAT=(*role-format-list*)
specifies display formats for tip columns. This option provides a way to control the formats of columns that appear in data tips.

(role-format-list)
a space-separated list of *role-name* = *format* pairs.

Example
```
TIPFORMAT=(CLUSTERHEIGHT=4.1)
```

Default The column format of the column assigned to the role or BEST6 if no format is assigned to a numeric column.

Restriction Only the roles that appear in the TIP= option are used.

Requirement A column must be assigned to each of the specified roles.

TIPLABEL=(*role-label-list*)
specifies display labels for tip columns. This option provides a way to control the labels of columns that appear in data tips.

role-label-list
a space-separated list of *rolename* ="*string*" pairs.

Example
```
TIPLABEL=(CLUSTERHEIGHT="Height")
```

Default The column label or column name of the column assigned to the role.

Restriction Only the roles that appear in the TIP= option are used.

Requirement A column must be assigned to each of the specified roles.

TREETYPE=RECTANGULAR | TRIANGULAR
specifies the type of tree structure to draw.

Default RECTANGULAR

XAXIS=X | X2
specifies whether data are mapped to the primary X (bottom) axis or to the secondary X2 (top) axis.

Default X

Interaction The overall plot specification and the layout type determine the axis display. For more information, see "How Axis Features Are Determined" on page 1040.

YAXIS=Y | Y2
specifies whether data are mapped to the primary Y (left) axis or to the secondary Y2 (right) axis.

Default Y

Interaction The overall plot specification and the layout type determine the axis display. For more information, see "How Axis Features Are Determined" on page 1040.

Details

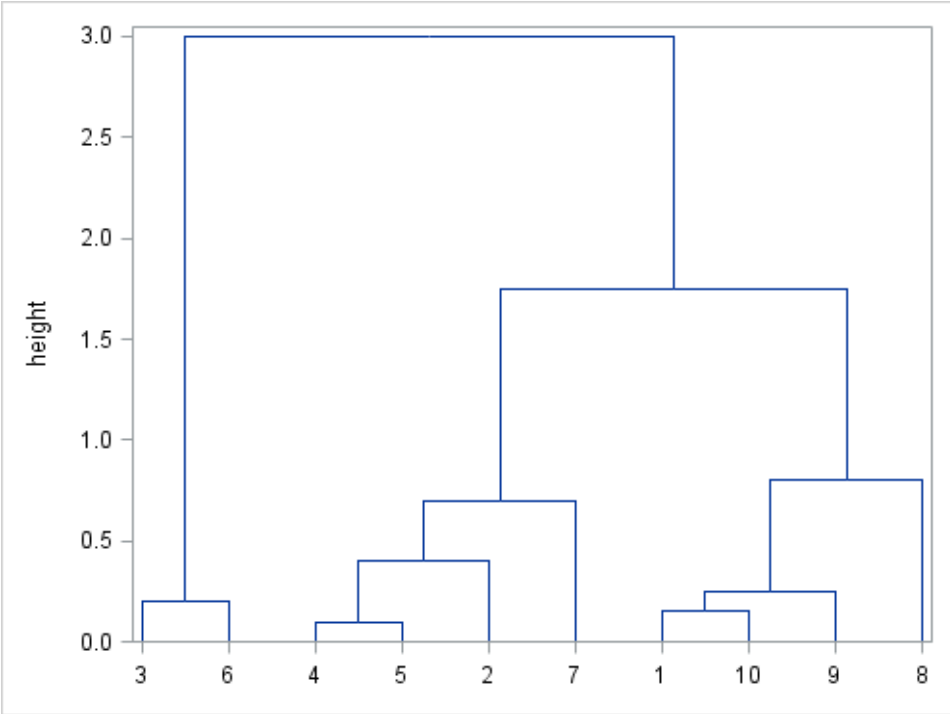
A dendrogram is a tree diagram that is typically used to show the cluster arrangements in hierarchical data. The DENDROGRAM statement supports clusters with only a single root. If multiple roots are found in the data, then a warning is written to the SAS log and the dendrogram is not drawn. The maximum number of nodes that is supported by the DENDROGRAM statement is determined by the DISCRETEMAX= option in the ODS GRAPHICS statement, which is 1000 by default.

In the Graph Template Language, a DENDROGRAM plot typically appears by itself in a LAYOUT OVERLAY container. You can overlay REFERENCELINE or BANDPLOT statements on a DENDROGRAM, but overlaying other plot types might produce unexpected results.

Using the DENDROGRAM statement in layouts where the axis ranges are merged across cells might produce unexpected results.

Example: DENDROGRAM Statement

The following graph was generated by the "Example Program" on page 479:



Example Program

```
data clustree;
  input id $ parent $7-12 height nClus;
  label id="Cluster ID" parent="Parent ID";
  datalines;
clus1       3 1
clus2 clus1 0.2 7
clus3 clus1 1.75 2
clus4 clus3 0.7 4
clus5 clus3 0.8 3
clus6 clus4 0.4 5
clus7 clus6 0.1 9
clus8 clus5 0.25 6
clus9 clus8 0.15 8
1     clus9 0 10
2     clus6 0 10
3     clus2 0 10
4     clus7 0 10
5     clus7 0 10
6     clus2 0 10
7     clus4 0 10
8     clus5 0 10
9     clus8 0 10
10    clus9 0 10
run;

proc template;
  define statgraph dendrogram;
  begingraph;
```

```
    layout overlay;
      dendrogram nodeID=id parentID=parent clusterheight=height;
    endlayout;
  endgraph;
end;
run;

proc sgrender data=clustree template=dendrogram;
run;
```

DENSITYPLOT Statement

Creates a univariate probability density curve computed from input data.

Requirement: If you include a histogram and a density plot in your graph and both plots specify the same data column, you must either specify SCALE=DENSITY in the HISTOGRAM statement or place the HISTOGRAM statement before the DENSITYPLOT statement in your template code. Otherwise, the density plot values might not scale properly to the histogram bins on the dependent axis. This requirement applies even when the histogram and density plots are in different cells in a multicell graph.

Tips: If the data density is not known, then use the KERNEL distribution option in the DENSITYPLOT statement.

Starting with SAS 9.4M3, subpixel rendering is enabled by default. To disable subpixel rendering, specify SUBPIXEL=OFF in the BEGINGRAPH statement or in an ODS GRAPHICS statement. For information about the BEGINGRAPH statement SUBPIXEL= option, see SUBPIXEL= on page 39. For information about the ODS GRAPHICS statement SUBPIXEL= option, see "ODS GRAPHICS Statement" on page 1561.

Syntax

DENSITYPLOT *numeric-column | expression* </<*distribution-option*> <*options*>>;

Summary of Optional Arguments

Appearance options

DATATRANSPARENCY=*number*
: specifies the degree of the transparency of the density curve and curve label.

LINEATTRS=*style-element | style-element* (*line-options*) | (*line-options*)
: specifies the attributes of the density curve.

ORIENT=VERTICAL | HORIZONTAL
: specifies the orientation of the Y axis.

Axes options

PRIMARY=TRUE | FALSE
: specifies that the data columns for this plot and the plot type be used for determining default axis features.

XAXIS=X | X2
: specifies whether data are mapped to the primary X (bottom) axis or to the secondary X2 (top) axis.

YAXIS=Y | Y2
: specifies whether data are mapped to the primary Y (left) axis or to the secondary Y2 (right) axis.

Data tip options

TIPFORMAT=(*role-format-list*)
: specifies display formats for tip columns.

TIPLABEL=(*role-label-list*)
: specifies display labels for tip columns.

Label options

CURVELABEL=*"string"*
: specifies a label for the density curve.

CURVELABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
: specifies the color and font attributes of the density curve label.

CURVELABELLOCATION=INSIDE | OUTSIDE
: specifies the location of the density curve label relative to the plot area.

CURVELABELPOSITION=AUTO | MAX | MIN | START | END
: specifies the position of the density curve label relative to the curve line.

CURVELABELSPLIT=TRUE | FALSE
: specifies whether to split the curve label at the specified split characters.

CURVELABELSPLITCHAR="*character-list*"
: specifies one or more characters on which the curve label can be split if needed.

CURVELABELSPLITCHARDROP=TRUE | FALSE
: specifies whether the split characters are included in the curve label text.

CURVELABELSPLITJUSTIFY=AUTO | CENTER | LEFT | RIGHT
: specifies the justification of the strings that are inside the curve label block.

LEGENDLABEL="*string*"
: specifies a label to be used in a discrete legend for this plot.

Midpoint options

GROUP=*column* | *discrete-attr-var* | *expression*
: creates a separate density curve for each unique group value in the specified column.

INCLUDEMISSINGGROUP=TRUE | FALSE
: specifies whether missing values of the group variable are included in the plot.

Plot reference options

NAME="*string*"
assigns a name to this plot statement for reference in other template statements.

Statistics options

FREQ=*numeric-column | expression*
specifies a numeric column that provides frequencies for each observation that is read.

WEIGHT=*numeric-column | expression*
specifies a column that contains a density-curve calculation *a priori* weight for each observation of the input data object.

Required Arguments

numeric-column
specifies a numeric column of data values that are used to calculate the parameters for the probability distribution.

expression
specifies an expression that calculates values when those values are not stored in the data.

Optional Arguments

CURVELABEL=*"string"*
specifies a label for the density curve.

Default No curve label is displayed.

Restriction This option is not valid when the GROUP= option is specified.

Tip The font and color attributes for the label are specified by the CURVELABELATTRS= option.

CURVELABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font attributes of the density curve label.

Default The GraphValueText style element.

Interaction For this option to take effect, the CURVELABEL=curvelabel option must also be used.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Text Options" on page 1606 for available *text-options*.

CURVELABELLOCATION=INSIDE | OUTSIDE
specifies the location of the density curve label relative to the plot area.

INSIDE
locates the labels inside the plot area

OUTSIDE
locates the labels outside the plot area

Default INSIDE

Restriction OUTSIDE cannot be used when the DENSITYPLOT is used in multi-cell layouts such as LATTICE, DATAPANEL, or DATALATTICE, where axes can be external to the grid.

Interaction This option is used in conjunction with the CURVELABELPOSITION= option to determine where the curve label appears. For more information, see "Location and Position of Curve Labels" on page 213.

CURVELABELPOSITION=AUTO | MAX | MIN | START | END
specifies the position of the density curve label relative to the curve line.

AUTO
positions the density label automatically near the end of the density curve along unused axes whenever possible (typically Y2 or X2) to avoid collision with tick values.

Restriction This option is used only when CURVELABELLOCATION=OUTSIDE.

MAX
forces the density label to appear near maximum density X-values (typically, to the right).

MIN
forces the density label to appear near minimum density X-values (typically, to the left).

START
forces the density label to appear near the beginning of the curve.

Restriction This option is used only when CURVELABELLOCATION=INSIDE.

Tip This option is particularly useful when the curve line has a spiral shape.

END
forces the density label to appear near the end of the curve.

Restriction This option is used only when CURVELABELLOCATION=INSIDE.

Tip This option is particularly useful when the curve line has a spiral shape.

Defaults AUTO when CUVELABELLOCATION=OUTSIDE.

END when CURVELABELLOCATION=INSIDE.

Restriction The AUTO setting is ignored if CURVELABELLOCATION=INSIDE is specified. The START and END settings are ignored if CURVELABELLOCATION=OUTSIDE is specified.

Interactions For this option to take effect, the CURVELABEL= option must also be specified.

This option is used in conjunction with the CURVELABELLOCATION= option to determine where the density label appears. For more information, see "Location and Position of Curve Labels" on page 213.

Note When you specify TICKVALUELIST=, VIEWMAX=, or VIEWMIN= in an axis statement, the data points that are used to determine the position of the curve label might fall outside of the graph area. In that case, the curve label might not be displayed or might be positioned incorrectly.

Tip When END is in effect, no attempt is made to avoid curve label collisions. If your curve labels collide, try using MAX instead.

CURVELABELSPLIT=TRUE | FALSE

specifies whether to split the curve label at the specified split characters. When a curve label is split, the label is split on each occurrence of the specified split characters.

Default FALSE. The curve label is not split.

Requirement The CURVELABEL= option must also be specified.

Interactions The CURVELABELSPLITCHAR= option specifies one or more characters on which the splits occur.

This option has no effect when CURVELABELPOSITION=AUTO.

See "boolean " on page xii for other Boolean values that you can use.

CURVELABELSPLITCHAR="*character-list*"

specifies one or more characters on which the curve label can be split if needed. When multiple split characters are specified, each character in the list is treated as a separate split character unless the specified characters appear consecutively in the curve label. In that case, all of the specified split characters together are treated as a single split character.

When CURVELABEL= is specified and CURVELABELSPLIT=TRUE, the curve label is split unconditionally at each occurrence of any of the specified split characters. If the curve label does not contain any of the specified characters, then the label is not split.

"character-list"

one or more characters with no delimiter between each character and enclosed in quotation marks.

Default A blank space

Requirements The list of characters must be enclosed in quotation marks.

Multiple characters must be specified with no delimiters. For example, to specify the split characters a, b, and c, use the following option:

```
curvelabelsplitchar="abc"
```

The CURVELABEL= option and the CURVELABELSPLIT=TRUE option must also be specified.

Interactions This option has no effect if CURVELABELPOSITION=AUTO.

The CURVELABELSPLITCHARDROP= option specifies whether the split characters are included in the curve label or are dropped.

Notes When multiple characters are specified, the order of the characters in the list is not significant.

The split characters are case sensitive.

Tip Use the CURVELABELSPLITJUSTIFY= option to specify the justification of the strings in the curve label block.

CURVELABELSPLITCHARDROP=TRUE | FALSE
specifies whether the split characters are included in the curve label text.

TRUE
drops the split characters from the curve label text.

FALSE
includes the split characters in the curve label text.

When CURVELABELSPLIT=TRUE and CURVELABELSPLITCHARDROP=FALSE, each split character remains as the last character in the current line. The characters that follow the split character, up to and including the next split character, are then wrapped to the next line.

The following figure shows an example of a curve label with the following specifications:

- CURVELABELPOSITION=MAX
- CURVELABEL="Product*Group*A"
- CURVELABELSPLIT=TRUE
- CURVELABELSPLITCHARDROP=TRUE | FALSE
- CURVELABELSPLITCHAR="*"

Note: The horizontal line to the left of the label represents the maximum end of the curve for reference.

When CURVELABELSPLITCHARDROP=TRUE, the asterisks are removed from the label. When CURVELABELSPLITCHARDROP=FALSE, each asterisk remains as the last character in the line prior to the new line.

Default TRUE. The split characters are dropped from the curve label.

Requirement The CURVELABEL= option and the CURVELABELSPLIT=TRUE option must also be specified.

Interaction The CURVELABELSPLITCHAR= option specifies the split characters.

See "boolean " on page xii for other Boolean values that you can use.

CURVELABELSPLITJUSTIFY=AUTO | CENTER | LEFT | RIGHT
specifies the justification of the strings that are inside the curve label block.

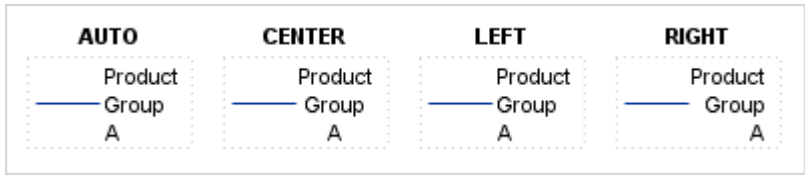
AUTO
justifies the labels based on the CURVELABELPOSITION= option.

CURVELABELPOSITION= Value	Justification
MAX or END	LEFT
MIN or START	RIGHT

CENTER
LEFT
RIGHT
justifies the labels center, left, or right, as specified.

The following figure shows an example in which CURVELABELPOSITION=MAX.

Note: The horizontal line to the left of each label represents the maximum end of the curve for reference.



In this case, because CURVELABELPOSITION=MAX, AUTO left-justifies the lines of text.

Default AUTO

Requirement The CURVELABEL= option and the CURVELABELSPLIT=TRUE option must also be specified.

Interaction This option has no effect if CURVELABELPOSITION=AUTO.

DATATRANSPARENCY=*number*
specifies the degree of the transparency of the density curve and curve label.

Default 0

Range 0–1, where 0 is opaque and 1 is entirely transparent

FREQ=*numeric-column* | *expression*
specifies a numeric column that provides frequencies for each observation that is read.

Default All observations have a frequency count of 1.

Restriction If the value of *numeric-column* is missing or is less than 1 for an observation, then that observation is not used in the analysis. If the value is not an integer, then only the integer portion is used.

Note If *n* is the value of the numeric column for a given observation, then that observation is used *n* times for the purposes of any statistical computation. The marker for that observation is drawn *n* times, which increases the marker weight slightly with frequency.

GROUP=*column* | *discrete-attr-var* | *expression*
creates a separate density curve for each unique group value in the specified column.

Note: This feature applies to SAS 9.4M2 and to later releases.

discrete-attr-var
specifies a discrete attribute map variable.

The discrete attribute map variable is created by a DISCRETEATTRVAR statement.

Restriction A discrete attribute map variable specification must be a direct reference to the attribute map variable. It cannot be set by a dynamic variable.

Default Each distinct group value is represented in the plot by a different line color and pattern. The line color is determined by the ContrastColor attribute of the GraphData1–GraphDataN and GraphMissing style elements. The line pattern is determined by the LineStyle attribute of the GraphData1–GraphDataN and GraphMissing style elements.

Notes The group values are mapped in the order in which they appear in the data.

If you specify a column in a SAS data set, the visual attributes for each group value are assigned in data order. If you specify a column in a CAS in-memory table, the visual attributes for each group value are assigned in ascending order of the group column character values or of unformatted numeric values.

Tips You can individually override the representations that are used to identify the groups. For example, in some ODS styles, each distinct group value is represented by a different line color and pattern. In that case, you can use the PATTERN= setting on the LINEATTRS= option to assign the same line pattern to all of the curves.

By default, ODS Graphics limits the number of groups to 1000. When this limit is exceeded, the GROUP= option is ignored. Use the GROUPMAX= option in the ODS GRAPHICS statement to change the maximum number of groups that can be processed.

See "DISCRETEATTRVAR Statement" on page 1516

"Example 3: Grouped Density Plot" on page 495

INCLUDEMISSINGGROUP=TRUE | FALSE
specifies whether missing values of the group variable are included in the plot.

Note: This feature applies to SAS 9.4M2 and to later releases.

Default TRUE

Interaction For this option to take effect, the GROUP= option must also be specified.

Tip The attributes of the missing group value are determined by the GraphMissing style element unless a discrete attribute map is in effect, the MISSING= system option changes the default missing character, or a user-defined format is applied to the group value. In those cases, the attributes of the missing group value are determined by a GraphData1–GraphDataN style element instead of by the GraphMissing style element.

See "boolean " on page xii for other Boolean values that you can use.

LEGENDLABEL="*string*"
specifies a label to be used in a discrete legend for this plot.

Default The *string* specified on the NAME= option.

Restriction This option applies only to an associated DISCRETELEGEND statement.

LINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the attributes of the density curve.

Defaults For non-grouped data, the GraphFit style element.

For grouped data, the ContrastColor and LineStyle attributes of the GraphData1–GraphDataN style elements, and the GraphFit:LineThickness style reference.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

NAME="*string*"
assigns a name to this plot statement for reference in other template statements. The specified name is used primarily in legend statements to coordinate the use of colors and line patterns between the plot and the legend.

Restrictions The *string* is case sensitive, cannot contain spaces, and must define a unique name within the template.

This option does not support variables that are created by the DYNAMIC, MVAR, and NMVAR template statements.

Interaction The *string* is used as the default legend label if the LEGENDLABEL= option is not used.

ORIENT=VERTICAL | HORIZONTAL
specifies the orientation of the Y axis.

Default VERTICAL

PRIMARY=TRUE | FALSE
specifies that the data columns for this plot and the plot type be used for determining default axis features. This option is needed only when two or more plots within an overlay-type layout contribute to a common axis.

Default FALSE

Restriction This option is ignored if the plot is placed under a GRIDDED or LATTICE layout block.

Note In an OVERLAY layout, only one plot in an overlay can be the primary plot on a per-axis basis. When no plot is designated as the primary plot, the first plot that can be a primary plot is considered the primary plot. If multiple plots specify PRIMARY=TRUE for the same axis, then the last such plot encountered is considered the primary plot.

See "When Plots Share Data and a Common Axis" on page 1046

"boolean " on page xii for other Boolean values that you can use.

TIPFORMAT=(*role-format-list*)
specifies display formats for tip columns. This option provides a way to control the formats of columns that appear in data tips.

(*role-format-list*)
a space-separated list of *role-name = format* pairs.

Example `TIPFORMAT=(Y=6.2)`

Default The column format of the column assigned to the role or BEST6 if no format is assigned to a numeric column.

Requirement To enable data tips in the output, you must include an ODS GRAPHICS ON statement that specifies the IMAGEMAP option, and you must write the output to the ODS HTML destination.

Note The columns assigned to the X and Y roles are automatically included in the data tip information.

TIPLABEL=(*role-label-list*)
specifies display labels for tip columns. This option provides a way to control the labels of columns that appear in data tips.

role-label-list
a space-separated list of *rolename* ="*string*" pairs.

Example `TIPLABEL=(Y="Curve")`

Default The column label or column name of the column assigned to the role.

Note The columns assigned to the X and Y roles are automatically included in the data tip information.

WEIGHT=*numeric-column* | *expression*
specifies a column that contains a density-curve calculation *a priori* weight for each observation of the input data object.

Requirement The value must be nonnegative.

Note The values of the weight variable must be greater than zero. If the weight value for an observation is zero, negative, or missing, that observation is deleted from the analysis.

XAXIS=X | X2
specifies whether data are mapped to the primary X (bottom) axis or to the secondary X2 (top) axis.

Default X

Interaction The overall plot specification and the layout type determine the axis display. For more information, see "How Axis Features Are Determined" on page 1040.

YAXIS=Y | Y2
specifies whether data are mapped to the primary Y (left) axis or to the secondary Y2 (right) axis.

Default Y

Interaction The overall plot specification and the layout type determine the axis display. For more information, see "How Axis Features Are Determined" on page 1040.

Distribution Options

KERNEL (<C=*positive-number*> <WEIGHTFUNCTION=NORMAL | QUADRATIC | TRIANGULAR> <MAXPOINTS=*positive-integer*>)

specifies a nonparametric kernel density estimate. By default, the kernel density estimates are computed by minimizing the approximate mean integrated square error (AMISE). It is the same method that the UNIVARIATE procedure uses to compute kernel density estimates. The general form of the kernel density estimator is as follows.

$$\hat{f}_{\lambda}(x) = \frac{100h\,\%}{n\lambda}\sum_{i=1}^{n} K_0\left(\frac{x - x_i}{\lambda}\right)$$

In the equation, $K_0(\cdot)$ is the weight function, λ is the bandwidth, n is the sample size, and x_i is the ith observation. You can use the C= suboption to specify the bandwidth and the WEIGHTFUNCTION= suboption to specify the weight function $K_0(\cdot)$.

For more information about the kernel density estimate, see Kernel Density Estimates in the UNIVARIATE procedure description in *Base SAS Procedures Guide: Statistical Procedures*.

> **TIP** Use the KERNEL distribution option when the data density is not known.

C=*positive-number*

specifies a positive number (0 < *number* <= 100) that represents the *standardized bandwidth*.

The value of λ, referred to as the bandwidth parameter, determines the degree of smoothness in the estimated density function. You specify λ indirectly by specifying a standardized bandwidth c with the C=*kernel-option*. If Q is the interquartile range and n is the sample size, then c is related to λ by the following equation:

$$\lambda = cQn - \frac{1}{5}$$

Default Calculated from the data as the bandwidth that minimizes the AMISE.

Range 0 < *number* <= 100

WEIGHTFUNCTION=NORMAL | QUADRATIC | TRIANGULAR

specifies one of the weight functions NORMAL, QUADRATIC, or TRIANGULAR.

The following table shows the formulas for the weight functions.

Weight Function	Formula
NORMAL	$K_0(t) = \frac{1}{\sqrt{2\pi}}\exp\left(-\frac{1}{2}t^2\right)$ for $-\infty < t < \infty$
QUADRATIC	$K_0(t) = \frac{3}{4}\left(1 - t^2\right)$ for $\lvert t\rvert \leq 1$
TRIANGULAR	$K_0(t) = 1 - \lvert t\rvert$ for $\lvert t\rvert \leq 1$

Default NORMAL

Note In prior SAS releases, the weight function was specified with the WEIGHT= option. In SAS 9.4 and later releases, the WEIGHT= option is not valid as a distribution option. You must use the WEIGHTFUNCTION= option instead.

MAXPOINTS=*positive-integer*
specifies the maximum number of points generated for the curve.

Default 512

Requirements Prior to SAS 9.4M5, *positive-integer* must be greater than or equal to 2.

Starting with SAS 9.4M5, *positive-integer* must be greater than or equal to 16.

NORMAL (<MU=*number*> <SIGMA=*number*> <MAXPOINTS=*number*>)
specifies a normal density estimate, with mean and standard deviation. The fitted density function equation is as follows:

$$p(x) = \frac{100h\,\%}{\sigma\sqrt{2\,\pi}}\exp\left(-\frac{1}{2}\left(\frac{x-\mu}{\sigma}\right)^2\right) \text{ for } -\infty < x < \infty$$

In the equation, μ is the mean and σ is the standard deviation ($\sigma > 0$). You can specify μ with the MU= suboption and σ with the SIGMA= suboption. By default, ODS estimates μ with the sample mean and σ with the sample standard deviation.

For more information, see the discussion of Kernel Density Estimates for the UNIVARIATE procedure in the documentation for Base SAS.

MU=*number*
specifies the mean.

Default The value is calculated from the data.

SIGMA=*number*
specifies the standard deviation.

Default The value is calculated from the data.

MAXPOINTS=*positive-integer*
specifies the maximum number of points generated for the curve.

Default 200

Requirements Prior to SAS 9.4M5, *positive-integer* must be greater than or equal to 2.

Starting with SAS 9.4M5, *positive-integer* must be greater than or equal to 16.

Details

A typical DENSITYPLOT statement specifies either the NORMAL or the KERNEL distribution option. If no distribution option is specified, then the NORMAL() option is used. The following syntax explicitly shows the default case:

```
DENSITYPLOT numeric-column / NORMAL()
```

To specify a kernel distribution, use the following plot syntax:

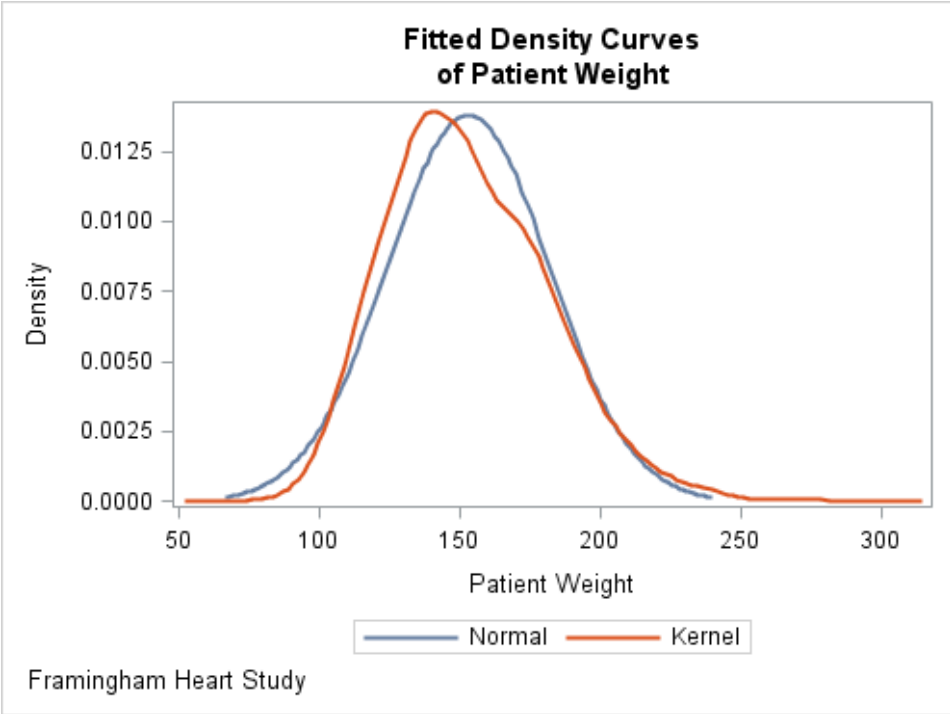
```
DENSITYPLOT numeric-column / KERNEL()
```

If more than one distribution option is specified, then the last distribution option specified is used.

Examples

Example 1: Overlaid Density Plots

The following graph was generated by the "Example Program" on page 494:



Example Program

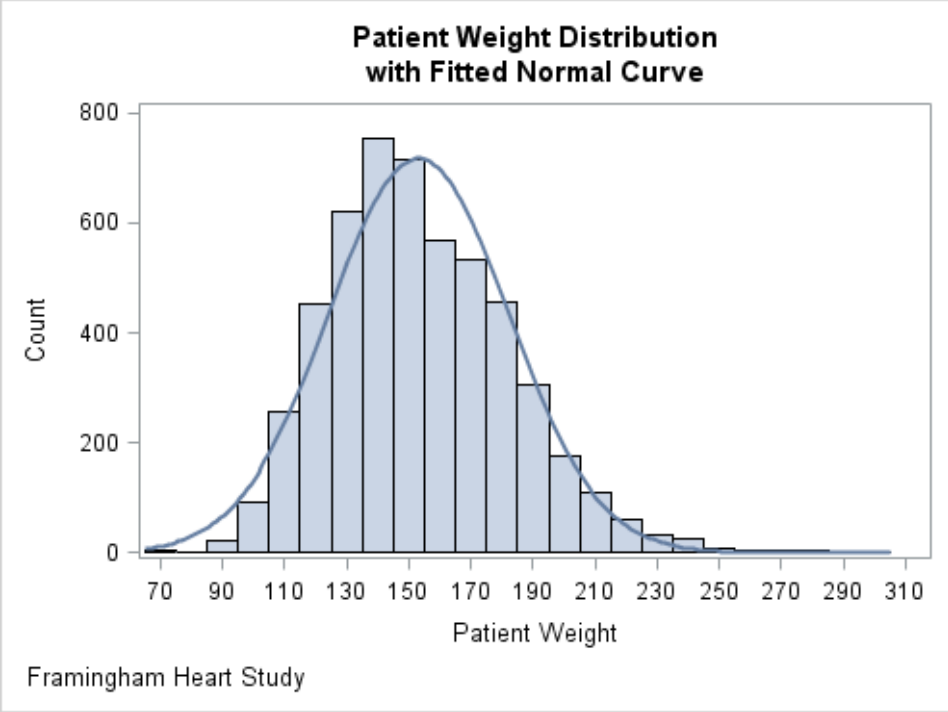
When used as a standalone plot or overlaid with other density plots, the dependent axis shows the computed density values.

```
proc template;
  define statgraph densityplot1;
    begingraph;
      entrytitle "Fitted Density Curves";
      entrytitle "of Patient Weight";
      entryfootnote halign=left "Framingham Heart Study";
      layout overlay;
        densityplot weight / normal()
         lineattrs=graphfit name="n" legendlabel="Normal";
        densityplot weight / kernel()
         lineattrs=graphfit2 name="k" legendlabel="Kernel";
        discretelegend "n" "k";
      endlayout;
    endgraph;
  end;
run;
proc sgrender data=sashelp.heart template=densityplot1;
  label weight="Patient Weight";
run;
```

Example 2: Density Plot and Histogram

When one or more density plots are overlaid on a histogram, the dependent axis shows the statistic indicated by the histogram's SCALE= option. The area under

each density curve is equal to the area of the histogram. The following graph was generated by the "Example Program" on page 495:

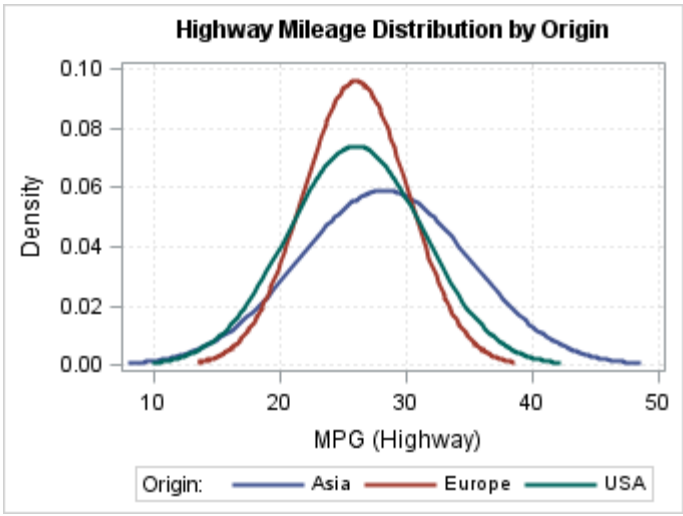


Example Program

```
proc template;
  define statgraph densityplot2;
    begingraph;
      entrytitle "Patient Weight Distribution";
      entrytitle "with Fitted Normal Curve";
      entryfootnote halign=left "Framingham Heart Study";
      layout overlay;
        histogram weight / primary=true scale=count;
        densityplot weight / normal() lineattrs=graphfit;
      endlayout;
    endgraph;
  end;
run;
proc sgrender data=sashelp.heart template=densityplot2;
  label weight="Patient Weight";
run;
```

Example 3: Grouped Density Plot

The following graph was generated by the "Example Program" on page 496:



Example Program

```
proc template;
  define statgraph densityplot;
    begingraph;
      entrytitle "Highway Mileage Distribution by Origin";
      layout overlay /
        xaxisopts=(griddisplay=on
          gridattrs=(color=lightgray pattern=dot))
        yaxisopts=(griddisplay=on
          gridattrs=(color=lightgray pattern=dot));
        densityplot mpg_highway / name="densityplot" group=origin;
        discretelegend "densityplot" / title="Origin:";
      endlayout;
    endgraph;
  end;
run;

proc sgrender template=densityplot data=sashelp.cars;
run;
```

DROPLINE Statement

Creates a horizontal or vertical drop line from a point to an axis.

Requirement: A DROPLINE statement must be used within a 2-D layout (for example, an OVERLAY, OVERLAYEQUATED, DATALATTICE, or DATAPANEL layout).

Syntax

DROPLINE X=*x-axis-value* | *column* | *expression*
Y=*y-axis-value* | *column* | *expression* </*options*>;

Summary of Optional Arguments

Appearance options

CLIP=TRUE | FALSE
: specifies whether the data for the line are considered when determining the data ranges for the axes.

DATASKIN=NONE | CRISP | GLOSS | MATTE | PRESSED | SHEEN
: enhances the visual appearance of the drop line.

DATATRANSPARENCY=*number*
: specifies the degree of the transparency of the drop line.

LINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
: specifies the attributes of the drop line.

Axes options

DISCRETEOFFSET=*number*
: specifies an amount to offset all drop lines from discrete X values, or Y values, or both.

DROPTO=X | Y | BOTH
: specifies the axis to which the line is dropped.

XAXIS=X | X2
: specifies whether data are mapped to the primary X (bottom) axis or to the secondary X2 (top) axis.

YAXIS=Y | Y2
: specifies whether data are mapped to the primary Y (left) axis or to the secondary Y2 (right) axis.

Label options

LABEL=*"string"* | *string-column*
: specifies a label for the point(s) indicated by the X= and Y= arguments.

LABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
: specifies the color and font attributes of the drop line label(s).

LEGENDLABEL="*string*"
: specifies a label to be used in a discrete legend for this plot.

Plot reference options

NAME="*string*"
: assigns a name to this plot statement for reference in other template statements.

Required Arguments

X=*x-axis-value* | *column* | *expression*
specifies the X coordinate of the drop line(s).

Requirement Values must agree in type with the X-axis data type. For example, you should use numeric SAS date or time values (or SAS date/time constants) for a time axis.

Note When a character value is specified, leading blanks are honored and trailing blanks are ignored when the specified value is compared with the data values.

Tip By default, if a specified value is outside of the X-axis data range, then the data range is extended to include the value. This behavior can be changed with the CLIP= option.

Y=*y-axis-value* | *column* | *expression*
specifies the Y coordinate of the drop line(s).

Requirement Values must agree in type with the Y-axis data type.

Note When a character value is specified, leading blanks are honored and trailing blanks are ignored when the specified value is compared with the data values.

Tip By default, if a specified value is outside of the Y-axis data range, then the data range is extended to include the value. This behavior can be changed with the CLIP= option.

Optional Arguments

CLIP=TRUE | FALSE
specifies whether the data for the line are considered when determining the data ranges for the axes.

FALSE
specifies that the reference line values are to be considered when the axis range is determined. The reference lines are drawn as follows based on the axis type:

- For a discrete axis, the reference line values that are not already on the axis are added to the end of the axis data list. When applicable, the axis values are then sorted:
  - If the axis values are numeric values, then they are sorted ordinally.
  - If the axis values are character values and a sorting option is applied to the axis, then they are sorted as specified by the sorting option.

  Reference lines are then drawn at the specified locations.
- For a linear, log, or time axis, a new axis data list is created by performing a mathematical union of the data values and the reference line values. The reference lines are then drawn at the locations specified.

TRUE
specifies that the reference line values are not to be considered when the axis range is determined. The reference lines are drawn as follows based on the axis type:

- For a discrete axis, if the reference line value exactly matches a value on the axis, then a reference line is drawn at that location. Otherwise, the reference line is not drawn.

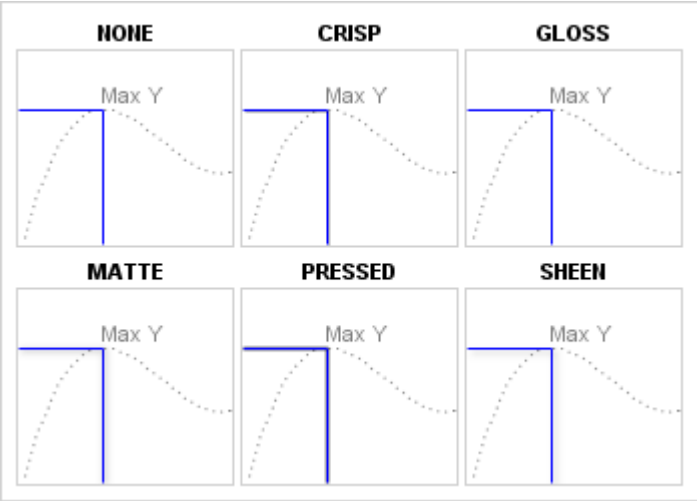
  Note: If the axis values are formatted, then the reference line value must exactly match the formatted axis value in order for the line to be drawn.

- For a linear, log, or time axis, if the reference line value is within the axis data range, then the reference line is drawn at the specified location. Otherwise, the reference line is not drawn.

Default FALSE

See "boolean " on page xii for other Boolean values that you can use.

DATASKIN=NONE | CRISP | GLOSS | MATTE | PRESSED | SHEEN
enhances the visual appearance of the drop line. The following figure shows drop lines with each of the skins applied.



Default The DATASKIN= option value that is specified in the BEGINGRAPH statement. If that value is not specified, then the GraphSkins:DataSkin style element value is used.

Restriction Starting with SAS 9.4M1, the maximum number of skinned graphical elements is limited to 200 per plot in an OVERLAY or PROTOTYPE layout. When this limit is exceeded for a plot, the specified data skin is not applied to that plot. In that case, use the DATASKINMAX= option in your ODS GRAPHICS statement to increase the maximum limit.

Interaction This option overrides the BEGINGRAPH statement DATASKIN= option.

DATATRANSPARENCY=*number*
specifies the degree of the transparency of the drop line.

Default 0

Range 0–1, where 0 is opaque and 1 is entirely transparent

Note This option does not affect the point labels.

DISCRETEOFFSET=*number*
specifies an amount to offset all drop lines from discrete X values, or Y values, or both.

Default 0 (no offset, all drop lines are centered on discrete X values, or discrete Y values, or both)

Range -0.5 to +0.5 where 0.5 represents half the distance between discrete ticks. If the X axis is discrete, then a positive offset is to the right. If the Y axis is discrete, then a positive offset is up. If REVERSE=TRUE on the X or Y axis, then the offset direction is also reversed.

Restriction This option applies to discrete axes only. For nondiscrete axes, this option is ignored.

Tip Setting the discrete offset for the plots does not affect the axis minimum and maximum offsets. In some cases, setting a discrete offset can cause clipping at each end of the axis. In those cases, use the OFFSETMIN= and OFFSETMAX= axis options to increase the axis minimum and maximum offsets to accommodate the discrete offset.

DROPTO=X | Y | BOTH
specifies the axis to which the line is dropped.

X
draws one or more droplines to an X axis.

Tip The XAXIS= option determines whether the X axis or X2 axis is the endpoint for the line.

Y
draws one or more droplines to a Y axis.

Tip The YAXIS= option determines whether the Y axis or Y2 axis is the endpoint for the line.

BOTH
draws one or more droplines to both axes.

Note This option is valid starting in SAS 9.4M1.

Default X

LABEL=*"string" | string-column*
specifies a label for the point(s) indicated by the X= and Y= arguments.

Default No label is specified

Interaction If drawing multiple drop lines using X=*column* or Y=*column*, then you can assign corresponding labels by using a column to define the labels.

Note Starting with SAS 9.4M1, space is reserved at the maximum end of the X axis to accommodate the length of the labels regardless of where the labels appear in the plot.

Tips You can use the OFFSETMAX= axis option to adjust the amount of space that is reserved on the X axis for the labels.

The font and color attributes for the label are specified by the LABELATTRS= option.

LABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font attributes of the drop line label(s).

Default The GraphValueText style element.

Interaction For this option to have any effect, the LABEL= option must also be specified.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Text Options" on page 1606 for available *text-options*.

LEGENDLABEL="*string*"
specifies a label to be used in a discrete legend for this plot.

Default The *string* specified on the NAME= option.

Restriction This option applies only to an associated DISCRETELEGEND statement.

LINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the attributes of the drop line.

Default The GraphReference style element.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

NAME="*string*"
assigns a name to this plot statement for reference in other template statements. The specified name is used primarily in legend statements to coordinate the use of colors and line patterns between the plot and the legend.

Restrictions The *string* is case sensitive, cannot contain spaces, and must define a unique name within the template.

This option does not support variables that are created by the DYNAMIC, MVAR, and NMVAR template statements.

Interaction The *string* is used as the default legend label if the LEGENDLABEL= option is not used.

XAXIS=X | X2
specifies whether data are mapped to the primary X (bottom) axis or to the secondary X2 (top) axis.

Default X

Restriction Another plot that establishes a data range for the designed axis must be included.

Interaction The overall plot specification and the layout type determine the axis display. For more information, see "How Axis Features Are Determined" on page 1040.

YAXIS=Y | Y2
specifies whether data are mapped to the primary Y (left) axis or to the secondary Y2 (right) axis.

Default Y

Restriction Another plot that establishes a data range for the designed axis must be included.

Interaction The overall plot specification and the layout type determine the axis display. For more information, see "How Axis Features Are Determined" on page 1040.

Details

A drop line is always drawn perpendicular from the specified point to the X (bottom), X2 (top), Y (left), or Y2 (right) axis. Axis offsets do not apply to drop lines, so they always meet the axis line.

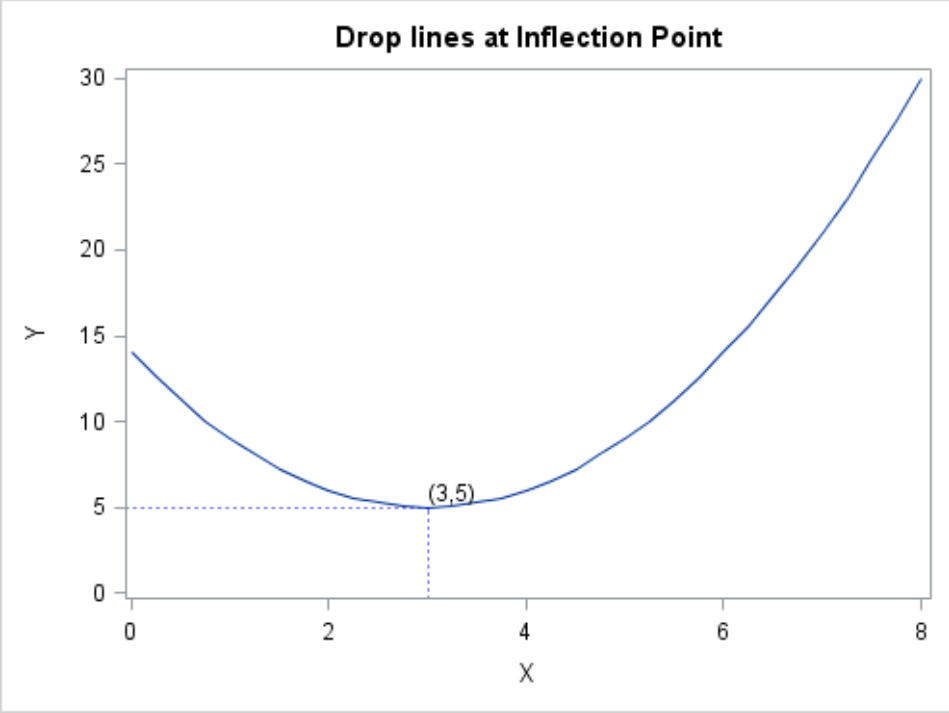
The DROPTO= option controls whether a horizontal or vertical drop line is created. DROPTO=X specifies the horizontal axis for a vertical drop line, and DROPTO=Y specifies the vertical axis for a horizontal drop line.

A DROPLINE statement can be used only within a 2-D overlay-type layout (OVERLAY, OVERLAYEQUATED, PROTOTYPE). Another plot statement that is derived from data values that provide boundaries for the axis area must be included in the layout. For example, it can be used with a scatter plot or a histogram. You can generate multiple drop lines by specifying a column for X and Y. The column type (numeric or string) must agree with the type of data presented on the axis.

To generate both a vertical and a horizontal drop line from a single point, use multiple DROPLINE statements.

Example: DROPLINE Statement

The following graph was generated by the "Example Program" on page 503. The graph shows two DROPLINE statements originating from the same point (X=3, Y=5). One statement uses DROPTO=X and the other uses DROPTO=Y.



Example Program

```
proc template;
  define statgraph dropline;
    begingraph;
      entrytitle "Drop lines at Inflection Point";
      layout overlay / yaxisopts=(linearopts=(viewmin=0));
        seriesplot x=x y=y;
        dropline x=3 y=5 / dropto=x
         lineattrs=(color=blue pattern=dot) label="(3,5)";
        dropline x=3 y=5 / dropto=y
         lineattrs=(color=blue pattern=dot);
      endlayout;
   endgraph;
  end;
run;

data test;
  do X=0 to 8 by 0.25;
    Y=(x-3)*(x-3) + 5;
      output;
  end;
```

```
run;

proc sgrender data=test template=dropline;
run;
```

ELLIPSE Statement

Creates a confidence ellipse computed from input data.

Requirements: An ELLIPSE statement must be used in a two-dimensional overlay-type layout (for example, an OVERLAY, OVERLAYEQUATED, or PROTOTYPE layout).

The ELLIPSE statement must be overlaid with another plot that is derived from data values that provide boundaries for the axis area. It is typically overlaid with a scatter plot.

Syntax

ELLIPSE X=*numeric-column* | *expression*
Y=*numeric-column* | *expression* < */options* >;

Summary of Optional Arguments

Appearance options

CLIP=TRUE | FALSE
: specifies whether the data for the ellipse are considered when determining the data ranges for the axes.

DATATRANSPARENCY=*number*
: specifies the degree of the transparency of the ellipse fill color and outline.

DISPLAY=(*display-options*) | STANDARD | ALL
: specifies which ellipse features to display.

FILLATTRS=*style-element* | *style-element* (*fill-options*) | (*fill-options*)
: specifies the appearance of the interior fill area of the ellipse.

FILLPATTERNATTRS=*style-element* | (*fill-pattern-options*)
: specifies the appearance of the pattern-filled areas.

OUTLINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
: specifies the attributes of the ellipse outline.

Axes options

XAXIS=X | X2
: specifies whether data are mapped to the primary X (bottom) axis or to the secondary X2 (top) axis.

YAXIS=Y | Y2

specifies whether data are mapped to the primary Y (left) axis or to the secondary Y2 (right) axis.

Label options

LEGENDLABEL="*string*"
: specifies a label to be used in a discrete legend for this plot.

Midpoint options

GROUP=*column* | *discrete-attr-var* | *expression*
: creates a separate ellipse for each unique group value in the specified column.

INCLUDEMISSINGGROUP=TRUE | FALSE
: specifies whether missing values of the group variable are included in the plot.

Plot reference options

NAME="*string*"
: assigns a name to this plot statement for reference in other template statements.

Statistics options

ALPHA=*positive-number*
: sets a significance value for the confidence level to compute for the ellipse.

FREQ=*numeric-column* | *expression*
: specifies a numeric column that provides frequencies for each observation that is read.

TYPE=MEAN | PREDICTED
: specifies the type of ellipse.

Required Arguments

X=*numeric-column* | *expression*
specifies the numeric column for the X values.

Y=*numeric-column* | *expression*
specifies the numeric column for the Y values.

Optional Arguments

ALPHA=*positive-number*
sets a significance value for the confidence level to compute for the ellipse.

Default 0.05

Range 0 < *number* < 1

Note ALPHA=0.05 represents a 95% confidence level.

See TYPE=

CLIP=TRUE | FALSE
specifies whether the data for the ellipse are considered when determining the data ranges for the axes.

FALSE
the data for the ellipse contribute to the data range for each axis.

Each axis might be extended to force the display of the entire ellipse.

TRUE
the data for the ellipse are ignored when establishing axis scales.

Each axis scale is determined by the other plots in the parent layout. This might result in the ellipse not being entirely displayed (clipped) if its data range is not within the data ranges of the other plots.

Default FALSE

See "boolean " on page xii for other Boolean values that you can use.

DATATRANSPARENCY=*number*
specifies the degree of the transparency of the ellipse fill color and outline.

Default 0

Range 0–1, where 0 is opaque and 1 is entirely transparent

Tip The FILLATTRS= option can be used to set transparency for just the ellipse fill. You can combine this option with FILLATTRS= to set one transparency for the ellipse outline but a different transparency for the ellipse fill. Example:

```
datatransparency=0.2 fillattrs=(transparency=0.6)
```

DISPLAY=(*display-options*) | STANDARD | ALL
specifies which ellipse features to display.

(*display-options*)
specifies a space-separated list of one or more display options, enclosed in parentheses.

The list can contain one or more of the following options:

OUTLINE
displays the ellipse outline

FILL
displays the ellipse fill color

FILLPATTERN
displays the ellipse fill pattern

Note This feature applies to SAS 9.4M5 and to later releases.

Tip By default, this option has no effect if the active ODS style does not specify a fill pattern. To display a fill pattern in that case, select an ODS style that supports fill patterns or use the

FILLPATTERNATTRS= option to specify a fill pattern for the ellipse.

STANDARD
specifies OUTLINE only

ALL
specifies all features: FILL, FILLPATTERN, and OUTLINE

Default GraphEllipse:DisplayOpts style reference.

Tip Use FILLATTRS= and OUTLINEATTRS= to control the appearance of the ellipse outline and fill color. Starting with SAS 9.4M1, use the FILLPATTERNATTRS= on page 507 option to control the appearance of the ellipse fill pattern.

FILLATTRS=*style-element* | *style-element* (*fill-options*) | (*fill-options*)
specifies the appearance of the interior fill area of the ellipse.

Default The GraphDataDefault style element.

Interaction For this option to have any effect, the fill must be enabled by the ODS style or the DISPLAY= option.

Tip The DATATRANSPARENCY= option sets the transparency for the ellipse fill and ellipse outline. You can combine this option with DATATRANSPARENCY= to set one transparency for the outline but a different transparency for the fill. Example:

```
datatransparency=0.2 fillattrs=(transparency=0.6)
```

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Fill Color Options" on page 1600 for available *fill-options*.

FILLPATTERNATTRS=*style-element* | (*fill-pattern-options*)
specifies the appearance of the pattern-filled areas.

Note: This feature applies to SAS 9.4M5 and to later releases.

Defaults For non-grouped data, the ContrastColor and FillPattern attributes of GraphDataDefault.

For grouped data, the ContrastColor and FillPattern attributes of GraphData1–GraphDataN.

Interaction For this option to take effect, the DISPLAY= option must include FILLPATTERN among the display options.

Tip In order to change the fill pattern for each group value in ODS styles such as HTMLBlue that use color-priority attribute rotation, specify ATTRPRIORITY=NONE in an ODS GRAPHICS statement or in the BEGINGRAPH statement in your graph template. For more

information, see "Attribute Rotation Patterns" in *SAS Graph Template Language: User's Guide*.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Fill Pattern Options" on page 1601 for available *fill-pattern-options*.

FREQ=*numeric-column* | *expression*
specifies a numeric column that provides frequencies for each observation that is read.

Default All observations have a frequency count of 1.

Restriction If the value of *numeric-column* is missing or is less than 1 for an observation, then that observation is not used in the analysis. If the value is not an integer, then only the integer portion is used.

Note If *n* is the value of the numeric column for a given observation, then that observation is used *n* times for the purposes of any statistical computation. The marker for that observation is drawn *n* times, which increases the marker weight slightly with frequency.

GROUP=*column* | *discrete-attr-var* | *expression*
creates a separate ellipse for each unique group value in the specified column.

Note: This feature applies to SAS 9.4M2 and to later releases.

discrete-attr-var
specifies a discrete attribute map variable.

The discrete attribute map variable is created by a DISCRETEATTRVAR statement.

Restriction A discrete attribute map variable specification must be a direct reference to the attribute map variable. It cannot be set by a dynamic variable.

A distinct ellipse is created for each group value by varying the visual attributes of the ellipse display features. The display features are controlled by the current ODS style or by the DISPLAY= option. The default group appearance for each display feature is shown in the following table.

Display Feature [1]	Style Attributes That Control Default Group Appearance
Fill color	Color attribute of a GraphData1–GraphDataN style element or the GraphMissing style element.
Fill pattern [2]	FillPattern and ContrastColor attributes of a GraphData1–GraphDataN style element or the GraphMissing style element. The ContrastColor attribute controls the color of the fill pattern.

Display Feature [1]	Style Attributes That Control Default Group Appearance
	If the active ODS style does not specify FillPattern, fill patterns are not displayed by default.
Outline	ContrastColor and LineStyle attributes of a GraphData1–GraphDataN style element or the GraphMissing style element.

1 The default display features are determined by the DisplayOpts attribute of the GraphEllipse style element.
2 Fill patterns are valid for ellipse plots starting with SAS 9.4M5.

Notes The group values are mapped in the order in which they appear in the data.

If you specify a column in a SAS data set, the visual attributes for each group value are assigned in data order. If you specify a column in a CAS in-memory table, the visual attributes for each group value are assigned in ascending order of the group column character values or of unformatted numeric values.

Tips You can individually override the representations that are used to identify the groups. For example, in some ODS styles, each distinct group value is represented by a different line color and pattern. In that case, you can use the PATTERN= setting on the OUTLINEATTRS= option to assign the same line pattern to all of the ellipses.

By default, ODS Graphics limits the number of groups to 1000. When this limit is exceeded, the GROUP= option is ignored. Use the GROUPMAX= option in the ODS GRAPHICS statement to change the maximum number of groups that can be processed.

See "Example 2: 95% Confidence Ellipses by Plant Species" on page 514

"DISCRETEATTRVAR Statement" on page 1516

INCLUDEMISSINGGROUP=TRUE | FALSE
specifies whether missing values of the group variable are included in the plot.

Note: This feature applies to SAS 9.4M2 and to later releases.

Default TRUE

Interaction For this option to take effect, the GROUP= option must also be specified.

Tip The attributes of the missing group value are determined by the GraphMissing style element unless a discrete attribute map is in effect, the MISSING= system option changes the default missing character, or a user-defined format is applied to the group value. In those cases, the attributes of the missing group value are

determined by a GraphData1–GraphDataN style element instead of by the GraphMissing style element.

See "boolean " on page xii for other Boolean values that you can use.

LEGENDLABEL="*string*"
specifies a label to be used in a discrete legend for this plot.

Default The *string* specified on the NAME= option.

Restriction This option applies only to an associated DISCRETELEGEND statement.

NAME="*string*"
assigns a name to this plot statement for reference in other template statements. The specified name is used primarily in legend statements to coordinate the use of colors and line patterns between the plot and the legend.

Restrictions The *string* is case sensitive, cannot contain spaces, and must define a unique name within the template.

This option does not support variables that are created by the DYNAMIC, MVAR, and NMVAR template statements.

Interaction The *string* is used as the default legend label if the LEGENDLABEL= option is not used.

OUTLINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the attributes of the ellipse outline.

Defaults For non-grouped data, the GraphDataDefault style element.

For grouped data, the ContrastColor and LineStyle attributes of the GraphData1–GraphDataN style elements, and the LineThickness attribute of the GraphDataDefault style element.

Interaction For this option to have any effect, the outlines must be enabled by the ODS style or the DISPLAY= option.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

TYPE=MEAN | PREDICTED
specifies the type of ellipse.

MEAN
specifies a confidence ellipse of the mean

PREDICTED
specifies a prediction ellipse for a new observation

Default MEAN

See ALPHA= option for specifying a confidence level.

For statistical details about how the ellipse is calculated, see "Confidence and Prediction Ellipses " on page 511.

XAXIS=X | X2
specifies whether data are mapped to the primary X (bottom) axis or to the secondary X2 (top) axis.

Default X

Interaction The overall plot specification and the layout type determine the axis display. For more information, see "How Axis Features Are Determined" on page 1040.

YAXIS=Y | Y2
specifies whether data are mapped to the primary Y (left) axis or to the secondary Y2 (right) axis.

Default Y

Interaction The overall plot specification and the layout type determine the axis display. For more information, see "How Axis Features Are Determined" on page 1040.

Details

Statement Description

The ELLIPSE statement can be used only within 2-D overlay-type layouts. It computes an ellipse for a set of points specified by the X and Y columns and a confidence level specified by the ALPHA= option. Use the TYPE= option to control whether a predicted or confidence ellipse is generated.

Confidence and Prediction Ellipses

Two types of ellipses can be computed for the input data (where observations correspond to points in a scatter plot). One is a confidence ellipse for the population mean (TYPE=MEAN), and the other is a prediction ellipse for a new observation (TYPE=PREDICT). Both assume a bivariate normal distribution.

Let $\overline{Z}$ and S be the sample mean and sample covariance matrix of a random sample of size *n* from a bivariate normal distribution with mean μ and covariance matrix Σ. The variable $\overline{Z} - \mu$ is distributed as a bivariate normal variate with mean zero and covariance $(\frac{1}{n})\Sigma$, and it is independent of S. Using Hotelling's T^2 statistic, which is defined as follows:

$$T^2 = n(\overline{Z} - \mu)' S^{-1} (\overline{Z} - \mu)$$

A $100(1-\alpha)\,\%$ confidence ellipse for μ is computed from the following equation:

$$\frac{n}{n-1}(\overline{Z} - \mu)' S^{-1} (\overline{Z} - \mu) = \frac{2}{n-2} F_{2,n-2}(1-\alpha)$$

where $F_{2,n-2}(1-\alpha)$ is the $(1-\alpha)$ critical value of an F distribution with degrees of freedom 2 and $n-2$.

A prediction ellipse is a region for predicting a new observation in the population. It also approximates a region containing a specified percentage of the population.

Denote a new observation as the bivariate random variable Z_{new}. The following variable:

$$Z_{new} - \overline{Z} = (Z_{new} - \mu) - (\overline{Z} - \mu)$$

is distributed as a bivariate normal variate with mean zero (the zero vector) and covariance $(1+\frac{1}{n})\Sigma$, and it is independent of S. A $100(1-\alpha)\,\%$ prediction ellipse is then given by the following equation:

$$\frac{n}{n-1}(\overline{Z}-\mu)'S^{-1}(\overline{Z}-\mu) = \frac{2(n+1)}{n-2}F_{2,n-2}(1-\alpha)$$

The family of ellipses generated by different critical values of the F distribution has a common center (the sample mean) and common major and minor axis directions.

The shape of an ellipse depends on the aspect ratio of the plot. The ellipse indicates the correlation between the two variables if the variables are standardized (by dividing the variables by their respective standard deviations). In this situation, the ratio between the major and minor axis lengths is:

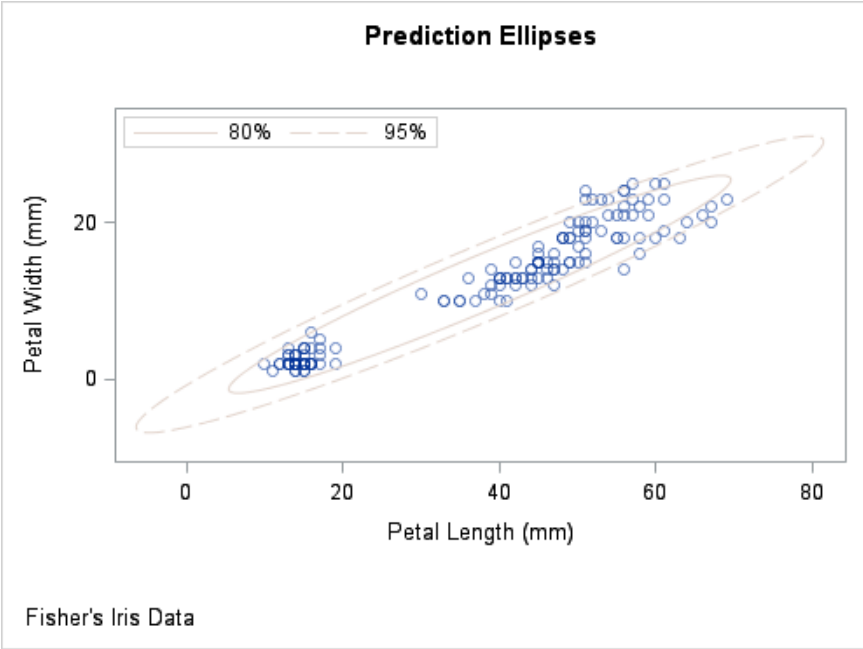
$$\sqrt{\frac{1+|r|}{1-|r|}}$$

In particular, if $r = 0$, then the ratio is 1, which corresponds to a circular confidence contour and indicates that the variables are uncorrelated. A larger value of the ratio indicates a larger positive or negative correlation between the variables.

Examples

Example 1: Prediction Ellipses

The following graph was generated by the "Example Program" on page 513:



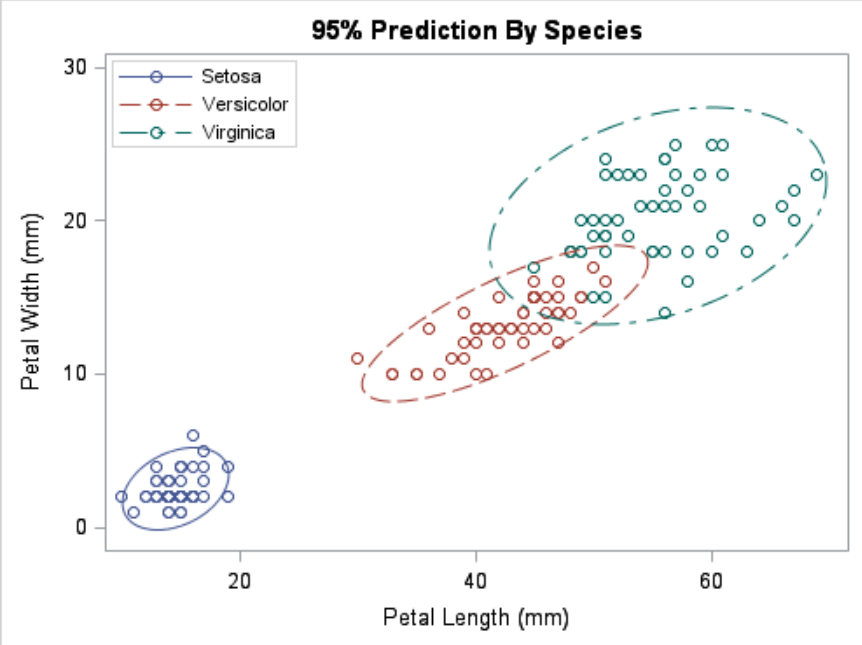
Example Program

This example overlays two ELLIPSE statements on a SCATTERPLOT of the same data. Both ELLIPSE statements use TYPE= PREDICTED. One ELLIPSE statement uses ALPHA= 0.2, and the other uses ALPHA=0.05.

```
proc template;
  define statgraph ellipse;
    begingraph;
      entrytitle "Prediction Ellipses";
      layout overlayequated / equatetype=equate;
        scatterplot x=petallength y=petalwidth /
          datatransparency=0.5;
        ellipse x=petallength y=petalwidth /
          type=predicted  alpha=0.2
          name="p80" legendlabel="80%"
          outlineattrs=graphconfidence;
        ellipse x=petallength y=petalwidth /
          type=predicted  alpha=0.05
          name="p95" legendlabel="95%"
          outlineattrs=graphconfidence2;
        discretelegend "p80" "p95" /
          location=inside autoalign=(topleft);
      endlayout;
      entryfootnote halign=left "Fisher's Iris Data";
    endgraph;
  end;
run;
proc sgrender data=sashelp.iris template=ellipse;
run;
```

Example 2: 95% Confidence Ellipses by Plant Species

The following graph was generated by the "Example Program" on page 514:



Example Program

```
proc template;
  define statgraph ellipsegroup;
    begingraph;
      entrytitle "95% Prediction By Species";
      layout overlay;
        scatterplot x=petallength y=petalwidth / name="sp"
          group=species;
        ellipse x=petallength y=petalwidth / group=species
          type=predicted alpha=0.05 name="p95";
        mergedlegend "sp" "p95" / location=inside
          autoalign=(topleft) across=1;
      endlayout;
    endgraph;
  end;
run;

proc sgrender data=sashelp.iris template=ellipsegroup;
run;
```

ELLIPSEPARM Statement

Creates an ellipse specified by slope, axis, and origin parameters.

Requirements: An ELLIPSEPARM statement must be used in a two-dimensional overlay-type layout (for example, an OVERLAY, OVERLAYEQUATED, or PROTOTYPE layout).

The ELLIPSEPARM statement must be overlaid with another plot that is derived from data values that provide boundaries for the axis area. It is typically overlaid with a scatter plot.

Tip: You can generate a single ellipse by specifying a constant for each required argument. You can generate multiple ellipses by specifying a numeric column for any or all required arguments. If any of the SEMIMAJOR= , SEMIMINOR= , XORIGIN= or YORIGIN= constants or columns contains a missing value, then no ellipse is drawn. To request a vertical major axis, specify `SLOPE=.` (missing value) as a constant or column value.

Syntax

ELLIPSEPARM SEMIMAJOR=*number* | *numeric-column* | *expression*
SEMIMINOR=*number* | *numeric-column* | *expression*
SLOPE=*number* | *numeric-column* | *expression*
XORIGIN=*number* | *numeric-column* | *expression*
YORIGIN=*number* | *numeric-column* | *expression* </*options*>;

Summary of Optional Arguments

Appearance options

CLIP=TRUE | FALSE
: specifies whether the data for the ellipse are considered when determining the data ranges for the axes.

DATATRANSPARENCY=*number*
: specifies the degree of the transparency of the ellipse fill color and outline.

DISPLAY=(*display-options*) | STANDARD | ALL
: specifies which ellipse features to display.

FILLATTRS=*style-element* | *style-element* (*fill-options*) | (*fill-options*)
: specifies the appearance of the interior fill area of the ellipse.

FILLPATTERNATTRS=*style-element* | (*fill-pattern-options*)
: specifies the appearance of the pattern-filled areas.

INDEX=*positive-integer-column* | *expression*
: specifies indices for mapping ellipse attributes (fill and outline) to one of the GraphData1–GraphDataN style elements.

OUTLINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
: specifies the attributes of the ellipse outline.

Axes options

XAXIS=X | X2
: specifies whether data are mapped to the primary X (bottom) axis or to the secondary X2 (top) axis.

YAXIS=Y | Y2
: specifies whether data are mapped to the primary Y (left) axis or to the secondary Y2 (right) axis.

Label options

LEGENDLABEL="*string*"
: specifies a label to be used in a discrete legend for this plot.

Midpoint options

GROUP=*column* | *discrete-attr-var* | *expression*
: creates a separate ellipse for each unique group value of the specified column.

INCLUDEMISSINGGROUP=TRUE | FALSE
: specifies whether missing values of the group variable are included in the plot.

Plot reference options

NAME="*string*"
: assigns a name to this plot statement for reference in other template statements.

Required Arguments

SEMIMAJOR=*number* | *numeric-column* | *expression*
specifies half the length of the major axis for the ellipse. Values are in the same units as the data. The SEMIMAJOR value can be greater than, smaller than, or equal to the SEMIMINOR value.

Restriction If a numeric column is specified and the column contains negative values, then no ellipses are drawn. In SAS 9.4M2 and in earlier releases, the same is true if the column contains missing values. Starting with SAS 9.4M3, if the column contains a missing value, the ellipse for that observation is not drawn. However, the remaining ellipses that have nonmissing values for this argument and for SEMIMINOR= are drawn.

SEMIMINOR=*number* | *numeric-column* | *expression*
specifies half the length of the minor axis for the ellipse. Values are in the same units as the data. The SEMIMINOR value can be greater than, smaller than, or equal to the SEMIMAJOR value.

Restriction If a numeric column is specified and the column contains negative values, then no ellipses are drawn. In SAS 9.4M3 and in earlier releases, the same is true if the column contains missing values. Starting with SAS 9.4M3, if the column contains a missing value, the ellipse for that observation is not drawn. However, the remaining ellipses that have nonmissing values for this argument and for SEMIMAJOR= are drawn.

SLOPE=*number* | *numeric-column* | *expression*
specifies the slope of the major axis for the ellipse. Slope can be positive or negative.

Note The slope value is in the data space and might or might not be maintained in the screen space. Thus, setting `SLOPE=1` does not always generate a 45-degree line on the screen.

Tip Setting `SLOPE=0` creates a major axis parallel to the X axis. Setting `SLOPE=.` (missing value) creates a major axis parallel to the Y axis.

XORIGIN=*number* | *numeric-column* | *expression*
specifies the X coordinate of the center of the ellipse. Values are in the units of the data.

Tip By default, if the value specified for the XORIGIN= option is outside of the X-axis data range, then the data range is extended to include the specified point. This behavior can be changed with the CLIP= option.

YORIGIN=*number* | *numeric-column* | *expression*
specifies the Y coordinate of the center of the ellipse. Values are in the units of the data.

Tip By default, if the value specified for the YORIGIN= option is outside of the Y-axis data range, then the data range is extended to include the specified point. This behavior can be changed with the CLIP= option.

Optional Arguments

CLIP=TRUE | FALSE
specifies whether the data for the ellipse are considered when determining the data ranges for the axes.

FALSE
The data for the ellipse contribute to the data range for each axis.

Each axis might be extended to force the display of the entire ellipse.

TRUE
The data for the ellipse are ignored when establishing axis scales.

Each axis scale is determined by the other plots in the parent layout. This might result in the ellipse not being entirely displayed (clipped) if its data range is not within the data ranges of the other plots.

Default FALSE

See “boolean ” on page xii for other Boolean values that you can use.

DATATRANSPARENCY=*number*
specifies the degree of the transparency of the ellipse fill color and outline.

Default 0

Range 0–1, where 0 is opaque and 1 is entirely transparent

Tip The FILLATTRS= option can be used to set transparency for just the ellipse fill. You can combine this option with FILLATTRS= to set one

transparency for the ellipse outline but a different transparency for the ellipse fill. Example:

```
datatransparency=0.2 fillattrs=(transparency=0.6)
```

DISPLAY=(*display-options*) | STANDARD | ALL
specifies which ellipse features to display.

(*display-options*)
specifies a space-separated list of one or more display options, enclosed in parentheses.

The list can contain one or more of the following options:

OUTLINE
displays the ellipse outline

FILL
displays a filled ellipse

FILLPATTERN
displays the ellipse fill pattern

Note This feature applies to SAS 9.4M5 and to later releases.

Tip By default, this option has no effect if the active ODS style does not specify a fill pattern. To display a fill pattern in that case, select an ODS style that supports fill patterns or use the FILLPATTERNATTRS= option to specify a fill pattern for the ellipse.

STANDARD
displays OUTLINE only

ALL
displays all features: FILL, FILLPATTERN, and OUTLINE

Default GraphEllipse:DisplayOpts style reference.

Tip Use FILLATTRS= and OUTLINEATTRS= to control the appearance of the ellipse outline and fill color. Starting with SAS 9.4M5, use the FILLPATTERNATTRS= on page 519 option to control the appearance of the fill pattern.

FILLATTRS=*style-element* | *style-element* (*fill-options*) | (*fill-options*)
specifies the appearance of the interior fill area of the ellipse.

Defaults For non-grouped data, the GraphDataDefault style element.

For grouped data, the GraphData1–GraphDataN style elements.

Interaction For this option to have any effect, the fill must be enabled by the ODS style or the DISPLAY= option.

Tip The DATATRANSPARENCY option sets the transparency for the ellipse fill and ellipse outline. You can combine this option with DATATRANSPARENCY= to set one transparency for the outline but a different transparency for the fill. Example:

```
datatransparency=0.2 fillattrs=(transparency=0.6)
```

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Fill Color Options" on page 1600 for available *fill-options*.

FILLPATTERNATTRS=*style-element* | (*fill-pattern-options*)
specifies the appearance of the pattern-filled areas.

Note: This feature applies to SAS 9.4M5 and to later releases.

Defaults For non-grouped data, the ContrastColor and FillPattern attributes of GraphDataDefault.

For grouped data, the ContrastColor and FillPattern attributes of GraphData1–GraphDataN.

Interaction For this option to take effect, the DISPLAY= option must include FILLPATTERN among the display options.

Tip In order to change the fill pattern for each group value in ODS styles such as HTMLBlue that use color-priority attribute rotation, specify ATTRPRIORITY=NONE in an ODS GRAPHICS statement or in the BEGINGRAPH statement in your graph template. For more information, see "Attribute Rotation Patterns" in *SAS Graph Template Language: User's Guide*.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Fill Pattern Options" on page 1601 for available *fill-pattern-options*.

GROUP=*column* | *discrete-attr-var* | *expression*
creates a separate ellipse for each unique group value of the specified column.

discrete-attr-var
specifies a discrete attribute map variable.

The discrete attribute map variable is created by a DISCRETEATTRVAR statement.

Restriction A discrete attribute map variable specification must be a direct reference to the attribute map variable. It cannot be set by a dynamic variable.

A distinct ellipse is created for each group value by varying the visual attributes of the ellipse display features. The display features are controlled by the current ODS style or by the DISPLAY= option. The default group appearance for each display feature is shown in the following table.

Display Feature [1]	Style Attributes That Control Default Group Appearance
Fill color	Color attribute of a GraphData1–GraphDataN style element or the GraphMissing style element.
Fill pattern [2]	FillPattern and ContrastColor attributes of a GraphData1–GraphDataN style element or the GraphMissing style element. The ContrastColor attribute controls the color of the fill pattern. If the active ODS style does not specify FillPattern, fill patterns are not displayed by default.
Outline	ContrastColor and LineStyle attributes of a GraphData1–GraphDataN style element or the GraphMissing style element.

1 The default display features are determined by the DisplayOpts attribute of the GraphEllipse style element.

2 Fill patterns are valid for ellipse plots starting with SAS 9.4M5.

The representations that are used to identify the groups can be overridden individually. For example, each distinct group value might be represented by a different line pattern for the ellipses, but the PATTERN= suboption of the OUTLINEATTRS= option could be used to assign the same line pattern to all ellipse outlines, letting outline color distinguish group values.

Defaults If ellipse fills are enabled by the ODS style or by the DISPLAY= option, then each distinct group value is represented in the plot by a different fill color. Starting with SAS 9.4M5, each distinct group value can be represented by a different fill pattern, with or without a different fill color. The fill color and fill pattern are defined by the Color and FillPattern attributes of the GraphData1–GraphDataN and GraphMissing style elements.

If only ellipse outlines are enabled by the ODS style or by the DISPLAY= option, then each distinct group value is represented in the plot by a different ellipse outline color and line style. The outline colors and line styles are defined by the ContrastColor and LineStyle attributes of the GraphData1–GraphDataN style elements.

Restriction When the GROUP= option is specified, the group value must be a character or numeric column. For each group value, there must be a numeric column that does not contain missing values for SEMIMAJOR=, SEMIMINOR=, XORIGIN=, and YORIGIN=.The SLOPE=column can contain missing values. Under these circumstances, an ellipse is drawn for each group value.

Interaction The INCLUDEMISSINGGROUP option controls whether missing group values are considered a distinct group value.

Note If you specify a column in a SAS data set, the visual attributes for each group value are assigned in data order. If you specify a column in a CAS in-memory table, the visual attributes for each group value

are assigned in ascending order of the group column character values or of unformatted numeric values.

Tip By default, ODS Graphics limits the number of groups to 1000. When this limit is exceeded, the GROUP= option is ignored. Use the GROUPMAX= option in the ODS GRAPHICS statement to change the maximum number of groups that can be processed.

See "DISCRETEATTRVAR Statement" on page 1516

INCLUDEMISSINGGROUP=TRUE | FALSE
specifies whether missing values of the group variable are included in the plot.

Default TRUE

Interaction For this option to take effect, the GROUP= option must also be specified.

Tip The attributes of the missing group value are determined by the GraphMissing style element unless a discrete attribute map is in effect, the INDEX= option is used, the MISSING= system option changes the default missing character, or a user-defined format is applied to the group value. In those cases, the attributes of the missing group value are determined by a GraphData1–GraphDataN style element instead of by the GraphMissing style element.

See "boolean " on page xii for other Boolean values that you can use.

INDEX=*positive-integer-column* | *expression*
specifies indices for mapping ellipse attributes (fill and outline) to one of the GraphData1–GraphDataN style elements.

Requirements The column or expression value must be an integer value of 1 or greater. Otherwise, this option is ignored.

The positive-integer column must not contain missing values. Otherwise, the entire column is invalidated and this option is ignored.

All of the indexes for a specific group value must be the same. Otherwise, the results are unpredictable.

Interaction For this option to take effect, the GROUP= option must also be specified.

Notes The index values are 1-based indices. For the style attributes in GraphData1–GraphDataN, if the index value is greater than N, then a modulo operation remaps that index value to a number less than N to determine which style to use.

If you do not use this option, then the group values are mapped in the order of the data.

Tip You can use indexing to collapse the number of groups that are represented in a graph. For more information, see "Remapping Groups for Grouped Data" on page 211.

LEGENDLABEL="*string*"
specifies a label to be used in a discrete legend for this plot.

Default The *string* specified on the NAME= option.

Restriction This option applies only to an associated DISCRETELEGEND statement.

Interaction If the GROUP= option is specified, then this option is ignored.

NAME="*string*"
assigns a name to this plot statement for reference in other template statements. The specified name is used primarily in legend statements to coordinate the use of colors and line patterns between the plot and the legend.

Restrictions The *string* is case sensitive, cannot contain spaces, and must define a unique name within the template.

This option does not support variables that are created by the DYNAMIC, MVAR, and NMVAR template statements.

Interaction The *string* is used as the default legend label if the LEGENDLABEL= option is not used.

OUTLINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the attributes of the ellipse outline.

Defaults For non-grouped data, the GraphDataDefault style element.

For grouped data, the GraphData1–GraphDataN style elements.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

XAXIS=X | X2
specifies whether data are mapped to the primary X (bottom) axis or to the secondary X2 (top) axis.

Default X

Restriction Another plot that establishes a data range for the designed axis must be included.

Interaction The overall plot specification and the layout type determine the axis display. For more information, see "How Axis Features Are Determined" on page 1040.

YAXIS=Y | Y2
specifies whether data are mapped to the primary Y (left) axis or to the secondary Y2 (right) axis.

Default Y

Restriction Another plot that establishes a data range for the designed axis must be included.

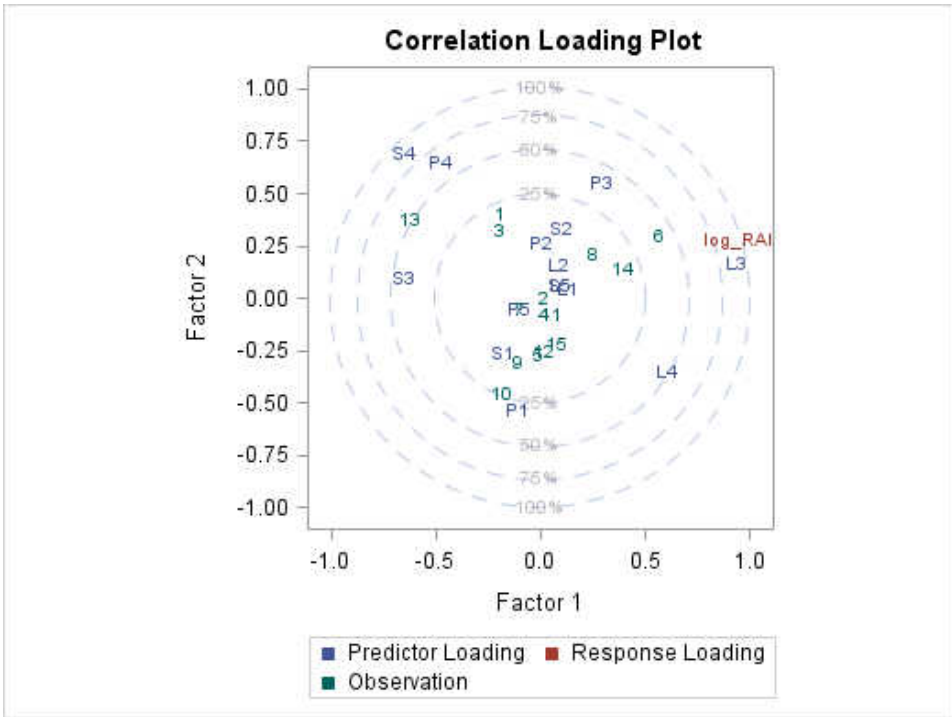
Interaction The overall plot specification and the layout type determine the axis display. For more information, see "How Axis Features Are Determined" on page 1040.

Details

The ELLIPSEPARM statement plots an ellipse with specified semimajor and semiminor axis lengths, a specified slope for the major axis, and the ellipse center. The ellipse center is the point of intersection of the semimajor and semiminor axes. It can be used only within a two-dimensional overlay-type layout (for example, an OVERLAY, OVERLAYEQUATED, or PROTOTYPE layout). The ELLIPSEPARM statement does not perform computations on input data to derive the location and shape of the ellipse. Another plot that is derived from data values that provide boundaries for the axis area must be included in the layout. It is typically overlaid with a scatter plot. See "ELLIPSE Statement" on page 504 for information about computed ellipses.

Example: ELLIPSEPARM Statement

The following graph was generated by the "Example Program" on page 524:



Overview

This is a simplified version of the CorrLoadPlot template for PROC PLS in the SAS/STAT product. It consists of overlaid scatter plots of the scores of the first two factors, the loadings of the model effects, and the loadings of the dependent variables. The loadings are scaled so that the amount of variation in the variables that is explained by the model is proportional to the distance from the origin; circles indicating various levels of explained variation are also overlaid.

The circles are drawn with ELLIPSEPARM statements by setting the SEMIMAJOR and SEMIMINOR lengths to be the same. Notice that all circles are concentric because they share the same origin (0,0). The radius of each circle is passed dynamically.

Also note that an OVERLAYEQUATED layout was used to force the length of unit intervals on both axes to be the same.

The input data shown is representative of that computed by the PLS procedure for the Correlation Loadings Plot shown in the PLS procedure example Spectrometric Calibration in *SAS/STAT User's Guide*.

Example Program

Here is the SAS program for this example.

```
proc template;
 define statgraph ellipseparm;
```

```
  dynamic RADIUS1 RADIUS2 RADIUS3 RADIUS4 ;
  begingraph;
   entrytitle "Correlation Loading Plot";
   layout overlayequated / equatetype=square
     commonaxisopts=
      (tickvaluelist=(-1 -0.75 -0.5 -0.25 0 0.25 0.5 0.75 1)
        viewmin=-1 viewmax=1)
     xaxisopts=
      (label="Factor 1" offsetmin=0.05 offsetmax=0.05)
     yaxisopts=
      (label="Factor 2" offsetmin=0.05 offsetmax=0.05);
    ellipseparm semimajor=RADIUS1 semiminor=RADIUS1 slope=0
     xorigin=0 yorigin=0 / clip=true display=(outline)
     outlineattrs=(pattern=dash) datatransparency=0.75;
    ellipseparm semimajor=RADIUS2 semiminor=RADIUS2 slope=0
     xorigin=0 yorigin=0 / clip=true display=(outline)
     outlineattrs=(pattern=dash) datatransparency=0.75;
    ellipseparm semimajor=RADIUS3 semiminor=RADIUS3 slope=0
     xorigin=0 yorigin=0 / clip=true display=(outline)
     outlineattrs=(pattern=dash) datatransparency=0.75;
    ellipseparm semimajor=RADIUS4 semiminor=RADIUS4 slope=0
     xorigin=0 yorigin=0 / clip=true display=(outline)
     outlineattrs=(pattern=dash) datatransparency=0.75;

    scatterplot x=xcirclelabel y=ycirclelabel / primary=true
     markercharacter=circlelabel datatransparency=0.75 ;
    scatterplot x=corr1 y=corr2 / name="ScatterVars"
     group=corrgroup markercharacter=corrlabel;
    discretelegend "ScatterVars";
   endlayout;
  endGraph;
 end;
run;

data corrplot;
infile cards missover dlm="#";
length CorrGroup $ 18 CorrLabel CorrLabel CircleLabel $ 8;
input Corr1 Corr2 CorrGroup CorrLabel xCircleLabel
yCircleLabel CircleLabel;
datalines;
-0.179 # -0.268 # Predictor Loading # S1 # 0 #  0.5   # 25%
 0.105 #  0.332 # Predictor Loading # S2 # 0 # -0.5   # 25%
-0.654 #  0.094 # Predictor Loading # S3 # 0 #  0.707 # 50%
-0.653 #  0.685 # Predictor Loading # S4 # 0 # -0.707 # 50%
 0.096 #  0.059 # Predictor Loading # S5 # 0 #  0.866 # 75%
 0.132 #  0.036 # Predictor Loading # L1 # 0 # -0.866 # 75%
 0.087 #  0.156 # Predictor Loading # L2 # 0 #  1     # 100%
 0.940 #  0.160 # Predictor Loading # L3 # 0 # -1     # 100%
 0.607 # -0.350 # Predictor Loading # L4
 0.096 #  0.059 # Predictor Loading # L5
-0.111 # -0.534 # Predictor Loading # P1
 0.003 #  0.256 # Predictor Loading # P2
 0.293 #  0.551 # Predictor Loading # P3
-0.480 #  0.643 # Predictor Loading # P4
-0.096 # -0.059 # Predictor Loading # P5
 0.946 #  0.279 # Response Loading  # log_RAI
```

```
-0.196 #  0.403 # Observation       # 1
 0.020 # -0.001 # Observation       # 2
-0.195 #  0.324 # Observation       # 3
 0.021 # -0.079 # Observation       # 4
-0.009 # -0.274 # Observation       # 5
 0.567 #  0.294 # Observation       # 6
-0.096 # -0.059 # Observation       # 7
 0.258 #  0.210 # Observation       # 8
-0.104 # -0.309 # Observation       # 9
-0.187 # -0.458 # Observation       # 10
 0.051 # -0.078 # Observation       # 11
 0.017 # -0.260 # Observation       # 12
-0.621 #  0.372 # Observation       # 13
 0.392 #  0.138 # Observation       # 14
 0.080 # -0.221 # Observation       # 15
;
run;

proc sgrender data=corrplot template=ellipseparm;
  dynamic radius1=0.50 radius2=0.71 radius3=0.87 radius4=1;
run;
```

FRINGEPLOT Statement

Creates a fringe plot on the X axis of an X-Y plot.

Syntax

FRINGEPLOT *numeric-column* | *expression* </*options*>;

Summary of Optional Arguments

Appearance options

DATATRANSPARENCY=*number*
: specifies the degree of the transparency of the fringe.

FRINGEHEIGHT=*dimension*
: specifies the height of the fringe lines.

INDEX=*positive-integer-column* | *expression*
: specifies indices for mapping line attributes (color and line pattern) to one of the GraphData1–GraphDataN style elements.

LINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
: specifies the attributes of the fringe lines for the data points.

Axes options

XAXIS=X | X2

specifies whether data are mapped to the primary X (bottom) axis or to the secondary X2 (top) axis.

Data tip options

ROLENAME=(*role-name-list*)
specifies user-defined roles that can be used to display information in the data tips.

TIP=(*role-list*) | NONE
specifies the information to display when the cursor is positioned over a fringe line.

TIPFORMAT=(*role-format-list*)
specifies display formats for tip columns.

TIPLABEL=(*role-label-list*)
specifies display labels for tip columns.

Label options

LEGENDLABEL="*string*"
specifies a label to be used in a discrete legend for this plot.

Midpoint options

GROUP=*column* | *discrete-attr-var* | *expression*
creates a distinct set of lines for each unique group value of the specified column.

INCLUDEMISSINGGROUP=TRUE | FALSE
specifies whether missing values of the group variable are included in the plot.

Plot reference options

NAME="*string*"
assigns a name to this plot statement for reference in other template statements.

Required Argument

numeric-column* | *expression
specifies a column that provides the X coordinates of the data values.

Optional Arguments

DATATRANSPARENCY=*number*
specifies the degree of the transparency of the fringe.

Default 0

Range 0–1, where 0 is opaque and 1 is entirely transparent

FRINGEHEIGHT=*dimension*
specifies the height of the fringe lines.

Default 10 px

See "dimension" on page xiii

GROUP=*column* | *discrete-attr-var* | *expression*
creates a distinct set of lines for each unique group value of the specified column.

discrete-attr-var
specifies a discrete attribute map variable.

The discrete attribute map variable is created by a DISCRETEATTRVAR statement.

Restriction A discrete attribute map variable specification must be a direct reference to the attribute map variable. It cannot be set by a dynamic variable.

Default Each distinct group value is represented in the plot by a different color. The colors are determined by the ContrastColor attribute of the GraphData1–GraphDataN and GraphMissing style elements. The line style and line thickness are determined by the GraphDataDefault style element.

Interactions The group values are mapped in the order of the data, unless the INDEX= option is used to alter the default sequence of colors and line patterns.

The INCLUDEMISSINGGROUP= option controls whether missing group values are considered a distinct group value.

Notes You can override the representations that are used to identify the groups. For example, you can use the LINEATTRS=(PATTERN=*pattern*) option to assign the same line pattern to all of the plot's line patterns, letting line color indicate group values. Likewise, you can use LINEATTRS=(COLOR=*color*) to assign the same color to all lines, letting line pattern indicate group values.

If you specify a column in a SAS data set, the visual attributes for each group value are assigned in data order. If you specify a column in a CAS in-memory table, the visual attributes for each group value are assigned in ascending order of the group column character values or of unformatted numeric values.

Tip By default, ODS Graphics limits the number of groups to 1000. When this limit is exceeded, the GROUP= option is ignored. Use the GROUPMAX= option in the ODS GRAPHICS statement to change the maximum number of groups that can be processed.

See "DISCRETEATTRVAR Statement" on page 1516

INCLUDEMISSINGGROUP=TRUE | FALSE
specifies whether missing values of the group variable are included in the plot.

Default TRUE

Interaction For this option to take effect, the GROUP= option must also be specified.

Tip The attributes of the missing group value are determined by the GraphMissing style element unless a discrete attribute map is in effect, the INDEX= option is used, the MISSING= system option changes the default missing character, or a user-defined format is applied to the group value. In those cases, the attributes of the missing group value are determined by a GraphData1–GraphDataN style element instead of by the GraphMissing style element.

See "boolean " on page xii for other Boolean values that you can use.

INDEX=*positive-integer-column* | *expression*
specifies indices for mapping line attributes (color and line pattern) to one of the GraphData1–GraphDataN style elements.

Requirements The column or expression value must be an integer value of 1 or greater. Otherwise, this option is ignored.

The positive-integer column must not contain missing values. Otherwise, the entire column is invalidated and this option is ignored.

All of the indexes for a specific group value must be the same. Otherwise, the results are unpredictable.

Interaction For this option to take effect, the GROUP= option must also be specified.

Notes The index values are 1-based indices. For the style attributes in GraphData1–GraphDataN, if the index value is greater than N, then a modulo operation remaps that index value to a number less than N to determine which style to use.

If you do not use this option, then the group values are mapped in the order of the data.

Tip You can use indexing to collapse the number of groups that are represented in a graph. For more information, see "Remapping Groups for Grouped Data" on page 211.

LEGENDLABEL="*string*"
specifies a label to be used in a discrete legend for this plot.

Default The X-column label. If a label is not defined, then the X-column name is used.

Restriction This option applies only to an associated DISCRETELEGEND statement.

LINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the attributes of the fringe lines for the data points.

Defaults For ungrouped data, the GraphDataDefault style element.

For grouped data, the LineStyle and LineThickness attributes of the GraphDataDefault style element, and the ContrastColor attribute of the GraphData1–GraphDataN style elements.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

NAME="*string*"
assigns a name to this plot statement for reference in other template statements. The specified name is used primarily in legend statements to coordinate the use of colors and line patterns between the plot and the legend.

Restrictions The *string* is case sensitive, cannot contain spaces, and must define a unique name within the template.

This option does not support variables that are created by the DYNAMIC, MVAR, and NMVAR template statements.

Interaction The *string* is used as the default legend label if the LEGENDLABEL= option is not used.

ROLENAME=(*role-name-list*)
specifies user-defined roles that can be used to display information in the data tips. This option provides a way to add to the data columns that appear in data tips that are specified by the TIP= option.

(role-name-list)
a space-separated list of *role-name = column* pairs.

Example The following example assigns the column Obs to the user-defined role TIP:

```
ROLENAME=(TIP1=OBS)
```

Default No user-defined roles

Requirement The role names that you choose must be unique and different from the predefined role X.

TIP=(*role-list*) | NONE
specifies the information to display when the cursor is positioned over a fringe line. If this option is used, then it replaces all of the information that is displayed by default. Roles for columns that do not contribute to the fringe plot can be specified along with roles that do.

role-list
an ordered, space-separated list of unique FRINGEPLOT and user-defined roles.

The FRINGEPLOT role is X.

Tip User-defined roles are defined with the ROLENAME= option.

Example The following example displays data tips for the columns assigned to the roles X and Y, as well as the column Pct, which is not assigned to any pre-defined FRINGEPLOT role. The Pct column should appear first in the data tip:

```
ROLENAME=(TIP1=PCT)
TIP=(X TIP1)
```

NONE
suppresses data tips from the plot.

Default The column assigned to the X role is automatically included in the data tip information.

Requirement To generate data tips in the output, you must include an ODS GRAPHICS ON statement that specifies the IMAGEMAP option, and you must write the output to the ODS HTML destination.

Interaction This option is ignored when the plot statement is in an OVERLAY or PROTOTYPE layout and the INCLUDERANGES= option is specified in the LINEAROPTS= or TIMEOPTS= option for either axis.

Tip The labels and formats for the TIP roles can be controlled with the TIPLABEL= and TIPFORMAT= options.

TIPFORMAT=(*role-format-list*)
specifies display formats for tip columns. This option provides a way to control the formats of columns that appear in data tips.

(role-format-list)
a space-separated list of *role-name* = *format* pairs.

Example
```
ROLENAME=(TIP1=SALARY)
TIP=(TIP1)
TIPFORMAT=(TIP1=DOLLAR12.)
```

Default The column format of the column assigned to the role or BEST6 if no format is assigned to a numeric column.

Restriction Only the roles that appear in the TIP= option are used.

Requirement A column must be assigned to each of the specified roles. (See the ROLENAME= option.)

TIPLABEL=(*role-label-list*)
specifies display labels for tip columns. This option provides a way to control the labels of columns that appear in data tips.

role-label-list
a space-separated list of *rolename* ="*string*" pairs.

Example
```
ROLENAME=(TIP1=PCT)
TIP=(TIP1)
TIPLABEL=(TIP1="Percent")
```

Default The column label or column name of the column assigned to the role.

Restriction Only the roles that appear in the TIP= option are used.

Requirement A column must be assigned to each of the specified roles. (See the ROLENAME= option.)

XAXIS=X | X2
specifies whether data are mapped to the primary X (bottom) axis or to the secondary X2 (top) axis.

Default X

Interaction The overall plot specification and the layout type determine the axis display. For more information, see "How Axis Features Are Determined" on page 1040.

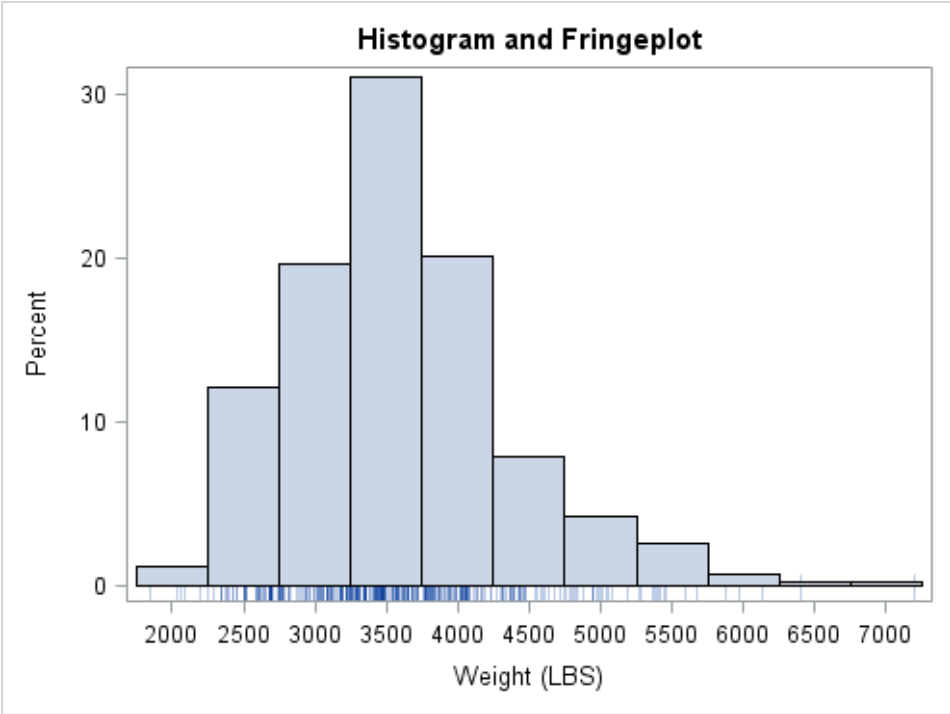
Note The display of the fringe lines is always anchored on the X axis (at the bottom of the plot area), even when the FRINGEPLOT's X-column data range is mapped to the X2 axis.

Details

In a FRINGEPLOT, each fringe line represents the location of the corresponding raw data value on the X axis. All fringe lines are of equal length.

Example: FRINGEPLOT Statement

The following graph was generated by the "Example Program" on page 533:



Example Program

```
proc template;
  define statgraph fringeplot;
    dynamic VAR VARLABEL;
    begingraph;
      entrytitle "Histogram and Fringeplot";
      layout overlay / xaxisopts=(label=VARLABEL)
                       yaxisopts=(offsetmin=0.03);
        fringeplot VAR / datatransparency=0.75
          fringeheight=3pct;
        histogram VAR;
      endlayout;
    endgraph;
  end;
run;

proc sgrender data=sashelp.cars template=fringeplot;
  dynamic var="weight" varlabel="Weight (LBS)";
run;
```

HEATMAP Statement

Creates a plot of color-coded rectangles for the response variable of a pair of X and Y variables after it bins the data in two dimensions.

Note: This feature applies to SAS 9.4M3 and to later releases.

Syntax

HEATMAP X=*numeric-column* | *expression*
Y=*numeric-column* | *expression* </*options*>;

Summary of Optional Arguments

Appearance options

COLORMODEL=*color-ramp-style-element* | (*color-list*)
specifies a color ramp to use with the COLORRESPONSE= option.

COLORRESPONSE=*numeric-column* | *range-attr-var* | *expression*
specifies a numeric column that is used to color the heat map regions.

COLORSTAT= FREQ | PCT | PROPORTION | SUM | MEAN
specifies the statistic to be calculated for the COLORRESPONSE= column.

DATATRANSPARENCY=*number*
specifies the degree of the transparency of the outline and fill for each region.

DISPLAY=(*display-options*) | STANDARD | ALL
specifies which region features to display.

FILLATTRS=(TRANSPARENCY=*number*)
specifies the transparency of the interior fill area of the regions.

OUTLINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the appearance of the rectangle outlines.

REVERSECOLORMODEL=TRUE | FALSE
specifies whether to reverse the gradient that is specified by the ODS style that is in effect or by the COLORMODEL= option.

WEIGHT=*numeric-column*
specifies a variable in the input data set that contains values to be used as *a priori* weights for the colored-region calculations.

XGAP=*number*
specifies the amount of horizontal space on either side of each color-coded region in the heat map.

YGAP=*number*
specifies the amount of horizontal space on either side of each color-coded region in the heat map.

Axes options

PRIMARY=TRUE | FALSE
specifies that the data columns for this plot are used for determining default axis features.

XAXIS=X | X2

specifies whether data is mapped to the primary X (bottom) axis or to the secondary X2 (top) axis.

XBINAXIS=TRUE | FALSE
specifies whether to use bins as the basis for x-axis tick marks.

XENDLABELS=TRUE | FALSE
specifies whether the X-axis ticks and tick values are placed at the bin end-points or at the bin mid-points.

YAXIS=Y | Y2
specifies whether data is mapped to the primary Y (left) axis or to the secondary Y2 (right) axis.

YBINAXIS=TRUE | FALSE
specifies whether to use bins as the basis for x-axis tick marks.

YENDLABELS=TRUE | FALSE
specifies whether the Y-axis ticks and tick values are placed at the bin end-points or at the bin mid-points.

Binning options

NXBINS=*positive-integer*
specifies the number of bins to use for the X role.

NYBINS=*positive-integer*
specifies the number of bins to use for the Y role.

XBINSIZE=*positive-number*
specifies the size of bins along the X role, in data units.

XBINSTART=*number*
specifies the data value for the first bin of the X role.

XBOUNDARY=UPPER | LOWER
specifies how an input value is counted when it lies on the endpoint of an X bin.

XVALUES=MIDPOINTS | LEFTPOINTS | RIGHTPOINTS
specifies whether the XBINSTART= value represents the midpoint, lower endpoint, or upper endpoint of the bin.

YBINSIZE=*positive-number*
specifies the size of bins along the Y role, in data units.

YBINSTART=*number*
specifies the data value for the first bin of the Y role.

YBOUNDARY=UPPER | LOWER
specifies how an input value is counted when it lies on the endpoint of an Y bin.

YVALUES=MIDPOINTS | LEFTPOINTS | RIGHTPOINTS
specifies whether the YBINSTART= value represents the midpoint, lower endpoint, or upper endpoint of the bin.

Data option

DISCRETEX=TRUE | FALSE
specifies whether the X axis is discrete when X= specifies a numeric column.

DISCRETEY=TRUE | FALSE

specifies whether the Y axis is discrete when Y= specifies a numeric column.

Data tip options

TIP=(*role-list*) | NONE
specifies the information to display when the cursor is positioned over a rectangle.

TIPFORMAT=(*role-format-list*)
specifies display formats for tip columns.

TIPLABEL=(*role-label-list*)
specifies display labels for tip columns.

Plot reference options

NAME="string"
assigns a name to a HEATMAP statement for reference in other template statements and log messages.

Statistics options

FREQ=*numeric-column* | *expression*
specifies a column for the frequency count for each observation in the input data.

Required Arguments

X=*column* | *expression*
specifies the column for the X values.

Requirement If X= specifies a numeric column, then the DISCRETEX= option must be set correctly for the X-axis type. When it is not set correctly, the heat map is not drawn. If the X-axis type is discrete, then you must specify DISCRETEX=TRUE in the HEATMAP statement. Otherwise, DISCRETEX=FALSE must be in effect.

See DISCRETEX= on page 538

Y=*column* | *expression*
specifies the column for the Y values.

Requirement If Y= specifies a numeric column, then the DISCRETEY= option must be set correctly for the Y-axis type. When it is not set correctly, the heat map is not drawn. If the Y-axis type is discrete, then you must specify DISCRETEY=TRUE in the HEATMAP statement. Otherwise, DISCRETEY=FALSE must be in effect.

See DISCRETEY= on page 538

Optional Arguments

COLORMODEL=*color-ramp-style-element* | (*color-list*)
specifies a color ramp to use with the COLORRESPONSE= option.

color-ramp-style-element
specifies the name of a color-ramp style element.

The style element should contain these style attributes:

STARTCOLOR
specifies the color for the smallest data value of the COLORRESPONSE= column.

NEUTRALCOLOR
specifies the color for the midpoint of the range of the COLORRESPONSE= column.

ENDCOLOR
specifies the color for the highest data value of the COLORRESPONSE= column.

(*color-list*)
specifies a space-separated list of colors to use in the color ramp. You can use style attribute references such as GraphData3:Color, color names, or RGB, CMYK, HLS, and HSV (HSB) color codes to specify a color. The list can contain a mix of style attribute references, color names, and color codes.

Requirement The list of colors must be enclosed in parentheses.

See "color " on page xii

Default The ThreeColorRamp style element

Interaction For this option to take effect, the COLORRESPONSE= option must also be specified.

Tip To reverse the start and end colors of the ramp that is assigned to the color model, use the REVERSECOLORMODEL= option.

COLORRESPONSE=*numeric-column* | *range-attr-var* | *expression*
specifies a numeric column that is used to color the heat map regions.

range-attr-var
specifies a range attribute map variable that is defined in a RANGEATTRVAR statement.

"RANGEATTRVAR Statement"

Restriction A range attribute map variable specification must be a direct reference to the attribute map variable. It cannot be set as a dynamic variable.

See "RANGEATTRVAR Statement" on page 1531

When a numeric column or expression is specified, the range of column or expression values are linearly mapped to the color ramp that is specified by the COLORMODEL= option. When a range attribute map variable is specified, the colors that are defined in the associated range attribute map are used instead.

Tips To display a legend with this option in effect, use a CONTINUOUSLEGEND statement.

Use the COLORSTAT= option to specify the statistic to compute for the COLORRESPONSE= column.

COLORSTAT= FREQ | PCT | PROPORTION | SUM | MEAN
specifies the statistic to be calculated for the COLORRESPONSE= column.

Default FREQ

Interaction When FREQ, PCT, or PROPORTION is specified, the colors are controlled by the FREQ= and WEIGHT= option values. When SUM or MEAN is specified, the colors are controlled by the FREQ=, WEIGHT=, and COLORRESPONSE= option values.

See COLORRESPONSE=

FREQ=

WEIGHT=

DATATRANSPARENCY=*number*
specifies the degree of the transparency of the outline and fill for each region.

Default 0

Range 0–1, where 0 is opaque and 1 is entirely transparent

Tip Use the FILLATTRS= option to set transparency for just the rectangle fills. You can combine this option with FILLATTRS= to set one transparency for the rectangle outlines and a different transparency for the rectangle fills. Example:

```
datatransparency=0.2 fillattrs=(transparency=0.6)
```

DISCRETEX=TRUE | FALSE
specifies whether the X axis is discrete when X= specifies a numeric column.

Default FALSE

Requirement If X= specifies a numeric column and the X-axis type is discrete, then you must specify DISCRETEX=TRUE. Otherwise, the heat map might not be drawn.

Interactions If X= specifies a character column, then this option is ignored, and the X axis is considered to be discrete.

When this option is set to TRUE, the XENDLABELS= option is ignored.

See X= on page 536

DISCRETEY=TRUE | FALSE
specifies whether the Y axis is discrete when Y= specifies a numeric column.

Default FALSE

Requirement If Y= specifies a numeric column and the Y-axis type is discrete, then you must specify DISCRETEY=TRUE. Otherwise, the heat map might not be drawn.

Interactions If Y= specifies a character column, then this option is ignored, and the Y axis is considered to be discrete.

When this option is set to TRUE, the YENDLABELS= option is ignored.

See Y= on page 536

DISPLAY=(*display-options*) | STANDARD | ALL
specifies which region features to display.

display-options
a space-separated list of options, enclosed in parentheses.

Currently, only OUTLINE is supported, which displays outlined, filled rectangles.

STANDARD
displays the region fill color

ALL
displays the region fill color and outline

Default STANDARD

FILLATTRS=(TRANSPARENCY=*number*)
specifies the transparency of the interior fill area of the regions.

Default The DATATRANSPARENCY= option value

Range 0–1, where 0 is opaque and 1 is entirely transparent

Restriction Only the TRANSPARENCY= sub option is honored. If a style element or any other fill sub option is specified, it is ignored by the HEATMAP statement.

Interaction This option overrides the DATATRANSPARENCY= option only for the colored region. It does not affect the region outlines.

Tip Use this option when you want the region fill to have a different degree of transparency than the outline.

FREQ=*numeric-column* | *expression*
specifies a column for the frequency count for each observation in the input data.

Restrictions If the value of FREQ for a given observation is missing or is less than 1, that observation is not used in the analysis.

If the value is not an integer, only the integer portion is used.

NAME="string"
assigns a name to a HEATMAP statement for reference in other template statements and log messages.

Restriction The *string* is case sensitive, cannot contain spaces, and must define a unique name within the template.

Tip This option is used mostly with legend statements in order to coordinate the use of colors and line patterns between the graph and the legend.

NXBINS=*positive-integer*
specifies the number of bins to use for the X role. The system determines the XBINSIZE= and XBINSTART= values if they are not specified. The bins always span the range of the data.

Default Determined by the system.

Restriction The number of bins is the product of the X and Y bins. Starting with SAS 9.4M4, the number of bins is limited to 100,000, by default.

Requirement You must specify a value of 2 or greater. Otherwise, this option is ignored.

Tip Starting with SAS 9.4M4, the limit on the number of bins is specified by the ODS GRAPHICS statement NXYBINSMAX= option, which defaults to 100,000. See NXYBINSMAX= on page 1573.

NYBINS=*positive-integer*
specifies the number of bins to use for the Y role. The system determines the YBINSIZE= and YBINSTART= values if they are not specified. The bins always span the range of the data.

Default Determined by the system.

Restriction The number of bins is the product of the X and Y bins. Starting with SAS 9.4M4, the number of bins is limited to 100,000, by default.

Requirement You must specify a value of 2 or greater. Otherwise, this option is ignored.

Tip Starting with SAS 9.4M4, the limit on the number of bins is specified by the ODS GRAPHICS statement NXYBINSMAX= option, which defaults to 100,000. See NXYBINSMAX= on page 1573.

OUTLINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the appearance of the rectangle outlines.

Default The ContrastColor, LineStyle, and LineThickness attributes of the GraphOutlines style element.

Interaction For this option to have any effect, outlines must be enabled by the DISPLAY= option.

Note When *style-element* is specified, only the style element's ContrastColor, LineStyle, and LineThickness attributes are used.

See "General Syntax for Attribute Options" on page 1599 for the syntax for using a *style-element* value

"Line Options" on page 1602 for available *line-options* values

PRIMARY=TRUE | FALSE
specifies that the data columns for this plot are used for determining default axis features.

Default FALSE. If no plot in an OVERLAY layout is designated as primary, the data columns associated with the first plot that could be primary is considered primary on a per-axis basis.

Restrictions Only one plot in an overlay can be primary on a per-axis basis. If multiple plots specify PRIMARY=TRUE for the same axis, the last one specified is considered the primary plot.

This option is ignored if the plot is placed in a GRIDDED or LATTICE layout block.

Tip This option is needed only when there are two or more plots within an overlay that contribute to a common axis. If PRIMARY=TRUE for one of them, then that plot's data columns are used to determine the axis features, regardless of where this plot statement occurs within the OVERLAY layout block.

REVERSECOLORMODEL=TRUE | FALSE
specifies whether to reverse the gradient that is specified by the ODS style that is in effect or by the COLORMODEL= option.

Default FALSE

See COLORMODEL= on page 536

TIP=(*role-list*) | NONE
specifies the information to display when the cursor is positioned over a rectangle. If this option is used, the specified information replaces all the information that is displayed by default. You can specify roles for columns that do not contribute to the bar chart along with roles that do.

(role-list)
an ordered, space-separated list of unique HEATMAP roles and user-defined roles.

HEATMAP roles include X, Y, and the implicit count.

Example To display data tips for the columns assigned to the roles X and Y as well as the user-defined role TIP1:

```
ROLENAME=(TIP1=OBS)
```

```
TIP=(TIP1 X Y)
```

NONE
suppresses data tips and URLs (if requested) in the graph output.

Default The columns assigned to these roles are automatically included in the data tip information: X and Y

Requirement To generate data tips, you must include an ODS GRAPHICS ON statement that specifies the IMAGEMAP option, and write the graphs to the ODS HTML destination.

Tip You can control the labels and formats for the TIP variables with the TIPLABEL= and TIPFORMAT= options.

TIPFORMAT=(*role-format-list*)
specifies display formats for tip columns.

(*role-format-list*)
a space-separated list of *role-name = format* pairs.

Example To specify a format for the user-defined TIP1 role:

```
ROLENAME=(TIP1=PCT)
TIP=(TIP1 X Y)
TIPFORMAT=(TIP1=PERCENT7.2)
```

Default The column format of the variable assigned to the role or BEST6. if no format is assigned to a numeric column.

Requirement This option provides a way to control the formats of columns that appear in data tips. Only the roles that appear in the TIP= option are used.

TIPLABEL=(*role-label-list*)
specifies display labels for tip columns.

(*role-label-list*)
a space-separated list of *role-name ="string"* pairs.

Example To specify a label for the user-defined TIP1 role:

```
ROLENAME=(TIP1=PCT)
TIP=(TIP1 X Y)
TIPLABEL=(TIP1="Percent")
```

Default The column label or column name of the variable assigned to the role.

Requirement This option provides a way to control the labels of columns that appear in data tips. Only the roles that appear in the TIP= option are used.

WEIGHT=*numeric-column*
specifies a variable in the input data set that contains values to be used as *a priori* weights for the colored-region calculations.

Requirement The values of the weight variable must be nonnegative.

Note If an observation's weight is zero, negative, or missing, the observation is deleted from the analysis.

XAXIS=X | X2
specifies whether data is mapped to the primary X (bottom) axis or to the secondary X2 (top) axis.

Default X

Interaction The overall plot specification and the layout type determine the axis display. For more information, see "How Axis Features Are Determined" on page 1040.

XBINAXIS=TRUE | FALSE
specifies whether to use bins as the basis for x-axis tick marks. When this option is FALSE, a standard axis is used, ignoring bin boundaries and midpoints.

Default TRUE

Interactions When this option is TRUE, the XENDLABELS= option determines how the axis ticks and value labels are displayed. When this option is FALSE, the XENDLABELS= option is ignored.

When this option is TRUE, the system attempts to compute nice values for the bin end points. In that case, the sum of the bin data ranges might exceed the actual data range.

When this option is TRUE, the axis ticks are in predetermined locations and are not changed when the parent layout specifies axis suboptions such as TICKVALUELIST=, TICKVALUESEQUENCE=, and INCLUDERANGES=.

See "boolean " on page xii for other Boolean values that you can use.

XBINSIZE=*positive-number*
specifies the size of bins along the X role, in data units. The system determines the NXBINS= and XBINSTART= values if they are not specified. The bins always span the X data range.

Default Determined by the system.

Restriction Starting with SAS 9.4M1, the number of bins is limited to approximately 100,000. Starting with SAS 9.4M4, the limit is specified by the ODS GRAPHICS statement option NXYBINSMAX=, which defaults to 100,000. If the total number of bins that are computed from the data, the XBINSTART= value, and the XBINSIZE= value exceeds the limit, SAS computes a new bin-size value that yields approximately the maximum number of bins. A warning of the change is written to the SAS log in that case.

Interaction The XGAP= option is applied after this option.

Tip Starting with SAS 9.4M4, you can use the ODS GRAPHICS statement NXYBINSMAX= option to change the limit on the number of bins. See NXYBINSMAX= on page 1573.

XBINSTART=*number*
specifies the data value for the first bin of the X role. The system determines the NXBINS= and XBINSIZE= values if they are not specified. The bins always span the X data range.

Default Determined by the system.

Interaction The XVALUES= option specifies how this value is interpreted.

XBOUNDARY=UPPER | LOWER
specifies how an input value is counted when it lies on the endpoint of an X bin. If this option is set to UPPER, then the value is counted as one of the values in the upper bin. Otherwise, it is counted in the lower bin.

Default UPPER

XENDLABELS=TRUE | FALSE
specifies whether the X-axis ticks and tick values are placed at the bin end-points or at the bin mid-points.

Default FALSE. The axis ticks and tick values are placed at the bin mid-points.

Restriction This option is ignored when the X axis is discrete.

Interaction This option is ignored when XBINAXIS=FALSE is in effect.

Tip The axis ticks and tick value placements are independent of the XVALUES= option.

XGAP=*number*
specifies the amount of horizontal space on either side of each color-coded region in the heat map.

Default 0

Interaction If the XBINSIZE= option is specified, the XGAP= value is subtracted from the specified X bin size.

XVALUES=MIDPOINTS | LEFTPOINTS | RIGHTPOINTS
specifies whether the XBINSTART= value represents the midpoint, lower endpoint, or upper endpoint of the bin.

Default MIDPOINTS

See XBINSTART= on page 544

XENDLABELS= on page 544

YAXIS=Y | Y2
specifies whether data is mapped to the primary Y (left) axis or to the secondary Y2 (right) axis.

Default Y

Interaction The overall plot specification and the layout type determine the axis display. For more information, see "How Axis Features Are Determined" on page 1040.

YBINAXIS=TRUE | FALSE
specifies whether to use bins as the basis for x-axis tick marks. When this option is FALSE, a standard axis is used, ignoring bin boundaries and midpoints.

Default TRUE

Interactions When this option is TRUE, the YENDLABELS= option determines how the axis ticks and value labels are displayed. When this option is FALSE, the YENDLABELS= option is ignored.

When this option is TRUE, the system attempts to compute nice values for the bin end points. In that case, the sum of the bin data ranges might exceed the actual data range.

When this option is TRUE, the axis ticks are in predetermined locations and are not changed when the parent layout specifies axis suboptions such as TICKVALUELIST=, TICKVALUESEQUENCE=, and INCLUDERANGES=.

See "boolean " on page xii for other Boolean values that you can use.

YBINSIZE=*positive-number*
specifies the size of bins along the Y role, in data units. The system determines the NYBINS= and YBINSTART= values if they are not specified. The bins always span the Y data range.

Default Determined by the system.

Restriction Starting with SAS 9.4M1, the number of bins is limited to approximately 100,000. Starting with SAS 9.4M4, the limit is specified by the ODS GRAPHICS statement option NXYBINSMAX=, which defaults to 100,000. If the total number of bins that are computed from the data, the YBINSTART= value, and the YBINSIZE= value exceeds the limit, SAS computes a new bin-size value that yields approximately the maximum number of bins. A warning of the change is written to the SAS log in that case.

Interaction The YGAP= option is applied after this option.

Tip Starting with SAS 9.4M4, you can use the ODS GRAPHICS statement NXYBINSMAX= option to change the limit on the number of bins. See NXYBINSMAX= on page 1573.

YBINSTART=*number*
specifies the data value for the first bin of the Y role. The system determines the NYBINS= and YBINSIZE= values if they are not specified. The bins always span the Y data range.

Default Determined by the system.

Interaction The YVALUES= option specifies how this value is interpreted.

YBOUNDARY=UPPER | LOWER
specifies how an input value is counted when it lies on the endpoint of an Y bin. If this option is set to UPPER, then the value is counted as one of the values in the upper bin. Otherwise, it is counted in the lower bin.

Default UPPER

YENDLABELS=TRUE | FALSE
specifies whether the Y-axis ticks and tick values are placed at the bin end-points or at the bin mid-points.

Default FALSE. The axis ticks and tick values are placed at the bin mid-points.

Restriction This option is ignored when the Y axis is discrete.

Interaction This option is ignored when YBINAXIS=FALSE is in effect.

Tip The axis ticks and tick value placements are independent of the YVALUES= option.

YGAP=*number*
specifies the amount of horizontal space on either side of each color-coded region in the heat map.

Default 0

Interaction If the YBINSIZE= option is specified, the YGAP= value is subtracted from the specified Y bin size.

YVALUES=MIDPOINTS | LEFTPOINTS | RIGHTPOINTS
specifies whether the YBINSTART= value represents the midpoint, lower endpoint, or upper endpoint of the bin.

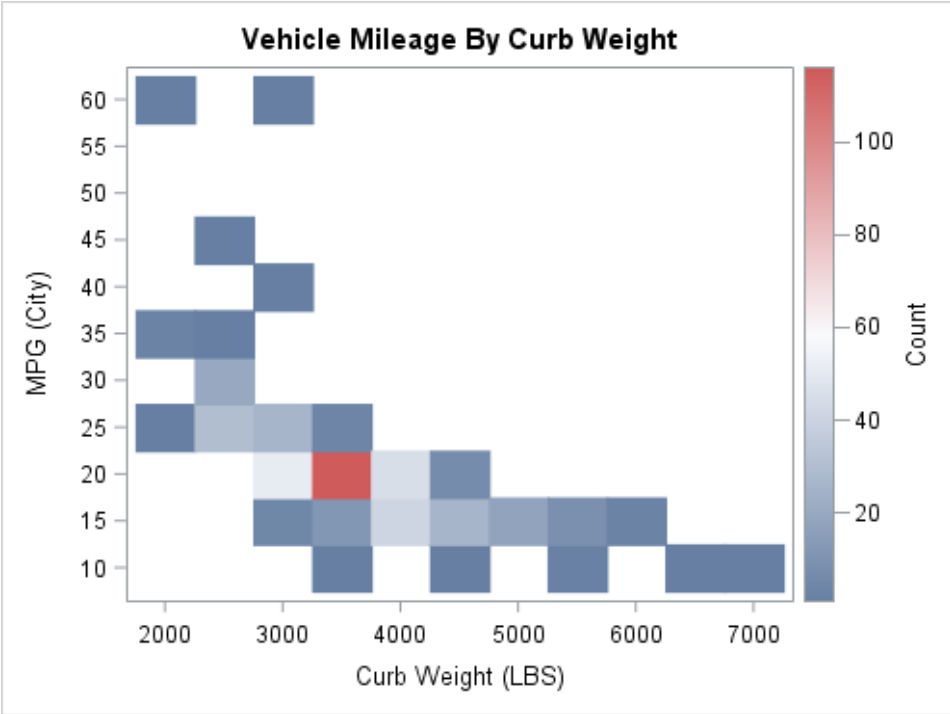
Default MIDPOINTS

See YBINSTART= on page 546

YENDLABELS= on page 546

Example: HEATMAP Statement

The following graph was generated by the “Example Program” on page 547.



Example Program

```
proc template;
  define statgraph heatmap;
    begingraph;
      entrytitle "Vehicle Mileage By Curb Weight";
      layout overlay /
        xaxisopts=(label="Curb Weight (LBS)");
        heatmap x=weight y=mpg_city / name="heatmap"
          nybins=11 ybinstart=10 ybinsize=5
          nxbins=11 xbinstart=2000 xbinsize=500;
        continuouslegend "heatmap" / title="Count"
          location=outside;
      endlayout;
    endgraph;
  end;
run;

proc sgrender data=sashelp.cars template=heatmap;
run;
```

HEATMAPPARM Statement

Creates a two-dimensional plot that represents the values of three variables. Generating an X, Y grid of rectangles from the values of two independent variables, it colors the rectangles to represent the values of a third variable, which can be a response variable or a group variable.

Restriction: Starting with SAS 9.4M4, the number of bins is limited to 100,000. If the number of bins exceeds the maximum, the heat map is not drawn. A warning message is written to the SAS log in that case.

Requirements: The COLORGROUP= or the COLORRESPONSE= role must be specified.

The data for a parameterized heat map in a single-cell graph or in a cell in a classification panel must have at least two bins for both the X and Y axes. Otherwise, the heat map is not drawn.

Note: The data for a parameterized heat map should contain only one observation for each X and Y value pair.

Tips: Starting with SAS 9.4M4, the limit on the number of bins is specified by the ODS GRAPHICS statement NXYBINSMAX= option. The default value is 100,000. See NXYBINSMAX= on page 1573.

Starting with SAS 9.4M3, you can use subpixel rendering with this statement. It is enabled by default. To disable subpixel rendering, specify SUBPIXEL=OFF in the BEGINGRAPH statement or in an ODS GRAPHICS statement. For information about the BEGINGRAPH statement SUBPIXEL= option, see SUBPIXEL= on page 39. For information about the ODS GRAPHICS statement SUBPIXEL= option, see "ODS GRAPHICS Statement" on page 1561.

Syntax

HEATMAPPARM X=*column* | *expression*
Y=*column* | *expression*
COLORGROUP=*column* | *discrete-attr-var* | *expression* </*options*>;

HEATMAPPARM X=*column* | *expression*
Y=*column* | *expression*
COLORRESPONSE=*numeric-column* | *range-attr-var* | *expression* </*options*>;

Summary of Optional Arguments

Appearance options

COLORMODEL=*color-ramp-style-element* | (*color-list*)
: specifies a color ramp to use with the COLORRESPONSE= option.

DATATRANSPARENCY=*number*
: specifies the degree of the transparency of the filled rectangles.

DISPLAY=(*display-options*) | STANDARD | ALL
: specifies which region features to display.

FILLATTRS=(TRANSPARENCY=*number*)
: specifies the transparency of the area fill in the rectangles.

INCLUDEMISSINGCOLOR=TRUE | FALSE
: specifies whether missing values of the color-group variable or of the color-response variable are included in the plot.

OUTLINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
: specifies the appearance of the outlines of the filled rectangles.

REVERSECOLORMODEL=TRUE | FALSE
: specifies whether to reverse the gradient (color ramp) that is defined by either the ODS style that is in effect or by the COLORMODEL= option.

XGAP=*number*
: specifies the amount of horizontal space on either side of each filled rectangle.

XVALUES=MIDPOINTS | LEFTPOINTS | RIGHTPOINTS
: specifies whether the input X values represent midpoints, lower endpoints, or upper endpoints of the bins.

YGAP=*number*
: specifies the amount of vertical space on either side of each filled rectangle.

YVALUES=MIDPOINTS | LEFTPOINTS | RIGHTPOINTS
: specifies whether the input Y values represent midpoints, lower endpoints, or upper endpoints of the bins.

Axes options

PRIMARY=TRUE | FALSE
: specifies that the data columns for this plot and the plot type be used for determining default axis features.

XAXIS=X | X2
: specifies whether data are mapped to the primary X (bottom) axis or to the secondary X2 (top) axis.

XBINAXIS=TRUE | FALSE
: specifies whether to use bins as the basis for X-axis tick marks.

XBOUNDARIES=(*numeric-list*)
: specifies the boundaries of the X-value bins.

YAXIS=Y | Y2
: specifies whether data are mapped to the primary Y (left) axis or to the secondary Y2 (right) axis.

YBINAXIS=TRUE | FALSE
: specifies whether to use bins as the basis for Y-axis tick marks.

YBOUNDARIES=(*numeric-list*)
: specifies the boundaries of the Y-value bins.

Data option

DISCRETEX=TRUE | FALSE
: specifies whether the X axis is discrete when X= specifies a numeric column.

DISCRETEY=TRUE | FALSE
: specifies whether the Y axis is discrete when Y= specifies a numeric column.

Data tip options

ROLENAME=(*role-name-list*)
: specifies user-defined roles that can be used to display information in the data tips.

TIP=(*role-list*) | NONE

specifies the information to display when the cursor is positioned over a filled rectangle.

TIPFORMAT=(*role-format-list*)
specifies display formats for tip columns.

TIPLABEL=(*role-label-list*)
specifies display labels for tip columns.

Label options

XENDLABELS=TRUE | FALSE
specifies whether the axis ticks and value labels are drawn at the endpoints of the bins or midpoints of the bins.

YENDLABELS=TRUE | FALSE
specifies whether the axis ticks and value labels are drawn at the endpoints of the bins or midpoints of the bins.

ODS options

URL=*string-column*
specifies an HTML page to display when a rectangle is selected.

Plot reference options

NAME="*string*"
assigns a name to this plot statement for reference in other template statements.

Required Arguments

X=*column* | *expression*
specifies the column for the X values.

Requirement If X= specifies a numeric column, then the DISCRETEX= option must be set correctly for the X-axis type. When it is not set correctly, the heat map is not drawn. If the X-axis type is discrete, then you must specify DISCRETEX=TRUE in the HEATMAP statement. Otherwise, DISCRETEX=FALSE must be in effect.

See DISCRETEX= on page 552

Y=*column* | *expression*
specifies the column for the Y values.

Requirement If Y= specifies a numeric column, then the DISCRETEY= option must be set correctly for the Y-axis type. When it is not set correctly, the heat map is not drawn. If the Y-axis type is discrete, then you must specify DISCRETEY=TRUE in the HEATMAP statement. Otherwise, DISCRETEY=FALSE must be in effect.

See DISCRETEY= on page 553

COLORGROUP=*column* | *discrete-attr-var* | *expression*
specifies a column or a discrete attribute variable that is used to discretely color the regions in the heat map.

discrete-attr-var
specifies a discrete attribute map variable.

The discrete attribute map variable is created by a DISCRETEATTRVAR statement.

Restriction A discrete attribute map variable specification must be a direct reference to the attribute map variable. It cannot be set by a dynamic variable.

Requirement This argument is required when the response variable is of type discrete.

Note If you specify a column in a SAS data set, colors are mapped to group values in data order. If you specify a column in a CAS in-memory table, colors are mapped to group values in ascending order of the group column character values or unformatted numeric values.

See "DISCRETEATTRVAR Statement" on page 1516

COLORRESPONSE=*numeric-column* | *range-attr-var* | *expression*
specifies a numeric column or a range attribute variable that is used to color the regions of the heat map.

range-attr-var
specifies a range attribute variable that is defined in a RANGEATTRVAR statement.

Restriction A range attribute variable specification must be a direct reference to the attribute variable. It cannot be set by a dynamic variable.

See "RANGEATTRVAR Statement" on page 1531

When *numeric-column* or *expression* is specified, the colors for each region are computed by mapping the values to a color ramp that is defined by the COLORMODEL= option. When *attr-variable* is specified, the colors defined in the associated RANGEATTRVAR or DISCRETEATTRVAR statement are used to color the regions.

Requirement This argument is required when the response variable is of type interval.

See "RANGEATTRVAR Statement" on page 1531

Optional Arguments

COLORMODEL=*color-ramp-style-element* | (*color-list*)
specifies a color ramp to use with the COLORRESPONSE= option.

color-ramp-style-element
specifies the name of a color-ramp style element.

The style element should contain these style attributes:

STARTCOLOR
specifies the color for the smallest data value of the COLORRESPONSE= column.

NEUTRALCOLOR
specifies the color for the midpoint of the range of the COLORRESPONSE= column.

ENDCOLOR
specifies the color for the highest data value of the COLORRESPONSE= column.

(*color-list*)
specifies a space-separated list of colors to use in the color ramp. You can use style attribute references such as GraphData3:Color, color names, or RGB, CMYK, HLS, and HSV (HSB) color codes to specify a color. The list can contain a mix of style attribute references, color names, and color codes.

Requirement The list of colors must be enclosed in parentheses.

See "color " on page xii

Default The ThreeColorRamp style element

Interaction For this option to take effect, the COLORRESPONSE= option must also be specified.

Tip To reverse the start and end colors of the ramp that is assigned to the color model, use the REVERSECOLORMODEL= option.

DATATRANSPARENCY=*number*
specifies the degree of the transparency of the filled rectangles.

Default 0

Range 0–1, where 0 is opaque and 1 is entirely transparent

Restriction The specified transparency is not applied to missing values. Missing values are always opaque.

DISCRETEX=TRUE | FALSE
specifies whether the X axis is discrete when X= specifies a numeric column.

Note: This feature applies to SAS 9.4M3 and to later releases.

Default FALSE

Requirements If X= specifies a numeric column and the X-axis type is discrete, then you must specify DISCRETEX=TRUE. Otherwise, the heat map might not be drawn.

In SAS programs that were written before SAS 9.4M3, if the HEATMAPPARM statement is used to plot data on a discrete category axis, you must add the DISCRETEX=TRUE option to the

HEATMAPPARM statement. Otherwise, the heat map is not drawn.

Interactions If X= specifies a character column, then this option is ignored, and the X axis is considered to be discrete.

When this option is set to TRUE, the XENDLABELS= option is ignored.

See X= on page 550

DISCRETEY=TRUE | FALSE
specifies whether the Y axis is discrete when Y= specifies a numeric column.

Note: This feature applies to SAS 9.4M3 and to later releases.

Default FALSE

Requirements If Y= specifies a numeric column and the Y-axis type is discrete, then you must specify DISCRETEY=TRUE. Otherwise, the heat map might not be drawn.

In SAS programs that were written before SAS 9.4M3, if the HEATMAPPARM statement is used to plot data on a discrete response axis, you must add the DISCRETEY=TRUE option to the HEATMAPPARM statement. Otherwise, the heat map is not drawn.

Interactions If Y= specifies a character column, then this option is ignored, and the Y axis is considered to be discrete.

When this option is set to TRUE, the YENDLABELS= option is ignored.

See Y= on page 550

DISPLAY=(*display-options*) | STANDARD | ALL
specifies which region features to display.

display-options
a space-separated list of options, enclosed in parentheses.

Currently, only OUTLINE is supported, which displays outlined, filled rectangles.

STANDARD
displays the region fill color

ALL
displays the region fill color and outline

Default STANDARD

FILLATTRS=(TRANSPARENCY=*number*)
specifies the transparency of the area fill in the rectangles.

Default The DATATRANSPARENCY= option value

Range 0–1, where 0 is opaque and 1 is entirely transparent

Restriction Only the TRANSPARENCY= suboption is honored. If a style element or any other fill suboption is specified, then it is ignored by the HEATMAPPARM statement.

Note The fill colors are determined by the COLORRESPONSE= or COLORGROUP= or column.

INCLUDEMISSINGCOLOR=TRUE | FALSE
specifies whether missing values of the color-group variable or of the color-response variable are included in the plot.

Note: This feature applies to SAS 9.4M2 and to later releases.

Default TRUE

Tip The attributes of the missing color-group or color-response value are determined by the GraphMissing style element unless a discrete attribute map is in effect, the MISSING= system option changes the default missing character, or a user-defined format is applied to the group value. In those cases, the attributes of the missing group value are determined by a GraphData1–GraphDataN style element instead of by the GraphMissing style element.

See COLORGROUP= on page 550

COLORRESPONSE= on page 551

“boolean ” on page xii for other Boolean values that you can use.

NAME="*string*"
assigns a name to this plot statement for reference in other template statements. The specified name is used primarily in legend statements to coordinate the use of colors and line patterns between the plot and the legend.

Restrictions The *string* is case sensitive, cannot contain spaces, and must define a unique name within the template.

This option does not support variables that are created by the DYNAMIC, MVAR, and NMVAR template statements.

OUTLINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the appearance of the outlines of the filled rectangles.

Default The ContrastColor, LineStyle, and LineThickness attributes of the GraphOutlines style element.

Interaction For this option to have any effect, outlines must be enabled by the DISPLAY= option.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

PRIMARY=TRUE | FALSE
specifies that the data columns for this plot and the plot type be used for determining default axis features. This option is needed only when two or more plots within an overlay-type layout contribute to a common axis.

Default FALSE

Restriction This option is ignored if the plot is placed under a GRIDDED or LATTICE layout block.

Note In an OVERLAY layout, only one plot in an overlay can be the primary plot on a per-axis basis. When no plot is designated as the primary plot, the first plot that can be a primary plot is considered the primary plot. If multiple plots specify PRIMARY=TRUE for the same axis, then the last such plot encountered is considered the primary plot.

See "When Plots Share Data and a Common Axis" on page 1046

"boolean " on page xii for other Boolean values that you can use.

REVERSECOLORMODEL=TRUE | FALSE
specifies whether to reverse the gradient (color ramp) that is defined by either the ODS style that is in effect or by the COLORMODEL= option.

Default FALSE

See COLORMODEL=

"boolean " on page xii for other Boolean values that you can use.

ROLENAME=(*role-name-list*)
specifies user-defined roles that can be used to display information in the data tips. This option provides a way to add to the data columns that appear in data tips that are specified by the TIP= option.

(*role-name-list*)
a space-separated list of *role-name = column* pairs.

Example The following example assigns the column Obs to the user-defined role TIP:

```
ROLENAME=(TIP1=OBS)
```

Default No user-defined roles

Requirement The role names that you choose must be unique and different from the predefined roles X, Y, COLORGROUP=, and COLORRESPONSE=.

TIP=(*role-list*) | NONE
specifies the information to display when the cursor is positioned over a filled rectangle. If this option is used, then it replaces all of the information that is displayed by default. Roles for columns that do not contribute to the heat map can be specified along with roles that do.

(*role-list*)
an ordered, space-separated list of unique HEATMAPPARM and user-defined roles. HEATMAPPARM roles include X and Y.

Example The following example displays data tips for the columns X and PCT. The Pct column is not assigned to any pre-defined HEATMAPPARM role, so it must first be assigned a role:

```
ROLENAME=(TIP1=PCT)
TIP=(X TIP1)
```

NONE
suppresses data tips from the plot.

Default The columns assigned to these roles are automatically included in the data tip information: X and Y, and COLORGROUP= or COLORRESPONSE=.

Requirement To enable data tips in the output, you must include an ODS GRAPHICS ON statement that specifies the IMAGEMAP option, and you must write the output to the ODS HTML destination.

Interaction This option is ignored when the plot statement is in an OVERLAY or PROTOTYPE layout and the INCLUDERANGES= option is specified in the LINEAROPTS= or TIMEOPTS= option for either axis.

Tip The labels and formats for the TIP variables can be controlled with the TIPLABEL= and TIPFORMAT= options.

TIPFORMAT=(*role-format-list*)
specifies display formats for tip columns. This option provides a way to control the formats of columns that appear in data tips.

(*role-format-list*)
a space-separated list of *role-name* = *format* pairs.

Example
```
ROLENAME=(TIP1=SALARY)
TIP=(TIP1)
TIPFORMAT=(TIP1=DOLLAR12.)
```

Default The column format of the column assigned to the role or BEST6 if no format is assigned to a numeric column.

Restriction Only the roles that appear in the TIP= option are used.

Requirement A column must be assigned to each of the specified roles. (See the ROLENAME= option.)

TIPLABEL=(*role-label-list*)
specifies display labels for tip columns. This option provides a way to control the labels of columns that appear in data tips.

role-label-list
a space-separated list of *rolename* ="*string*" pairs.

Example
```
ROLENAME=(TIP1=PCT)
TIP=(TIP1)
TIPLABEL=(TIP1="Percent")
```

Default The column label or column name of the column assigned to the role.

Restriction Only the roles that appear in the TIP= option are used.

Requirement A column must be assigned to each of the specified roles. (See the ROLENAME= option.)

URL=*string-column*
specifies an HTML page to display when a rectangle is selected.

string-column
specifies a column that contains a valid HTML page reference (HREF) for each rectangle that is to have an active link.

Example `http://www.sas.com`

Requirement To generate a plot with selectable rectangles, you must include an ODS GRAPHICS ON statement that specifies the IMAGEMAP option, and you must write the output to the ODS HTML destination.

Interactions This option has no effect when TIP=NONE.

This option is ignored when the plot statement is in an OVERLAY or PROTOTYPE layout and the INCLUDERANGES= option is specified in the LINEAROPTS= or TIMEOPTS= option for either axis.

Tips The URL value can be blank for some X and Y pairs. In that case, no action is taken when the corresponding rectangle is selected.

The URL value can be the same for any X and Y pairs. In that case, the same action is taken when the rectangle for those X and Y pairs is selected.

By default, drill-down links open in a new browser window (link target _blank). To specify a different target for your drill-down links, such as _self or _parent, add the DRILLTARGET="*target*" option to your ODS GRAPHICS statement. See DRILLTARGET= on page 1568.

XAXIS=X | X2
specifies whether data are mapped to the primary X (bottom) axis or to the secondary X2 (top) axis.

Default X

Interaction The overall plot specification and the layout type determine the axis display. For more information, see "How Axis Features Are Determined" on page 1040.

XBINAXIS=TRUE | FALSE
specifies whether to use bins as the basis for X-axis tick marks. When this option is FALSE, a standard axis is used, ignoring bin boundaries and midpoints.

Default TRUE

Interactions When this option is TRUE, the XENDLABELS= option determines how the axis ticks and value labels are displayed. When this option is FALSE, the XENDLABELS= option is ignored.

When this option is TRUE, the axis ticks are in predetermined locations and are not changed when the parent layout specifies axis suboptions such as TICKVALUELIST=, TICKVALUESEQUENCE=, and INCLUDERANGES=.

See "boolean " on page xii for other Boolean values that you can use.

XBOUNDARIES=(*numeric-list*)
specifies the boundaries of the X-value bins. The boundaries are specified as a space-separated list of values enclosed in parentheses. The keywords MIN and MAX can be used as one of the values in the list of boundaries. Keywords MIN and MAX indicate the minimum and maximum data values for the X variable.

Interaction This option is ignored if the X values are not numeric.

Tip This option can be used to specify unequal bins.

Example
```
xboundaries=(MIN 20 200 250 MAX)
```

XENDLABELS=TRUE | FALSE
specifies whether the axis ticks and value labels are drawn at the endpoints of the bins or midpoints of the bins.

Default FALSE. The axis ticks and values labels are drawn at the bin midpoints.

Restriction This option is ignored when the X axis is discrete.

Interactions If this option is set to FALSE, then the axis ticks and value labels are drawn at the bin midpoints, regardless of whether the XVALUES= option identifies the X data as endpoint values or midpoint values.

This option is ignored when XBINAXIS=FALSE is in effect.

See "boolean " on page xii for other Boolean values that you can use.

XGAP=*number*
specifies the amount of horizontal space on either side of each filled rectangle.

Default 0

XVALUES=MIDPOINTS | LEFTPOINTS | RIGHTPOINTS
specifies whether the input X values represent midpoints, lower endpoints, or upper endpoints of the bins.

Default MIDPOINTS

See XENDLABELS=

YAXIS=Y | Y2
specifies whether data are mapped to the primary Y (left) axis or to the secondary Y2 (right) axis.

Default Y

Interaction The overall plot specification and the layout type determine the axis display. For more information, see "How Axis Features Are Determined" on page 1040.

YBINAXIS=TRUE | FALSE
specifies whether to use bins as the basis for Y-axis tick marks. When this option is FALSE, a standard axis is used, ignoring bin boundaries and midpoints.

Default TRUE

Interactions When this option is TRUE, the YENDLABELS= option determines how the axis ticks and value labels are displayed. When this option is FALSE, the YENDLABELS= option is ignored.

When this option is TRUE, the axis ticks are in predetermined locations and are not changed when the parent layout specifies axis suboptions such as TICKVALUELIST=, TICKVALUESEQUENCE=, and INCLUDERANGES=.

See "boolean " on page xii for other Boolean values that you can use.

YBOUNDARIES=(*numeric-list*)
specifies the boundaries of the Y-value bins. The boundaries are specified as a space-separated list of values enclosed in parentheses. The keywords MIN and MAX can be used as one of the values in the list of boundaries. Keywords MIN and MAX indicate the minimum and maximum data values for the Y variable. Example:

```
yboundaries=(MIN 20 200 250 MAX)
```

Interaction This option is ignored if the Y values are not numeric.

Tip This option can be used to specify unequal bins.

YENDLABELS=TRUE | FALSE
specifies whether the axis ticks and value labels are drawn at the endpoints of the bins or midpoints of the bins.

Default FALSE. The axis ticks and values labels are drawn at the bin midpoints.

Restriction This option is ignored when the Y axis is discrete.

Interactions If this option is set to FALSE, then the axis ticks and value labels are drawn at the bin midpoints, regardless of whether the YVALUES= option identifies the Y data as endpoint values or midpoint values.

This option is ignored when YBINAXIS=FALSE is in effect.

See "boolean " on page xii for other Boolean values that you can use.

YGAP=*number*
specifies the amount of vertical space on either side of each filled rectangle.

Default 0

YVALUES=MIDPOINTS | LEFTPOINTS | RIGHTPOINTS
specifies whether the input Y values represent midpoints, lower endpoints, or upper endpoints of the bins.

Default MIDPOINTS

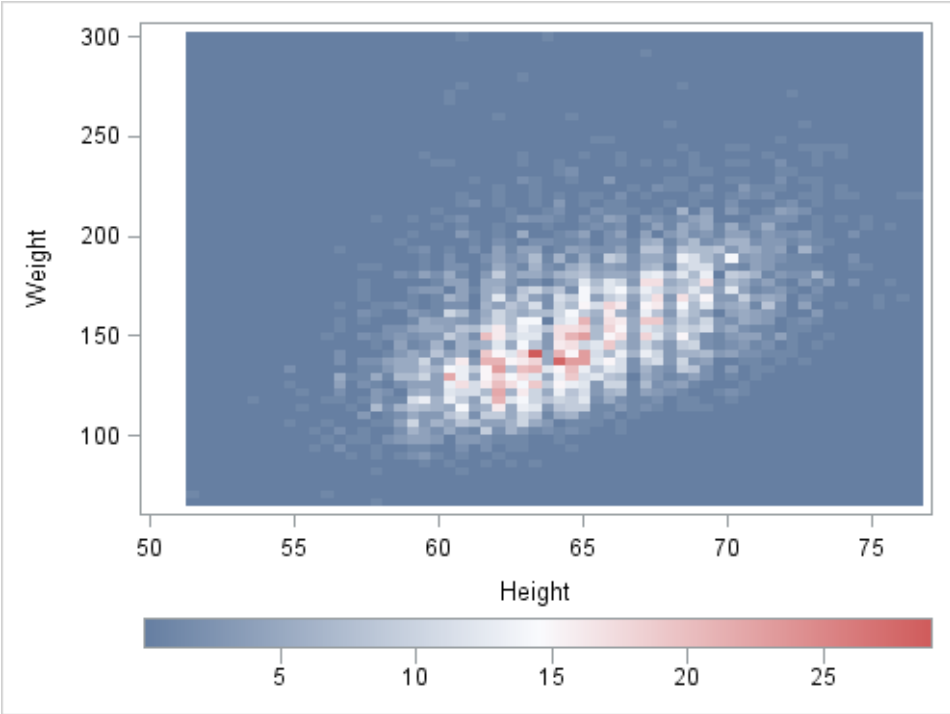
See YENDLABELS=

Details

A heat map is useful for visualizing the magnitude of a response variable in relation to two independent variables. For example, in molecular biology, heat maps can be used to track the expression of genes across multiple sample studies. In the HEATMAPPARM statement, you specify the independent variables in the X and Y arguments. For a response variable that has discrete values, use the COLORGROUP argument, or for a response variable that has interval values, use the COLORRESPONSE argument. For interval response variables, you can use the COLORMODEL= option to define the color ramp that is used to fill the rectangles.

Example: HEATMAPPARM Statement

The following graph was generated by the "Example Program" on page 561:



Example Program

```
proc template;
  define statgraph heatmapparm;
    begingraph;
      layout overlay;
        heatmapparm x=height y=weight colorresponse=count /
          name="heatmapparm" xbinaxis=false ybinaxis=false;
        continuouslegend "heatmapparm" / location=outside
valign=bottom;
      endlayout;
    endgraph;
  end;
run;

proc sgrender data=sashelp.gridded template=heatmapparm;
run;
```

HIGHLOWPLOT Statement

Creates a display of floating vertical or horizontal lines or bars that connect the minimum and maximum response values for each value of a categorical variable.

Requirements: Either the X= or Y= argument must be specified, but you cannot specify both on the same HIGHLOWPLOT statement.

The HIGH= and LOW= arguments are required.

Note: Specifying the X= option creates a vertical high-low chart, which would typically be used in the financial industry to plot stock values over time. Specifying the Y= option creates a horizontal high-low chart, which would typically be used in the Health and Life Sciences industry to display over time the duration of adverse events or of adverse reactions to medication.

Tips: For charts that have a large number of bars that are very close together, slight variations in spacing that normally occur due to integer rounding can become more obvious. Subpixel rendering provides more precise bar spacing in that case. In SAS 9.4M2 and in earlier releases, specify SUBPIXEL=ON in the BEGINGRAPH statement to enable subpixel rendering. See SUBPIXEL= on page 39. Starting with SAS 9.4M3, subpixel rendering is enabled by default.

To disable subpixel rendering in SAS 9.4M3 and in later releases, specify SUBPIXEL=OFF in the BEGINGRAPH statement or in an ODS GRAPHICS statement. For information about the BEGINGRAPH statement SUBPIXEL= option, see SUBPIXEL= on page 39. For information about the ODS GRAPHICS statement SUBPIXEL= option, see "ODS GRAPHICS Statement" on page 1561.

Syntax

HIGHLOWPLOT X=*column* | *expression*
LOW=*numeric-column* | *expression*
HIGH=*numeric-column* | *expression* < */options* >;

HIGHLOWPLOT Y=*column* | *expression*
LOW=*numeric-column* | *expression*
HIGH=*numeric-column* | *expression* < */options* >;

Summary of Optional Arguments

Appearance options

BARWIDTH=*number*
: specifies the width of a bar as a ratio of the maximum possible width.

CLIPCAP=TRUE | FALSE
: specifies whether a special clip cap is displayed to indicate where clipping occurred.

CLIPCAPSHAPE=DEFAULT | BARBEDARROW | CLIPPEDARROW | CLOSEDARROW | FILLEDARROW | OPENARROW | SERIF
: specifies the shape of the arrowhead on the clipped end of a line or bar when CLIPCAP=TRUE.

CLOSE=*numeric-column* | *expression*
: specifies a column or expressions whose values are used to display a closing-value indicator.

CLUSTERWIDTH=*number*
: on a discrete axis, specifies the width of the group clusters as a fraction of the midpoint spacing. On an interval axis, specifies the width of the

group clusters as a fraction of the minimum interval between adjacent data values.

COLORMODEL=*color-ramp-style-element* | (*color-list*)
specifies a color ramp to use with the COLORRESPONSE= option.

COLORRESPONSE=*numeric-column* | *range-attr-var* | *expression*
specifies the column or range attribute variable to use to map the bar or line colors.

DATASKIN=NONE | CRISP | GLOSS | MATTE | PRESSED | SHEEN
enhances the visual appearance of the filled bars or lines of a high-low chart.

DATATRANSPARENCY=*number*
specifies the degree of the transparency of the colored regions, and the high-end and low-end labels.

DISPLAY=(*display-options*) | STANDARD | ALL
specifies which bar features to display.

ENDCAPDISPLAYPOLICY=AUTO | ALWAYS
specifies the policy for displaying end caps when end caps are present.

FILLATTRS=*style-element* | *style-element* (*fill-options*) | (*fill-options*)
specifies the appearance of the interior fill area of the bars.

FILLPATTERNATTRS=*style-element* | (*fill-pattern-options*)
specifies the appearance of the pattern-filled areas.

HIGHCAP=*column* | NONE | SERIF | BARBEDARROW | FILLEDARROW | OPENARROW | CLOSEDARROW
specifies the type of cap used at the high end of the bar or line.

INDEX=*positive-integer-column* | *expression*
specifies indices for mapping line attributes (color and line pattern) or bar attributes (fill and outline) to one of the GraphData1–GraphDataN style elements.

INTERVALBARWIDTH=*dimension*
specifies the width of the floating bars.

LINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the attributes of the floating plot lines.

LOWCAP=*column* | NONE | SERIF | BARBEDARROW | FILLEDARROW | OPENARROW | CLOSEDARROW
specifies the type of cap used at the low end of the bar or line.

OPEN=*numeric-column* | *expression*
specifies a column or expressions whose values are used to display an opening-value indicator.

OUTLINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the appearance of the outlines of the filled regions.

TYPE=LINE | BAR
specifies whether data values should be represented by bars or lines.

Axes options

PRIMARY=TRUE | FALSE
specifies that the data columns for this plot and the plot type be used for determining default axis features.

XAXIS=X | X2

specifies whether data are mapped to the primary X (bottom) axis or to the secondary X2 (top) axis.

YAXIS=Y | Y2
specifies whether data are mapped to the primary Y (left) axis or to the secondary Y2 (right) axis.

Data tip options

ROLENAME=(*role-name-list*)
specifies user-defined roles that can be used to display information in the data tips.

TIP=(*role-list*) | NONE
specifies the information to display when the cursor is positioned over a bar or line.

TIPFORMAT=(*role-format-list*)
specifies display formats for tip columns.

TIPLABEL=(*role-label-list*)
specifies display labels for tip columns.

Label options

HIGHLABEL=*column* | *expression*
specifies the label to display at the high end of the bar or line.

LABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font attributes of the labels for the bars or lines.

LEGENDLABEL="*string*"
specifies a label to be used in a discrete legend for this plot.

LOWLABEL=*column* | *expression*
specifies the label to appear at the low end of each floating bar or line.

Midpoint options

DISCRETEOFFSET=*number*
specifies an amount to offset all bars or lines from the category midpoints when graphing multiple response variables side by side on a common axis.

GROUP=*column* | *discrete-attr-var* | *expression*
creates a distinct set of floating bars or lines for each unique group value in the specified column.

GROUPDISPLAY=OVERLAY | CLUSTER
specifies whether grouped bars or lines are overlaid or clustered around the category midpoints.

GROUPORDER=DATA | REVERSEDATA | ASCENDING | DESCENDING
specifies the ordering of the groups within a category.

INCLUDEMISSINGGROUP=TRUE | FALSE
specifies whether missing values of the group variable are included in the plot.

Plot reference options

NAME="*string*"
assigns a name to this plot statement for reference in other template statements.

Required Arguments

Either the X= or Y= argument must be specified, but you cannot specify both on the same HIGHLOWPLOT statement. The HIGH= and LOW= arguments are required.

X=*column* | *expression*
specifies a column or expression representing the values in a vertical high-low chart. The values can be character or numeric.

Y=*column* | *expression*
specifies a column or expression representing the values in a horizontal high-low chart. The values can be character or numeric.

LOW=*numeric-column* | *expression*
specifies a column or expression representing the values of the lower end of the floating bar or line.

HIGH=*numeric-column* | *expression*
specifies a column or expression representing the values of the higher end of the floating bar or line.

Optional Arguments

BARWIDTH=*number*
specifies the width of a bar as a ratio of the maximum possible width.

Default 0.85

Range 0–1, where 0 is the minimum width, which is one pixel wide, and 1 is the maximum possible width

Restriction This option has an effect only when TYPE= BAR.

Interaction Prior to SAS 9.4M3, this option is ignored for an interval high-low plot, and the bar width is controlled by the INTERVALBARWIDTH= option. Starting with SAS 9.4M3, this option is honored for an interval high-low plot but it can be overridden by the INTERVALBARWIDTH= option.

Notes This option is needed only to change the default behavior.

By default, the bar width automatically adjusts based on the number of bars to be displayed and the wall width.

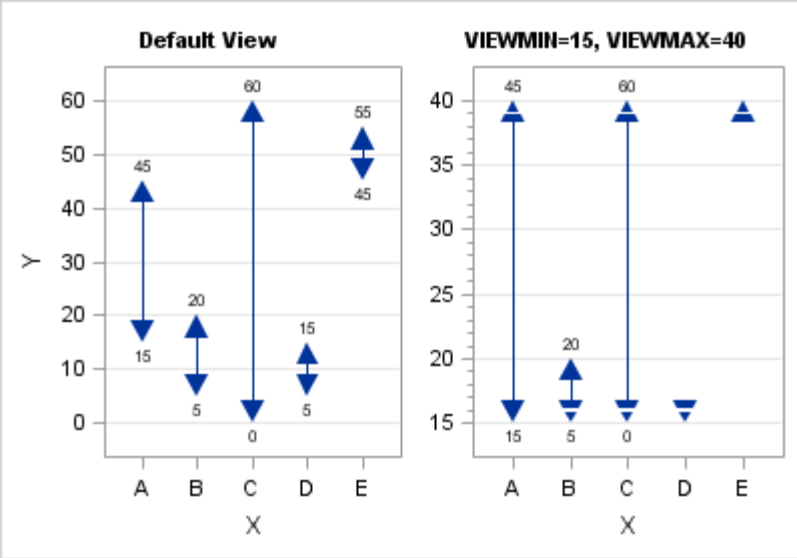
Tip To remove any inter-bar gap, set BARWIDTH=1.

See DISCRETEOFFSET= option for examples of using this option.

CLIPCAP=TRUE | FALSE
specifies whether a special clip cap is displayed to indicate where clipping occurred. When the VIEWMIN= and VIEWMAX= axis options are specified for an axis and a data value exceeds the specified axis range, the bar for that value is clipped. In that case, when CLIPCAP=TRUE, a special clip cap is displayed at the clipped end of the bar. If the bar already has a high or low cap, then it is replaced by the clip cap.

For vertical bars, the clip cap is added to the end of the bar that is clipped by the Y-axis range. The default clip cap is a vertical clipped arrowhead that points toward the clip edge (or). For horizontal bars, the cap is added to the end of the bar that is clipped by the X-axis range. The default clip cap is a horizontal clipped arrowhead that points toward the clip edge (or). If an entire bar is clipped, then a clip cap is displayed at the high or low side where the bar was clipped.

The following figure shows a side-by-side comparison of a vertical line high-low chart with no clipping and with clipping when CLIPCAP=TRUE.



The first graph shows the default case in which no clipping occurs. The second graph shows the case in which VIEWMIN= and VIEWMAX= specify a range that causes clipping on the Y axis. In the second graph, the clip caps indicate clipping for each category line as follows:

A the high end of the line is clipped.

B the low end of the line is clipped.

C both ends of the line are clipped.

D the entire line is clipped at the low end.

E the entire line is clipped at the high end.

Default FALSE

Interaction Clip caps appear only when CLIPCAP=TRUE and the data values exceed the axis range that is specified by the VIEWMIN= and VIEWMAX= options. When the VIEWMIN= and VIEWMAX= options are not specified, the axis range is adjusted to accommodate the data values and clipping does not occur.

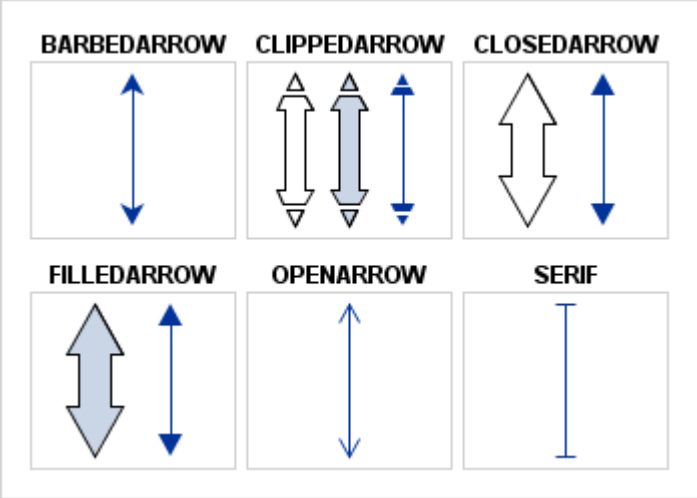
Note If the HIGHLABEL= and LOWLABEL= options are in effect and the bar is clipped, then the label value at the clipped end is drawn at the tip of the clip cap. If the entire bar is clipped, then the labels are not shown.

Tip Use the CLIPCAPSHAPE= option to specify a different clip-cap arrowhead.

See "boolean " on page xii for other Boolean values that you can use.

CLIPCAPSHAPE=DEFAULT | BARBEDARROW | CLIPPEDARROW | CLOSEDARROW | FILLEDARROW | OPENARROW | SERIF

specifies the shape of the arrowhead on the clipped end of a line or bar when CLIPCAP=TRUE. The following figure shows each of the clip-cap arrowhead shapes for vertical lines and bars that are clipped at both ends.



In SAS 9.4M1 and earlier releases, this option specifies the arrowhead shape only for the clipped end of clipped lines (TYPE=LINE). For bars (TYPE=BAR), this option is ignored, and CLIPPEDARROW is always used as the arrowhead shape for the clipped end of clipped bars.

Starting with SAS 9.4M2, this option specifies the arrowhead shape for the clipped end of clipped lines or clipped bars. For bars, you can specify the CLIPPEDARROW shape for filled and unfilled bars. When any value other than CLIPPEDARROW or DEFAULT is specified for bars, the FILLEDARROW shape is used for filled bars, and the CLOSEDARROW shape is used for unfilled bars.

Default DEFAULT, which is the same as CLIPPEDARROW

Interaction This option is ignored when CLIPCAP=FALSE.

CLOSE=*numeric-column* | *expression*

specifies a column or expressions whose values are used to display a closing-value indicator. This option is typically used when TYPE=LINE, but it can be used when TYPE=BAR. For vertical high-low charts, the value is represented by a short horizontal line extending from the side that displays the higher X values. For horizontal high-low charts, the value is represented by a short vertical line extending from the side that displays the higher Y values.

CLUSTERWIDTH=*number*

on a discrete axis, specifies the width of the group clusters as a fraction of the midpoint spacing. On an interval axis, specifies the width of the group clusters as a fraction of the minimum interval between adjacent data values.

Default 0.85

Range 0–1, where 0 is the minimum width, which is one pixel wide, and 1 is the maximum possible width

Interaction For this option to take effect, the GROUP= option must also be specified, and the GROUPDISPLAY= option must be set to CLUSTER.

COLORMODEL=*color-ramp-style-element* | (*color-list*)
specifies a color ramp to use with the COLORRESPONSE= option.

color-ramp-style-element
specifies the name of a color-ramp style element.

The style element should contain these style attributes:

STARTCOLOR
specifies the color for the smallest data value of the COLORRESPONSE= column.

NEUTRALCOLOR
specifies the color for the midpoint of the range of the COLORRESPONSE= column.

ENDCOLOR
specifies the color for the highest data value of the COLORRESPONSE= column.

(*color-list*)
specifies a space-separated list of colors to use in the color ramp. You can use style attribute references such as GraphData3:Color, color names, or RGB, CMYK, HLS, and HSV (HSB) color codes to specify a color. The list can contain a mix of style attribute references, color names, and color codes.

Requirement The list of colors must be enclosed in parentheses.

See “color ” on page xii

Defaults For lines or for outline-only bars, the ThreeColorAltRamp style element.

For bars with fill, the ThreeColorRamp style element

Interaction For this option to take effect, the COLORRESPONSE= option must also be specified.

COLORRESPONSE=*numeric-column* | *range-attr-var* | *expression*
specifies the column or range attribute variable to use to map the bar or line colors.

Note: This feature applies to SAS 9.4M3 and to later releases.

range-attr-var
specifies a range attribute map variable that is defined in a RANGEATTRVAR statement.

"RANGEATTRVAR Statement"

Restriction A range attribute map variable specification must be a direct reference to the attribute map variable. It cannot be set as a dynamic variable.

See "RANGEATTRVAR Statement" on page 1531

When a numeric column or expression is specified, the range of column or expression values are linearly mapped to the color ramp that is specified by the COLORMODEL= option. When a range attribute map variable is specified, the colors that are defined in the associated range attribute map are used instead.

Requirement For a grouped plot, the COLORRESPONSE values should remain constant for each group value. If the COLORRESPONSE column has multiple values for a single GROUP value, unexpected results might occur.

Interactions When the GROUP= option is specified with the COLORRESPONSE= option, the color attributes are controlled by the COLORRESPONSE= option.

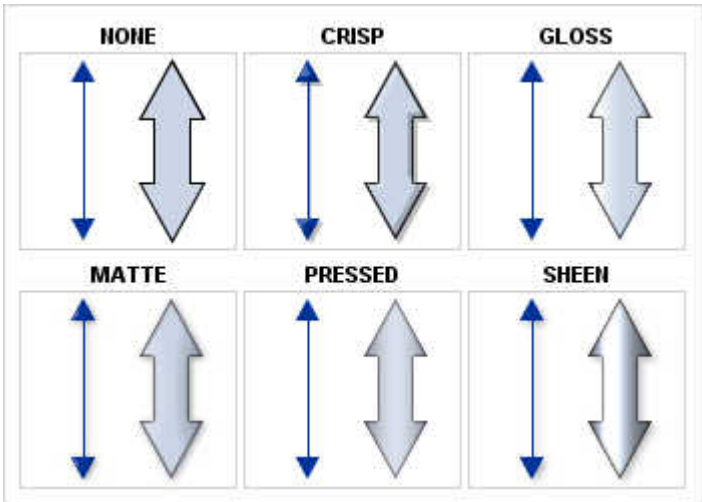
When fill is displayed, this option overrides suboption COLOR= in the FILLATTRS= option and varies the fill color according to the color gradient or the attribute map.

When only the outlines are displayed, this option overrides suboption COLOR= in the OUTLINEATTRS= option and varies the outline color according to the color gradient or the attribute map.

Tips To display a legend with this option in effect, use a CONTINUOUSLEGEND statement.

For a numeric column or expression, the ThreeColorRamp style element defines the fill color gradient, and the ThreeColorAltRamp style element defines the outline color gradient.

DATASKIN=NONE | CRISP | GLOSS | MATTE | PRESSED | SHEEN
enhances the visual appearance of the filled bars or lines of a high-low chart. The following figure shows a high-low chart that contains a filled bar and a line with each of the skins applied.



Default The DATASKIN= option value that is specified in the BEGINGRAPH statement. If that value is not specified, then the GraphSkins:DataSkin style element value is used.

Restriction Starting with SAS 9.4M1, the maximum number of skinned graphical elements is limited to 200 per plot in an OVERLAY or PROTOTYPE layout. When this limit is exceeded for a plot, the specified data skin is not applied to that plot. In that case, use the DATASKINMAX= option in your ODS GRAPHICS statement to increase the maximum limit.

Interactions This option overrides the BEGINGRAPH statement DATASKIN= option.

When TYPE=BAR, the DISPLAY= option in effect must include FILL in order for the DATASKIN= option to have any effect.

For filled bars, the skin appearance is based on the FILLATTRS= option color specification.

DATATRANSPARENCY=*number*

specifies the degree of the transparency of the colored regions, and the high-end and low-end labels.

Default 0

Range 0–1, where 0 is opaque and 1 is entirely transparent

Tip The FILLATTRS option can be used to set transparency for just the colored regions. You can combine this option with FILLATTRS= to set one transparency for the outlines but a different transparency for the region fills . Example:

```
datatransparency=0.2 fillattrs=(transparency=0.6)
```

DISCRETEOFFSET=*number*

specifies an amount to offset all bars or lines from the category midpoints when graphing multiple response variables side by side on a common axis.

Default 0 (no offset, all bars or lines are centered on the category midpoints)

Range −0.5 to +0.5, where 0.5 represents half the distance between category ticks. Normally, a positive offset is to the right for a vertical plot and up for a horizontal plot. (If the layout's axis options set REVERSE=TRUE, then the offset direction is also reversed.)

Restriction This option applies to discrete axes only. For nondiscrete axes, this option is ignored.

Tip Setting the discrete offset for the plots does not affect the axis minimum and maximum offsets. In some cases, setting a discrete offset can cause clipping at each end of the axis. In those cases, use the OFFSETMIN= and OFFSETMAX= axis options to increase the axis minimum and maximum offsets to accommodate the discrete offset.

See "About the DISCRETEOFFSET= Option" on page 585

DISPLAY=(*display-options*) | STANDARD | ALL
specifies which bar features to display.

(*display-options*)
specifies a space-separated list of one or more display options, enclosed in parentheses.

The list can contain one or more of the following options:

FILL
displays the bar fill color

OUTLINE
displays the bar outline

FILLPATTERN
displays the bar fill pattern

Note This feature applies to SAS 9.4M5 and to later releases.

Tip By default, this option has no effect if the active ODS style does not specify a fill pattern. To display a fill pattern in that case, select an ODS style that supports fill patterns or use the FILLPATTERNATTRS= option to specify a fill pattern for the bars.

STANDARD
specifies FILL and OUTLINE

ALL
specifies all features: FILL, FILLPATTERN, and OUTLINE

Defaults In SAS 9.4M4 and in earlier releases, STANDARD

Starting in SAS 9.4M5, the GraphHighLow:DisplayOpts style reference, if defined in the active ODS style. Otherwise, STANDARD.

Requirement You must also specify TYPE=BAR. Otherwise, this option is ignored.

Tip Use the OUTLINEATTRS= and FILLATTRS= options to control the appearance of the bar outline and fill color. Starting with SAS 9.4M5, use the FILLPATTERNATTRS= on page 573 option to control the appearance of the bar fill pattern.

ENDCAPDISPLAYPOLICY=AUTO | ALWAYS
specifies the policy for displaying end caps when end caps are present.

AUTO
draws the end caps only for the elements with a low-to-high range that is large enough to accommodate the end caps.

Draws just the bar or line for the rest.

ALWAYS
always draws the end caps.

Note When the low-to-high range is not large enough for the end caps, the end caps might overlap. The data ranges that are smaller than the end-cap size might not be resolvable beyond the rendered size of the end caps.

Default AUTO

Interactions This option is honored only when the option TYPE=LINE is in effect.

This option is ignored if the LOWCAP= or HIGHCAP= option is not set or is effectively set to NONE.

FILLATTRS=*style-element* | *style-element* (*fill-options*) | (*fill-options*)
specifies the appearance of the interior fill area of the bars.

Defaults For non-grouped data, the GraphDataDefault:Color style reference.

For grouped data, the Color attribute of GraphData1–GraphDataN style elements.

Interactions For this option to take effect, TYPE=BAR must also be specified, and the DISPLAY= option must allow the fill to be displayed.

When COLORRESPONSE= is in effect, the FILLATTRS= suboption COLOR= is ignored, and the bar fill colors vary according to the gradient.

Tip The DATATRANSPARENCY= option sets the transparency for the colored regions and the outlines around them. You can combine this option with DATATRANSPARENCY= to set one transparency for the outlines but a different transparency for the colored regions. Example:

```
datatransparency=0.2 fillattrs=(transparency=0.6)
```

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Fill Color Options" on page 1600 for available *fill-options*.

FILLPATTERNATTRS=*style-element* | (*fill-pattern-options*)
specifies the appearance of the pattern-filled areas.

Note: This feature applies to SAS 9.4M5 and to later releases.

Defaults For non-grouped data, the ContrastColor and FillPattern attributes of GraphDataDefault.

For grouped data, the ContrastColor and FillPattern attributes of GraphData1–GraphDataN.

Interactions For this option to take effect, the DISPLAY= option must include FILLPATTERN among the display options.

Starting with SAS 9.4M5, when COLORRESPONSE= is in effect and the DISPLAY= option enables FILLPATTERN display, the FILLPATTERNATTRS= suboption COLOR= is ignored, and the fill-pattern colors vary according to the gradient.

Tip In order to change the fill pattern for each group value in ODS styles such as HTMLBlue that use color-priority attribute rotation, specify ATTRPRIORITY=NONE in an ODS GRAPHICS statement or in the BEGINGRAPH statement in your graph template. For more information, see "Attribute Rotation Patterns" in *SAS Graph Template Language: User's Guide*.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Fill Pattern Options" on page 1601 for available *fill-pattern-options*.

GROUP=*column* | *discrete-attr-var* | *expression*
creates a distinct set of floating bars or lines for each unique group value in the specified column.

discrete-attr-var
specifies a discrete attribute map variable.

The discrete attribute map variable is created by a DISCRETEATTRVAR statement.

Restriction A discrete attribute map variable specification must be a direct reference to the attribute map variable. It cannot be set by a dynamic variable.

When TYPE= on page 583LINE (default), combinations of line color and line style are used to create a distinct line for each group value. The ContrastColor

and LineStyle attributes of a GraphData1–GraphDataN style element or the GraphMissing style element control the color and line style of each group line.

When TYPE=BAR, a distinct bar is created for each group value by varying the visual attributes of the bar display features. The display features are controlled by the current ODS style or by the DISPLAY= option. The default group appearance for each display feature is shown in the following table.

Display Feature [1]	Style Attributes That Control Default Group Appearance
Fill color	Color attribute of a GraphData1–GraphDataN style element or the GraphMissing style element.
Fill pattern [2]	FillPattern and ContrastColor attributes of a GraphData1–GraphDataN style element or the GraphMissing style element. The ContrastColor attribute controls the color of the fill pattern.
Outline	■ if the outline is enabled with fill color, fill pattern, or both, ContrastColor attribute of a GraphData1–GraphDataN style element or the GraphMissing style element with a solid line style ■ if the outline is the only display feature enabled, ContrastColor and LineStyle attributes of a GraphData1–GraphDataN style element or the GraphMissing style element

1 Fill color and the bar outline are displayed by default.
2 Fill patterns are valid for high-low plots starting with SAS 9.4M5.

Interactions

If the X or Y role is discrete, then the bars or lines representing the group can be drawn in a cluster or overlaid, based on the setting for the GROUPDISPLAY= option. However, if the X or Y role is interval, then the lines representing the group are overlaid and the GROUPDISPLAY= option is ignored.

By default, the group values are mapped in the order of the data. Use the GROUPORDER= option to control the sorting order of the grouped bar segments. Use the INDEX= option to alter the default sequence of colors and line patterns.

The INCLUDEMISSINGGROUP= option determines whether missing group values are considered a distinct group value.

When both the GROUP= and COLORRESPONSE= options are specified, the color attributes are controlled by the COLORRESPONSE= option.

Note If you specify a column in a SAS data set, the visual attributes for each group value are assigned in data order. If you specify a column in a CAS in-memory table, the visual attributes for each group value are assigned in ascending order of the group column character values or of unformatted numeric values.

Tips The representations that are used to identify the groups can be overridden. For example, if each distinct group value is represented by a different line pattern, you can use the LINEATTRS=(PATTERN=*pattern*) specification to assign the same line pattern to all the plot lines. In that case, the line color denotes group values. Likewise, you can use LINEATTRS=(COLOR=*color*) to assign the same color to all lines, letting line pattern denote group values.

By default, ODS Graphics limits the number of groups to 1000. When this limit is exceeded, the GROUP= option is ignored. Use the GROUPMAX= option in the ODS GRAPHICS statement to change the maximum number of groups that can be processed.

See "DISCRETEATTRVAR Statement" on page 1516

GROUPDISPLAY=OVERLAY | CLUSTER

specifies whether grouped bars or lines are overlaid or clustered around the category midpoints.

OVERLAY

centers the bars or lines for matching category values on the midpoints.

The bars or lines in each set of group values are superimposed on each other.

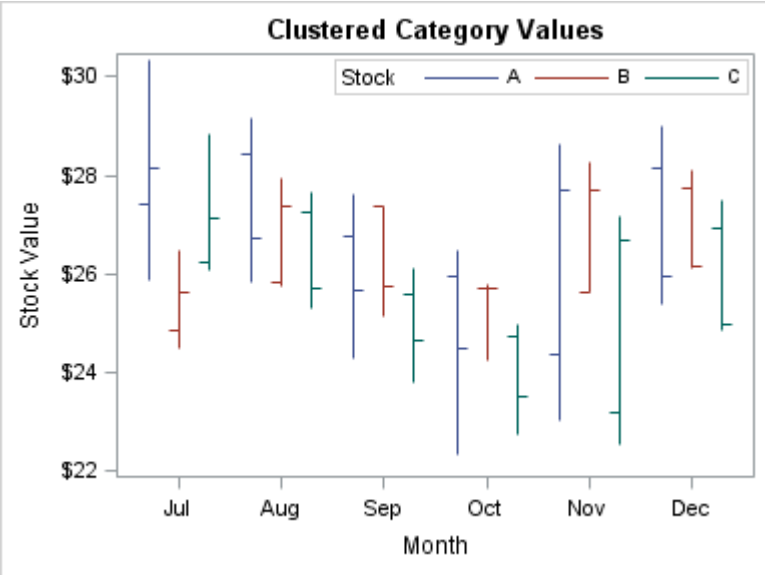
CLUSTER

clusters the bars or lines for matching category values around the midpoints.

Each cluster of group values is centered at the midpoint for the category.

The following example shows the effect of clustering the lines in a stock report when the category values are grouped into a single response variable. Note that if your category values are not grouped in the same column but are stored in separate columns, then you can get this same effect by using the DISCRETEOFFSET= option.

```
layout overlay /
    yaxisopts=(label="Stock Value");
  highlowplot x=month high=high low=low /
    close=close open=open
    legendlabel="Stock" name="cluster"
    group=stock groupdisplay=cluster
    lineattrs=(pattern=solid);
  discretelegend "cluster" / title="Stock"
    location=inside halign=right valign=top;
endlayout;
```



Default OVERLAY

Interaction For this option to take effect, the GROUP= option must also be specified.

Note When you plot a SAS data set, the items for each group value are drawn in data order. When you plot a CAS in-memory table, they are drawn in ascending order of the group column character values or unformatted numeric values.

GROUPORDER=DATA | REVERSEDATA | ASCENDING | DESCENDING
specifies the ordering of the groups within a category.

DATA
orders the groups within a category in the group-column data order.

REVERSEDATA
orders the groups within a category in the reverse group-column data order.

Note: This feature applies to SAS 9.4M2 and to later releases.

Tip This option is useful when you want to reverse the category axis.

ASCENDING
orders the groups within a category in ascending order.

DESCENDING
orders the groups within a category in descending order.

Defaults DATA if the data is a SAS data set.

ASCENDING if the data is a CAS in-memory table. Sorting is based on nonformatted values for numeric group values or on formatted values for character group values.

Interactions This option is ignored if the GROUP= option is not also specified.

This option is ignored when GROUPDISPLAY=OVERLAY.

By default, the groups in the legend are shown in the order that is specified in GROUPORDER.

Notes

When plotting a SAS data set, attributes such as color, symbol, and pattern are assigned to each group in DATA order by default. When plotting a CAS in-memory table, attributes are assigned in ascending order of the group column character values or unformatted numeric values by default.

The ASCENDING and DESCENDING settings linguistically sort the group values within each category (or X value) for display position purposes only. For numeric data, the order is based on the unformatted values. For character data, the order is based on the formatted values. The data order of the observations and the visual attributes that are assigned to the group values remain unchanged.

In SAS 9.4M6 and earlier releases, when data stored in a CAS in-memory table is used and DATA or REVERSEDATA is specified, unpredictable results might occur. To generate consistent graphs in that case, specify ASCENDING or DESCENDING. Starting with SAS Viya 3.5 and SAS Studio 5.2, when data stored in a CAS in-memory table is used and DATA or REVERSEDATA is specified, it is ignored, and ASCENDING is used instead.

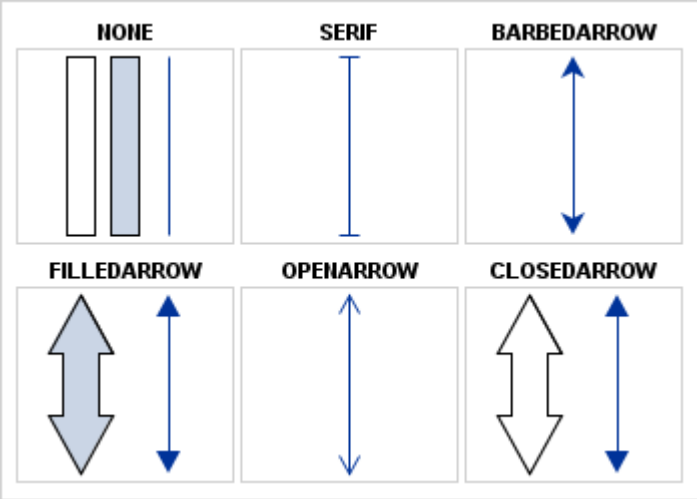
HIGHCAP=*column* | NONE | SERIF | BARBEDARROW | FILLEDARROW | OPENARROW | CLOSEDARROW

specifies the type of cap used at the high end of the bar or line. All of the keywords can be specified for any high-low chart. The effect of each keyword depends on the setting for the TYPE= and DISPLAY= options as follows:

- When TYPE=BAR and DISPLAY= includes FILL, FILLEDARROW is used for all settings other than NONE.
- When TYPE=BAR and DISPLAY= does not include FILL, CLOSEDARROW is used for all settings other than NONE.
- When TYPE=LINE and CLOSEDARROW is specified, FILLEDARROW is used instead.

The following figure shows the effect of each cap value on horizontal lines, filled bars, and unfilled bars.

Figure 6.1 *Horizontal High and Low Cap Shapes for Lines, Filled Bars, and Unfilled Bars*



Default NONE

Interaction When TYPE=BAR, the caps are drawn to fit within the bar width. The width of the bar itself is reduced.

Note If the length of the high-low element is smaller than the cap, then the cap is not drawn.

HIGHLABEL=*column* | *expression*
specifies the label to display at the high end of the bar or line.

INCLUDEMISSINGGROUP=TRUE | FALSE
specifies whether missing values of the group variable are included in the plot.

Default TRUE

Interaction For this option to take effect, the GROUP= option must also be specified.

Tip The attributes of the missing group value are determined by the GraphMissing style element unless a discrete attribute map is in effect, the INDEX= option is used, the MISSING= system option changes the default missing character, or a user-defined format is applied to the group value. In those cases, the attributes of the missing group value are determined by a GraphData1–GraphDataN style element instead of by the GraphMissing style element.

See “boolean ” on page xii for other Boolean values that you can use.

INDEX=*positive-integer-column* | *expression*
specifies indices for mapping line attributes (color and line pattern) or bar attributes (fill and outline) to one of the GraphData1–GraphDataN style elements.

Requirements The column or expression value must be an integer value of 1 or greater. Otherwise, this option is ignored.

The positive-integer column must not contain missing values. Otherwise, the entire column is invalidated and this option is ignored.

All of the indexes for a specific group value must be the same. Otherwise, the results are unpredictable.

Interaction For this option to take effect, the GROUP= option must also be specified.

Notes The index values are 1-based indices. For the style attributes in GraphData1–GraphDataN, if the index value is greater than N, then a modulo operation remaps that index value to a number less than N to determine which style to use.

If you do not use this option, then the group values are mapped according to the setting of the GROUPORDER= option.

Tip You can use indexing to collapse the number of groups that are represented in a graph. For more information, see "Remapping Groups for Grouped Data" on page 211.

INTERVALBARWIDTH=*dimension*
specifies the width of the floating bars.

Defaults Prior to SAS 9.4M3, 85% of the smallest interval between any two bars for the given plot

Starting with SAS 9.4M3, the BARWIDTH= option setting

Restriction For this option to take effect, TYPE=BAR must be set, and the independent variable must be of type interval.

Interaction Prior to SAS 9.4M3, this option controls the bar width for a high-low plot. Starting with SAS 9.4M3, this option overrides the BARWIDTH= option.

Tip The bar width that you specify with this option is honored even if the bars overlap. If the bars overlap, reduce the interval bar width or use the BARWIDTH= option instead.

See "dimension" on page xiii

LABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font attributes of the labels for the bars or lines.

Defaults In SAS 9.4M2 and earlier releases, the GraphDataText style element.

Starting with SAS 9.4M2, the GraphDataText style element is the default for non-grouped data. For grouped data, the data label color is determined by the ContrastColor attribute of the GraphData1–GraphDataN style elements.

See "General Syntax for Attribute Options" on page 1599 for the syntax for using a *style-element*.

"Text Options" on page 1606 for available *text-options*.

LEGENDLABEL="*string*"
specifies a label to be used in a discrete legend for this plot.

Default The *string* specified on the NAME= option.

Restriction This option applies only to an associated DISCRETELEGEND statement.

Interaction If the GROUP= option is specified, then this option is ignored.

LINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the attributes of the floating plot lines.

Defaults For non-grouped data, the GraphDataDefault style element.

For grouped data, the ContrastColor, LineStyle, and LineThickness attributes of the GraphData1–GraphDataN style elements.

Interaction For this option to have any effect, TYPE= LINE must also be specified.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

LOWCAP=*column* | NONE | SERIF | BARBEDARROW | FILLEDARROW | OPENARROW | CLOSEDARROW
specifies the type of cap used at the low end of the bar or line. All of the keywords can be specified for any high-low chart. The effect of each keyword depends on the setting for the TYPE= and DISPLAY= options as follows:

- When TYPE=BAR and DISPLAY= includes FILL, FILLEDARROW is used for all settings other than NONE.
- When TYPE=BAR and DISPLAY= does not include FILL, CLOSEDARROW is used for all settings other than NONE.
- When TYPE=LINE and CLOSEDARROW is specified, FILLEDARROW is used instead.

Figure 6.4 on page 578 shows the effect of each cap value on horizontal lines, filled bars, and unfilled bars.

Default NONE

Interaction When TYPE=BAR, the caps are drawn to fit within the bar width. The width of the bar itself is reduced.

Note If the length of the high-low element is smaller than the cap, then the cap is not drawn.

LOWLABEL=*column* | *expression*
specifies the label to appear at the low end of each floating bar or line.

NAME="*string*"
assigns a name to this plot statement for reference in other template statements. The specified name is used primarily in legend statements to coordinate the use of colors and line patterns between the plot and the legend.

Restrictions The *string* is case sensitive, cannot contain spaces, and must define a unique name within the template.

This option does not support variables that are created by the DYNAMIC, MVAR, and NMVAR template statements.

OPEN=*numeric-column* | *expression*
specifies a column or expressions whose values are used to display an opening-value indicator. This option is typically used when TYPE=LINE, but it can be used when TYPE=BAR. For vertical high-low charts, the value is represented by a short horizontal line extending from the side that displays the lower X values. For horizontal high-low charts, the value is represented by a short vertical line extending from the side that displays the lower Y values.

OUTLINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the appearance of the outlines of the filled regions.

Defaults For non-grouped data, the ContrastColor, LineThickness, and LineStyle attributes of the GraphOutlines style element.

For grouped data when FILL is displayed, the LineThickness and LineStyle attributes of the GraphOutlines style element, and the ContrastColor attribute of the GraphData1–GraphDataN style elements.

For grouped data when FILL is not displayed, the LineThickness attribute of the GraphOutlines style element, and the ContrastColor and LineStyle attributes of the GraphData1–GraphDataN style elements.

Interactions For this option to have any effect, TYPE=BAR must be specified, and outlines must be enabled by the ODS style or the DISPLAY= option.

When the COLORRESPONSE= and DISPLAY=(OUTLINE) options are in effect, the OUTLINEATTRS= suboption COLOR= is ignored, and the bar outline colors vary according to the gradient.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

PRIMARY=TRUE | FALSE
specifies that the data columns for this plot and the plot type be used for determining default axis features. This option is needed only when two or more plots within an overlay-type layout contribute to a common axis.

Default FALSE

Restriction This option is ignored if the plot is placed under a GRIDDED or LATTICE layout block.

Note In an OVERLAY layout, only one plot in an overlay can be the primary plot on a per-axis basis. When no plot is designated as the primary plot, the first plot that can be a primary plot is considered the primary plot. If multiple plots specify PRIMARY=TRUE for the same axis, then the last such plot encountered is considered the primary plot.

See "When Plots Share Data and a Common Axis" on page 1046

"boolean " on page xii for other Boolean values that you can use.

ROLENAME=(*role-name-list*)
specifies user-defined roles that can be used to display information in the data tips. This option provides a way to add to the data columns that appear in data tips that are specified by the TIP= option.

(role-name-list)
a space-separated list of *role-name = column* pairs.

Example The following example assigns the column Obs to the user-defined role TIP:

```
ROLENAME=(TIP1=OBS)
```

Default No user-defined roles

Requirement The role names that you choose must be unique and different from the predefined roles X, Y, LOW, HIGH, OPEN, and CLOSE.

TIP=(*role-list*) | NONE
specifies the information to display when the cursor is positioned over a bar or line. If this option is used, then the information specified replaces all of the information that is displayed by default. You can specify roles for columns that do not contribute to the bar chart along with roles that do.

(role-list)
an ordered, space-separated list of unique HIGHLOWPLOT and user-defined roles.

HIGHLOWPLOT roles include X, Y, LOW, HIGH, OPEN, CLOSE, GROUP, and COLORRESPONSE.

Note The COLORRESPONSE role is valid starting with SAS 9.4M3.

Example The following example displays data tips for the columns X and Pct. The Pct column is not assigned to any pre-defined HIGHLOWPLOT role, so it must first be assigned a role.

```
ROLENAME=(TIP1=PCT)
TIP=(X TIP1)
```

NONE
suppresses data tips from the plot.

Default The columns assigned to these roles are automatically included in the data tip information: X or Y and GROUP.

Requirement To generate data tips in the output, you must include an ODS GRAPHICS ON statement with the IMAGEMAP option specified, and you must write the output to the ODS HTML destination.

Interaction This option is ignored when the plot statement is in an OVERLAY or PROTOTYPE layout and the INCLUDERANGES= option is specified in the LINEAROPTS= or TIMEOPTS= option for either axis.

Tip You can control the labels and formats for the TIP roles with the TIPLABEL= and TIPFORMAT= options.

TIPFORMAT=(*role-format-list*)
specifies display formats for tip columns. This option provides a way to control the formats of columns that appear in data tips.

(role-format-list)
a space-separated list of *role-name* = *format* pairs.

Example
```
ROLENAME=(TIP1=SALARY)
TIP=(TIP1)
TIPFORMAT=(TIP1=DOLLAR12.)
```

Default The column format of the column assigned to the role or BEST6 if no format is assigned to a numeric column.

Restriction Only the roles that appear in the TIP= option are used.

Requirement A column must be assigned to each of the specified roles. (See the ROLENAME= option.)

TIPLABEL=(*role-label-list*)
specifies display labels for tip columns. This option provides a way to control the labels of columns that appear in data tips.

role-label-list
a space-separated list of *rolename* ="*string*" pairs.

Example
```
ROLENAME=(TIP1=PCT)
TIP=(TIP1)
TIPLABEL=(TIP1="Percent")
```

Default The column label or column name of the column assigned to the role.

Restriction Only the roles that appear in the TIP= option are used.

Requirement A column must be assigned to each of the specified roles. (See the ROLENAME= option.)

TYPE=LINE | BAR
specifies whether data values should be represented by bars or lines.

BAR
uses fill and outline attributes.

LINE
uses line attributes.

Default LINE

XAXIS=X | X2
specifies whether data are mapped to the primary X (bottom) axis or to the secondary X2 (top) axis.

Default X

Interactions When the Y= argument is specified, the HIGH= and LOW= arguments are mapped to the axis that is specified on this option (X or X2).

The overall plot specification and the layout type determine the axis display. For more information, see "How Axis Features Are Determined" on page 1040.

YAXIS=Y | Y2
specifies whether data are mapped to the primary Y (left) axis or to the secondary Y2 (right) axis.

Default Y

Interactions When the X= argument is specified, the HIGH= and LOW= arguments are mapped to the axis that is specified on this option (Y or Y2).

The overall plot specification and the layout type determine the axis display. For more information, see "How Axis Features Are Determined" on page 1040.

Details

Statement Description

A high-low chart specifies that floating vertical or horizontal lines or bars connect the minimum and maximum response values for each value of a categorical variable. The data should have at least two response values for every category value. Otherwise, the single value is displayed without the connecting line or bar. In the statement syntax, the X and Y arguments can specify a column with character or numeric values. The LOW and HIGH arguments must specify a numeric column.

The HIGHLOWPLOT statement can be used to create a plot showing the high and low response values for observations along a time axis. The independent variable can be interval or discrete. The HIGHLOWPLOT has two common uses:

- One typical use of a high-low chart is in the financial industry to plot stock values by day. The OPEN= and CLOSE= options are typically used in the plot,

and the TYPE= option is set to LINE (the default), as illustrated in "Example 1: Vertical High-low Chart" on page 586 .

- Another typical use of a high-low chart is in the Health and Life Sciences industry to display over time the duration of adverse events or of adverse reactions to medication. The HIGHCAP= and LOWCAP= options are typically used in the plot, and the TYPE= option is set to BAR, as illustrated in "Example 2: Horizontal High-low Chart" on page 587 .

For both vertical and horizontal high-low charts, the data values can be grouped using the GROUP= option. For grouped data, the data values are not summarized. Each observation is plotted independently, and the line or bar segment for each category value can use different display characteristics.

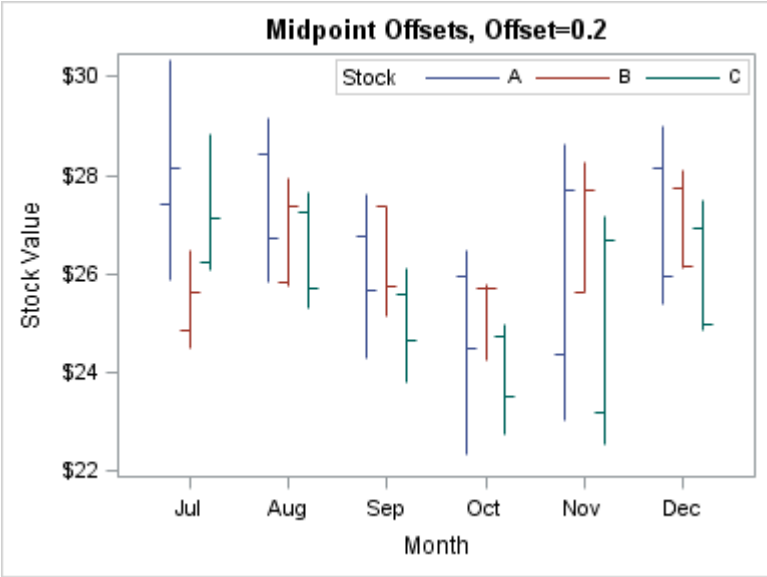
About the DISCRETEOFFSET= Option

This feature is useful for graphing multiple response variables side by side on a common axis. By default within an overlay-type layout, if multiple HIGHLOWPLOT statements are used with different response variables, then the bars or lines for matching category values are centered on the midpoints and superimposed on each other. In those cases, you can make it easier to distinguish among superimposed bars or lines by assigning a different width for them in each HIGHLOWPLOT statement in the overlay.

If you prefer to avoid superimposed bars or lines, then you can assign a different offset to each HIGHLOWPLOT statement. If desired, you can adjust the width of the bar or line in conjunction with DISCRETEOFFSET= to create narrower bars that require less width within the plot area.

The following example defines offsets for the lines in a stock report:

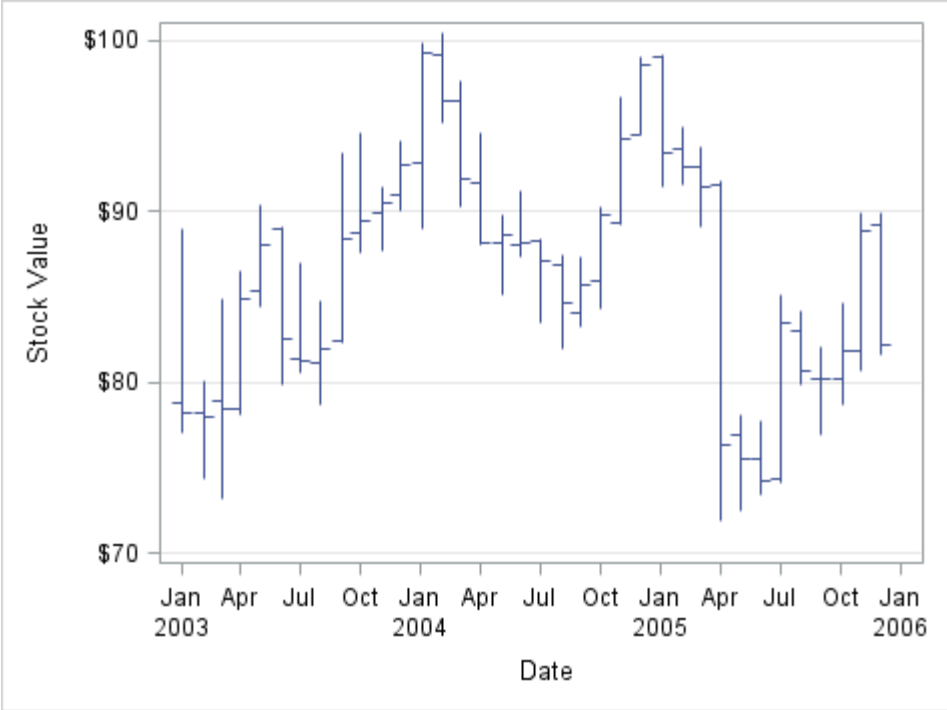
```
layout overlay / cycleattrs=true
    yaxisopts=(label="Stock Value");
  highlowplot x=month high=a_high low=a_low /
    close=a_close open=a_open
    legendlabel="A" name="ahighlow" lineattrs=(pattern=solid)
    discreteoffset=-0.2 ;
  highlowplot x=month high=b_high low=b_low /
    close=b_close open=b_open
    legendlabel="B" name="bhighlow" lineattrs=(pattern=solid)
    discreteoffset=0 ;
  highlowplot x=month high=c_high low=c_low /
    close=c_close open=c_open
    legendlabel="C" name="chighlow" lineattrs=(pattern=solid)
    discreteoffset=+0.2 ;
  discretelegend "ahighlow" "bhighlow" "chighlow" / title="Stock"
    location=inside halign=right valign=top;
endlayout;
```



Examples

Example 1: Vertical High-low Chart

The following vertical high-low chart was generated by "Example Program" on page 587:

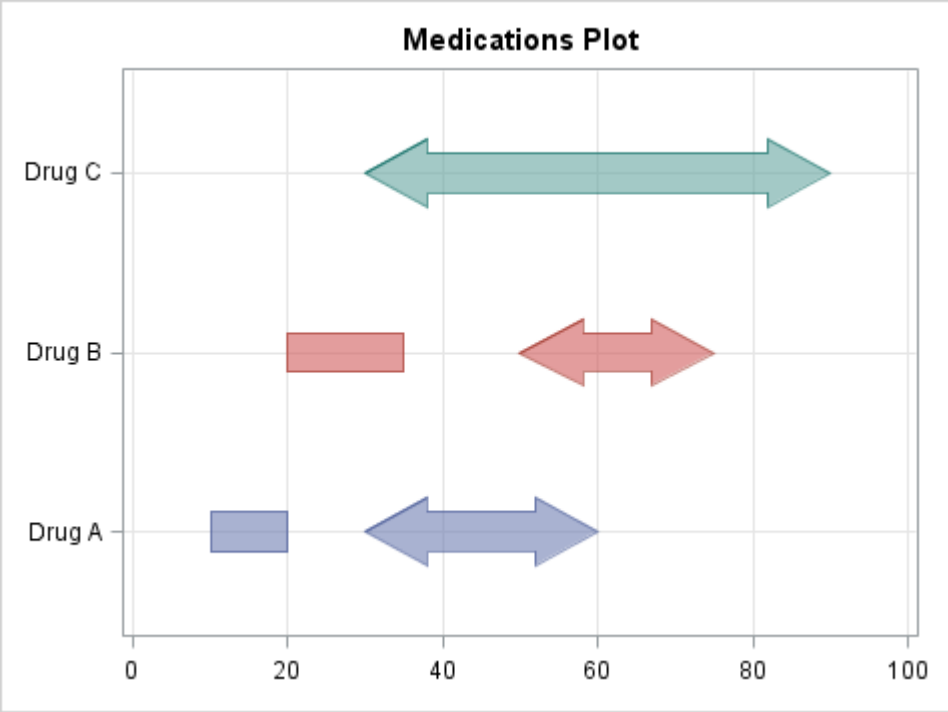


Example Program

```
proc template;
define statgraph highlow;
  begingraph;
    layout overlay /
        yaxisopts=(griddisplay=on label="Stock Value");
      highlowplot x=date high=high low=low /
        open=open close=close;
    endlayout;
  endgraph;
end;

proc sgrender data=sashelp.stocks template=highlow;
  where date >= '01JAN03'd and stock="IBM";
run;
```

Example 2: Horizontal High-low Chart

The following horizontal high-low chart was generated by "Example Program" on page 587 :



Example Program

```
data highlowbar;
  length cap $ 12;
  input drug $ 1-10 low high cap $;
  datalines;
```

```
Drug A    10   20  NONE
Drug A    30   60  FILLEDARROW
Drug B    20   35  NONE
Drug B    50   75  FILLEDARROW
Drug C    30   90  FILLEDARROW
;
proc template;
define statgraph highlowbar;
  begingraph;
    entrytitle 'Medications Plot';
    layout overlay /
      xaxisopts=(
        griddisplay=on
        linearopts=(viewmin=0 viewmax=100)
        display=(line ticks tickvalues))
      yaxisopts=(
        griddisplay=on
        display=(line ticks tickvalues));
      highlowplot y=drug high=high low=low /
        group=drug outlineattrs=(pattern=solid)
        datatransparency=0.4
        type=bar barwidth=0.4
        highcap=cap lowcap=cap;
    endlayout;
  endgraph;
end;

proc sgrender data=highlowbar template=highlowbar;
run;
```

HISTOGRAM Statement

Creates a univariate histogram computed from input data.

Requirement: If you include a histogram and a density plot in your graph and both plots specify the same data column, you must either specify SCALE=DENSITY in the HISTOGRAM statement or place the HISTOGRAM statement before the DENSITYPLOT statement in your template code. Otherwise, the density plot values might not scale properly to the histogram bins on the dependent axis. This requirement applies even when the histogram and density plots are in different cells in a multicell graph.

Note: When a histogram is placed on a log axis, binning is done on a linear scale, but the bins are drawn on the log scale. As a result, the bins might have different widths along the log axis.

Syntax

HISTOGRAM *numeric-column* | *expression* <*/options*>;

Summary of Optional Arguments

Appearance options

BINSTART=*number*
: specifies the X coordinate of the first bin.

BINWIDTH=*positive-number*
: specifies the bin width.

BOUNDARY=UPPER | LOWER
: specifies how a boundary is counted when it lies on the endpoint of a bin.

DATASKIN=NONE | CRISP | GLOSS | MATTE | PRESSED | SHEEN
: enhances the visual appearance of the filled bars.

DATATRANSPARENCY=*number*
: specifies the degree of the transparency of the bar fills and bar outlines.

DISPLAY=(*display-options*) | STANDARD | ALL
: specifies which bar features to display.

FILLATTRS=*style-element* | *style-element* (*fill-options*) | (*fill-options*)
: specifies the appearance of the interior fill area of the bars.

FILLENDCOLOR=*color*
: specifies the end color of the color gradient for the bar fill.

FILLPATTERNATTRS=*style-element* | (*fill-pattern-options*)
: specifies the appearance of the pattern-filled areas.

FILLTYPE=SOLID | ALPHAGRADIENT | COLORGRADIENT | GRADIENT
: specifies the bar fill type.

NBINS=*positive-integer*
: specifies the number of bins.

ORIENT=VERTICAL | HORIZONTAL
: specifies the orientation of the Y axis and the bars.

OUTLINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
: specifies the line properties of the bar outlines.

XVALUES=MIDPOINTS | LEFTPOINTS | RIGHTPOINTS
: specifies whether the input X values represent midpoints, lower endpoints, or upper endpoints of the bins.

Axes options

BINAXIS=TRUE | FALSE
: specifies whether to use bins as the basis for the axis tick marks.

PRIMARY=TRUE | FALSE
: specifies that the data columns for this plot and the plot type be used for determining default axis features.

SCALE=PERCENT | COUNT | PROPORTION | DENSITY
: specifies the scale for the Y axis.

XAXIS=X | X2
: specifies whether data are mapped to the primary X (bottom) axis or to the secondary X2 (top) axis.

YAXIS=Y | Y2
: specifies whether data are mapped to the primary Y (left) axis or to the secondary Y2 (right) axis.

Data tip options

TIPFORMAT=(*role-format-list*)
: specifies display formats for tip columns.

TIPLABEL=(*role-label-list*)
: specifies display labels for tip columns.

Label options

DATALABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
: specifies the color and font attributes of the bar labels.

DATALABELTYPE=NONE | AUTO | COUNT | DENSITY | PERCENT | PROPORTION
: specifies the statistic to display at the end of each bar.

ENDLABELS=TRUE | FALSE
: specifies whether the axis ticks and value labels are drawn at the bin endpoints (TRUE) or at the bin midpoints (FALSE).

LEGENDLABEL="*string*"
: specifies a label to be used in a discrete legend for this plot.

Midpoint options

GROUP=*column* | *discrete-attr-var* | *expression*
: creates a separate bar segment or bar for each unique group value in the specified column.

INCLUDEMISSINGGROUP=TRUE | FALSE
: specifies whether missing values of the group variable are included in the plot.

Plot reference options

NAME="*string*"
: assigns a name to this plot statement for reference in other template statements.

Statistics options

FREQ=*numeric-column* | *expression*
: specifies a numeric column that provides frequencies for each observation that is read.

WEIGHT=*numeric-column* | *expression*
: specifies a column that contains a bin-width calculation *a priori* weight for each observation of the input data object.

Required Argument

numeric-column* | *expression
: specifies a column that contains numeric values, or a dynamic variable that refers to such a column.

Optional Arguments

BINAXIS=TRUE | FALSE
: specifies whether to use bins as the basis for the axis tick marks.

TRUE
specifies that the ENDLABELS= option determines how the axis ticks and value labels are displayed.

FALSE
specifies that standard axes are used. Bin boundaries and midpoints that are set by the ENDLABELS= option are ignored.

Default TRUE

Interactions This option is ignored when this histogram is not the primary plot. For more information about primary plots, see "When Plots Share Data and a Common Axis" on page 1046.

BINAXIS=TRUE is ignored when the histogram is placed on a log axis.

When this option is set to TRUE, some X-axis options that are set on the parent layout might not apply, such as INTEGER=, TICKVALUELIST=, TICKVALUESEQUENCE=, and INCLUDERANGES=.

See "ENDLABELS=TRUE | FALSE" on page 594

"boolean " on page xii for other Boolean values that you can use.

BINSTART=*number*
specifies the X coordinate of the first bin. This option can be used with the BINWIDTH= and NBINS= options to specify the bins.

Default Determined by the system.

Interaction This option is ignored if XVALUES=LEFTPOINT and the specified BINSTART value is greater than the minimum of your data.

Note If the BINSTART= value is less than the minimum data value, then the lower end of the histogram might be padded with zero-height bins in order to accommodate the BINSTART= value.

See XVALUES=

BINWIDTH=*positive-number*
specifies the bin width. This option can be used with the BINSTART= and NBINS= options to specify the bins.

Default Determined by the system.

Restriction Starting with SAS 9.4M1, the number of bins is limited to approximately 10,000. If the number of bins computed from the data, the BINSTART= value, and the BINWIDTH= value exceeds the limit, SAS computes a new bin-width value that yields approximately the maximum number of bins. A warning of the change is written to the SAS log in that case.

Interaction This option is ignored when the NBINS= option is also specified (with or without the BINSTART= option) and the resulting data

range does not completely span the unbinned input data range. In that case, the NBINS= option is honored and the default bin width is used instead.

Note When BINSTART=, NBINS=, or both are specified with this option and the resulting data range is greater than the unbinned input data range, the histogram might be padded with zero-height bins in order to accommodate the BINSTART=, NBINS=, and BINWIDTH= option values.

Tip Starting with SAS 9.4M4, the limit on the number of bins is specified by the ODS GRAPHICS statement NBINSMAX= option. The default value is 10,000. See NBINSMAX= on page 1573.

BOUNDARY=UPPER | LOWER
specifies how a boundary is counted when it lies on the endpoint of a bin. If this option is set to UPPER, then the value is counted as one of the values in the upper bin (the bin to the right). Otherwise, it is counted in the lower bin.

Default UPPER

DATALABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font attributes of the bar labels.

Note: This feature applies to SAS 9.4M5 and to later releases.

Default The GraphDataText style element

Interactions The DATALABEL= option must be specified for this option to have any effect.

When text options are specified, any font properties that are not specified (color, family, size, weight, and style) are derived from the GraphDataText style element.

See "General Syntax for Attribute Options" on page 1599

"Text Options" on page 1606

DATALABELTYPE=NONE | AUTO | COUNT | DENSITY | PERCENT | PROPORTION
specifies the statistic to display at the end of each bar.

NONE
suppresses the data labels.

AUTO
uses the SCALE= option value. By default, SCALE=PERCENT.

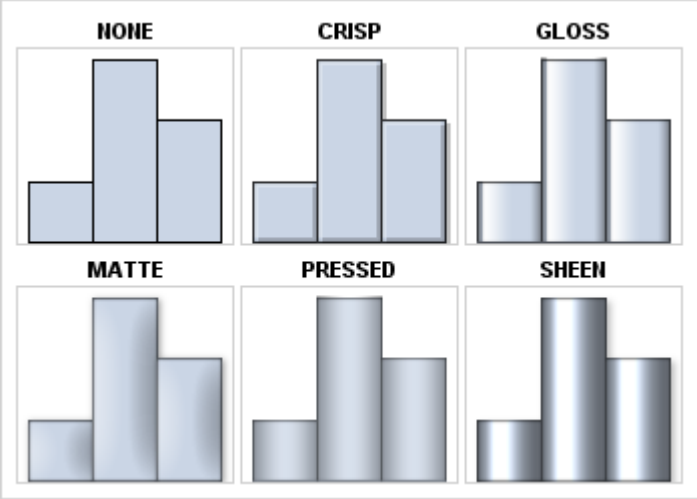
See "SCALE=PERCENT | COUNT | PROPORTION | DENSITY" on page 601

COUNT
DENSITY
PERCENT
PROPORTION
specifies that the count, density, percentage, or proportion statistic is to be displayed at the end of each bar.

Default NONE

Interaction When DATALABELTYPE=AUTO, the SCALE= option determines the statistic that is displayed at the end of each bar.

DATASKIN=NONE | CRISP | GLOSS | MATTE | PRESSED | SHEEN
enhances the visual appearance of the filled bars. The following figure shows histogram bars with each of the skins applied.



Default The DATASKIN= option value that is specified in the BEGINGRAPH statement. If that value is not specified, then the GraphSkins:DataSkin style element value is used.

Restriction Starting with SAS 9.4M1, the maximum number of skinned graphical elements is limited to 200 per plot in an OVERLAY or PROTOTYPE layout. When this limit is exceeded for a plot, the specified data skin is not applied to that plot. In that case, use the DATASKINMAX= option in your ODS GRAPHICS statement to increase the maximum limit.

Requirement For this option to have any effect, the fill must be enabled by the ODS style or the DISPLAY= option.

Interactions This option overrides the BEGINGRAPH statement DATASKIN= option.

The data skin appearance is based on the FILLATTRS= color.

When a data skin is applied, all bar outlines are set by the skin, and the OUTLINEATTRS= option is ignored.

When FILLTYPE=GRADIENT is in effect, DATASKIN=SHEEN is ignored. In that case, use one of the other skins.

DATATRANSPARENCY=*number*
specifies the degree of the transparency of the bar fills and bar outlines.

Default 0

Range 0–1, where 0 is opaque and 1 is entirely transparent

Tip The FILLATTRS= option can be used to set transparency for just the bar fills. You can combine this option with FILLATTRS= to set one transparency for the bar outlines but a different transparency for the bar fills. Example:

```
datatransparency=0.2 fillattrs=(transparency=0.6)
```

DISPLAY=(*display-options*) | STANDARD | ALL
specifies which bar features to display.

(*display-options*)
specifies a space-separated list of one or more display options, enclosed in parentheses.

The list can contain one or more of the following options:

FILL
displays the bar fill color

FILLPATTERN
displays the bar fill pattern

Note This option is valid starting in SAS 9.4M1.

OUTLINE
displays the bar outline

STANDARD
specifies FILL and OUTLINE

ALL
specifies all features: FILL, FILLPATTERN, and OUTLINE

Default The GraphHistogram:DisplayOpts style reference.

Tip Use the OUTLINEATTRS= , FILLATTRS= , and FILLPATTERNATTRS= options to control the appearance of the bars.

ENDLABELS=TRUE | FALSE
specifies whether the axis ticks and value labels are drawn at the bin endpoints (TRUE) or at the bin midpoints (FALSE).

Default FALSE.

Interactions This option is ignored if this plot is not the primary plot in the parent layout. For more information, see the PRIMARY= option.

This option is ignored if BINAXIS= FALSE. By default, BINAXIS=TRUE.

If the TICKS= suboption is specified in the XAXISOPTS= option, then this option is ignored.

See "boolean " on page xii for other Boolean values that you can use.

FILLATTRS=*style-element* | *style-element* (*fill-options*) | (*fill-options*)
specifies the appearance of the interior fill area of the bars.

Defaults In SAS 9.4M1 and earlier releases, the Color attribute of the GraphDataDefault style element

Starting with SAS 9.4M2, the Color attribute of the GraphDataDefault style element for non-grouped data or the GraphData1–GraphDataN style elements for grouped data.

Interactions For this option to have any effect, the fill must be enabled by the ODS style or the DISPLAY= option.

When a discrete attribute map is in effect for the histogram, the fill colors that are specified by the attribute map take precedence over COLOR. If the attribute map provides no color for a value, COLOR prevails for that value.

Tip The DATATRANSPARENCY= option sets the transparency for bar fills and bar outlines. You can combine this option with DATATRANSPARENCY= to set one transparency for the outlines but a different transparency for the fills. Example:

```
datatransparency=0.2 fillattrs=(transparency=0.6)
```

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Fill Color Options" on page 1600 for available *fill-options*.

FILLENDCOLOR=*color*
specifies the end color of the color gradient for the bar fill.

Note: This feature applies to SAS 9.4M5 and to later releases.

Default The GraphWall style element Color attribute.

Requirement FILLTYPE=COLORGRADIENT must be in effect. Otherwise, this option is ignored.

See "color " on page xii

FILLPATTERNATTRS=*style-element* | (*fill-pattern-options*)
specifies the appearance of the pattern-filled areas.

Note: This option is valid starting in SAS 9.4M1.

Defaults For non-grouped data, the ContrastColor and FillPattern attributes of GraphDataDefault.

For grouped data, the ContrastColor and FillPattern attributes of GraphData1–GraphDataN.

Restriction In SAS 9.4M4 and in earlier releases, the only styles that are delivered by SAS that support fill patterns are JOURNAL2, JOURNAL3, and MONOCHROMEPRINTER. If *style-element* is specified and the active ODS style does not support fill patterns, this option is ignored.

Interaction For this option to take effect, the DISPLAY= option must include FILLPATTERN among the display options.

Tip In order to change the fill pattern for each group value in ODS styles such as HTMLBlue that use color-priority attribute rotation, specify ATTRPRIORITY=NONE in an ODS GRAPHICS statement or in the BEGINGRAPH statement in your graph template. For more information, see "Attribute Rotation Patterns" in *SAS Graph Template Language: User's Guide*.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Fill Pattern Options" on page 1601 for available *fill-pattern-options*.

FILLTYPE=SOLID | ALPHAGRADIENT | COLORGRADIENT | GRADIENT
specifies the bar fill type.

Note: This feature applies to SAS 9.4M2 and to later releases.

SOLID
fills each bar with the color that is assigned to that bar.

ALPHAGRADIENT
fills each bar with a color and a transparency gradient that starts at the bar top with the initial transparency that is assigned to that bar, and ends with full transparency at the bar baseline.

Note: This feature applies to SAS 9.4M5 and to later releases.

Tips The fill color is determined by a style element or by the FILLATTRS= option COLOR= suboption. The initial transparency is determined by the DATATRANSPARENCY= option or by the FILLATTRS= option TRANSPARENCY= suboption.

For grouped plots, use the FILLATTRS= option in a discrete attribute map to set the initial transparency in the gradients for specific values.

COLORGRADIENT
fills each bar with a color gradient that starts with the fill color that is assigned to that bar and ends with the color that is specified in the FILLENDCOLOR= option.

Note: This feature applies to SAS 9.4M5 and to later releases.

Alias GRADIENT

Interaction The SHEEN data skin cannot be used when FILLTYPE=GRADIENT is in effect. You can use one of the other data skins.

Tip Use the DATATRANSPARENCY= option or the FILLATTRS= option TRANSPARENCY= suboption to set the initial transparency in the gradients.

See "FILLENDCOLOR=*color*" on page 595

GRADIENT
fills each bar with a color and a transparency gradient that starts at the bar top with the initial transparency that is assigned to that bar, and ends with full transparency at the bar baseline.

Note: This option applies to SAS 9.4M2 through SAS 9.4M4. Starting with SAS 9.4M5, ALPHAGRADIENT replaces GRADIENT, and GRADIENT is changed to an alias of COLORGRADIENT.

Interaction The SHEEN data skin cannot be used when FILLTYPE=GRADIENT is in effect. You can use one of the other data skins.

Tips The initial fill color is determined by a style element or by the FILLATTRS= option COLOR= suboption. The initial transparency is determined by the DATATRANSPARENCY= option or by the FILLATTRS= option TRANSPARENCY= suboption.

For grouped plots, use the FILLATTRS= option in a discrete attribute map to set the initial transparency in the gradients for specific values.

Default SOLID

Interaction The DISPLAY= option must include FILL for this option to have any effect.

Note The output for SAS programs written prior to SAS 9.4M5 that specify FILLTYPE=GRADIENT might change starting with SAS 9.4M5. To restore the original appearance, specify FILLTYPE=ALPHAGRADIENT.

See DATASKIN= on page 593

FREQ=*numeric-column* | *expression*
specifies a numeric column that provides frequencies for each observation that is read.

Default All observations have a frequency count of 1.

Restriction If the value of *numeric-column* is missing or is less than 1 for an observation, then that observation is not used in the analysis. If the value is not an integer, then only the integer portion is used.

Notes If the value of *numeric-column* for a category is 0, that category is represented as a 1-pixel-high bar. If the value of *numeric-column* is missing for a category, a bin-width-wide space is reserved for that category.

If *n* is the value of the numeric column for a given observation, then that observation is used *n* times for the purposes of any statistical computation. The marker for that observation is drawn *n* times, which increases the marker weight slightly with frequency.

GROUP=*column* | *discrete-attr-var* | *expression*
creates a separate bar segment or bar for each unique group value in the specified column.

Note: This feature applies to SAS 9.4M2 and to later releases.

discrete-attr-var
specifies a discrete attribute map variable.

The discrete attribute map variable is created by a DISCRETEATTRVAR statement.

Restriction A discrete attribute map variable specification must be a direct reference to the attribute map variable. It cannot be set by a dynamic variable.

A distinct bar or bar segment is created for each group value by varying the visual attributes of the bar display features that are enabled by the current ODS style or by the DISPLAY= option. The default group appearance for each display feature is shown in the following table.

Display Feature[1]	Style Attributes That Control Default Group Appearance
Fill color	Color attribute of a GraphData1–GraphDataN style element or the GraphMissing style element.
Fill pattern	FillPattern and ContrastColor attributes of a GraphData1–GraphDataN style element or the GraphMissing style element. The ContrastColor attribute controls the color of the fill pattern.

Display Feature[1]	Style Attributes That Control Default Group Appearance
	If the active ODS style does not specify FillPattern, fill patterns are not displayed by default.
Outline	■ if the outline is enabled with fill color, ContrastColor attribute of a GraphData1–GraphDataN style element or the GraphMissing style element with a solid line style ■ if the outline is enabled with fill pattern or if the outline is the only display feature enabled, ContrastColor and LineStyle attributes of a GraphData1–GraphDataN style element or the GraphMissing style element

1 The default display features are determined by the DisplayOpts attribute of the GraphHistogram style element.

Note If you specify a column in a SAS data set, the visual attributes for each group value are assigned in data order. If you specify a column in a CAS in-memory table, the visual attributes for each group value are assigned in ascending order of the group column character values or of unformatted numeric values.

Tips You can individually override the representations that are used to identify the groups. For example, in some ODS styles, each distinct group value is represented by a different line pattern for the bar outlines. In that case, you can use the PATTERN= setting on the OUTLINEATTRS= option to assign the same line pattern to all of the bar outlines.

By default, ODS Graphics limits the number of groups to 1000. When this limit is exceeded, the GROUP= option is ignored. Use the GROUPMAX= option in the ODS GRAPHICS statement to change the maximum number of groups that can be processed.

See “Example 2: Histogram of Highway Mileage Grouped by Origin” on page 605

“DISCRETEATTRVAR Statement” on page 1516

INCLUDEMISSINGGROUP=TRUE | FALSE

specifies whether missing values of the group variable are included in the plot.

Note: This feature applies to SAS 9.4M2 and to later releases.

Default TRUE

Interaction For this option to take effect, the GROUP= option must also be specified.

Tip The attributes of the missing group value are determined by the GraphMissing style element unless a discrete attribute map is in effect, the MISSING= system option changes the default missing character, or a user-defined format is applied to the group value. In those cases, the attributes of the missing group value are determined by a GraphData1–GraphDataN style element instead of by the GraphMissing style element.

See "boolean " on page xii for other Boolean values that you can use.

LEGENDLABEL="*string*"
specifies a label to be used in a discrete legend for this plot.

Default The *string* specified on the NAME= option.

Restriction This option applies only to an associated DISCRETELEGEND statement.

NAME="*string*"
assigns a name to this plot statement for reference in other template statements. The specified name is used primarily in legend statements to coordinate the use of colors and line patterns between the plot and the legend.

Restrictions The *string* is case sensitive, cannot contain spaces, and must define a unique name within the template.

This option does not support variables that are created by the DYNAMIC, MVAR, and NMVAR template statements.

Interaction The *string* is used as the default legend label if the LEGENDLABEL= option is not used.

NBINS=*positive-integer*
specifies the number of bins. This option can be used with the BINSTART= and BINWIDTH= options to specify the bins.

Default Determined by the system.

Ranges A positive integer in SAS 9.4 and earlier releases

2–10000 starting with SAS 9.4M1

Note When BINWIDTH=, BINSTART=, or both are specified with this option and the resulting data range is greater than the unbinned input data range, the histogram might be padded with zero-height bins in order to accommodate the BINSTART=, BINWIDTH=, and NBINS= option values.

Tip Starting with SAS 9.4M4, the limit on the number of bins is specified by the ODS GRAPHICS statement NBINSMAX= option. The default value is 10,000. See NBINSMAX= on page 1573.

ORIENT=VERTICAL | HORIZONTAL
specifies the orientation of the Y axis and the bars.

Default VERTICAL

OUTLINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the line properties of the bar outlines.

Defaults For non-grouped data, the GraphOutlines style element.

In SAS 9.4M1 and earlier releases, for grouped data and filled bars, the ContrastColor and LineStyle attributes of the GraphData1–GraphDataN style elements, and the LineThickness attribute of the GraphOutlines style element.

Starting with SAS 9.4M2, for grouped data and filled bars, the ContrastColor attribute of the GraphData1–GraphDataN style elements, and the LineThickness and LineStyle attributes of the GraphOutlines style element.

Interaction For this option to have any effect, the outlines must be enabled by the ODS style or by the DISPLAY= option.

See "General Syntax for Attribute Options" on page 1599 for the syntax for using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

PRIMARY=TRUE | FALSE
specifies that the data columns for this plot and the plot type be used for determining default axis features. This option is needed only when two or more plots within an overlay-type layout contribute to a common axis.

Default FALSE

Restriction This option is ignored if the plot is placed under a GRIDDED or LATTICE layout block.

Note In an OVERLAY layout, only one plot in an overlay can be the primary plot on a per-axis basis. When no plot is designated as the primary plot, the first plot that can be a primary plot is considered the primary plot. If multiple plots specify PRIMARY=TRUE for the same axis, then the last such plot encountered is considered the primary plot.

See "When Plots Share Data and a Common Axis" on page 1046

"boolean " on page xii for other Boolean values that you can use.

SCALE=PERCENT | COUNT | PROPORTION | DENSITY
specifies the scale for the Y axis.

PERCENT
displays the percentages between 0 and 100 on the Y axis.

COUNT
displays the frequency counts on the Y axis.

PROPORTION
displays the proportions between 0 and 1 on the Y axis.

DENSITY
displays the true density estimates on the Y axis.

Default PERCENT

Requirement If you need to include a histogram and a density plot in your graph and both plots specify the same data column, place the HISTOGRAM statement before the DENSITYPLOT statement, or specify SCALE=DENSITY in the HISTOGRAM statement. Otherwise, the density plot values might not scale properly to the histogram bins on the dependent axis. This requirement applies even when the histogram and density plot are in different cells in the graph.

Tip When SCALE=PERCENT, the response axis tick values do not include a percent sign after each value. To add a percent sign after each response axis tick value in that case, use SCALE=PROPORTION, and then specify the options shown in the following example for the response axis:

```
yaxisopts=(label="Percent" linearopts=(tickvalueformat=percent.))
```

TIPFORMAT=(*role-format-list*)
specifies display formats for tip columns. This option provides a way to control the formats of columns that appear in data tips.

(role-format-list)
a space-separated list of *role-name = format* pairs.

Example `TIPFORMAT=(Y=6.2)`

Default The column format of the column assigned to the role or BEST6 if no format is assigned to a numeric column.

Requirement To enable data tips in the output, you must include an ODS GRAPHICS ON statement that specifies the IMAGEMAP option, and you must write the output to the ODS HTML destination.

Note The X role represents the binned value. The Y role represents the computed amount of X in the units specified by the SCALE= option.

TIPLABEL=(*role-label-list*)
specifies display labels for tip columns. This option provides a way to control the labels of columns that appear in data tips.

role-label-list
a space-separated list of *rolename ="string"* pairs.

Example `TIPLABEL=(Y="Percent")`

Default The column label or column name of the column assigned to the role.

Note The Y role represents the computed amount of X in the units specified by the SCALE= option.

WEIGHT=*numeric-column* | *expression*
specifies a column that contains a bin-width calculation *a priori* weight for each observation of the input data object.

Requirement The value must be nonnegative.

Note The values of the weight variable must be greater than zero. If the weight value for an observation is zero, negative, or missing, that observation is deleted from the analysis.

XAXIS=X | X2
specifies whether data are mapped to the primary X (bottom) axis or to the secondary X2 (top) axis.

Default X

Interaction The overall plot specification and the layout type determine the axis display. For more information, see "How Axis Features Are Determined" on page 1040.

XVALUES=MIDPOINTS | LEFTPOINTS | RIGHTPOINTS
specifies whether the input X values represent midpoints, lower endpoints, or upper endpoints of the bins. For example, if BINSTART=10 and BINWIDTH=10, then using LEFTPOINTS would result in bins 10 - 20, 20 - 30, and so on. Using RIGHTPOINTS would result in bins 0 - 10, 10 - 20, ..., and using MIDPOINTS would result in bins 5 - 15, 15 - 25, ...

Default MIDPOINTS

YAXIS=Y | Y2
specifies whether data are mapped to the primary Y (left) axis or to the secondary Y2 (right) axis.

Default Y

Interaction The overall plot specification and the layout type determine the axis display. For more information, see "How Axis Features Are Determined" on page 1040.

Details

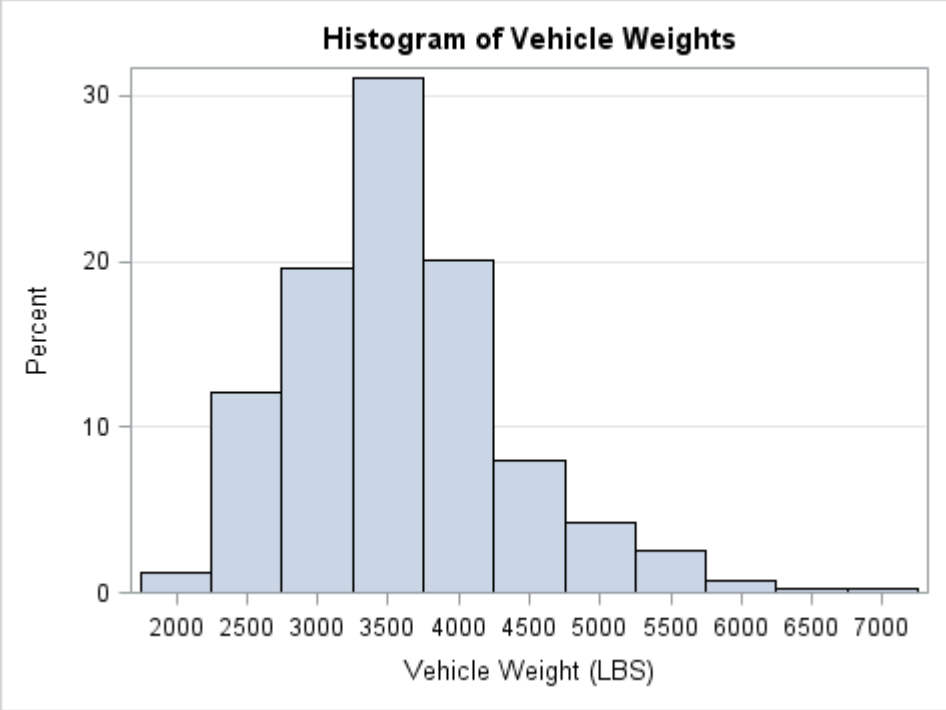
The histogram's default bin width is computed by using the number of observations and the range of the data. When a curve is overlaid on the histogram, the histogram's bin width is used to scale the curve so that the area under the curve is equal to the area of the histogram.

The X axis and Y axis are linear by default. You can change axis properties with the XAXISOPTS= and YAXISOPTS= options of the layout statement.

Examples

Example 1: Histogram of Vehicle Weight

The following graph was generated by the "Example Program" on page 604:

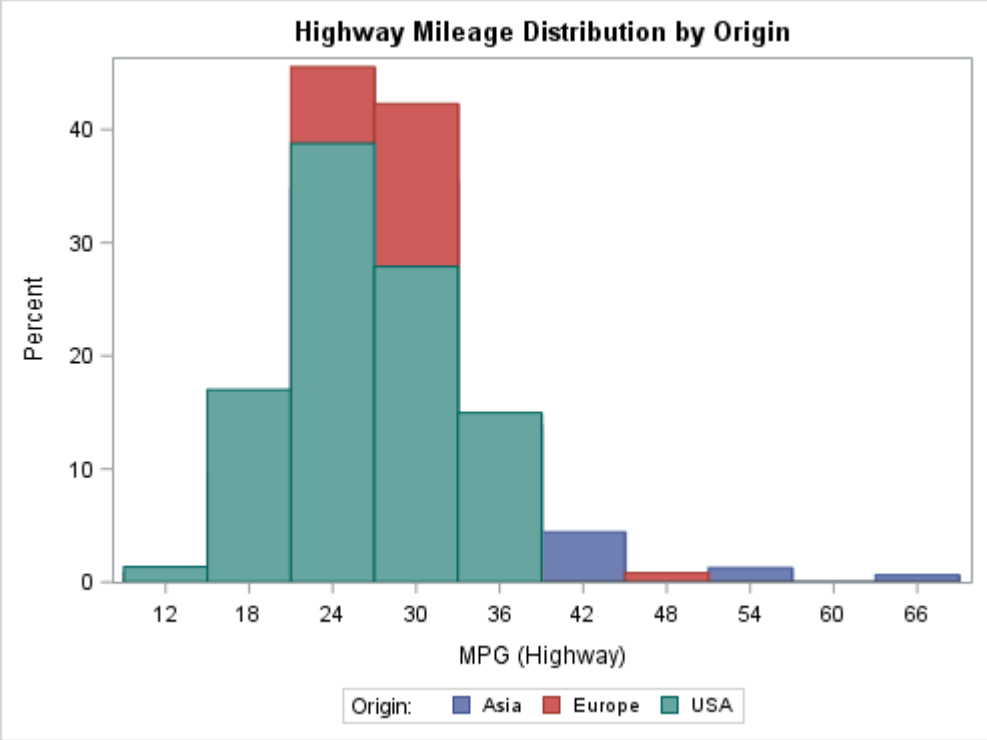


Example Program

```
proc template;
  define statgraph histogram;
    begingraph;
      entrytitle "Histogram of Vehicle Weights";
      layout overlay /
        xaxisopts=(label="Vehicle Weight (LBS)")
        yaxisopts=(griddisplay=on);
        histogram weight;
      endlayout;
    endgraph;
  end;
run;

proc sgrender data=sashelp.cars template=histogram;
run;
```

Example 2: Histogram of Highway Mileage Grouped by Origin

The following graph was generated by the "Example Program" on page 605.



Example Program

```
proc template;
  define statgraph histogram;
    begingraph;
      entrytitle "Highway Mileage Distribution by Origin";
      layout overlay /;
        histogram mpg_highway / name="histogram" group=origin;
        discretelegend "histogram" / title="Origin:";
      endlayout;
    endgraph;
  end;
run;

proc sgrender template=histogram data=sashelp.cars;
run;
```

HISTOGRAMPARM Statement

Creates a univariate histogram for specified values of bin midpoints and bin frequencies.

Restrictions: Only uniform width bins are supported.

Starting with SAS 9.4M4, the number of bins is limited to 10,000. If the number of bins exceeds the limit, the histogram is not drawn. A warning message is written to the SAS log in that case.

Tips:

Starting with SAS 9.4M4, the limit on the number of bins is specified by the ODS GRAPHICS statement NBINSMAX= option. The default value is 10,000. See NBINSMAX= on page 1573.

Starting with SAS 9.4M3, you can use subpixel rendering with this statement. It is enabled by default. To disable subpixel rendering, specify SUBPIXEL=OFF in the BEGINGRAPH statement or in an ODS GRAPHICS statement. For information about the BEGINGRAPH statement SUBPIXEL= option, see SUBPIXEL= on page 39. For information about the ODS GRAPHICS statement SUBPIXEL= option, see "ODS GRAPHICS Statement" on page 1561.

Syntax

HISTOGRAMPARM X=*numeric-column* | *expression*
Y=*non-negative-numeric-column* | *expression* </*options*>;

Summary of Optional Arguments

Appearance options

DATASKIN=NONE | CRISP | GLOSS | MATTE | PRESSED | SHEEN
: enhances the visual appearance of the filled bars.

DATATRANSPARENCY=*number*
: specifies the degree of the transparency of the bars (outline and fill).

DISPLAY=(*display-options*) | STANDARD | ALL
: specifies which bar features to display.

FILLATTRS=*style-element* | *style-element* (*fill-options*) | (*fill-options*)
: specifies the appearance of the interior fill area of the bars.

FILLENDCOLOR=*color*
: specifies the end color of the color gradient for the bar fill.

FILLPATTERNATTRS=*style-element* | (*fill-pattern-options*)
: specifies the appearance of the pattern-filled areas.

FILLTYPE=SOLID | ALPHAGRADIENT | COLORGRADIENT | GRADIENT
: specifies the bar fill type.

ORIENT=VERTICAL | HORIZONTAL
: specifies the orientation of the Y axis and the bars.

OUTLINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
: specifies the line properties of the bar outlines.

XVALUES=MIDPOINTS | LEFTPOINTS | RIGHTPOINTS
: specifies whether the input X values represent midpoints, lower endpoints, or upper endpoints of the bins.

Axes options

BINAXIS=TRUE | FALSE

specifies whether to use bins as the basis for the axis tick marks.

PRIMARY=TRUE | FALSE
specifies that the data columns for this plot and the plot type be used for determining default axis features.

XAXIS=X | X2
specifies whether data are mapped to the primary X (bottom) axis or to the secondary X2 (top) axis.

YAXIS=Y | Y2
specifies whether data are mapped to the primary Y (left) axis or to the secondary Y2 (right) axis.

Data tip options

ROLENAME=(*role-name-list*)
specifies user-defined roles that can be used to display information in the data tips.

TIP=(*role-list*) | NONE
specifies the information to display when the cursor is positioned over a histogram bin.

TIPFORMAT=(*role-format-list*)
specifies display formats for tip columns.

TIPLABEL=(*role-label-list*)
specifies display labels for tip columns.

Label options

DATALABEL=*column* | *expression*
specifies a column for the bar labels.

DATALABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font attributes of the bar labels.

DATALABELFITPOLICY=AUTO | NONE | ROTATE | SPLIT | SPLITALWAYS
specifies a policy for avoiding collisions among the bar labels when labels are displayed.

DATALABELSPLITCHAR="*character-list*"
specifies one or more characters on which the data labels can be split.

DATALABELSPLITCHARDROP=TRUE | FALSE
specifies whether the split characters are included in the data labels.

ENDLABELS=TRUE | FALSE
specifies whether the axis ticks and value labels are drawn at the bin endpoints (TRUE) or at the bin midpoints (FALSE).

LEGENDLABEL="*string*"
specifies a label to be used in a discrete legend for this plot.

Plot reference options

NAME="*string*"
assigns a name to this plot statement for reference in other template statements.

Required Arguments

X=*numeric-column* | *expression*
specifies the column for the midpoint values.

Requirement When you plot a SAS data set, you must sort the data in ascending order of the specified X column before you plot the data. When you plot a CAS in-memory table, you do not need to sort the data. The data is automatically sorted in ascending order of the X column formatted character values or of the unformatted numeric values before the data is plotted.

Y=*non-negative-numeric-column* | *expression*
specifies the column for the frequency values. These values can be frequency counts, percentages, or proportions between 0 and 1.

Requirement The Y values cannot be negative.

Note If the value of Y= is 0 for a category, that category is represented as a 1-pixel-high bar. If the value of Y= is missing for a category, a bin-width-wide space is reserved for that category.

Optional Arguments

BINAXIS=TRUE | FALSE
specifies whether to use bins as the basis for the axis tick marks.

TRUE
specifies that the ENDLABELS= option determines how the axis ticks and value labels are displayed.

FALSE
specifies that standard axes are used. Bin boundaries and midpoints that are set by the ENDLABELS= option are ignored.

Default TRUE

Interactions This option is ignored when this histogram is not the primary plot. For more information about primary plots, see “When Plots Share Data and a Common Axis” on page 1046.

BINAXIS=TRUE is ignored when the histogram is placed on a log axis.

When this option is set to TRUE, some X-axis options that are set on the parent layout might not apply, such as INTEGER=, TICKVALUELIST=, TICKVALUESEQUENCE=, and INCLUDERANGES=.

See “ENDLABELS=TRUE | FALSE” on page 614

“boolean ” on page xii for other Boolean values that you can use.

DATALABEL=*column* | *expression*
specifies a column for the bar labels. The labels appear at the top or end of each bar, depending on the chart orientation.

Default No data labels are displayed

DATALABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font attributes of the bar labels.

Default The GraphDataText style element

Interactions The DATALABEL= option must be specified for this option to have any effect.

When text options are specified, any font properties that are not specified (color, family, size, weight, and style) are derived from the GraphDataText style element.

See "General Syntax for Attribute Options" on page 1599

"Text Options" on page 1606

DATALABELFITPOLICY=AUTO | NONE | ROTATE | SPLIT | SPLITALWAYS
specifies a policy for avoiding collisions among the bar labels when labels are displayed.

AUTO
selects a collision avoidance policy based on the chart orientation and data type.

For a numeric column with ORIENT=VERTICAL, AUTO rotates the labels if they do not fit the midpoint spacing. For a character column, AUTO splits the labels if they do not fit the midpoint spacing.

Note When ORIENT=HORIZONTAL, AUTO always draws the labels horizontally.

Tip If character labels do not fit after splitting, then try using ROTATE instead of AUTO.

See ORIENT= on page 618 for information about chart orientation.

NONE
does not attempt to fit bar labels that collide.

ROTATE
rotates the bar labels for vertical bars if the labels collide in the available width.

Requirement The chart orientation must be vertical (ORIENT=VERTICAL).

SPLIT
splits the label for vertical bars at a split character only if a split is needed at that character in order to make the label fit the available space.

No split occurs at split characters that occur where a split is not needed. If the label does not contain any of the specified split characters, then a split

does not occur. In that case, if the label does not fit the available space, then it might collide with the adjoining labels.

Requirement The chart orientation must be vertical (ORIENT=VERTICAL).

See DATALABELSPLITCHAR= for information about specifying the split characters

SPLITALWAYS
splits the label for vertical bars at every occurrence of a split character.

If the label does not contain any of the specified split characters, then a split does not occur.

Requirement The chart orientation must be vertical (ORIENT=VERTICAL).

See DATALABELSPLITCHAR= for information about specifying the split characters

INSIDEPREFERRED
attempts to place the data labels in a horizontal bar chart inside the bars.

Note: This feature applies to SAS 9.4M5 and to later releases.

Restrictions This option applies to non-grouped or cluster-grouped horizontal bar charts only.

Label splitting is not supported when a label is placed inside a bar.

Requirement For a grouped horizontal bar chart, the GROUPDISPLAY=CLUSTER option must be in effect. Otherwise, the INSIDEPREFERRED policy is ignored.

Interaction If SEGMENTLABEL=TRUE is in effect, the INSIDEPREFERRED policy is ignored, and the labels are placed outside.

Notes If any bar label does not fit inside its bar because the font height is too high, all of the bar labels are placed outside.

If any bar label cannot fit inside the length of its bar, that label is placed outside of its bar and is fit using the AUTO fit policy.

If the outside labels collide because the font height is greater than the midpoint space, then all labels are dropped.

```
WARNING: The bar labels are suppressed. Use DATALABELFITPOLICY=NONE to
force the labels to be displayed.
```

Default AUTO

Requirement The DATALABEL= option must also be specified.

DATALABELSPLITCHAR="*character-list*"
specifies one or more characters on which the data labels can be split. When multiple split characters are specified, each character in the list is treated as a separate split character unless the specified characters appear consecutively in the data label. In that case, all of the specified split characters together are treated as a single split character.

When DATALABELFITPOLICY=SPLIT, data labels are split on a split character only if a split is needed at that point in order to make the label fit. When DATALABELFITPOLICY=SPLITALWAYS, the data labels are split unconditionally on each occurrence of a split character. If the data label does not contain any of the specified characters, then the label is not split.

"character-list"
one or more characters with no space between each character and enclosed in quotation marks.

Default A blank space

Requirements The list of characters must be enclosed in quotation marks.

Multiple characters must be specified with no space between them. For example, to specify the split characters a, b, and c, use the following option:

```
datalabelsplitchar="abc"
```

The DATALABELFITPOLICY= option must specify SPLIT or SPLITALWAYS.

Interactions The DATALABELFITPOLICY= option specifies the policy that is used to manage the split behavior of the data labels.

The DATALABELSPLITCHARDROP= option specifies whether the split characters are included in the data label or are dropped.

Notes When multiple characters are specified, the order of the characters in the list is not significant.

The split characters are case sensitive.

DATALABELSPLITCHARDROP=TRUE | FALSE
specifies whether the split characters are included in the data labels.

TRUE
drops a split character from the data label when a split occurs at that character.

Split characters at which a split does not occur are left in place. The DATALABELFITPOLICY= option determines where the labels are split. When DATALABELFITPOLICY=SPLIT, each label is split at a split character only where a split is needed in order to make the label fit the available space. At each split point, the split character is dropped, and the characters that follow the split character, up to but not including the split character at the next split point, are wrapped to the following line.

When DATALABELFITPOLICY=SPLITALWAYS, each label is split at every instance of a split character. All of the split characters are dropped. The characters that follow each split character, up to but not including the next split character, are wrapped to the next line.

The following figure shows how label “Product*Group*1” is split when the DATALABELSPLITCHARDROP=TRUE and DATALABELSPLITCHAR="*" options are used with the SPLIT and SPLITALWAYS fit policies.

In this example, when DATALABELFITPOLICY=SPLIT, the label is split at the first occurrence of the asterisk in order to make the label fit. No split is needed at the second asterisk. The first asterisk is dropped, and Group*1 wraps to the next line. Notice that the second asterisk is not dropped in this case. When DATALABELFITPOLICY=SPLITALWAYS, the label is split at every occurrence of the asterisk. In this case, both asterisks are dropped, and the characters that follow each asterisk wrap to the next line.

FALSE
includes the split characters in the data label.

The DATALABELFITPOLICY= option determines how the split characters are displayed. When DATALABELFITPOLICY=SPLIT, each data label is split at a split character only where a split is needed in order to make the label fit the available space. A split might not occur at every split character in the label. At each split point, the split character remains as the last character in the current line. The characters that follow the split character, up to and including the split character at the next split point, are then wrapped to the following line. This process repeats until the entire data label is displayed.

When DATALABELFITPOLICY=SPLITALWAYS, each data label is split at every instance of a split character in the label regardless of whether a split is actually needed. Each split character remains as the last character in the current line. The characters that follow each split character, up to and including the next split character, are then wrapped to the next line.

The following figure shows how label “Product*Group*1” is split when the DATALABELSPLITCHARDROP=FALSE and DATALABELSPLITCHAR="*" options are used with the SPLIT and SPLITALWAYS fit policies.

In this example, when DATALABELFITPOLICY=SPLIT, the label is split at the first occurrence of the asterisk in order to make the label fit. No split is needed at the second asterisk. The characters that follow the first asterisk wrap to the next line. When DATALABELFITPOLICY=SPLITALWAYS, the label is split at every occurrence of the asterisk. Each asterisk remains as the last character in the current line, and the characters that follow are wrapped to the next line.

Default TRUE. A split character is dropped from thedata label when a split occurs at that character.

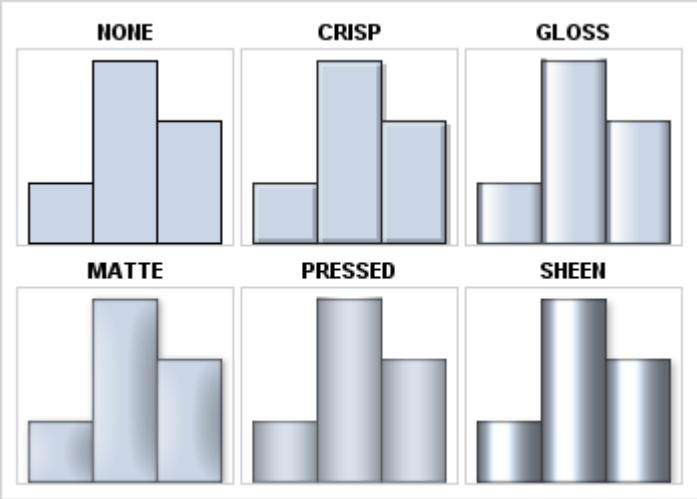
Requirements The DATALABEL= option must also be specified.

The DATALABELFITPOLICY= option must specify SPLIT or SPLITALWAYS.

Interaction The DATALABELSPLITCHAR= option specifies the split characters.

See "boolean " on page xii for other Boolean values that you can use.

DATASKIN=NONE | CRISP | GLOSS | MATTE | PRESSED | SHEEN
enhances the visual appearance of the filled bars. The following figure shows histogram bars with each of the skins applied.



Default The DATASKIN= option value that is specified in the BEGINGRAPH statement. If that value is not specified, then the GraphSkins:DataSkin style element value is used.

Restriction Starting with SAS 9.4M1, the maximum number of skinned graphical elements is limited to 200 per plot in an OVERLAY or PROTOTYPE layout. When this limit is exceeded for a plot, the specified data skin is not applied to that plot. In that case, use the DATASKINMAX= option in your ODS GRAPHICS statement to increase the maximum limit.

Requirement For this option to have any effect, the fill must be enabled by the ODS style or the DISPLAY= option.

Interactions This option overrides the BEGINGRAPH statement DATASKIN= option.

The data skin appearance is based on the FILLATTRS= color.

When a data skin is applied, all bar outlines are set by the skin, and the OUTLINEATTRS= option is ignored.

When FILLTYPE=GRADIENT is in effect, DATASKIN=SHEEN is ignored. In that case, use one of the other skins.

DATATRANSPARENCY=*number*
specifies the degree of the transparency of the bars (outline and fill).

Default 0

Range 0–1, where 0 is opaque and 1 is entirely transparent

Tip The FILLATTRS= option can be used to set transparency for just the bar fills. You can combine this option with FILLATTRS= to set one transparency for the bar outlines but a different transparency for the bar fills. Example:

```
datatransparency=0.2 fillattrs=(transparency=0.6)
```

DISPLAY=(*display-options*) | STANDARD | ALL
specifies which bar features to display.

(*display-options*)
a space-separated list of one or more of the following options, enclosed in parentheses:

FILL
displays the bar fill color

FILLPATTERN
displays the bar fill pattern

Note This option is valid starting in SAS 9.4M1.

OUTLINE
displays the bar outline

STANDARD
specifies FILL and OUTLINE

ALL
specifies all features: FILL, FILLPATTERN, and OUTLINE

Default The GraphHistogram:DisplayOpts style reference.

Tip Use the OUTLINEATTRS= , FILLATTRS= , and FILLPATTERNATTRS= options to control the appearance of the bars.

ENDLABELS=TRUE | FALSE
specifies whether the axis ticks and value labels are drawn at the bin endpoints (TRUE) or at the bin midpoints (FALSE).

Default FALSE.

Interactions This option is ignored if this plot is not the primary plot in the parent layout. For more information, see the PRIMARY= option.

This option is ignored if BINAXIS= FALSE. By default, BINAXIS=TRUE.

If the TICKS= suboption is specified in the XAXISOPTS= option, then this option is ignored.

See "boolean " on page xii for other Boolean values that you can use.

FILLATTRS=*style-element* | *style-element* (*fill-options*) | (*fill-options*)
specifies the appearance of the interior fill area of the bars.

Default The GraphDataDefault style element

Interactions For this option to have any effect, the fill must be enabled by the ODS style or the DISPLAY= option.

When a discrete attribute map is in effect for the histogram, the fill colors that are specified by the attribute map take precedence over COLOR. If the attribute map provides no color for a value, COLOR prevails for that value.

Tip The DATATRANSPARENCY= option sets the transparency for bar fills and bar outlines. You can combine this option with DATATRANSPARENCY= to set one transparency for the outlines but a different transparency for the fills. Example:

```
datatransparency=0.2 fillattrs=(transparency=0.6)
```

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Fill Color Options" on page 1600 for available *fill-options*.

FILLENDCOLOR=*color*
specifies the end color of the color gradient for the bar fill.

Note: This feature applies to SAS 9.4M5 and to later releases.

Default The GraphWall style element Color attribute.

Requirement FILLTYPE=COLORGRADIENT must be in effect. Otherwise, this option is ignored.

See "color " on page xii

FILLPATTERNATTRS=*style-element* | (*fill-pattern-options*)
specifies the appearance of the pattern-filled areas.

Note: This option is valid starting in SAS 9.4M1.

Defaults For non-grouped data, the ContrastColor and FillPattern attributes of GraphDataDefault.

For grouped data, the ContrastColor and FillPattern attributes of GraphData1–GraphDataN.

Interaction For this option to take effect, the DISPLAY= option must include FILLPATTERN among the display options.

Tip In order to change the fill pattern for each group value in ODS styles such as HTMLBlue that use color-priority attribute rotation, specify ATTRPRIORITY=NONE in an ODS GRAPHICS statement or in the BEGINGRAPH statement in your graph template. For more information, see "Attribute Rotation Patterns" in *SAS Graph Template Language: User's Guide*.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Fill Pattern Options" on page 1601 for available *fill-pattern-options*.

FILLTYPE=SOLID | ALPHAGRADIENT | COLORGRADIENT | GRADIENT
specifies the bar fill type.

Note: This feature applies to SAS 9.4M2 and to later releases.

SOLID
fills each bar with the color that is assigned to that bar.

ALPHAGRADIENT
fills each bar with a color and a transparency gradient that starts at the bar top with the initial transparency that is assigned to that bar, and ends with full transparency at the bar baseline.

Note: This feature applies to SAS 9.4M5 and to later releases.

Tips The fill color is determined by a style element or by the FILLATTRS= option COLOR= suboption. The initial transparency is determined by the DATATRANSPARENCY= option or by the FILLATTRS= option TRANSPARENCY= suboption.

For grouped plots, use the FILLATTRS= option in a discrete attribute map to set the initial transparency in the gradients for specific values.

COLORGRADIENT
fills each bar with a color gradient that starts with the fill color that is assigned to that bar and ends with the color that is specified in the FILLENDCOLOR= option.

Note: This feature applies to SAS 9.4M5 and to later releases.

Alias GRADIENT

Interaction The SHEEN data skin cannot be used when FILLTYPE=GRADIENT is in effect. You can use one of the other data skins.

Tip Use the DATATRANSPARENCY= option or the FILLATTRS= option TRANSPARENCY= suboption to set the initial transparency in the gradients.

See "FILLENDCOLOR=*color*" on page 615

GRADIENT
fills each bar with a color and a transparency gradient that starts at the bar top with the initial transparency that is assigned to that bar, and ends with full transparency at the bar baseline.

Note: This option applies to SAS 9.4M2 through SAS 9.4M4. Starting with SAS 9.4M5, ALPHAGRADIENT replaces GRADIENT, and GRADIENT is changed to an alias of COLORGRADIENT.

Interaction The SHEEN data skin cannot be used when FILLTYPE=GRADIENT is in effect. You can use one of the other data skins.

Tips The initial fill color is determined by a style element or by the FILLATTRS= option COLOR= suboption. The initial transparency is determined by the DATATRANSPARENCY= option or by the FILLATTRS= option TRANSPARENCY= suboption.

For grouped plots, use the FILLATTRS= option in a discrete attribute map to set the initial transparency in the gradients for specific values.

Default SOLID

Interaction The DISPLAY= option must include FILL for this option to have any effect.

Note The output for SAS programs written prior to SAS 9.4M5 that specify FILLTYPE=GRADIENT might change starting with SAS 9.4M5. To restore the original appearance, specify FILLTYPE=ALPHAGRADIENT.

See DATASKIN= on page 613

LEGENDLABEL="*string*"
specifies a label to be used in a discrete legend for this plot.

Default The *string* specified on the NAME= option.

Restriction This option applies only to an associated DISCRETELEGEND statement.

NAME="*string*"
assigns a name to this plot statement for reference in other template statements. The specified name is used primarily in legend statements to coordinate the use of colors and line patterns between the plot and the legend.

Restrictions The *string* is case sensitive, cannot contain spaces, and must define a unique name within the template.

This option does not support variables that are created by the DYNAMIC, MVAR, and NMVAR template statements.

Interaction The *string* is used as the default legend label if the LEGENDLABEL= option is not used.

ORIENT=VERTICAL | HORIZONTAL
specifies the orientation of the Y axis and the bars.

Default VERTICAL

OUTLINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the line properties of the bar outlines.

Default The GraphOutlines style element.

Interaction For this option to have any effect, the outlines must be enabled by the ODS style or the DISPLAY= option.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

PRIMARY=TRUE | FALSE
specifies that the data columns for this plot and the plot type be used for determining default axis features. This option is needed only when two or more plots within an overlay-type layout contribute to a common axis.

Default FALSE

Restriction This option is ignored if the plot is placed under a GRIDDED or LATTICE layout block.

Note In an OVERLAY layout, only one plot in an overlay can be the primary plot on a per-axis basis. When no plot is designated as the primary plot, the first plot that can be a primary plot is considered the primary plot. If multiple plots specify PRIMARY=TRUE for the same axis, then the last such plot encountered is considered the primary plot.

See "When Plots Share Data and a Common Axis" on page 1046

"boolean " on page xii for other Boolean values that you can use.

ROLENAME=(*role-name-list*)
specifies user-defined roles that can be used to display information in the data tips. This option provides a way to add to the data columns that appear in data tips that are specified by the TIP= option.

(role-name-list)
a space-separated list of *role-name = column* pairs.

Example The following example assigns the column Obs to the user-defined role TIP:

```
ROLENAME=(TIP1=OBS)
```

Default No user-defined roles

Requirement The role names that you choose must be unique and different from the predefined roles X, Y, and DATALABEL.

TIP=(*role-list*) | NONE
specifies the information to display when the cursor is positioned over a histogram bin. If this option is used, then it replaces all of the information that is displayed by default. Roles for columns that do not contribute to the histogram can be specified along with roles that do.

(role-list)
an ordered, space-separated list of unique HISTOGRAMPARM and user-defined roles.

HISTOGRAMPARM roles include X, Y, and DATALABEL.

Tip User-defined roles are defined with the ROLENAME= option.

Example The following example displays data tips for the columns assigned to the roles X and Y, as well as the column Pct, which is not assigned to any pre-defined HISTOGRAMPARM role. The Pct column must first be assigned a role:

```
ROLENAME=(TIP1=PCT)
TIP=(X Y TIP1)
```

NONE
suppresses data tips from the plot.

Default The columns assigned to these roles are automatically included in the data tip information: X and Y.

Requirement To enable data tips in the output, you must include an ODS GRAPHICS ON statement that specifies the IMAGEMAP option, and you must write the output to the ODS HTML destination.

Interaction This option is ignored when the plot statement is in an OVERLAY or PROTOTYPE layout and the INCLUDERANGES= option is specified in the LINEAROPTS= or TIMEOPTS= option for either axis.

Tip The labels and formats for the TIP roles can be controlled with the TIPLABEL= and TIPFORMAT= options.

TIPFORMAT=(*role-format-list*)
specifies display formats for tip columns. This option provides a way to control the formats of columns that appear in data tips.

(role-format-list)
a space-separated list of *role-name* = *format* pairs.

Example
```
ROLENAME=(TIP1=SALARY)
TIP=(TIP1)
TIPFORMAT=(TIP1=DOLLAR12.)
```

Default The column format of the column assigned to the role or BEST6 if no format is assigned to a numeric column.

Restriction Only the roles that appear in the TIP= option are used.

Requirement A column must be assigned to each of the specified roles. (See the ROLENAME= option.)

TIPLABEL=(*role-label-list*)
specifies display labels for tip columns. This option provides a way to control the labels of columns that appear in data tips.

role-label-list
a space-separated list of *rolename* ="*string*" pairs.

Example
```
ROLENAME=(TIP1=PCT)
TIP=(TIP1)
TIPLABEL=(TIP1="Percent")
```

Default The column label or column name of the column assigned to the role.

Restriction Only the roles that appear in the TIP= option are used.

Requirement A column must be assigned to each of the specified roles. (See the ROLENAME= option.)

XAXIS=X | X2
specifies whether data are mapped to the primary X (bottom) axis or to the secondary X2 (top) axis.

Default X

Interaction The overall plot specification and the layout type determine the axis display. For more information, see "How Axis Features Are Determined" on page 1040.

XVALUES=MIDPOINTS | LEFTPOINTS | RIGHTPOINTS
specifies whether the input X values represent midpoints, lower endpoints, or upper endpoints of the bins.

Default MIDPOINTS

YAXIS=Y | Y2
specifies whether data are mapped to the primary Y (left) axis or to the secondary Y2 (right) axis.

Default Y

Interaction The overall plot specification and the layout type determine the axis display. For more information, see "How Axis Features Are Determined" on page 1040.

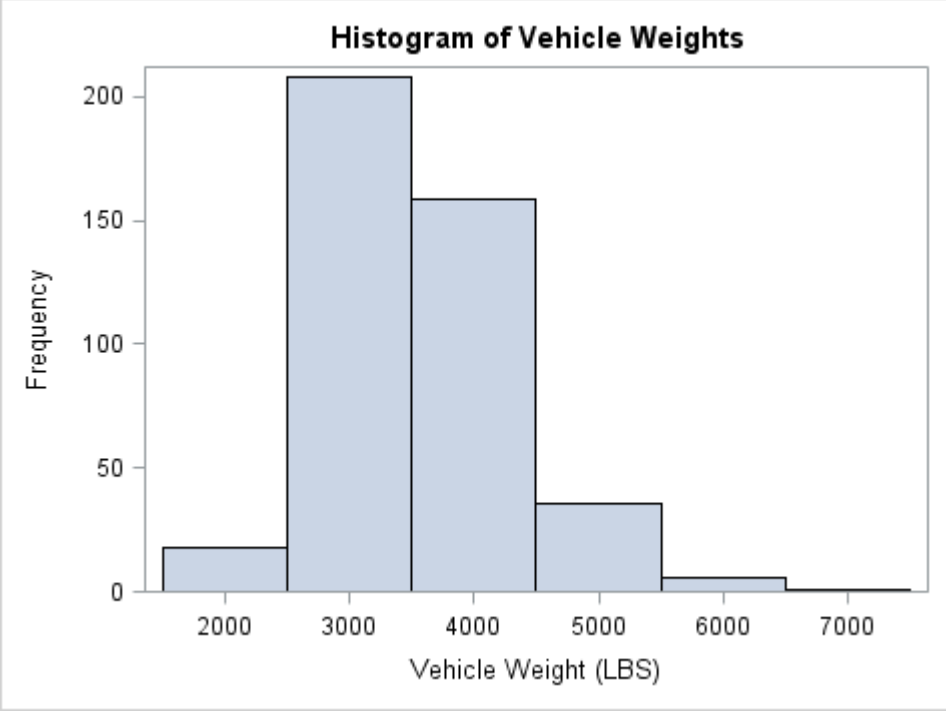
Details

When a curve is overlaid on the histogram, the histogram bin width is used to scale the curve so that the area under the curve is equal to the area of the histogram.

The X axis and Y axis are linear by default. You can change axis properties with the XAXISOPTS= and YAXISOPTS= options of the LAYOUT OVERLAY statement.

Example: HISTOGRAMPARM Statement

The following graph was generated by the "Example Program" on page 622:



Example Program

```
proc template;
  define statgraph histogramparm;
    begingraph;
      entrytitle "Histogram of Vehicle Weights";
      layout overlay;
        histogramparm  x=midpoint y=frequency;
      endlayout;
    endgraph;
  end;
run;

data bins;
  input Midpoint Frequency;
  label midpoint="Vehicle Weight (LBS)";
datalines;
2000 18
3000 208
4000 159
5000 36
6000 6
7000 1
;
run;

proc sgrender data=bins template=histogramparm;
run;
```

LINECHART Statement

Creates a line chart that is computed from input data.

Restrictions: GROUPDISPLAY= STACK has stringent requirements for the data. If the requirements are not met for all the data, then the line chart is not drawn. If the LINECHART statement is in a LAYOUT DATALATTICE or LAYOUT DATAPANEL block, then the requirements are tested for all of the data, not for each individual panel.

The category axis (the X axis when ORIENT=VERTICAL or the Y axis when ORIENT=HORIZONTAL) is always discrete.

The response axis (the Y axis when ORIENT=VERTICAL or the X axis when ORIENT=HORIZONTAL) is always numeric.

The LINECHART statement performs discrete binning for a numeric category column only.

Note: Specifying only the CATEGORY= option creates a computed line chart with vertices representing frequency counts or percents of unique CATEGORY values. For a non-grouped chart, specifying both the CATEGORY= and RESPONSE= options creates a computed line chart with vertices representing the summarized values of the RESPONSE values that are categorized by unique CATEGORY values.

Tips: The line segments in the chart always join the categorical values in the order in which they appear on the axis. By default, the vertices in the line chart appear in the order in which the X values occur in the input data. To change the categorical axis tick value order, use the SORTORDER= or TICKVALUELIST= suboption of the DISCRETEOPTS= option for the X axis. For example:

```
XAXISOPTS=(DISCRETEOPTS=(SORTORDER=ASCENDINGFORMATTED))
```

The response axis of the line chart includes the zero value by default. You can use the BASELINEINTERCEPT= to change the Y intercept.

By default, missing category values are ignored. To treat missing category values as a category, include the INCLUDEMISSINGDISCRETE=TRUE option in the BEGINGRAPH statement.

Starting with SAS 9.4M3, subpixel rendering is enabled by default. To disable subpixel rendering, specify SUBPIXEL=OFF in the BEGINGRAPH statement or in an ODS GRAPHICS statement. For information about the BEGINGRAPH statement SUBPIXEL= option, see SUBPIXEL= on page 39. For information about the ODS GRAPHICS statement SUBPIXEL= option, see "ODS GRAPHICS Statement" on page 1561.

See: "LAYOUT DATALATTICE Statement" on page 51

"LAYOUT DATAPANEL Statement" on page 79

"Axis Options in Layouts" on page 1055

"BEGINGRAPH Statement" on page 25

Syntax

LINECHART CATEGORY=*column* | *expression* < */options* > ;

LINECHART CATEGORY=*column* | *expression*
RESPONSE=*numeric-column* | *expression* < */options* > ;

Summary of Optional Arguments

Appearance options

BREAK=TRUE | FALSE
: breaks the line at missing values of the RESPONSE variable.

COLORMODEL=*color-ramp-style-element* | (*color-list*)
: specifies a color ramp to use with the COLORRESPONSE= option.

COLORRESPONSE=*numeric-column* | *range-attr-var* | *expression*
: specifies the column or range attribute variable to use to map the line, marker, and fill colors.

DATASKIN=NONE | CRISP | GLOSS | MATTE | PRESSED | SHEEN
: enhances the visual appearance of the lines and markers.

DATATRANSPARENCY=*number*
: specifies the degree of the transparency of the line, markers, and vertex labels, if displayed.

DISPLAY=(*display-options*) | STANDARD | ALL
: specifies which line-chart features to display.

FILLATTRS=*style-element* | (*fill-options*)
: specifies the appearance of the filled area.

FILLEDOUTLINEDMARKERS=TRUE | FALSE
: specifies whether markers are drawn with both fill and an outline.

GROUPDISPLAY=OVERLAY | STACK
: specifies how to display grouped lines.

INDEX=*positive-integer-column* | *expression*
: specifies indices for mapping line attributes (color, marker symbol, and line pattern) and fill attributes to one of the GraphData1–GraphDataN style elements.

LINEATTRS=*style-element* | (*line-options*)
: specifies the appearance of the line.

MARKERATTRS=*style-element* | *style-element* (*marker-options*) | (*marker-options*)
: specifies the attributes of the data markers.

MARKERFILLATTRS=*style-element* | (*fill-options*)
: specifies the appearance of the filled markers.

MARKEROUTLINEATTRS=*style-element* | (*line-options*)
: specifies the appearance of the marker outlines.

ORIENT=VERTICAL | HORIZONTAL
: specifies the orientation of the Y axis.

SMOOTHCONNECT=TRUE | FALSE
: specifies that a smoothed line passes through all vertices.

Axes options

BASELINEINTERCEPT=*number* | AUTO | AXISMIN | AXISMINEXTEND | AXISMAX | AXISMAXEXTEND
: specifies the Y-intercept for the baseline.

PRIMARY=TRUE | FALSE
: specifies that the data columns for this plot and the plot type be used for determining default axis features.

XAXIS=X | X2
: specifies whether data are mapped to the primary X (bottom) axis or to the secondary X2 (top) axis.

YAXIS=Y | Y2
: specifies whether data are mapped to the primary Y (left) axis or to the secondary Y2 (right) axis.

Data tip options

ROLENAME=(*role-name-list*)
: specifies user-defined roles that can be used to display information in the data tips.

TIP=(*role-list*) | NONE
: specifies the information to display when the cursor is positioned over a line.

TIPFORMAT=(*role-format-list*)

specifies display formats for tip columns.

TIPLABEL=(*role-label-list*)
specifies display labels for tip columns.

Label options

LEGENDLABEL="*string*"
specifies a label to be used in a discrete legend for this plot.

VERTEXLABEL=TRUE | FALSE
specifies whether to label the vertices with their response value (or statistic).

VERTEXLABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font attributes of the vertex labels.

VERTEXLABELFORMAT=*format*
specifies the format used to display the vertex label response or statistic.

Midpoint options

GROUP=*column* | *discrete-attr-var* | *expression*
creates a separate line for each unique group value in the specified column.

GROUPORDER=DATA | REVERSEDATA | ASCENDING | DESCENDING
specifies the ordering of the groups within a category.

INCLUDEMISSINGGROUP=TRUE | FALSE
specifies whether missing values of the group variable are included in the plot.

ODS options

URL=*string-column*
specifies an HTML page to display when a line segment, marker, or fill area is selected.

Plot reference options

NAME="*string*"
assigns a name to this plot statement for reference in other template statements.

Statistics options

STAT=FREQ | PCT | PROPORTION | SUM | MEAN
specifies the statistic to be computed for the Y axis.

Required Argument

CATEGORY=*column* | *expression*
specifies the column or expression for the category values. Duplicated category values are summarized into a unique value. All values are treated as discrete.

Optional Arguments

BASELINEINTERCEPT=*number* | AUTO | AXISMIN | AXISMINEXTEND | AXISMAX | AXISMAXEXTEND

specifies the Y-intercept for the baseline.

number

specifies the Y coordinate of the baseline.

This value is included in the data range that is reported by the line chart.

Interaction When *number* is specified, if necessary, the response axis data range is extended to include the baseline intercept. When a logarithmic response axis is requested and *number* is 0 or a negative value, the response axis reverts to a linear axis. To restore the log axis in that case, set BASELINEINTERCEPT= to a positive value.

AUTO

bases the intercept on the response axis range.

The intercept is determined as follows:

- If the response axis range has both positive and negative values or contains 0, then the intercept is 0.
- If the response axis range contains all positive values, then AUTO is interpreted as AXISMINEXTEND.
- If the response axis range contains only negative values, then AUTO is interpreted as AXISMAXEXTEND.

AXISMIN

places the baseline at the minimum value of the axis range.

AXISMINEXTEND

places the baseline at the start of the minimum offset in the wall.

This location corresponds to the bottom edge of the wall when there is no inner margin plot and the axis is not reversed. If there is an inner margin plot at the bottom, then the baseline is placed at the boundary of the inner margin and the minimum offset.

AXISMAX

places the baseline at the maximum value of the axis range.

AXISMAXEXTEND

places the baseline at the start of the maximum offset in the wall.

This location corresponds to the top edge of the wall when there is no inner margin plot, and the axis is not reversed. If there is an inner margin plot at the top, then the baseline is placed at the boundary of the inner margin and the maximum offset.

Default AUTO

Interactions When GROUPDISPLAY= STACK is in effect, this option is ignored, and the plot is drawn as if BASELINEINTERCEPT=0.

When DISPLAY= includes FILL, the fill extends to the baseline that is specified by the BASELINEINTERCEPT= option.

BREAK=TRUE | FALSE
breaks the line at missing values of the RESPONSE variable.

Default FALSE

Note If BREAK=FALSE, then missing values are skipped and a continuous line is drawn.

See "boolean " on page xii for other Boolean values that you can use.

COLORMODEL=*color-ramp-style-element* | (*color-list*)
specifies a color ramp to use with the COLORRESPONSE= option.

color-ramp-style-element
specifies the name of a color-ramp style element.

The style element should contain these style attributes:

STARTCOLOR
specifies the color for the smallest data value of the COLORRESPONSE= column.

NEUTRALCOLOR
specifies the color for the midpoint of the range of the COLORRESPONSE= column.

ENDCOLOR
specifies the color for the highest data value of the COLORRESPONSE= column.

(*color-list*)
specifies a space-separated list of colors to use in the color ramp. You can use style attribute references such as GraphData3:Color, color names, or RGB, CMYK, HLS, and HSV (HSB) color codes to specify a color. The list can contain a mix of style attribute references, color names, and color codes.

Requirement The list of colors must be enclosed in parentheses.

See "color " on page xii

Default The ThreeColorAltRamp style element.

Interaction For this option to take effect, the COLORRESPONSE= option must also be specified.

COLORRESPONSE=*numeric-column* | *range-attr-var* | *expression*
specifies the column or range attribute variable to use to map the line, marker, and fill colors.

Note: This feature applies to SAS 9.4M3 and to later releases.

range-attr-var
specifies a range attribute map variable that is defined in a RANGEATTRVAR statement.

"RANGEATTRVAR Statement"

Restriction A range attribute map variable specification must be a direct reference to the attribute map variable. It cannot be set as a dynamic variable.

See "RANGEATTRVAR Statement" on page 1531

When a numeric column or expression is specified, the range of column or expression values are linearly mapped to the color ramp that is specified by the COLORMODEL= option. When a range attribute map variable is specified, the colors that are defined in the associated range attribute map are used instead.

Requirement The COLORRESPONSE values should remain constant for each group value in a grouped plot and for the entire plot in an ungrouped plot. If the COLORRESPONSE column has multiple values for a single GROUP value or for a non-grouped plot, unexpected results might occur.

Interactions When the GROUP= option is specified with the COLORRESPONSE= option, the color attributes are controlled by the COLORRESPONSE= option.

When this option is specified without the GROUP= option, only a single line is generated for the plot, and the line color is derived from the COLORRESPONSE= value.

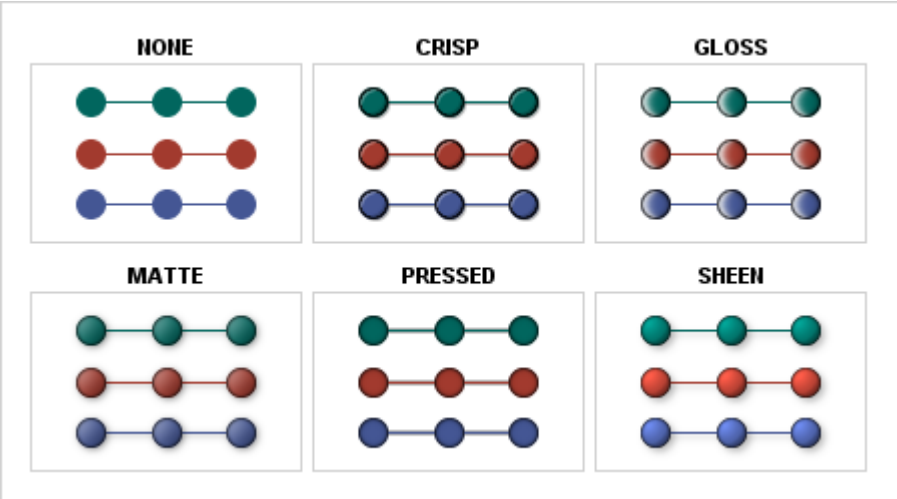
When fill is displayed, this option overrides suboption COLOR= in the FILLATTRS= option and varies the fill color according to the color gradient or the attribute map. The line and marker colors in that case are controlled by the ContrastColor attribute of the GraphDataDefault style element.

When fill is not displayed, this option overrides suboption COLOR= in the LINEATTRS= and MARKERATTRS= options, and varies the line and marker colors according to the color gradient or the attribute map.

Tips To display a legend with this option in effect, use a CONTINUOUSLEGEND statement.

For a numeric column or expression, the ThreeColorRamp style element defines the fill color gradient, and the ThreeColorAltRamp style element defines the line color gradient.

DATASKIN=NONE | CRISP | GLOSS | MATTE | PRESSED | SHEEN
enhances the visual appearance of the lines and markers. The following figure shows lines and CIRCLEFILLED markers with each of the skins applied.



Default The DATASKIN= option value that is specified in the BEGINGRAPH statement. If not specified, then the GraphSkins:DataSkin style element value is used.

Restriction Starting with SAS 9.4M1, the maximum number of skinned graphical elements is limited to 200 per plot in an OVERLAY or PROTOTYPE layout. When this limit is exceeded for a plot, the specified data skin is not applied to that plot. In that case, use the DATASKINMAX= option in your ODS GRAPHICS statement to increase the maximum limit.

Interactions This option overrides the BEGINGRAPH statement DATASKIN= option.

The skin appearance is based on the color that is in effect for the lines and markers.

DATATRANSPARENCY=*number*
specifies the degree of the transparency of the line, markers, and vertex labels, if displayed.

Default 0

Range 0–1, where 0 is opaque and 1 is entirely transparent

Tip The FILLATTRS= option can be used to set transparency for just the fills. You can combine this option with FILLATTRS= to set one transparency for the lines but a different transparency for the fills. For example:

```
datatransparency=0.2 fillattrs=(transparency=0.6)
```

DISPLAY=(*display-options*) | STANDARD | ALL
specifies which line-chart features to display.

(*display-options*)
a space-separated list of one or more display options enclosed in parentheses.

The list can include one or more of the following options:

FILL
displays a filled area between the line and the baseline

Interaction When GROUPDISPLAY=STACK, DISPLAY=FILL fills between adjacent group lines except for the first group, which fills to the baseline.

LINE
displays line segments that join the vertices

MARKERS
displays markers at each vertex

STANDARD
specifies LINE only

ALL
specifies all features: FILL, LINE, and MARKERS

Default STANDARD

Tip Use the LINEATTRS=, MARKERATTRS=, and FILLATTRS= options to control the appearance of the line segments, markers, and fill, respectively.

FILLATTRS=*style-element* | (*fill-options*)
specifies the appearance of the filled area.

Defaults For non-grouped data, the Color attribute of GraphDataDefault style element.

For grouped data, the Color attribute of GraphData1–GraphDataN style elements is used.

Interactions For this option to have any effect, the fill must be enabled by the ODS style or the DISPLAY= option.

When COLORRESPONSE= is in effect and the DISPLAY= option enables FILL display, the FILLATTRS= suboption COLOR= is ignored, and the fill colors vary according to the gradient.

Note When *style-element* is specified, only the style element's Color attribute is used.

Tip The DATATRANSPARENCY= option sets the transparency for the fills and the lines. You can combine this option with DATATRANSPARENCY= to set one transparency for the lines but a different transparency for the fills. For example:

```
datatransparency=0.2 fillattrs=(transparency=0.6)
```

See "General Syntax for Attribute Options" on page 1599

"Fill Color Options" on page 1600

FILLEDOUTLINEDMARKERS=TRUE | FALSE
specifies whether markers are drawn with both fill and an outline.

TRUE
draws filled markers (marker symbols with the suffix FILLED) using both fill and an outline.

When this option is TRUE, the fill color and outline color for filled markers are determined in the following ways:

- If the GROUP= option is specified, then by default, the fill color is derived from the GraphData1–GraphDataN style elements Color attribute, and the marker outlined color is derived from the GraphData1–GraphDataN style elements ContrastColor attribute.
- If the GROUP= option is not specified, then by default, the fill color is derived from the GraphDataDefault style elements Color attribute, and the marker outlined color is derived from the GraphOutline style elements ContrastColor attribute.

FALSE
draws the markers using fill or an outline, but not both.

Default FALSE

Tip To specify the marker fill and outline colors for a non-grouped plot, set this option to TRUE, and then use the MARKERFILLATTRS= and MARKEROUTLINEATTRS= options to specify the colors.

See GROUP= on page 631

MARKERFILLATTRS= on page 635

MARKEROUTLINEATTRS= on page 636

"boolean " on page xii for other Boolean values that you can use.

GROUP=*column* | *discrete-attr-var* | *expression*
creates a separate line for each unique group value in the specified column.

discrete-attr-var
specifies a discrete attribute map variable.

The discrete attribute map variable is created by a DISCRETEATTRVAR statement.

Restriction A discrete attribute map variable specification must be a direct reference to the attribute map variable. It cannot be set by a dynamic variable.

Default Each distinct group value is represented in the plot by a different combination of color, line pattern, and marker symbol. Lines and markers vary according to the ContrastColor, LineStyle, and MarkerSymbol attributes of the GraphData1–GraphDataN and GraphMissing style elements.

Interaction When both the GROUP= and COLORRESPONSE= options are specified, the color attributes are controlled by the COLORRESPONSE= option.

Tips The representations that are used to identify the groups can be overridden individually. For example, each distinct group value is represented by a different line pattern for the lines, but you can use the PATTERN= suboption of the LINEATTRS= option to assign the same line pattern to all lines.

By default, ODS Graphics limits the number of groups to 1000. When this limit is exceeded, the GROUP= option is ignored. Use the GROUPMAX= option in the ODS GRAPHICS statement to change the maximum number of groups that can be processed.

See "DISCRETEATTRMAP Statement" on page 1505

GROUPDISPLAY=OVERLAY | STACK
specifies how to display grouped lines.

OVERLAY
displays group values overlaid on top of each other.

STACK
displays group values as stacked lines.

Default OVERLAY

Restriction When STACK is in effect, if any response value is negative or if any crossing of the group value with the category is absent or is a missing value, then the chart is not drawn and a warning message is written to the SAS log.

Interaction When STACK is in effect, the BASELINEINTERCEPT= option is treated as if it is set to zero.

Tip When the response axis is linear, STAT=MEAN or STAT=PCT, and GROUPDISPLAY=STACK, the axis tick values might be displayed as integer values. When the response axis is linear, STAT=MEAN or STAT=PCT, and GROUPDISPLAY=OVERLAY, the axis tick values might be displayed as decimal values. To keep the integer axis values for both cases, you can specify the INTEGER=TRUE option for the response axis. See INTEGER= on page 1085.

GROUPORDER=DATA | REVERSEDATA | ASCENDING | DESCENDING
specifies the ordering of the groups within a category.

DATA
orders the groups within a category in the group-column data order.

REVERSEDATA
orders the groups within a category in the reverse group-column data order.

Note: This feature applies to SAS 9.4M2 and to later releases.

Tip This option is useful when you want to reverse the category axis.

ASCENDING
orders the groups within a category in ascending order.

DESCENDING
orders the groups within a category in descending order.

Defaults DATA if the data is a SAS data set.

ASCENDING if the data is a CAS in-memory table. Sorting is based on nonformatted values for numeric group values or on formatted values for character group values.

Interactions This option is ignored if the GROUP= option is not also specified.

By default, the groups in the legend are shown in the order that is specified in GROUPORDER.

Notes When plotting a SAS data set, attributes such as color, symbol, and pattern are assigned to each group in DATA order by default. When plotting a CAS in-memory table, attributes are assigned in ascending order of the group column character values or unformatted numeric values by default.

The ASCENDING and DESCENDING settings linguistically sort the group values within each category (or X value) for display position purposes only. For numeric data, the order is based on the unformatted values. For character data, the order is based on the formatted values. The data order of the observations and the visual attributes that are assigned to the group values remain unchanged.

In SAS 9.4M6 and earlier releases, when data stored in a CAS in-memory table is used and DATA or REVERSEDATA is specified, unpredictable results might occur. To generate consistent graphs in that case, specify ASCENDING or DESCENDING. Starting with SAS Viya 3.5 and SAS Studio 5.2, when data stored in a CAS in-memory table is used and DATA or REVERSEDATA is specified, it is ignored, and ASCENDING is used instead.

INCLUDEMISSINGGROUP=TRUE | FALSE
specifies whether missing values of the group variable are included in the plot.

Default TRUE

Interaction For this option to take effect, the GROUP= option must also be specified.

Tip The attributes of the missing group value are determined by the GraphMissing style element unless a discrete attribute map is in effect, the INDEX= option is used, the MISSING= system option changes the default missing character, or a user-defined format is applied to the group value. In those cases, the attributes of the missing group value are determined by a GraphData1–GraphDataN style element instead of by the GraphMissing style element.

See “boolean ” on page xii for other Boolean values that you can use.

INDEX=*positive-integer-column* | *expression*
specifies indices for mapping line attributes (color, marker symbol, and line pattern) and fill attributes to one of the GraphData1–GraphDataN style elements.

Requirements: The column or expression value must be an integer value of 1 or greater. Otherwise, this option is ignored.

The positive-integer column must not contain missing values. Otherwise, the entire column is invalidated and this option is ignored.

All of the indexes for a specific group value must be the same. Otherwise, the results are unpredictable.

Interaction: For this option to take effect, the GROUP= option must also be specified.

Notes: The index values are 1-based indices. For the style attributes in GraphData1–GraphDataN, if the index value is greater than N, then a modulo operation remaps that index value to a number less than N to determine which style to use.

If you do not use this option, then the group values are mapped in the order of the data.

Tip: You can use indexing to collapse the number of groups that are represented in a graph. For more information, see "Remapping Groups for Grouped Data" on page 211.

LEGENDLABEL="*string*"
specifies a label to be used in a discrete legend for this plot.

Default: If the RESPONSE= option is specified, then the response variable label is used. Otherwise, the CATEGORY= variable label is used. If a label is not assigned to the response variable or category variable, then the variable name is used.

Restriction: This option applies only to an associated DISCRETELEGEND statement.

Interaction: If the GROUP= option is specified, then this option is ignored.

LINEATTRS=*style-element* | (*line-options*)
specifies the appearance of the line.

Defaults: For non-grouped data, the GraphDataDefault style element.

For grouped data, the LineThickness attributes of the GraphDataDefault style element, and the ContrastColor and LineStyle attributes of the GraphData1–GraphDataN style elements.

Interaction: When COLORRESPONSE= is in effect, the LINEATTRS= suboption COLOR= is ignored, and the line fill colors vary according to the gradient.

Note When *style-element* is specified, only the style element's ContrastColor, LineStyle, and LineThickness attributes are used.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

MARKERATTRS=*style-element* | *style-element* (*marker-options*) | (*marker-options*)
specifies the attributes of the data markers.

Defaults For non-grouped data, GraphDataDefault style element.

For grouped data, the MarkerSymbol and ContrastColor attributes of the GraphData1–GraphDataN style elements, and the GraphDataDefault:MarkerSize style reference.

Interactions If FILLEDOUTLINEDMARKERS=TRUE, then this option's COLOR= suboption is ignored. In that case, to specify the marker fill color, use the MARKERFILLATTRS= option instead.

This option's COLOR= suboption overrides the default behavior for grouped data. When the COLOR= suboption is specified in that case, all markers have the same color, and the marker symbol alone distinguishes the markers.

This option's SYMBOL= suboption overrides the default behavior for grouped data. When the SYMBOL= suboption is specified in that case, all markers have the same symbol, and the symbol color alone distinguishes the markers.

The TRANSPARENCY= fill option overrides this option's DATATRANSPARENCY= suboption.

This option is ignored if the DISPLAY= option disables the display of the markers.

If the DATASKIN= option is in effect, then the data skin determines the marker outlines. Any outline-related settings from the current ODS style or from the marker attribute options are ignored.

Note When *style-element* is specified, only the style element's MARKERSYMBOL, CONTRASTCOLOR, and MARKERSIZE attributes are used.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Marker Options" on page 1604 for available *marker-options*.

MARKERFILLATTRS=*style-element* | (*fill-options*)
specifies the appearance of the filled markers.

Defaults For non-grouped data, the Color attribute of the GraphDataDefault style element

For grouped data, the Color attribute of a GraphData1–GraphDataN style element

Restriction The TRANSPARENCY= fill option is ignored. Use the MARKERATTRS= option to set the marker transparency.

Interaction This option is in effect only when FILLEDOUTLINEDMARKERS=TRUE and the DISPLAY= option enables fill display.

Note When *style-element* is specified, only the style element's Color attribute is used.

See "General Syntax for Attribute Options" on page 1599

"Fill Color Options" on page 1600

MARKEROUTLINEATTRS=*style-element* | (*line-options*)
specifies the appearance of the marker outlines.

Defaults For non-grouped data, the GraphOutlines style element.

For grouped data, the LineThickness attritube of the GraphOutlines style element and the ContrastColor attribute of a GraphData1–GraphDataN style element.

Restriction The line style of the marker outline is always solid.

Interaction This option is ignored when a data skin is applied by the current style or by the DATASKIN= option. In the latter case, the outline is set by the data skin.

Note When *style-element* is specified, only the style element's CONTRASTCOLOR and LINETHICKNESS attributes are used.

See "General Syntax for Attribute Options" on page 1599

"Line Options" on page 1602

NAME="*string*"
assigns a name to this plot statement for reference in other template statements. This option is used mostly in the CONTINUOUSLEGEND on page 1291 statement in order to coordinate the use of colors and line patterns between the plot and the legend.

Restrictions The *string* is case sensitive, cannot contain spaces, and must define a unique name within the template.

This option does not support variables that are created by the DYNAMIC, MVAR, and NMVAR template statements.

Interaction The *string* is used as the default legend label if the LEGENDLABEL= option is not used.

ORIENT=VERTICAL | HORIZONTAL
specifies the orientation of the Y axis.

Default VERTICAL

PRIMARY=TRUE | FALSE
specifies that the data columns for this plot and the plot type be used for determining default axis features. This option is needed only when two or more plots within an overlay-type layout contribute to a common axis.

Default FALSE

Restriction This option is ignored if the plot is placed under a GRIDDED or LATTICE layout block.

Note In an OVERLAY layout, only one plot in an overlay can be the primary plot on a per-axis basis. When no plot is designated as the primary plot, the first plot that can be a primary plot is considered the primary plot. If multiple plots specify PRIMARY=TRUE for the same axis, then the last such plot encountered is considered the primary plot.

See "When Plots Share Data and a Common Axis" on page 1046

"boolean " on page xii for other Boolean values that you can use.

ROLENAME=(*role-name-list*)
specifies user-defined roles that can be used to display information in the data tips. This option provides a way to add to the data columns that appear in data tips that are specified by the TIP= option.

(*role-name-list*)
a space-separated list of *role-name = column* pairs.

Example The following example assigns the column Obs to the user-defined role TIP:

```
ROLENAME=(TIP1=OBS)
```

Default No user-defined roles

Requirement The role names that you choose must be unique and different from the predefined roles CATEGORY, RESPONSE, DATALABEL, and GROUP.

Note The column values for a custom tip are not summarized using the STAT= statistic. For a given category value, the custom tip column values for that category value should be the same. Otherwise, unexpected results might occur.

SMOOTHCONNECT=TRUE | FALSE
specifies that a smoothed line passes through all vertices.

Default FALSE. Straight line segments are used if the vertices are to be connected.

Interaction This option is ignored when GROUPDISPLAY=STACK.

See "boolean " on page xii for other Boolean values that you can use.

STAT=FREQ | PCT | PROPORTION | SUM | MEAN
specifies the statistic to be computed for the Y axis. For line charts with no RESPONSE= column:

FREQ	frequency count
PCT	percentages between 0 and 100 inclusive
PROPORTION	proportions between 0 and 1 inclusive

For line charts with a RESPONSE= column:

SUM
MEAN

Defaults SUM for line charts that specify the RESPONSE= argument.

FREQ for line charts that do not specify the RESPONSE= argument.

TIP=(*role-list*) | NONE
specifies the information to display when the cursor is positioned over a line. If this option is used, then the information specified replaces all of the information that is displayed by default. You can specify roles for columns that do not contribute to the line chart along with roles that do.

(role-list)
an ordered, space-separated list of unique LINECHART roles and user-defined roles.

LINECHART roles include CATEGORY, RESPONSE, COLORRESPONSE, DATALABEL, and GROUP.

Note The COLORRESPONSE role is valid starting with SAS 9.4M1.

Tip User-defined roles are defined with the ROLENAME= option.

NONE
suppresses data tips and URLs (if requested) from the plot.

Default The columns assigned to the following roles are automatically included in the data tip information: CATEGORY, RESPONSE, and GROUP.

Restriction Data tips are available only for graphs that are written to the ODS HTML destination.

Requirement To generate data tips, include an ODS GRAPHICS ON statement that specifies the IMAGEMAP option. See "ODS GRAPHICS

Statement" on page 1561 for information about the ODS GRAPHICS statement.

Interaction This option is ignored when the plot statement is in an OVERLAY or PROTOTYPE layout and the INCLUDERANGES= option is specified in the LINEAROPTS= or TIMEOPTS= option for either axis.

Note The RESPONSE role represents the computed values for the CATEGORY role (and RESPONSE= role), based on the STAT= option.

Tip You can control the labels and formats for the TIP roles with the TIPLABEL= and TIPFORMAT= options.

Example To display data tips for the columns assigned to the roles X and Y as well as the user-defined role TIP1:

```
ROLENAME=(TIP1=OBS)
TIP=(TIP1 X Y)
```

TIPFORMAT=(*role-format-list*)

specifies display formats for tip columns. This option provides a way to control the formats of columns that appear in data tips.

(role-format-list)

a space-separated list of *role-name* = *format* pairs.

Example

```
ROLENAME=(TIP1=SALARY)
TIP=(TIP1)
TIPFORMAT=(TIP1=DOLLAR12.)
```

Default The column format of the column assigned to the role or BEST6 if no format is assigned to a numeric column.

Restriction Only the roles that appear in the TIP= option are used.

Requirement A column must be assigned to each of the specified roles. (See the ROLENAME= option.)

TIPLABEL=(*role-label-list*)

specifies display labels for tip columns. This option provides a way to control the labels of columns that appear in data tips.

role-label-list

a space-separated list of *rolename* ="*string*" pairs.

Example

```
ROLENAME=(TIP1=PCT)
TIP=(TIP1)
TIPLABEL=(TIP1="Percent")
```

Default The column label or column name of the column assigned to the role.

Restriction Only the roles that appear in the TIP= option are used.

Requirement A column must be assigned to each of the specified roles. (See the ROLENAME= option.)

URL=*string-column*
specifies an HTML page to display when a line segment, marker, or fill area is selected.

string-column
specifies a column that contains a valid HTML page reference (HREF) for each line that is to have an active link.

Example `http://www.sas.com`

Requirement To generate selectable line segments, markers, and fill areas, you must include an ODS GRAPHICS ON statement that specifies the IMAGEMAP option, and you must write the output to the ODS HTML destination.

Interactions This option has no effect when TIP=NONE.

This option is ignored when the plot statement is in an OVERLAY or PROTOTYPE layout and the INCLUDERANGES= option is specified in the LINEAROPTS= or TIMEOPTS= option for either axis.

Notes For non-grouped data, the values of the column are expected to be same for each unique X value. If they are not, then the results might be unpredictable.

For grouped data, the values of the column are expected to be the same for each unique X and GROUP combination.

Tips The URL value can be blank for some X values, meaning that no action is taken when the line segments for those X values are selected.

The URL value can be the same for different X values, meaning that the same action is taken when the line segments for those X values are selected.

By default, drill-down links open in a new browser window (link target _blank). To specify a different target for your drill-down links, such as _self or _parent, add the DRILLTARGET="*target*" option to your ODS GRAPHICS statement. See DRILLTARGET= on page 1568.

VERTEXLABEL=TRUE | FALSE
specifies whether to label the vertices with their response value (or statistic).

Default FALSE

Interaction When GROUPDISPLAY=STACK is in effect, vertex labeling displays the sum of the vertex responses per category.

Note By default, the vertex-label format is derived from the format that is assigned to the response column or from BEST6 if no format is assigned. The derived format retains the precision of the response-column format and, if necessary, increases the format width to accommodate the summarized value on the response axis.

Tips You can modify the visual attributes for the label by using the VERTEXLABELATTRS= option.

You can modify the text format by using the VERTEXTLABELFORMAT= option.

See "boolean " on page xii for other Boolean values that you can use.

VERTEXLABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)

specifies the color and font attributes of the vertex labels.

Default The GraphDataText style element.

Requirement VERTEXLABEL=TRUE must be in effect for this option to have any effect.

Interaction If one or more text options are specified and they do not include all the font properties (color, family, size, weight, style), then non-specified properties are derived from the GraphDataText style element.

Note When *style-element* is specified, only the style element's COLOR, FONTFAMILY, FONTSIZE, FONTSTYLE, and FONTWEIGHT attributes are used.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Text Options" on page 1606 for available *text-options*.

VERTEXLABELFORMAT=*format*

specifies the format used to display the vertex label response or statistic.

Default The vertex label format is derived from the format that is applied to the response column or from BEST6 if no format is assigned. The derived format retains the precision of the response-column format and, if necessary, increases the format width to accommodate the summarized value on the response axis.

Requirement VERTEXLABEL=TRUE must be in effect for this option to have any effect.

Note When a vertex-label format is specified with this option, the vertex labels are formatted as specified by *format*. The specified format is not automatically expanded to accommodate values that are too wide.

Tip If you want the vertex-label format to expand automatically for the response-column values, specify the format for the response column rather than in this option.

XAXIS=X | X2
specifies whether data are mapped to the primary X (bottom) axis or to the secondary X2 (top) axis.

Default X

Interaction The overall plot specification and the layout type determine the axis display. For more information, see "How Axis Features Are Determined" on page 1040.

YAXIS=Y | Y2
specifies whether data are mapped to the primary Y (left) axis or to the secondary Y2 (right) axis.

Default Y

Interaction The overall plot specification and the layout type determine the axis display. For more information, see "How Axis Features Are Determined" on page 1040.

Optional Response Argument

RESPONSE=*numeric-column* | *expression*
specifies the numeric column or expression for the response values.

Details

A line chart shows the relationship of one variable to another as trends in the data over a period of time. The trends are shown by connecting the successive data points with a line. Typically, a line chart is used to chart a response value against a discrete categorical value where each value on the horizontal axis has only one corresponding value on the vertical axis. A grouping variable can be used to show multiple trends based on the group values.

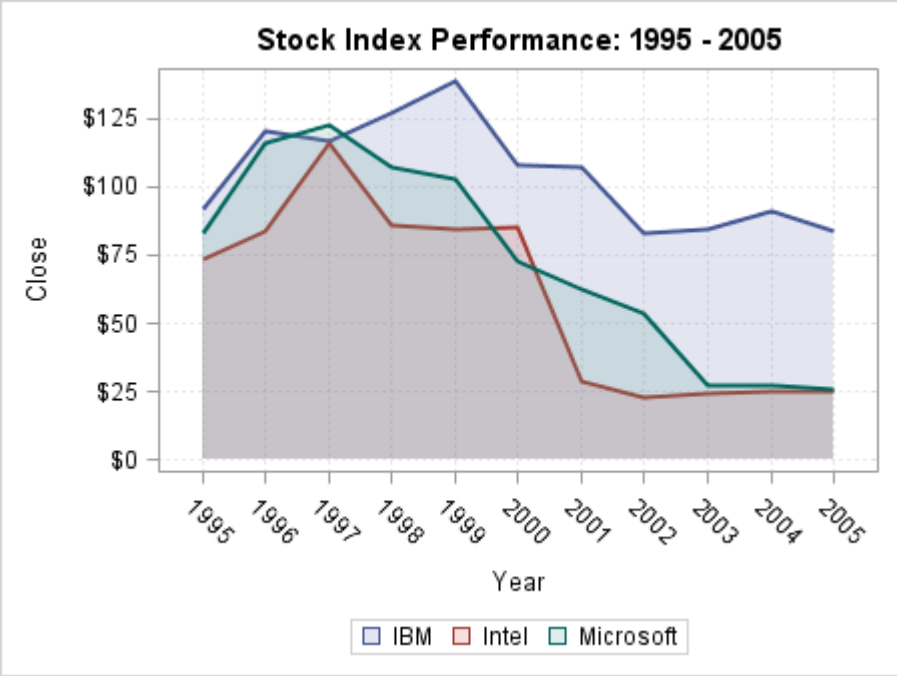
In a line chart, the category axis (X) is always discrete, and the response axis (Y) is always linear. The line segments in the chart always join the categorical values in the order in which they appear on the axis. The vertices in the line chart appear in the order in which the categorical values appear in the input data.

Examples

Example 1: Grouped Line Chart with Custom Line and Fill Attributes

This example shows you how to generate a simple line chart by using the LINECHART statement and how to use the statement options to customize the plot.

The following graph was generated by the "Example Program" on page 643. It shows the trend of the average closing price of the IBM, Intel, and Microsoft stocks from 1995 through 2005.



Example Program

Here is the SAS code for this example.

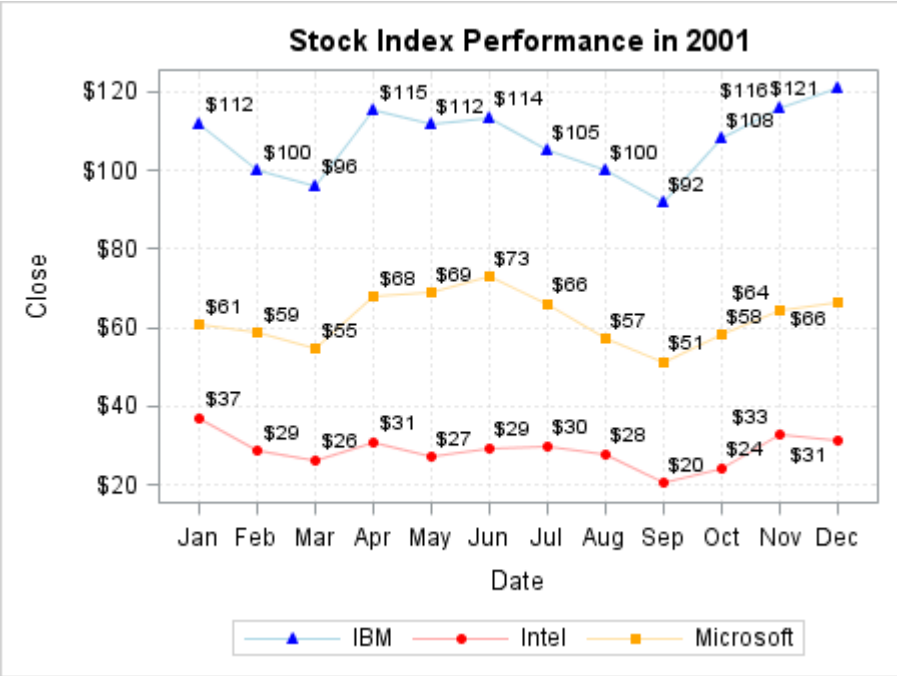
```
/* Extract per-year data for 1995 through 2005 from SASHELP.STOCKS */
data linechartdata;
   set sashelp.stocks(where=(year(date) between 1995 and 2005));
   year=year(date);
   label year="Year";
run;

/* Define the line chart template */
proc template;
   define statgraph linechart;
      begingraph;
         entrytitle "Stock Index Performance: 1995 - 2005";
         layout overlay /
```

```
                /* Add a grid */
                xaxisopts=(griddisplay=on gridattrs=(pattern=dot
                   color=lightgray))
                yaxisopts=(griddisplay=on gridattrs=(pattern=dot
                   color=lightgray));

                /* Generate the line chart */
                linechart category=year response=close / name="linechart"

                   /* Compute the mean statistic */
                   stat=mean

                   /* Group by stock to draw a line for each stock */
                   group=stock

                   /* Set the baseline at 0 */
                   baselineintercept=0

                   /* Display the lines and fill */
                   display=(line fill)

                   /* Specify the line attributes */
                   lineattrs=(thickness=2)

                   /* Specify the fill attributes */
                   fillattrs=(transparency=0.8);

                /* Add a legend */
                discretelegend "linechart";
             endlayout;
          endgraph;
       end;
    run;

    /* Generate the chart */
    proc sgrender data=linechartdata template=linechart;
    run;
```

Example 2: Grouped Line Chart with Discrete Attribute Map

This example shows you how to create a more flexible template that enables you to easily generate multiple line graphs that use different data. It also shows you how to customize the plot appearance by using a discrete attribute map.

The following graph was generated by the “Example Program” on page 645. It shows the trend of the average monthly closing price of the IBM, Intel, and Microsoft stocks for 2001.



Example Program

Here is the SAS code for this example.

```
/* Define the line chart template */
proc template;
   define statgraph linechart;
      begingraph;
         /* Create a dynamic variable for the year */
         dynamic year;

         /* Define the display attributes for each stock. Since
            DISCRETEATTRMAP does not support the MARKERATTRS=
            suboption SIZE=, the marker size is set separately. */
         discreteattrmap name="stocks" / ignorecase=true ;
            value "IBM" /
               markerattrs=(color=blue symbol=trianglefilled)
               lineattrs=(color=lightblue pattern=solid);
            value "Intel" /
               markerattrs=(color=red symbol=circlefilled)
               lineattrs=(color=verylightred pattern=solid);
            value "Microsoft" /
               markerattrs=(color=orange symbol=squarefilled)
               lineattrs=(color=verylightorange pattern=solid);
         enddiscreteattrmap ;

         /* Associate the attribute map with input data column Stock
and
            assign the name STOCKATTRS to the named association */
         discreteattrvar attrvar=stockattrs var=stock
attrmap="stocks" ;
```

```
            entrytitle "Stock Index Performance in " year;
            layout overlay /
               /* Add a grid */
               xaxisopts=(griddisplay=on gridattrs=(pattern=dot
                  color=lightgray))
               yaxisopts=(griddisplay=on gridattrs=(pattern=dot
                  color=lightgray));
               linechart category=date response=close / name="linechart"
                  /* Compute the mean */
                  stat=mean

                  /* Group by stock using the specified attributes */
                  group=stockattrs

                  /* Display the lines and markers */
                  display=(line markers)

                  /* Set the marker size */
                  markerattrs=(size=6)

                  /* Show vertex labels and specify their attributes */
                  vertexlabel=true
                  vertexlabelattrs=(size=7pt)
                  vertexlabelformat=dollar4.0;

               /* Add a legend */
               discretelegend "linechart";
            endlayout;
         endgraph;
   end;
run;

/* Create a macro that generates a line chart for a specific year */
%macro genchart(year=);
   /* Generate the chart */
   proc sgrender data=sashelp.stocks template=linechart;
      where year(date)=&year; /* Get the data for the specified year */
      format date monname3.;  /* Format the date as 3-letter month   */
      dynamic year="&year;";  /* Pass the year to the template       */
   run;
%mend genchart;

/* Generate a chart for 2001 */
%genchart(year=2001);
```

LINEPARM Statement

Creates a straight line specified by a point and a slope.

Requirement: A LINEPARM statement can be used only within a 2-D layout (OVERLAY, OVERLAYEQUATED, DATALATTICE, or DATAPANEL). Another plot statement that

is derived from data values that provide boundaries for the axis area must be included.

Syntax

LINEPARM X=*number* | *numeric-column* | *expression*
Y=*number* | *numeric-column* | *expression*
SLOPE=*number* | *numeric-column* | *expression* < */options* >;

Summary of Optional Arguments

Appearance options

CLIP=TRUE | FALSE
: specifies whether the data for the line is considered when the data ranges are determined for the axes.

DATATRANSPARENCY=*number*
: specifies the degree of the transparency of the line.

EXTEND=TRUE | FALSE
: specifies whether the line is to be drawn to the area bounded by the axes.

INDEX=*positive-integer-column* | *expression*
: specifies indices for mapping line attributes (color and line pattern) to one of the GraphData1–GraphDataN style elements.

LINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
: specifies the attributes of the line.

Axes options

XAXIS=X | X2
: specifies whether data are mapped to the primary X (bottom) axis or to the secondary X2 (top) axis.

YAXIS=Y | Y2
: specifies whether data are mapped to the primary Y (left) axis or to the secondary Y2 (right) axis.

Label options

CURVELABEL=*"string"* | *column* | *expression*
: specifies a label for the line.

CURVELABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
: specifies the color and font attributes of the line label.

CURVELABELLOCATION=INSIDE | OUTSIDE
: specifies the location of the line label relative to the plot area.

CURVELABELPOSITION=AUTO | MAX | MIN
: specifies the position of the line label relative to the line end points.

CURVELABELSPLIT=TRUE | FALSE
: specifies whether to split the line label at the specified split characters.

CURVELABELSPLITCHAR="*character-list*"
: specifies one or more characters on which the line label can be split if needed.

CURVELABELSPLITCHARDROP=TRUE | FALSE
: specifies whether the split characters are included in the line label text.

CURVELABELSPLITJUSTIFY=AUTO | CENTER | LEFT | RIGHT
: specifies the justification of the strings that are inside the line label block.

LEGENDLABEL="*string*"
: specifies a label to be used in a discrete legend for this plot.

Midpoint options

GROUP=*column* | *discrete-attr-var* | *expression*
: creates a separate parameterized line plot for each unique group value of the specified column.

INCLUDEMISSINGGROUP=TRUE | FALSE
: specifies whether missing values of the group variable are included in the plot.

Plot reference options

NAME="*string*"
: assigns a name to this plot statement for reference in other template statements.

Required Arguments

X=*number* | *numeric-column* | *expression*
specifies the X coordinate of a point. By default, if the specified value is outside of the data range, then the data range is extended to include the specified intercept. This behavior can be changed with the CLIP= option. If a *numeric-column* is specified and the column contains missing values, then no line is drawn for the missing values.

Values are displayed in the units of the data.

Y=*number* | *numeric-column* | *expression*
specifies the Y coordinate of a point. By default, if the specified value is outside of the data range, then the data range is extended to include the specified intercept. This behavior can be changed with the CLIP= option. If a *numeric-column* is specified and the column contains missing values, then no line is drawn for the missing values.

Values are displayed in the units of the data.

SLOPE=*number* | *numeric-column* | *expression*
specifies the slope of the line. Slope can be positive or negative. `SLOPE=0` creates a line parallel to the X axis. `SLOPE=.` (a missing value) creates a line parallel to the Y axis.

Optional Arguments

CLIP=TRUE | FALSE
specifies whether the data for the line is considered when the data ranges are determined for the axes.

FALSE
specifies that the data for the line contributes to the data range for each axis.

Each axis might be extended in order to force the display of the line. When CLIP=FALSE, the SLOPE= option determines how the X= and Y= values contribute to the axis data range in the following ways:

- If SLOPE=0, then only the Y= values contribute to the axis data range.
- If SLOPE=. (missing), then only the X= values contribute to the axis data range.
- If SLOPE= is neither 0 nor missing, then the X= and Y= values contribute to the axis data range.

TRUE
specifies that the data for the line is ignored when axis scales are being established.

Each axis scale is determined by the other plots in the layout. In this case, the line might not be displayed if its data range is not within the data ranges of the other plots.

Default FALSE

See “boolean ” on page xii for other Boolean values that you can use.

CURVELABEL=*"string"* | *column* | *expression*
specifies a label for the line.

Default No line label is displayed

Restrictions When the GROUP= option is specified, *"string"* and *expression* are not valid. Use *column* in that case.

When the GROUP= option is not specified, *column* is not valid. Use *"string"* or *expression* in that case.

The line label for missing values is ignored.

Tip The font and color attributes for the label are specified by the CURVELABELATTRS= option.

See GROUP= on page 654

CURVELABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font attributes of the line label.

Defaults For non-grouped data, the GraphValueText style element.

For grouped data, text color is derived from the GraphData1:ContrastColor–GraphDataN:ContrastColor style references. The font is derived from the GraphValueText style element.

Interactions For this option to take effect, the CURVELABEL= option must also be used.

This option's COLOR= setting overrides the colors indicated by the GROUP= option.

Tip When the GROUP= option is used, each distinct group value might be represented by a different color. The line label that is associated with the group is assigned the group color. This option can be used to specify a single color for all line labels in a plot, without affecting the line colors.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Text Options" on page 1606 for available *text-options*.

CURVELABELLOCATION=INSIDE | OUTSIDE
specifies the location of the line label relative to the plot area.

INSIDE
locates the labels inside the plot area

OUTSIDE
locates the labels outside the plot area

Default INSIDE

Restriction OUTSIDE cannot be used when the LINEPARM is used in multi-cell layouts such as LATTICE, DATAPANEL, or DATALATTICE, where axes might be external to the grid.

Interactions For this option to take effect, the CURVELABEL= option must also be specified.

This option is used in conjunction with the CURVELABELPOSITION= option to determine where the line labels appear.

See "Location and Position of Curve Labels" on page 213

CURVELABELPOSITION=AUTO | MAX | MIN
specifies the position of the line label relative to the line end points. This option is used in conjunction with the CURVELABELLOCATION= option to determine where the line label appears.

AUTO
automatically positions the line label near the line boundary along unused axes whenever possible (typically Y2 and X2) in order to avoid collision with tick values.

Restriction This option is used only when CURVELABELLOCATION= OUTSIDE.

MAX
forces the line label to appear near maximum line values (typically, upper right).

MIN
forces the line label to appear near minimum line values (typically, lower left).

Defaults AUTO when CUVELABELLOCATION=OUTSIDE.

MAX when CURVELABELLOCATION=INSIDE.

Restriction The AUTO setting is ignored if CURVELABELLOCATION= INSIDE is specified.

Interaction For this option to take effect, the CURVELABEL= option must also be specified.

Note When you specify TICKVALUELIST=, VIEWMAX=, or VIEWMIN= in an axis statement, the data points that are used to determine the position of the curve label might fall outside of the graph area. In that case, the curve label might not be displayed or might be positioned incorrectly.

See "Location and Position of Curve Labels" on page 213

CURVELABELSPLIT=TRUE | FALSE
specifies whether to split the line label at the specified split characters. When a line label is split, the label is split on each occurrence of the specified split characters.

Default FALSE. The line label is not split.

Requirement The CURVELABEL= option must also be specified.

Interactions The CURVELABELSPLITCHAR= option specifies one or more characters on which the splits occur.

This option has no effect when CURVELABELPOSITION=AUTO.

See "boolean " on page xii for other Boolean values that you can use.

CURVELABELSPLITCHAR="*character-list*"
specifies one or more characters on which the line label can be split if needed. When multiple split characters are specified, each character in the list is treated as a separate split character unless the specified characters appear consecutively in the line label. In that case, all of the specified split characters together are treated as a single split character.

When CURVELABEL= is specified and CURVELABELSPLIT=TRUE, the line label is split unconditionally at each occurrence of any of the specified split

characters. If the line label does not contain any of the specified characters, then the label is not split.

"character-list"
one or more characters with no delimiter between each character and enclosed in quotation marks.

Default A blank space

Requirements The list of characters must be enclosed in quotation marks.

Multiple characters must be specified with no delimiters. For example, to specify the split characters a, b, and c, use the following option:

```
curvelabelsplitchar="abc"
```

The CURVELABEL= option and the CURVELABELSPLIT=TRUE option must also be specified.

Interactions This option has no effect if CURVELABELPOSITION=AUTO.

The CURVELABELSPLITCHARDROP= option specifies whether the split characters are included in the line label or are dropped.

Notes When multiple characters are specified, the order of the characters in the list is not significant.

The split characters are case sensitive.

Tip Use the CURVELABELSPLITJUSTIFY= option to specify the justification of the strings in the line label block.

CURVELABELSPLITCHARDROP=TRUE | FALSE
specifies whether the split characters are included in the line label text.

TRUE
drops the split characters from the line label text.

FALSE
includes the split characters in the line label text.

When CURVELABELSPLIT=TRUE and CURVELABELSPLITCHARDROP=FALSE, each split character remains as the last character in the current line. The characters that follow the split character, up to and including the next split character, are then wrapped to the next line.

The following figure shows an example of a line label with the following specifications:

- CURVELABELPOSITION=MAX
- CURVELABEL="Product*Group*A"
- CURVELABELSPLIT=TRUE
- CURVELABELSPLITCHARDROP=TRUE | FALSE
- CURVELABELSPLITCHAR="*"

Note: The horizontal line to the left of the label represents the maximum end of the line for reference.

When CURVELABELSPLITCHARDROP=TRUE, the asterisks are removed from the label. When CURVELABELSPLITCHARDROP=FALSE, each asterisk remains as the last character in the line prior to the new line.

Default TRUE. The split characters are dropped from the line label.

Requirement The CURVELABEL= option and the CURVELABELSPLIT=TRUE option must also be specified.

Interaction The CURVELABELSPLITCHAR= option specifies the split characters.

See "boolean " on page xii for other Boolean values that you can use.

CURVELABELSPLITJUSTIFY=AUTO | CENTER | LEFT | RIGHT
specifies the justification of the strings that are inside the line label block.

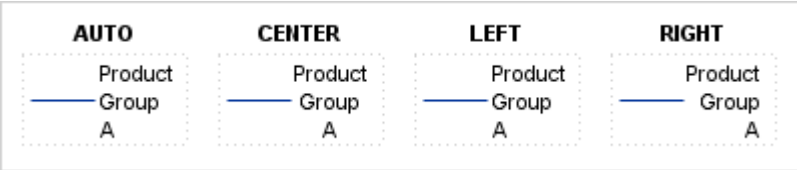
AUTO
justifies the labels based on the CURVELABELPOSITION= option.

CURVELABELPOSITION= Value	Justification
MAX or END	LEFT
MIN or START	RIGHT

CENTER
LEFT
RIGHT
justifies the labels center, left, or right, as specified.

The following figure shows an example in which CURVELABELPOSITION=MAX.

Note: The horizontal line to the left of each label represents the maximum end of the line for reference.



In this case, because CURVELABELPOSITION=MAX, AUTO left-justifies the lines of text.

Default AUTO

Requirement The CURVELABEL= option and the CURVELABELSPLIT=TRUE option must also be specified.

Interaction This option has no effect if CURVELABELPOSITION=AUTO.

DATATRANSPARENCY=*number*

specifies the degree of the transparency of the line.

Default 0

Range 0–1, where 0 is opaque and 1 is entirely transparent

Note This option does not affect the line label.

EXTEND=TRUE | FALSE

specifies whether the line is to be drawn to the area bounded by the axes.

Default FALSE

Note If this option is not specified, then there can be a small gap between the line and the axis. The gap is controlled by the axis offset. If the offset is set to 0, then there is no gap.

See "boolean " on page xii for other Boolean values that you can use.

GROUP=*column* | *discrete-attr-var* | *expression*

creates a separate parameterized line plot for each unique group value of the specified column.

discrete-attr-var

specifies a discrete attribute map variable.

The discrete attribute map variable is created by a DISCRETEATTRVAR statement.

Restriction A discrete attribute map variable specification must be a direct reference to the attribute map variable. It cannot be set by a dynamic variable.

Default Each distinct group value might be represented in the plot by a different combination of line color and line pattern. Line colors vary according to the ContrastColor attribute of the GraphData1–GraphDataN and GraphMissing style elements. The line patterns

vary according to the LineStyle attribute of the GraphData1–GraphDataN and GraphMissing style elements.

Restriction When this option is used, the X, Y, and SLOPE arguments must specify numeric columns.

Interactions The group values are mapped in the order of the data, unless the INDEX= option is used to alter the default sequence of line colors and line patterns

The INCLUDEMISSINGGROUP option controls whether missing group values are considered a distinct group value.

Note If you specify a column in a SAS data set, the visual attributes for each group value are assigned in data order. If you specify a column in a CAS in-memory table, the visual attributes for each group value are assigned in ascending order of the group column character values or of unformatted numeric values.

Tips The LINEATTRS= option can be used to override the representations that are used to identify the groups. For example, LINEATTRS=(PATTERN=SOLID) can be used to assign the same pattern to all of the lines, letting the line color distinguish group values. Likewise, LINEATTRS=(COLOR=BLACK) can be used to assign the same color to all of the lines, letting the line pattern distinguish group values.

By default, ODS Graphics limits the number of groups to 1000. When this limit is exceeded, the GROUP= option is ignored. Use the GROUPMAX= option in the ODS GRAPHICS statement to change the maximum number of groups that can be processed.

See “DISCRETEATTRVAR Statement” on page 1516

INCLUDEMISSINGGROUP=TRUE | FALSE

specifies whether missing values of the group variable are included in the plot.

Default TRUE

Interaction For this option to take effect, the GROUP= option must also be specified.

Tip The attributes of the missing group value are determined by the GraphMissing style element unless a discrete attribute map is in effect, the INDEX= option is used, the MISSING= system option changes the default missing character, or a user-defined format is applied to the group value. In those cases, the attributes of the missing group value are determined by a GraphData1–GraphDataN style element instead of by the GraphMissing style element.

See “boolean ” on page xii for other Boolean values that you can use.

INDEX=*positive-integer-column* | *expression*

specifies indices for mapping line attributes (color and line pattern) to one of the GraphData1–GraphDataN style elements.

Requirements The column or expression value must be an integer value of 1 or greater. Otherwise, this option is ignored.

The positive-integer column must not contain missing values. Otherwise, the entire column is invalidated and this option is ignored.

All of the indexes for a specific group value must be the same. Otherwise, the results are unpredictable.

Interaction For this option to take effect, the GROUP= option must also be specified.

Notes The index values are 1-based indices. For the style attributes in GraphData1–GraphDataN, if the index value is greater than N, then a modulo operation remaps that index value to a number less than N to determine which style to use.

If you do not use this option, then the group values are mapped in the order of the data.

Tip You can use indexing to collapse the number of groups that are represented in a graph. For more information, see "Remapping Groups for Grouped Data" on page 211.

LEGENDLABEL="*string*"
specifies a label to be used in a discrete legend for this plot.

Default The *string* specified on the NAME= option.

Restriction This option applies only to an associated DISCRETELEGEND statement.

Interaction If the GROUP= option is specified, then this option is ignored.

LINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the attributes of the line.

Defaults For non-grouped data, the GraphDataDefault style element.

For grouped data, the ContrastColor, LineStyle, and LineThickness attributes of the GraphData1–GraphDataN style elements.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

NAME="*string*"
assigns a name to this plot statement for reference in other template statements. The specified name is used primarily in legend statements to coordinate the use of colors and line patterns between the plot and the legend.

Restrictions The *string* is case sensitive, cannot contain spaces, and must define a unique name within the template.

This option does not support variables that are created by the DYNAMIC, MVAR, and NMVAR template statements.

Interaction The *string* is used as the default legend label if the LEGENDLABEL= option is not used.

XAXIS=X | X2
specifies whether data are mapped to the primary X (bottom) axis or to the secondary X2 (top) axis.

Default X

Restriction Another plot that establishes a data range for the designed axis must be included.

Interaction The overall plot specification and the layout type determine the axis display. For more information, see "How Axis Features Are Determined" on page 1040.

YAXIS=Y | Y2
specifies whether data are mapped to the primary Y (left) axis or to the secondary Y2 (right) axis.

Default Y

Restriction Another plot that establishes a data range for the designed axis must be included.

Interaction The overall plot specification and the layout type determine the axis display. For more information, see "How Axis Features Are Determined" on page 1040.

Details

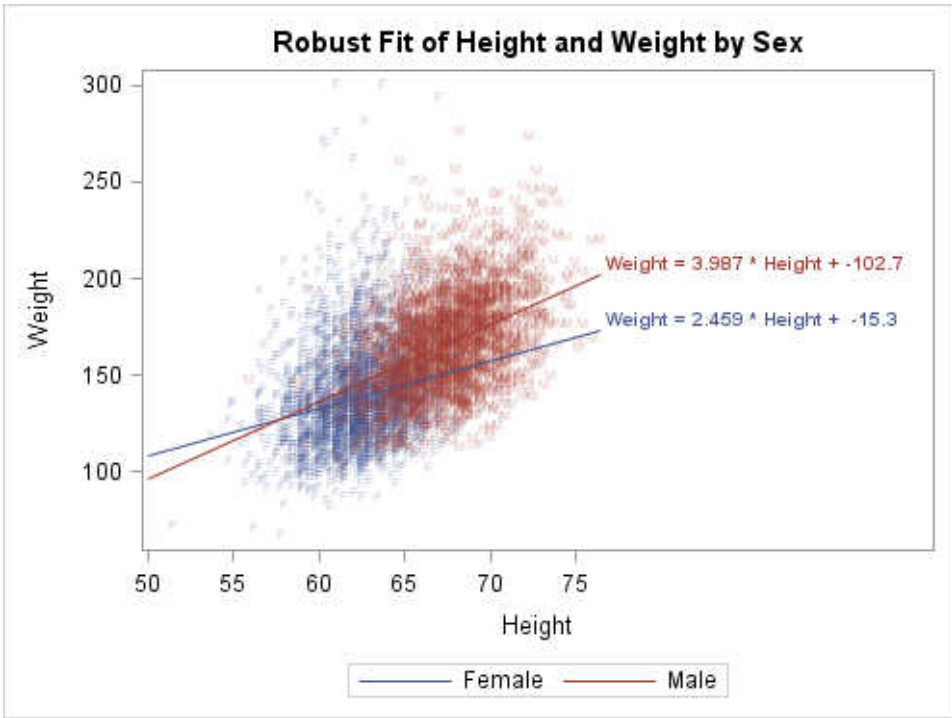
The LINEPARM statement creates a straight line. You can generate a single line by specifying a constant for each required argument. You can generate multiple lines by specifying a numeric column for any or all required arguments. If any of the X= or Y= columns contains a missing value, then no line is drawn. To request a vertical line, specify `SLOPE=.` (specify a missing value as a constant or column value).

A LINEPARM statement can be used in any layout except GRIDDED or OVERLAY3D layouts. The parent layout must include another plot statement that is derived from data values that establish a data range for the axes. For example, it can be used with a scatter plot or a histogram.

To draw vertical or horizontal reference lines, consider using the simpler REFERENCELINE statement.

Example: LINEPARM Statement

The following graph was generated by the "Example Program" on page 658:



Example Program

The LINEPARM statement draws a line based on a point and the slope of the line that passes through that point. You can use this statement to create a reference line with any slope or, in this example, to draw a fit from a linear regression. Many SAS/STAT procedures create output data sets containing a Y-intercept and slope and coefficient for the linear regression equation.

```
proc template;
 define statgraph lineparm;
  begingraph;
   entrytitle "Robust Fit of Height and Weight by Sex ";
   layout overlay / xaxisopts=(offsetmax=0.35);
    scatterplot x=height y=weight / group=sex
     markercharacter=eval(substr(sex,1,1))
     markercharacterattrs=(size=5pt) datatransparency=0.7;
    lineparm x=0 y=intercept slope=slope /
     name="Line" group=sex clip=true
     curvelabel=eval("Weight = "||put(slope,5.3)||
       " * Height + "||put(intercept,6.1))
     curvelabellocation=inside
     curvelabelattrs=(size=8pt);
    discretelegend "Line";
   endlayout;
  endgraph;
```

```
 end;
run;

proc sort data=sashelp.heart(keep=height weight sex)
     out=heart;
  by sex;
run;

ods exclude all;
proc robustreg data=heart method=m
     outest=stats(rename=(height=slope));
  by sex;
  model weight=height;
run;

data all;
  merge heart stats(keep=intercept slope sex);
run;

ods select all;
proc sgrender data=all template=lineparm;
run;
```

LOESSPLOT Statement

Creates a fitted loess curve computed from input data.

Restriction: The LOESSPLOT statement supports only models of one independent and one dependent variable.

Note: If the input data contains a large number of observations, then it might take several minutes to generate the plot.

Tips: By default, the LOESSPLOT statement will process up to 5000 observations. If the input data exceeds 5000 observations, then the plot is not generated. In that case, you can use the ODS GRAPHICS statement LOESSMAXOBS= option to extend the limit. See "Details" on page 671.

Starting with SAS 9.4M3, subpixel rendering is enabled by default. To disable subpixel rendering, specify SUBPIXEL=OFF in the BEGINGRAPH statement or in an ODS GRAPHICS statement. For information about the BEGINGRAPH statement SUBPIXEL= option, see SUBPIXEL= on page 39. For information about the ODS GRAPHICS statement SUBPIXEL= option, see "ODS GRAPHICS Statement" on page 1561.

Syntax

LOESSPLOT X=*numeric-column* | *expression*
Y=*numeric-column* | *expression* </<*regression-options*> <*options*>>;

Summary of Optional Arguments

Appearance options

DATATRANSPARENCY=*number*
: specifies the degree of the transparency of the loess curve.

INDEX=*positive-integer-column* | *expression*
: specifies indices for mapping line attributes (color and line pattern) to one of the GraphData1–GraphDataN style elements.

LINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
: specifies the attributes of the loess curve.

Axes options

PRIMARY=TRUE | FALSE
: specifies that the data columns for this plot and the plot type be used for determining default axis features.

XAXIS=X | X2
: specifies whether data are mapped to the primary X (bottom) axis or to the secondary X2 (top) axis.

YAXIS=Y | Y2
: specifies whether data are mapped to the primary Y (left) axis or to the secondary Y2 (right) axis.

Data tip options

TIPFORMAT=(*role-format-list*)
: specifies display formats for tip columns.

TIPLABEL=(*role-label-list*)
: specifies display labels for tip columns.

Label options

CURVELABEL=*"string"*
: specifies a label for the loess curve.

CURVELABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
: specifies the color and font attributes of the curve labels.

CURVELABELLOCATION=INSIDE | OUTSIDE
: specifies the location of the curve label relative to the plot area.

CURVELABELPOSITION=AUTO | MAX | MIN | START | END
: specifies the position of the curve label relative to the curve line.

CURVELABELSPLIT=TRUE | FALSE
: specifies whether to split the curve label at the specified split characters.

CURVELABELSPLITCHAR="*character-list*"
: specifies one or more characters on which the curve label can be split if needed.

CURVELABELSPLITCHARDROP=TRUE | FALSE
: specifies whether the split characters are included in the curve label text.

CURVELABELSPLITJUSTIFY=AUTO | CENTER | LEFT | RIGHT
: specifies the justification of the strings that are inside the curve label block.

LEGENDLABEL="*string*"
specifies a label to be used in a discrete legend for this plot.

Midpoint options

GROUP=*column | discrete-attr-var | expression*
creates a distinct set of curves from just the observations that correspond to each unique group value of the specified column.

INCLUDEMISSINGGROUP=TRUE | FALSE
specifies whether missing values of the group variable are included in the plot.

Plot reference options

NAME="*string*"
assigns a name to this plot statement for reference in other template statements.

Required Arguments

X=*numeric-column* | *expression*
specifies the column for the X values.

Y=*numeric-column* | *expression*
specifies the column for the Y values.

Optional Arguments

CURVELABEL="*string*"
specifies a label for the loess curve.

Default No curve label is displayed

Interaction This option is not valid when the GROUP= option is specified.

Tip The font and color attributes for the label are specified by the CURVELABELATTRS= option.

CURVELABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font attributes of the curve labels.

Default The GraphValueText style element.

Interactions For this option to take effect, the CURVELABEL= option must also be specified.

If the GROUP= option is specified, then this option is ignored.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Text Options" on page 1606 for available *text-options*.

CURVELABELLOCATION=INSIDE | OUTSIDE
specifies the location of the curve label relative to the plot area.

INSIDE
locates the labels inside the plot area

OUTSIDE
locates the labels outside the plot area

Default INSIDE

Restriction OUTSIDE cannot be used when the LOESSPLOT is used in multicell layouts such as LATTICE, DATAPANEL, or DATALATTICE, where axes might be external to the grid.

Interactions For this option to take effect, the CURVELABEL= option must also be specified.

This option is used in conjunction with the CURVELABELPOSITION= option to determine where the curve labels appear.

See "Location and Position of Curve Labels" on page 213

CURVELABELPOSITION=AUTO | MAX | MIN | START | END
specifies the position of the curve label relative to the curve line. This option is used in conjunction with the CURVELABELLOCATION= option to determine where the curve label appears.

AUTO
automatically positions the curve label near the curve boundary along unused axes whenever possible (typically Y2 and X2) in order to avoid collision with tick values.

Restriction This option is used only when CURVELABELPOSITION=OUTSIDE.

MAX
forces the curve label to appear near maximum curve values (typically, upper right).

MIN
forces the curve label to appear near minimum curve values (typically, lower left).

START
forces the curve label to appear near the beginning of the curve.

Restriction This option is used only when CURVELABELLOCATION=INSIDE.

Tip This option is particularly useful when the curve line has a spiral shape.

END
forces the curve label to appear near the end of the curve.

Restriction This option is used only when CURVELABELLOCATION=INSIDE.

Tip This option is particularly useful when the curve line has a spiral shape.

Defaults AUTO when CUVELABELLOCATION=OUTSIDE.

END when CURVELABELLOCATION=INSIDE.

Interactions For this option to take effect, the CURVELABEL= option must also be specified.

The AUTO setting is ignored if CURVELABELLOCATION=INSIDE is specified. The START and END settings are ignored if CURVELABELLOCATION=OUTSIDE is specified.

Note When you specify TICKVALUELIST=, VIEWMAX=, or VIEWMIN= in an axis statement, the data points that are used to determine the position of the curve label might fall outside of the graph area. In that case, the curve label might not be displayed or might be positioned incorrectly.

Tip When END is in effect, no attempt is made to avoid curve label collisions. If your curve labels collide, try using MAX instead.

See “Location and Position of Curve Labels” on page 213

CURVELABELSPLIT=TRUE | FALSE

specifies whether to split the curve label at the specified split characters. When a curve label is split, the label is split on each occurrence of the specified split characters.

Default FALSE. The curve label is not split.

Requirement The CURVELABEL= option must also be specified.

Interactions The CURVELABELSPLITCHAR= option specifies one or more characters on which the splits occur.

This option has no effect when CURVELABELPOSITION=AUTO.

See “boolean ” on page xii for other Boolean values that you can use.

CURVELABELSPLITCHAR="*character-list*"

specifies one or more characters on which the curve label can be split if needed. When multiple split characters are specified, each character in the list is treated as a separate split character unless the specified characters appear consecutively in the curve label. In that case, all of the specified split characters together are treated as a single split character.

When CURVELABEL= is specified and CURVELABELSPLIT=TRUE, the curve label is split unconditionally at each occurrence of any of the specified split characters. If the curve label does not contain any of the specified characters, then the label is not split.

"character-list"
one or more characters with no delimiter between each character and enclosed in quotation marks.

Default A blank space

Requirements The list of characters must be enclosed in quotation marks.

Multiple characters must be specified with no delimiters. For example, to specify the split characters a, b, and c, use the following option:

```
curvelabelsplitchar="abc"
```

The CURVELABEL= option and the CURVELABELSPLIT=TRUE option must also be specified.

Interactions This option has no effect if CURVELABELPOSITION=AUTO.

The CURVELABELSPLITCHARDROP= option specifies whether the split characters are included in the curve label or are dropped.

Notes When multiple characters are specified, the order of the characters in the list is not significant.

The split characters are case sensitive.

Tip Use the CURVELABELSPLITJUSTIFY= option to specify the justification of the strings in the curve label block.

CURVELABELSPLITCHARDROP=TRUE | FALSE
specifies whether the split characters are included in the curve label text.

TRUE
drops the split characters from the curve label text.

FALSE
includes the split characters in the curve label text.

When CURVELABELSPLIT=TRUE and CURVELABELSPLITCHARDROP=FALSE, each split character remains as the last character in the current line. The characters that follow the split character, up to and including the next split character, are then wrapped to the next line.

The following figure shows an example of a curve label with the following specifications:

- CURVELABELPOSITION=MAX
- CURVELABEL="Product*Group*A"
- CURVELABELSPLIT=TRUE
- CURVELABELSPLITCHARDROP=TRUE | FALSE
- CURVELABELSPLITCHAR="*"

Note: The horizontal line to the left of the label represents the maximum end of the curve for reference.

When CURVELABELSPLITCHARDROP=TRUE, the asterisks are removed from the label. When CURVELABELSPLITCHARDROP=FALSE, each asterisk remains as the last character in the line prior to the new line.

Default TRUE. The split characters are dropped from the curve label.

Requirement The CURVELABEL= option and the CURVELABELSPLIT=TRUE option must also be specified.

Interaction The CURVELABELSPLITCHAR= option specifies the split characters.

See "boolean " on page xii for other Boolean values that you can use.

CURVELABELSPLITJUSTIFY=AUTO | CENTER | LEFT | RIGHT
specifies the justification of the strings that are inside the curve label block.

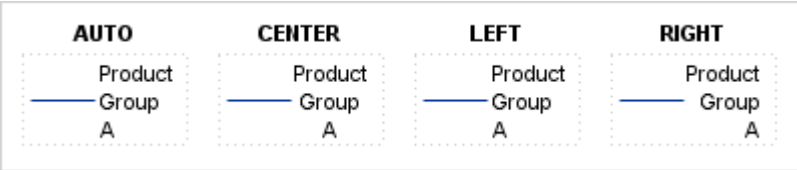
AUTO
justifies the labels based on the CURVELABELPOSITION= option.

CURVELABELPOSITION= Value	Justification
MAX or END	LEFT
MIN or START	RIGHT

CENTER
LEFT
RIGHT
justifies the labels center, left, or right, as specified.

The following figure shows an example in which CURVELABELPOSITION=MAX.

Note: The horizontal line to the left of each label represents the maximum end of the curve for reference.



In this case, because CURVELABELPOSITION=MAX, AUTO left-justifies the lines of text.

Default AUTO

Requirement The CURVELABEL= option and the CURVELABELSPLIT=TRUE option must also be specified.

Interaction This option has no effect if CURVELABELPOSITION=AUTO.

DATATRANSPARENCY=*number*

specifies the degree of the transparency of the loess curve.

Default 0

Range 0–1, where 0 is opaque and 1 is entirely transparent

GROUP=*column* | *discrete-attr-var* | *expression*

creates a distinct set of curves from just the observations that correspond to each unique group value of the specified column.

discrete-attr-var

specifies a discrete attribute map variable.

The discrete attribute map variable is created by a DISCRETEATTRVAR statement.

Restriction A discrete attribute map variable specification must be a direct reference to the attribute map variable. It cannot be set by a dynamic variable.

Default Each distinct group value might be represented in the plot by a different combination of color and line pattern. Line colors vary according to the ContrastColor attribute of the GraphData1–GraphDataN and GraphMissing style elements. Line patterns vary according to the LineStyle attribute of the GraphData1–GraphDataN style elements.

Restriction The input data must be sorted by the GROUP= column.

Interactions The group values are mapped in the order of the data, unless the INDEX= option is used to alter the default sequence of line colors and line patterns.

The INCLUDEMISSINGGROUP option controls whether missing group values are considered a distinct group value.

Tips The LINEATTRS= option can be used to override the representations that are used to identify the groups. For example, LINEATTRS=(PATTERN=SOLID) can be used to assign the same

pattern to all of the loess curves, letting the line color distinguish group values. Likewise, LINEATTRS=(COLOR=BLACK) can be used to assign the same color to all of the curves, letting the line pattern distinguish group values.

By default, ODS Graphics limits the number of groups to 1000. When this limit is exceeded, the GROUP= option is ignored. Use the GROUPMAX= option in the ODS GRAPHICS statement to change the maximum number of groups that can be processed.

See "DISCRETEATTRVAR Statement" on page 1516

INCLUDEMISSINGGROUP=TRUE | FALSE

specifies whether missing values of the group variable are included in the plot.

Default TRUE

Interaction For this option to take effect, the GROUP= option must also be specified.

Tip The attributes of the missing group value are determined by the GraphMissing style element unless a discrete attribute map is in effect, the INDEX= option is used, the MISSING= system option changes the default missing character, or a user-defined format is applied to the group value. In those cases, the attributes of the missing group value are determined by a GraphData1–GraphDataN style element instead of by the GraphMissing style element.

See "boolean " on page xii for other Boolean values that you can use.

INDEX=*positive-integer-column* | *expression*

specifies indices for mapping line attributes (color and line pattern) to one of the GraphData1–GraphDataN style elements.

Requirements The column or expression value must be an integer value of 1 or greater. Otherwise, this option is ignored.

The positive-integer column must not contain missing values. Otherwise, the entire column is invalidated and this option is ignored.

All of the indexes for a specific group value must be the same. Otherwise, the results are unpredictable.

Interaction For this option to take effect, the GROUP= option must also be specified.

Notes The index values are 1-based indices. For the style attributes in GraphData1–GraphDataN, if the index value is greater than N, then a modulo operation remaps that index value to a number less than N to determine which style to use.

If you do not use this option, then the group values are mapped in the order of the data.

Tip You can use indexing to collapse the number of groups that are represented in a graph. For more information, see "Remapping Groups for Grouped Data" on page 211.

LEGENDLABEL="*string*"
specifies a label to be used in a discrete legend for this plot.

Default The *string* specified on the NAME= option.

Restriction This option applies only to an associated DISCRETELEGEND statement.

Interaction If the GROUP= option is specified, then this option is ignored.

LINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the attributes of the loess curve.

Default The GraphFit style element.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

NAME="*string*"
assigns a name to this plot statement for reference in other template statements. The specified name is used primarily in legend statements to coordinate the use of colors and line patterns between the plot and the legend.

Restrictions The *string* is case sensitive, cannot contain spaces, and must define a unique name within the template.

This option does not support variables that are created by the DYNAMIC, MVAR, and NMVAR template statements.

Interaction The *string* is used as the default legend label if the LEGENDLABEL= option is not used.

PRIMARY=TRUE | FALSE
specifies that the data columns for this plot and the plot type be used for determining default axis features. This option is needed only when two or more plots within an overlay-type layout contribute to a common axis.

Default FALSE

Restriction This option is ignored if the plot is placed under a GRIDDED or LATTICE layout block.

Note In an OVERLAY layout, only one plot in an overlay can be the primary plot on a per-axis basis. When no plot is designated as the primary plot, the first plot that can be a primary plot is considered the primary plot. If multiple plots specify PRIMARY=TRUE for the same axis, then the last such plot encountered is considered the primary plot.

See "When Plots Share Data and a Common Axis" on page 1046

"boolean " on page xii for other Boolean values that you can use.

TIPFORMAT=(*role-format-list*)
specifies display formats for tip columns. This option provides a way to control the formats of columns that appear in data tips.

(role-format-list)
a space-separated list of *role-name = format* pairs.

Example `TIPFORMAT=(Y=6.2)`

Default The column format of the column assigned to the role or BEST6 if no format is assigned to a numeric column.

Requirement To enable data tips in the output, you must include an ODS GRAPHICS ON statement that specifies the IMAGEMAP option, and you must write the output to the ODS HTML destination.

Note The columns assigned to the X, Y, and GROUP (if assigned) roles are automatically included in the data tip information.

TIPLABEL=(*role-label-list*)
specifies display labels for tip columns. This option provides a way to control the labels of columns that appear in data tips.

role-label-list
a space-separated list of *rolename ="string"* pairs.

Example `TIPLABEL=(Y="Curve")`

Default The column label or column name of the column assigned to the role.

Note The columns assigned to the X, Y, and GROUP (if assigned) roles are automatically included in the data tip information.

XAXIS=X | X2
specifies whether data are mapped to the primary X (bottom) axis or to the secondary X2 (top) axis.

Default X

Interaction The overall plot specification and the layout type determine the axis display. For more information, see "How Axis Features Are Determined" on page 1040.

YAXIS=Y | Y2
specifies whether data are mapped to the primary Y (left) axis or to the secondary Y2 (right) axis.

Default Y

Interaction The overall plot specification and the layout type determine the axis display. For more information, see "How Axis Features Are Determined" on page 1040.

Loess Regression Options

ALPHA=*positive-number*
specifies the confidence level to compute.

Default 0.05

Range 0 < *number* < 1

Tip ALPHA=0.05 represents a 95% confidence level.

CLM=*"name"*
produces confidence limits for a mean predicted value for each observation. The confidence level is set by the ALPHA= option.

Interaction "*name*" is a unique name within the template that is case sensitive and cannot contain spaces. It must be assigned in order for the confidence limits to be computed. To display confidence limits, you must use this name as the required argument of a MODELBAND statement.

DEGREE=1 | 2
specifies the degree of the local polynomials to use for each local regression. The valid values are 1 for local linear fitting or 2 for local quadratic fitting.

Default 1

INTERPOLATION=LINEAR | CUBIC
specifies the degree of the interpolating polynomials used for blending local polynomial fits at the kd tree vertices.

CUBIC
cubic polynomials

LINEAR
linear polynomials

Default LINEAR

MAXPOINTS=*positive-integer*
specifies the maximum number of predicted points generated for the loess curve as well as confidence limits.

Default 201

SMOOTH=AUTO | *positive-number*
specifies a smoothing parameter value. The value represents the proportion of observations that are used for local regression.

AUTO
automatically selects a smoothing parameter value.

positive-number
specifies a smoothing parameter value.

Range (0,1]

See What is loess regression? on blogs.sas.com.

The LOESS Procedure in *SAS/STAT User's Guide* for information about the fitting methodology that the LOESSPLOT statement uses.

Default AUTO

REWEIGHT=NONE | *positive-integer*
specifies the number of iterative re-weighting steps to be done. Such iterations are appropriate when there are outliers in the data or when the error distribution is a symmetric long-tailed distribution.

Default NONE

WEIGHT=*numeric-column*
specifies a column in the input data set that contains values to be used as *a priori* weights for a loess fit. The values of the weight column must be nonnegative. If an observation's weight is zero, negative, or missing, then the observation is deleted from the analysis.

Details

The LOESSPLOT statement supports only statistical models of one independent and one dependent variable. For more information about the fitting methodology, see The LOESS Procedure in *SAS/STAT User's Guide*.

In addition to the loess curve, the LOESSPLOT statement can compute confidence levels for the fitted line. To display the confidence levels:

1. Use the CLM= option to declare a name for the confidence level of the mean .
2. Use a MODELBAND statement to refer this name. This statement draws a confidence band from this information. See "MODELBAND Statement" on page 673 for information about how to control the appearance of the confidence band.

By default, the LOESSPLOT statement will process up to 5000 observations. If the input data contains more than 5000 observations, then the plot is not drawn and the following note is written to the SAS log:

```
NOTE: The number of observations of the LOESS plot (nnnn) exceeds the
limit of 5000. Specify the LOESSMAXOBS option of the ODS GRAPHICS statement to
override the limit.
```

In that case, you can use the following statement to extend the limit:

```
ods graphics / loessmaxobs=nnnn
```

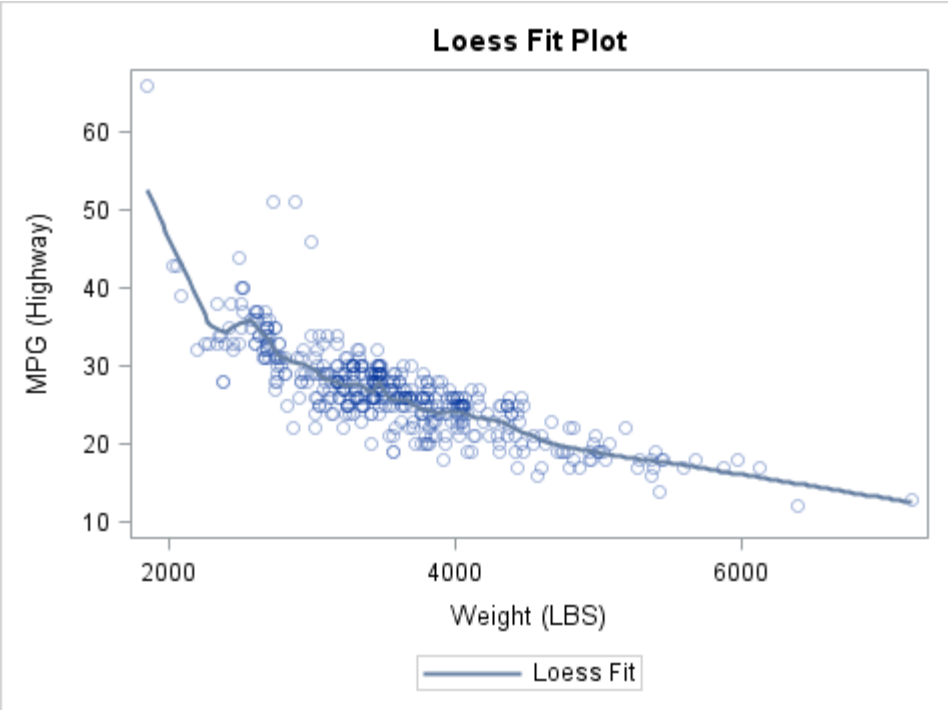
where *nnnn* is the new limit.

Note: When the input data contains a large number of observations, it might take several minutes to generate the plot.

For more information about the LOESSMAXOBS= option, see "ODS GRAPHICS Statement" on page 1561.

Example: LOESSPLOT Statement

The following graph was generated by the "Example Program" on page 672:



Example Program

```
proc template;
  define statgraph loessplot;
    begingraph;
      entrytitle "Loess Fit Plot";
      layout overlay;
        scatterplot x=weight y=mpg_highway /
          datatransparency=0.7;
        loessplot x=weight y=mpg_highway / name="fitline"
          alpha=0.05 legendlabel="Loess Fit";
        discretelegend "fitline";
      endlayout;
    endgraph;
```

```
  end;
run;

proc sgrender data=sashelp.cars template=loessplot;
run;
```

MODELBAND Statement

Creates a band showing confidence limits for an associated smoother plot.

Requirement: A MODELBAND statement must be associated with a smoother statement (LOESSPLOT, REGRESSIONPLOT, or PBSPLINEPLOT) that specifies a fitted model and a type of confidence level to compute.

Interaction: Starting with SAS 9.4M2, a confidence band that depicts confidence limits for individual predicted values (CLI) for a weighted spline plot or regression plot is displayed as a high-low chart instead of a band.

Note: Grouping in the MODELBAND statement is controlled by the smoother statement. To create a grouped model-band plot, specify the GROUP= option in the smoother statement.

Syntax

MODELBAND *"confidence-name"* </*options*>;

Summary of Optional Arguments

Appearance options

ANTIALIAS=AUTO | OFF
: specifies whether anti-aliasing is turned off for this plot.

DATATRANSPARENCY=*number*
: specifies the degree of the transparency of the band fill and the band outline.

DISPLAY=(*display-options*) | STANDARD | ALL
: specifies which band features to display.

FILLATTRS=*style-element* | *style-element* (*fill-options*) | (*fill-options*)
: specifies the appearance of the filled modelband area.

FILLPATTERNATTRS=*style-element* | (*fill-pattern-options*)
: specifies the appearance of the pattern-filled areas.

OUTLINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
: specifies the attributes of the modelband outlines.

Axes options

XAXIS=X | X2

specifies whether data are mapped to the primary X (bottom) axis or to the secondary X2 (top) axis.

YAXIS=Y | Y2
specifies whether data are mapped to the primary Y (left) axis or to the secondary Y2 (right) axis.

Data tip options

TIPFORMAT=(*role-format-list*)
specifies display formats for tip columns.

TIPLABEL=(*role-label-list*)
specifies display labels for tip columns.

Label options

CURVELABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font attributes of the upper and lower band labels.

CURVELABELLOCATION=INSIDE | OUTSIDE
specifies the location of the band labels relative to the plot area.

CURVELABELLOWER="*string*"
specifies a label for the lower band limit.

CURVELABELPOSITION=AUTO | MAX | MIN | START | END
specifies the position of the band label relative to the band line.

CURVELABELSPLIT=TRUE | FALSE
specifies whether to split the curve labels at the specified split characters.

CURVELABELSPLITCHAR="*character-list*"
specifies one or more characters on which the curve labels can be split if needed.

CURVELABELSPLITCHARDROP=TRUE | FALSE
specifies whether the split characters are included in the curve label text.

CURVELABELSPLITJUSTIFY=AUTO | CENTER | LEFT | RIGHT
specifies the justification of the strings that are inside the curve label blocks.

CURVELABELUPPER="*string*"
specifies a label for the upper band limit.

LEGENDLABEL="*string*"
specifies a label to be used in a discrete legend for this plot.

Plot reference options

NAME="*string*"
assigns a name to this plot statement for reference in other template statements.

Required Argument

"confidence-name"
specifies the case-sensitive name assigned to a confidence option in a smoother plot statement.

Requirement *confidence-name* must have been assigned to the CLM= or CLI= option on a smoother plot statement such as LOESSPLOT, REGRESSIONPLOT, or PBSPLINEPLOT.

Optional Arguments

ANTIALIAS=AUTO | OFF
specifies whether anti-aliasing is turned off for this plot.

Note: This feature applies to SAS 9.4M2 and to later releases.

AUTO
specifies that anti-aliasing is controlled by the ANTIALIAS= option in the ODS GRAPHICS statement.

OFF
specifies that anti-aliasing is always disabled for this plot.

Default AUTO

Interaction This option overrides the ANTIALIAS= option in the ODS GRAPHICS statement.

CURVELABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font attributes of the upper and lower band labels.

Default The GraphValueText style element.

Interactions For this option to take effect, the CURVELABELLOWER= or CURVELABELUPPER= option must also be specified.

If the smoother statement's GROUP= option is specified, then this option is ignored.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Text Options" on page 1606 for available *text-options*.

CURVELABELLOWER=*"string"*
specifies a label for the lower band limit.

Default No curve label is displayed for the lower band

Interaction If the smoother statement's GROUP= option is specified, then this option is ignored.

Tip The font and color attributes for the label are specified by the CURVELABELATTRS= option.

CURVELABELUPPER=*"string"*
specifies a label for the upper band limit.

Default No curve label is displayed for the upper band

Interaction If the smoother statement's GROUP= option is specified, then this option is ignored.

Tip The font and color attributes for the label are specified by the CURVELABELATTRS= option.

CURVELABELLOCATION=INSIDE | OUTSIDE
specifies the location of the band labels relative to the plot area.

INSIDE
locates the labels inside the plot area

OUTSIDE
locates the labels outside the plot area

Default INSIDE

Restriction OUTSIDE cannot be used when the MODELBAND is used in multi-cell layouts such as LATTICE, DATAPANEL, or DATALATTICE, where axes might be external to the grid.

Interactions For this option to take effect, the CURVELABELLOWER= or CURVELABELUPPER= option must also be specified.

This option is used in conjunction with the CURVELABELPOSITION= option to determine where the band labels appear.

See "Location and Position of Curve Labels" on page 213

CURVELABELPOSITION=AUTO | MAX | MIN | START | END
specifies the position of the band label relative to the band line.

AUTO
automatically positions the band labels near the band boundary along unused axes whenever possible (typically Y2 and X2).

Restriction This option is used only when CURVELABELPOSITION=OUTSIDE.

MAX
forces the band label to appear near maximum band values (typically, upper right)

MIN
forces the band label to appear near minimum band values (typically, lower left)

START
forces the band label to appear near the beginning of the band.

Restriction This option is used only when CURVELABELLOCATION=INSIDE.

Tip This option is particularly useful when the curve line has a spiral shape.

END
forces the band label to appear near the end of the band.

Restriction This option is used only when CURVELABELLOCATION=INSIDE.

Tip This option is particularly useful when the curve line has a spiral shape.

Defaults AUTO when CUVELABELLOCATION=OUTSIDE.

END when CURVELABELLOCATION=INSIDE.

Restrictions The AUTO setting is ignored if CURVELABELLOCATION=INSIDE is specified.

The START and END settings are ignored if CURVELABELLOCATION=OUTSIDE is specified.

Interactions For this option to take effect, the CURVELABELLOWER= or CURVELABELUPPER= option must also be specified.

This option is used in conjunction with the CURVELABELLOCATION= option to determine where the band label appears.

Note When you specify TICKVALUELIST=, VIEWMAX=, or VIEWMIN= in an axis statement, the data points that are used to determine the position of the band label might fall outside of the graph area. In that case, the band label might not be displayed or might be positioned incorrectly.

Tip When END is in effect, no attempt is made to avoid curve label collisions. If your curve labels collide, try using MAX instead.

See “Location and Position of Curve Labels” on page 213

CURVELABELSPLIT=TRUE | FALSE
specifies whether to split the curve labels at the specified split characters. When a curve label is split, the label is split on each occurrence of the specified split characters.

Default FALSE. The curve label is not split.

Requirement The CURVELABEL= option must also be specified.

Interactions The CURVELABELSPLITCHAR= option specifies one or more characters on which the splits occur.

This option has no effect when CURVELABELPOSITION=AUTO.

See “boolean ” on page xii for other Boolean values that you can use.

CURVELABELSPLITCHAR="*character-list*"
specifies one or more characters on which the curve labels can be split if needed. When multiple split characters are specified, each character in the list is treated as a separate split character unless the specified characters appear consecutively in the curve label. In that case, all of the specified split characters together are treated as a single split character.

When CURVELABEL= is specified and CURVELABELSPLIT=TRUE, the curve labels are split unconditionally at each occurrence of any of the specified split characters. If the curve label does not contain any of the specified characters, then the label is not split.

"character-list"
one or more characters with no delimiter between each character and enclosed in quotation marks.

Default A blank space

Requirements The list of characters must be enclosed in quotation marks.

Multiple characters must be specified with no delimiters. For example, to specify the split characters a, b, and c, use the following option:

```
curvelabelsplitchar="abc"
```

The CURVELABEL= option and the CURVELABELSPLIT=TRUE option must also be specified.

Interactions This option has no effect if CURVELABELPOSITION=AUTO.

The CURVELABELSPLITCHARDROP= option specifies whether the split characters are included in the curve labels or are dropped.

Notes When multiple characters are specified, the order of the characters in the list is not significant.

The split characters are case sensitive.

Tip Use the CURVELABELSPLITJUSTIFY= option to specify the justification of the strings in the curve label blocks.

CURVELABELSPLITCHARDROP=TRUE | FALSE
specifies whether the split characters are included in the curve label text.

TRUE
drops the split characters from the curve label text.

FALSE
includes the split characters in the curve label text.

When CURVELABELSPLIT=TRUE and CURVELABELSPLITCHARDROP=FALSE, each split character remains as the last character in the current line. The characters that follow the split character, up to and including the next split character, are then wrapped to the next line.

The following figure shows an example of a curve label with the following specifications:

- CURVELABELPOSITION=MAX
- CURVELABEL="Product*Group*A"
- CURVELABELSPLIT=TRUE
- CURVELABELSPLITCHARDROP=TRUE | FALSE
- CURVELABELSPLITCHAR="*"

Note: The horizontal line to the left of the label represents the maximum end of the series line for reference.

When CURVELABELSPLITCHARDROP=TRUE, the asterisks are removed from the label. When CURVELABELSPLITCHARDROP=FALSE, each asterisk remains as the last character in the line prior to the new line.

Default TRUE. The split characters are dropped from the curve labels.

Requirement The CURVELABEL= option and the CURVELABELSPLIT=TRUE option must also be specified.

Interaction The CURVELABELSPLITCHAR= option specifies the split characters.

See "boolean " on page xii for other Boolean values that you can use.

CURVELABELSPLITJUSTIFY=AUTO | CENTER | LEFT | RIGHT
specifies the justification of the strings that are inside the curve label blocks.

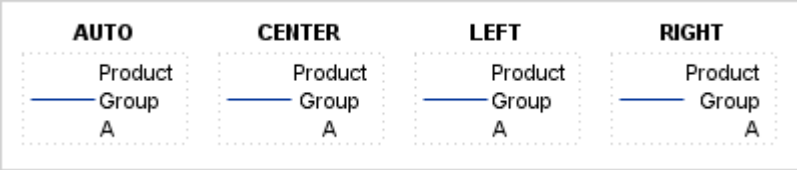
AUTO
justifies the labels based on the CURVELABELPOSITION= option.

CURVELABELPOSITION= Value	Justification
MAX or END	LEFT
MIN or START	RIGHT

CENTER
LEFT
RIGHT
justifies the labels center, left, or right, as specified.

The following figure shows an example in which CURVELABELPOSITION=MAX.

Note: The horizontal line to the left of each label represents the maximum end of the band for reference.



In this case, because CURVELABELPOSITION=MAX, AUTO left-justifies the lines of text.

Default AUTO

Requirement The CURVELABEL= option and the CURVELABELSPLIT=TRUE option must also be specified.

Interaction This option has no effect if CURVELABELPOSITION=AUTO.

DATATRANSPARENCY=*number*
specifies the degree of the transparency of the band fill and the band outline.

Default 0

Range 0–1, where 0 is opaque and 1 is entirely transparent

Note This option does not affect the curve label.

Tip The FILLATTRS= option can be used to set transparency for just the filled band area. You can combine this option with FILLATTRS= to set one transparency for the band fill but a different transparency for the band fill. Example:

```
datatransparency=0.2 fillattrs=(transparency=0.6)
```

DISPLAY=(*display-options*) | STANDARD | ALL
specifies which band features to display.

(*display-options*)
specifies a space-separated list of one or more display options, enclosed in parentheses.

The list can contain one or more of the following options:

FILL
displays the band fill color

OUTLINE
displays the band outline

STANDARD
specifies FILL only

ALL
specifies all features: FILL and OUTLINE

Default The GraphBand:DisplayOpts style reference.

Tip Use the OUTLINEATTRS= and FILLATTRS= options to control the appearance of the band.

FILLATTRS=*style-element* | *style-element* (*fill-options*) | (*fill-options*)
specifies the appearance of the filled modelband area.

Defaults For non-grouped data, the GraphConfidence:Color style reference.

For grouped data, the GraphData1:Color–GraphDataN:Color style references.

Interaction For this option to have any effect, the fill must be enabled by the ODS style or the DISPLAY= option.

Note Grouping in the MODELBAND statement is controlled by the smoother statement. To create a grouped model-band plot, specify the GROUP= option in the smoother statement.

Tip The DATATRANSPARENCY= option sets the transparency for band outline and the band fill. You can combine this option with DATATRANSPARENCY= to set one transparency for the band outline but a different transparency for the band fill. Example:

```
datatransparency=0.2 fillattrs=(transparency=0.6)
```

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Fill Color Options" on page 1600 for available *fill-options*.

FILLPATTERNATTRS=*style-element* | (*fill-pattern-options*)
specifies the appearance of the pattern-filled areas.

Note: This feature applies to SAS 9.4M5 and to later releases.

Defaults For non-grouped data, the ContrastColor and FillPattern attributes of GraphDataDefault.

For grouped data, the ContrastColor and FillPattern attributes of GraphData1–GraphDataN.

Interaction For this option to take effect, the DISPLAY= option must include FILLPATTERN among the display options.

Note Grouping in the MODELBAND statement is controlled by the smoother statement. To create a grouped model-band plot, specify the GROUP= option in the smoother statement.

Tip In order to change the fill pattern for each group value in ODS styles such as HTMLBlue that use color-priority attribute rotation, specify ATTRPRIORITY=NONE in an ODS GRAPHICS statement or in the BEGINGRAPH statement in your graph template. For more

information, see "Attribute Rotation Patterns" in *SAS Graph Template Language: User's Guide*.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Fill Pattern Options" on page 1601 for available *fill-pattern-options*.

LEGENDLABEL="*string*"
specifies a label to be used in a discrete legend for this plot.

Default The *string* specified on the NAME= option.

Restriction This option applies only to an associated DISCRETELEGEND statement.

Interaction The smoother statement's GROUP= option overrides this option.

NAME="*string*"
assigns a name to this plot statement for reference in other template statements. The specified name is used primarily in legend statements to coordinate the use of colors and line patterns between the plot and the legend.

Restrictions The *string* is case sensitive, cannot contain spaces, and must define a unique name within the template.

This option does not support variables that are created by the DYNAMIC, MVAR, and NMVAR template statements.

Interaction The *string* is used as the default legend label if the LEGENDLABEL= option is not used.

OUTLINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the attributes of the modelband outlines.

Defaults For non-grouped data, the GraphConfidence style element.

For grouped data, the GraphData1: ContrastColor–GraphDataN:ContrastColor style references.

Interaction If DISPLAY=(FILL), then this option has no effect.

Note Grouping in the MODELBAND statement is controlled by the smoother statement. To create a grouped model-band plot, specify the GROUP= option in the smoother statement.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

TIPFORMAT=(*role-format-list*)
specifies display formats for tip columns. This option provides a way to control the formats of columns that appear in data tips.

(role-format-list)

a space-separated list of *role-name = format* pairs. The *role-names* X, LIMITLOWER, LIMITUPPER, GROUP, and INDEX are available to indicate which data tip values to format.

Example
```
TIPFORMAT=(LIMITUPPER=5.3 LIMITLOWER=5.3)
```

Default The column format of the column assigned to the role or BEST6 if no format is assigned to a numeric column.

Requirement To enable data tips in the output, you must include an ODS GRAPHICS ON statement that specifies the IMAGEMAP option, and you must write the output to the ODS HTML destination.

TIPLABEL=(*role-label-list*)

specifies display labels for tip columns. This option provides a way to control the labels of columns that appear in data tips.

role-label-list

a space-separated list of *rolename* ="*string*" pairs. The *role-names* X, LIMITLOWER, LIMITUPPER, GROUP, and INDEX are available to indicate which data tip values to label.

Example
```
TIP=(X)
TIPLABEL=(X="Type")
```

Default The column label or column name of the column assigned to the role.

XAXIS=X | X2

specifies whether data are mapped to the primary X (bottom) axis or to the secondary X2 (top) axis.

Default X

Requirement The setting for this option should be the same as for the smoother statement referenced by the confidence-name .

Interaction The overall plot specification and the layout type determine the axis display. For more information, see "How Axis Features Are Determined" on page 1040.

YAXIS=Y | Y2

specifies whether data are mapped to the primary Y (left) axis or to the secondary Y2 (right) axis.

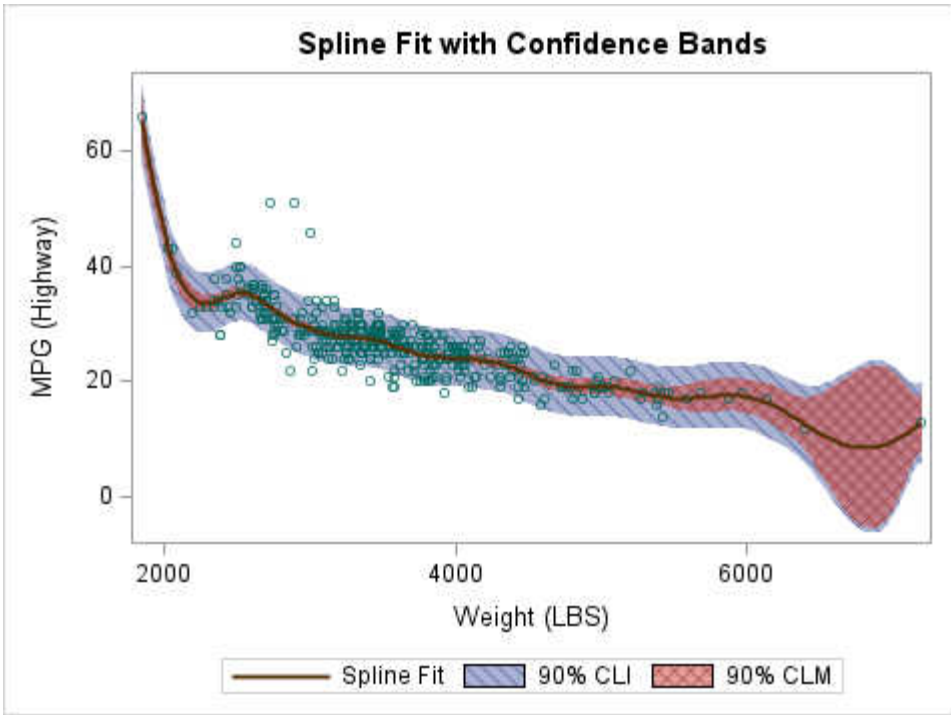
Default Y

Requirement The setting for this option should be the same as for the smoother statement referenced by the confidence-name .

Interaction The overall plot specification and the layout type determine the axis display. For more information, see "How Axis Features Are Determined" on page 1040.

Example: MODELBAND Statement

The following graph was generated by the "Example Program" on page 684:



Example Program

```
proc template;
   define statgraph modelband;
      begingraph / attrpriority=none;
         entrytitle "Spline Fit with Confidence Bands";
         layout overlay / cycleattrs=true;
            modelband "cliband" / name="confband1" display=all
               legendlabel="90% CLI" datatransparency=0.4;
            modelband "clmband" / name="confband2" display=all
               legendlabel="90% CLM" datatransparency=0.4;
            scatterplot x=weight y=mpg_highway /
               markerattrs=(size=4pt symbol=circle)
               datatransparency=0.3;
            pbsplineplot x=weight y=mpg_highway / name="fitline"
               clm="clmband" cli="cliband"
               alpha=0.1 legendlabel="Spline Fit"
               lineattrs=(pattern=solid thickness=2px);
            discretelegend "fitline" "confband1" "confband2";
         endlayout;
      endgraph;
   end;
run;

proc sgrender data=sashelp.cars template=modelband;
```

```
run;
```

MOSAICPLOTPARM Statement

Creates a mosaic plot from pre-summarized categorical data.

Restriction: You can use the MOSAICPLOTPARM statement in GRIDDED, LATTICE, and REGION layouts only.

Note: On z/OS hosts, the mosaic plot categories might appear in an order other than data order.

Syntax

MOSAICPLOTPARM CATEGORY=(*column-list*)
COUNT=*non-negative-numeric-column* | *expression* < */options* >;

Summary of Optional Arguments

Appearance options

COLORGROUP=*column* | *discrete-attr-var*
: specifies the category column to use for discrete fill colors for the tiles.

COLORMODEL=*color-ramp-style-element* | (*color-list*)
: specifies a color ramp to use with the COLORRESPONSE= option.

COLORRESPONSE=*numeric-column* | *range-attr-var* | *expression*
: specifies a numeric column to use to map tile fill colors to a continuous gradient.

DATATRANSPARENCY=*number*
: specifies the degree of the transparency of the tile fill, outlines, and the values that are located inside the tiles if those values are displayed.

DISPLAY=(*display-options*) | STANDARD | ALL
: specifies which mosaic-plot features to display.

FILLATTRS=*style-element* | (*fill-options*)
: specifies the appearance of the tile fill areas.

GUTTER=*dimension* | (*dimension-list*)
: specifies the gutter (gap) between the splits.

OUTLINEATTRS=*style-element* | (*line-options*)
: specifies the appearance of the tile outlines.

REVERSECOLORMODEL=TRUE | FALSE
: specifies whether to reverse the gradient (color ramp) that is defined by either the ODS style that is in effect or by the COLORMODEL= option.

SQUARED=TRUE | FALSE
: specifies that a square aspect ratio be used for the plot area.

Data tip options

ROLENAME=(*role-name-list*)
: specifies user-defined roles that can be used to display information in the data tips.

TIP=(*role-list*) | NONE
: specifies the information that is displayed when the cursor is positioned over a tile.

TIPFORMAT=(*role-format-list*)
: specifies display formats for tip columns.

TIPLABEL=(*role-label-list*)
: specifies display labels for tip columns.

Label options

INSIDEVALUEATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
: specifies the color and font attributes of the category values when they are located inside a tile.

LABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
: specifies the color and font attributes of the category labels.

LEGENDLABEL="*string*"
: specifies a label to be used in a discrete legend for this plot.

VALUEATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
: specifies the color and font attributes of the category values that are located outside of the tiles.

VALUELOCATION=AUTO | INSIDE | OUTSIDE
: specifies the location of the category column values in a two-way plot.

XVALUEFITPOLICY=ROTATE | NONE
: specifies a policy for avoiding collisions along the width of the plot among category values that are outside of the tiles.

YVALUEFITPOLICY=NONE | ROTATEALWAYS
: specifies a policy for avoiding collisions along the height of the plot among category values that are outside of the tiles.

ODS options

URL=*string-column*
: specifies the URL of an HTML page to display when a tile is selected.

Plot reference options

NAME="*string*"
: assigns a name to this plot statement for reference in other template statements.

Required Arguments

CATEGORY=(*column-list*)
specifies a list of columns of category (classification) values.

Restriction No more than three columns can be specified.

Note When a SAS data set is plotted, the category values are arranged in data order. When a CAS in-memory table is plotted, the category values are arranged in ascending order of the formatted character values or the unformatted numeric values of the category column or columns.

COUNT=*non-negative-numeric-column* | *expression*
specifies the column of counts (pre-summarized) for each of the category value combinations.

Restriction The column values cannot be negative.

Tip You need to provide only the category crossings with nonzero counts.

Optional Arguments

COLORGROUP=*column* | *discrete-attr-var*
specifies the category column to use for discrete fill colors for the tiles.

discrete-attr-var
specifies a discrete attribute map variable.

The discrete attribute map variable is created by a DISCRETEATTRVAR statement.

Restriction A discrete attribute map variable specification must be a direct reference to the attribute map variable. It cannot be set by a dynamic variable.

Each unique value of this column is mapped to the Color attribute of the GraphData1–GraphDataN style elements that are in effect. If a discrete attribute map variable is specified, the color mapping from its associated DISCRETEATTRMAP statement is used.

Restriction This column or the associated column in the discrete attribute map variable must be one of the columns in the category column list.

Interactions This option is ignored if the COLORRESPONSE= option is specified.

This option overrides the FILLATTRS= option.

Note If you specify a column in a SAS data set, colors are mapped to group values in data order. If you specify a column in a CAS in-memory table, colors are mapped to group values in ascending order of the group column character values or unformatted numeric values.

COLORMODEL=*color-ramp-style-element* | (*color-list*)
specifies a color ramp to use with the COLORRESPONSE= option.

color-ramp-style-element
specifies the name of a color-ramp style element.

The style element should contain these style attributes:

STARTCOLOR
specifies the color for the smallest data value of the COLORRESPONSE= column.

NEUTRALCOLOR
specifies the color for the midpoint of the range of the COLORRESPONSE= column.

ENDCOLOR
specifies the color for the highest data value of the COLORRESPONSE= column.

(*color-list*)
specifies a space-separated list of colors to use in the color ramp. You can use style attribute references such as GraphData3:Color, color names, or RGB, CMYK, HLS, and HSV (HSB) color codes to specify a color. The list can contain a mix of style attribute references, color names, and color codes.

Requirement The list of colors must be enclosed in parentheses.

See "color " on page xii

Default The ThreeColorRamp style element

Interaction For this option to take effect, the COLORRESPONSE= option must also be specified.

Tip To reverse the start and end colors of the ramp that is assigned to the color model, use the REVERSECOLORMODEL= option.

COLORRESPONSE=*numeric-column* | *range-attr-var* | *expression*
specifies a numeric column to use to map tile fill colors to a continuous gradient.

range-attr-var
specifies a range attribute map variable that is defined in a RANGEATTRVAR statement.

"RANGEATTRVAR Statement"

Restriction A range attribute map variable specification must be a direct reference to the attribute map variable. It cannot be set as a dynamic variable.

See "RANGEATTRVAR Statement" on page 1531

When a numeric column or expression is specified, the range of column or expression values are linearly mapped to the color ramp that is specified by the COLORMODEL= option. When a range attribute map variable is specified, the colors that are defined in the associated range attribute map are used instead.

Interactions When fill is displayed, this option overrides suboption COLOR= in the FILLATTRS= option and varies the fill color according to the color gradient or the attribute map.

When only the outlines are displayed, this option overrides suboption COLOR= in the OUTLINEATTRS= option and varies the outline color according to the color gradient or the attribute map.

Tip To display a legend with this option in effect, use a CONTINUOUSLEGEND statement.

DATATRANSPARENCY=*number*
specifies the degree of the transparency of the tile fill, outlines, and the values that are located inside the tiles if those values are displayed.

Default 0

Range 0–1, where 0 is opaque and 1 is entirely transparent

Restriction The specified transparency is not applied to missing values. Missing values are always opaque.

DISPLAY=(*display-options*) | STANDARD | ALL
specifies which mosaic-plot features to display.

display-options
a space-separated list of one or more display options, enclosed in parentheses.

The list can contain one or more of the following options:

FILL
displays filled tiles

OUTLINE
displays the tile outline

LABELS
displays the category column labels

TICKS
displays the category ticks

VALUES
displays the category values

STANDARD
specifies FILL, OUTLINE, LABELS, and VALUES

ALL
specifies all features: FILL, OUTLINE, LABELS, TICKS, and VALUES

Default STANDARD

Interactions If neither FILL nor OUTLINE are present in the display-options list, then filled and outlined tiles are displayed.

If YVALUELOCATION=INSIDE or if YVALUELOCATION=AUTO and is effectively set to INSIDE, then the axis ticks are not displayed even if the display of the ticks is specified for the axis.

FILLATTRS=*style-element* | (*fill-options*)
specifies the appearance of the tile fill areas. See "General Syntax for Attribute Options" on page 1599 for the syntax on using a style element. See "Fill Color Options" on page 1600 for the available fill options.

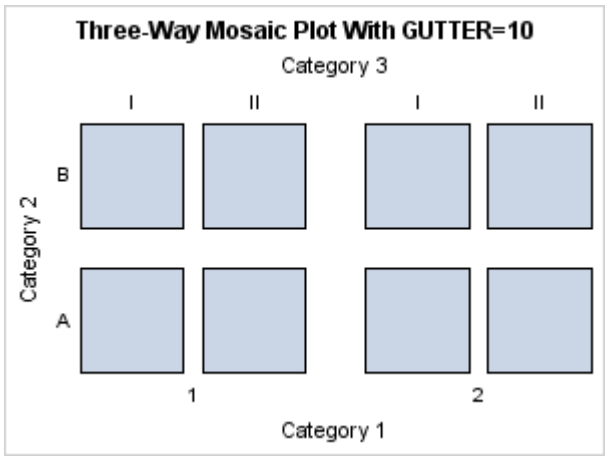
Default The GraphDataDefault style element

Interaction When COLORRESPONSE= is in effect and the DISPLAY= option enables FILL display, the FILLATTRS= suboption COLOR= is ignored, and the fill colors vary according to the gradient.

Note When *style-element* is specified, only the style element's Color attribute is used.

GUTTER=*dimension* | (*dimension-list*)
specifies the gutter (gap) between the splits. The splits occur in the following way:

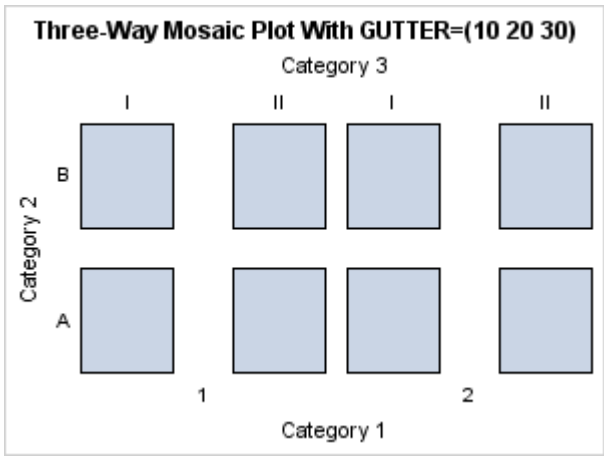
- When a single dimension is specified, the dimension applies to the gap for the last split, which has the smallest gap. From the next-to-last last split to the first split, the gutter is doubled on each split. A single dimension has the effect of setting a minimum gap for the plot. The following figure shows an example in which GUTTER=10.



Note: The plot contains equally sized tiles for demonstration purposes.

In this case, the gaps are 30 pixels for the first split, 20 pixels for the second split, and 10 pixels for the third split (minimum gap).

- When a list of dimension values is used, the values apply to each split in the order in which they are specified. The following figure shows an example in which GUTTER=(10 20 30).



In this case, the gaps are 10 pixels for the first split, 20 pixels for the second split, and 30 pixels for the third split.

Default 3px. Dimensions with no units are assumed to be in pixels.

See "dimension" on page xiii

INSIDEVALUEATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)

specifies the color and font attributes of the category values when they are located inside a tile. See "General Syntax for Attribute Options" on page 1599for the syntax on using a style element. See "Text Options" on page 1606 for the available text options.

Default The GraphValueText style element.

Interaction If one or more text options are specified and they do not include all the font properties such as color, family, size, weight, and style, then the non-specified properties are derived from the GraphValueText style element.

Note When *style-element* is specified, only the element's COLOR, FONTFAMILY, FONTSIZE, FONTSTYLE, and FONTWEIGHT attributes are used.

Tip You can use the VALUEATTRS= option to change the text attributes for the values that are located outside the plot area.

LABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)

specifies the color and font attributes of the category labels. See "General Syntax for Attribute Options" on page 1599for the syntax on using a style element. See "Text Options" on page 1606 for the available text options.

Default The GraphLabelText style element.

Interaction If one or more text options are specified and they do not include all the font properties such as color, family, size, weight, and style, then the non-specified properties are derived from the GraphLabelText style element.

Note When *style-element* is specified, only the style element's COLOR, FONTFAMILY, FONTSIZE, FONTSTYLE, and FONTWEIGHT attributes are used.

LEGENDLABEL="*string*"
specifies a label to be used in a discrete legend for this plot.

Default The *string* specified on the NAME= option.

Restriction This option applies only to an associated DISCRETELEGEND statement.

Interaction If the COLORGROUP= option is in effect, then this option is ignored.

NAME="*string*"
assigns a name to this plot statement for reference in other template statements. The specified name is used primarily in legend statements to coordinate the use of colors and line patterns between the plot and the legend.

Restrictions The *string* is case sensitive, cannot contain spaces, and must define a unique name within the template.

This option does not support variables that are created by the DYNAMIC, MVAR, and NMVAR template statements.

Interaction The *string* is used as the default legend label if the LEGENDLABEL= option is not used.

OUTLINEATTRS=*style-element* | (*line-options*)
specifies the appearance of the tile outlines. See "General Syntax for Attribute Options" on page 1599for the syntax on using a style element. See "Line Options" on page 1602 for the available line options.

Default The GraphOutlines style element.

Interaction When the COLORRESPONSE= and DISPLAY=(OUTLINE) options are in effect, the OUTLINEATTRS= suboption COLOR= is ignored, and the outline colors vary according to the gradient.

Note When *style-element* is used, only the style element's ContrastColor, LineStyle, and LineThickness are used.

REVERSECOLORMODEL=TRUE | FALSE
specifies whether to reverse the gradient (color ramp) that is defined by either the ODS style that is in effect or by the COLORMODEL= option.

Default FALSE

See COLORMODEL=

"boolean " on page xii for other Boolean values that you can use.

ROLENAME=(*role-name-list*)
specifies user-defined roles that can be used to display information in the data tips. This option provides a way to add to the data columns that appear in data tips that are specified by the TIP= option.

(*role-name-list*)
a space-separated list of *role-name = column* pairs.

Example The following example assigns the column Obs to the user-defined role TIP:
```
ROLENAME=(TIP1=OBS)
```

Default No user-defined roles

Requirement The role names that you choose must be unique and different from the predefined roles. The predefined roles are CATEGORY1–CATEGORY*n* (in the order in which they are specified in the CATEGORY= option), COUNT, COLORGROUP, and COLORRESPONSE.

SQUARED=TRUE | FALSE
specifies that a square aspect ratio be used for the plot area.

Default FALSE

Restriction This option applies to multi-way plots only.

Tip Setting this option to TRUE makes the height of the plot the same as its width, which can make it easier to compare the proportions.

See "boolean " on page xii for other Boolean values that you can use.

TIP=(*role-list*) | NONE
specifies the information that is displayed when the cursor is positioned over a tile. If this option is used, then all of the information that is displayed by default is replaced. Roles for columns that do not contribute to the bar chart can be specified along with roles that do.

(*role-list*)
an ordered, space-separated list of unique MOSAICPLOTPARM roles and user-defined roles.

The MOSAICPLOTPARM roles include COUNT, COLORGROUP, and COLORRESPONSE. User-defined roles are defined with the ROLENAME= option.

NONE
suppresses data tips and URLs (if requested) from the plot.

Default The columns that are assigned to the category columns and COUNT roles are automatically included in the data tip information.

Requirement To generate data tips, you must include an ODS GRAPHICS ON statement with the IMAGEMAP option specified. You must also write the graphs to the ODS HTML destination.

Interaction The labels and formats for the TIP roles can be controlled with the TIPLABEL= and TIPFORMAT= options.

Example To display data tips for the columns that are assigned to the roles X and Y as well as the user-defined role TIP1:

```
ROLENAME=(TIP1=OBS)
TIP=(TIP1 X Y)
```

TIPFORMAT=(*role-format-list*)

specifies display formats for tip columns. This option provides a way to control the formats of columns that appear in data tips.

(role-format-list)

a space-separated list of *role-name* = *format* pairs.

Example

```
ROLENAME=(TIP1=SALARY)
TIP=(TIP1)
TIPFORMAT=(TIP1=DOLLAR12.)
```

Default The column format of the column assigned to the role or BEST6 if no format is assigned to a numeric column.

Restriction Only the roles that appear in the TIP= option are used.

Requirement A column must be assigned to each of the specified roles. (See the ROLENAME= option.)

Note This option is no longer supported starting with SAS 9.4M4. To format tip values in SAS 9.4M4 and in later releases, use a FORMAT statement in the SGRENDER procedure step. See "FORMAT Statement" in *SAS ODS Graphics: Procedures Guide*.

TIPLABEL=(*role-label-list*)

specifies display labels for tip columns. This option provides a way to control the labels of columns that appear in data tips.

role-label-list

a space-separated list of *rolename* ="*string*" pairs.

Example

```
ROLENAME=(TIP1=PCT)
TIP=(TIP1)
TIPLABEL=(TIP1="Percent")
```

Default The column label or column name of the column assigned to the role.

Restriction Only the roles that appear in the TIP= option are used.

Requirement A column must be assigned to each of the specified roles. (See the ROLENAME= option.)

URL=*string-column*
specifies the URL of an HTML page to display when a tile is selected.

string-column
specifies a column that contains a valid HTML page reference (HREF) for each tile that is to have an active link.

Example `http://www.sas.com`

Requirement To generate selectable tiles, you must include an ODS GRAPHICS ON statement that specifies the IMAGEMAP option. You must also write the graphs to the ODS HTML destination.

Tips The URL value can be blank for some tiles, which means that no action is taken when those tiles are selected. The URL value can be the same for different tiles, which means that the same action is taken when those tiles are selected.

By default, drill-down links open in a new browser window (link target _blank). To specify a different target for your drill-down links, such as _self or _parent, add the DRILLTARGET="*target*" option to your ODS GRAPHICS statement. See DRILLTARGET= on page 1568.

VALUEATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font attributes of the category values that are located outside of the tiles. See "General Syntax for Attribute Options" on page 1599for the syntax on using a style element. See "Text Options" on page 1606 for the available text options.

Default The GraphValueText style element.

Interaction If one or more text options are specified and they do not include all the font properties such as color, family, size, weight, and style, then the non-specified properties are derived from the GraphValueText style element.

Note When *style-element* is used, only the style element's COLOR, FONTFAMILY, FONTSIZE, FONTSTYLE, and FONTWEIGHT attributes are used.

Tip You can use the INSIDEVALUEATTRS= option to change text attributes for values that are located inside the tiles.

VALUELOCATION=AUTO | INSIDE | OUTSIDE
specifies the location of the category column values in a two-way plot.

AUTO
locates the values for the second category in the CATEGORY= list that are outside of the tiles.

If the first category in the CATEGORY= list has any missing crossings with the second category, or if any of the second category values collide, then the values are located inside the tiles per the default fit policy.

See "CATEGORY=(*column-list*)" on page 686

INSIDE
for each category value, locates the values inside the largest tile.

OUTSIDE
locates the values outside of the tiles, in the plot area.

Default AUTO

Restriction This option applies to two-way plots only.

XVALUEFITPOLICY=ROTATE | NONE
specifies a policy for avoiding collisions along the width of the plot among category values that are outside of the tiles.

ROTATE
rotates the values if any of the values collide.

NONE
does not attempt to fit values that collide.

Default ROTATE

YVALUEFITPOLICY=NONE | ROTATEALWAYS
specifies a policy for avoiding collisions along the height of the plot among category values that are outside of the tiles.

NONE
does not attempt to fit values that collide.

ROTATEALWAYS
rotates the values regardless of whether any of the values collide.

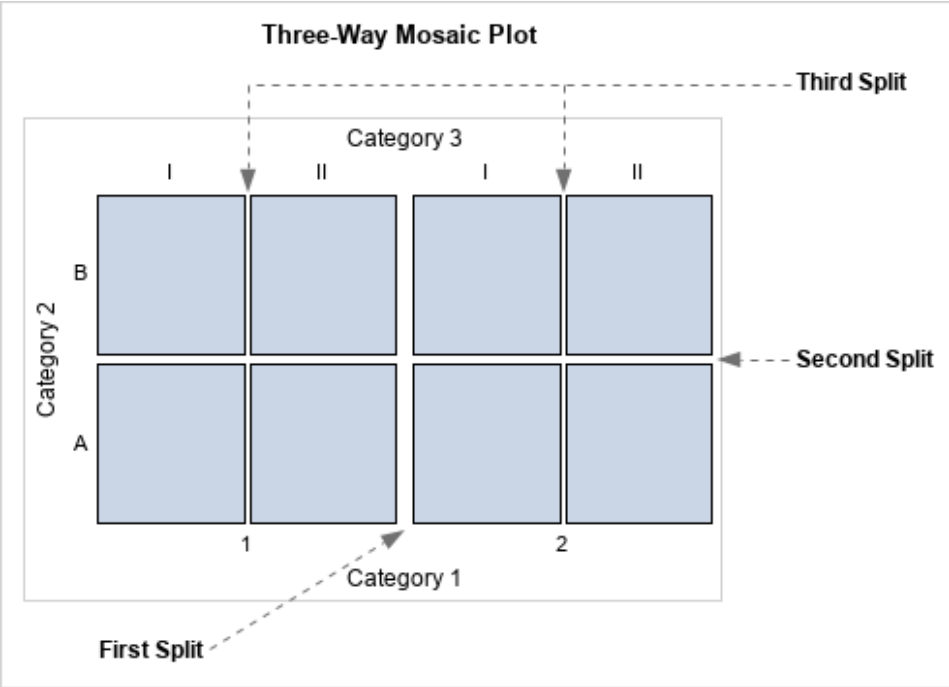
Default NONE

Interaction This option is effective only when VALUELOCATION=OUTSIDE.

Details

A mosaic plot displays relative frequencies for categorical variables. Each crossing of the categorical values is represented by a tile. The area of each tile is proportional to the frequency of that crossing. The plot is the result of an iterative process. The first iteration splits the plot area into tiles along the width according to the relative frequency of the first category column values. Subsequent iterations split the tiles from the previous iteration in the direction orthogonal to the previous split by using the relative frequencies of each category column's values. By default, the gap (or gutter) for each split gets progressively smaller, with a minimum gap of 3 pixels. You can use the GUTTER= option to specify a different gap for each split.

The following figure provides an example of a three-way mosaic plot, which has three categories.

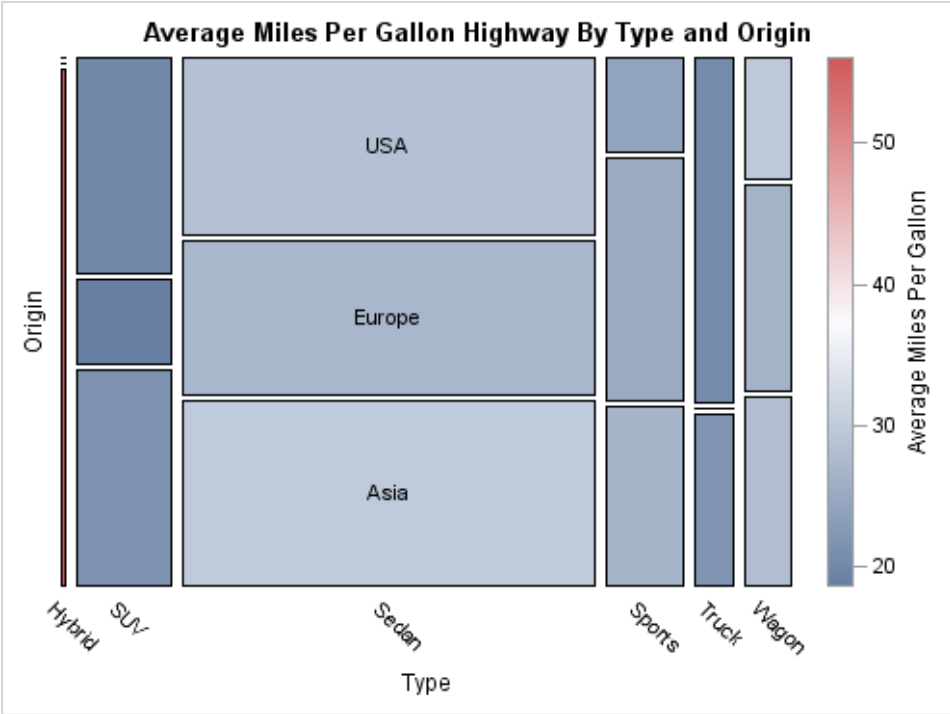


Note: The plot contains equally sized tiles for demonstration purposes.

In the example plot, the first split is along the width for CATEGORY 1. The second split is along the height for CATEGORY 2. Finally, the third split is along the width for CATEGORY 3. Notice how the gaps between the tiles get progressively smaller from the first split to the last split.

Example: MOSAICPLOTPARM Statement

The following graph was generated by the "Example Program" on page 698:



Example Program

```
/* Summarize the SASHELP.CARS data for ORIGIN and TYPE */
proc summary data=sashelp.cars nway;
  class origin type;
  var mpg_highway;
  output out=mileage mean=avgMpg N=count / noinherit;
run;

/* Generate the plot */
proc template;
  define statgraph mosaicPlotParm;
    begingraph;
      layout region;
       mosaicPlotParm category=(type origin) count=count /
          name="mosaic" colorresponse=avgMpg;
       continuouslegend "mosaic" / title="Average Miles Per Gallon"
          pad=(left=5);
      endlayout;
    endgraph;
  end;
run;

proc sgrender data=mileage template=mosaicPlotParm;
run;
```

NEEDLEPLOT Statement

Creates a plot of observations as points connected to a baseline by vertical line segments.

Syntax

NEEDLEPLOT X=*column* | *expression*
Y=*numeric-column* | *expression* </*options*>;

Summary of Optional Arguments

Appearance options

BASELINEATTRS=*style-element* | (*line-options*)
specifies the appearance of the baseline.

CLUSTERWIDTH=*number*
specifies the width of the group clusters as a fraction of the midpoint spacing or bin width.

DATASKIN=NONE | CRISP | GLOSS | MATTE | PRESSED | SHEEN
enhances the visual appearance of the needle plot lines.

DATATRANSPARENCY=*number*
specifies the degree of the transparency of the needle lines, markers, and data labels, if displayed.

DISPLAY=(*display-options*) | STANDARD | ALL
specifies which needle features to display.

DISPLAYBASELINE=ON | OFF | AUTO
specifies whether the baseline is displayed.

INDEX=*positive-integer-column* | *expression*
specifies indices for mapping line attributes (color, marker symbol, and line pattern) to one of the GraphData1–GraphDataN style elements.

LINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the attributes of the needle lines for the data points.

MARKERATTRS=*style-element* | *style-element* (*marker-options*) | (*marker-options*)
specifies the attributes of the data markers.

Axes options

BASELINEINTERCEPT=*number* | RELATIVE
specifies the Y-intercept for the baseline.

PRIMARY=TRUE | FALSE
specifies that the data columns for this plot and the plot type be used for determining default axis features.

XAXIS=X | X2
: specifies whether data are mapped to the primary X (bottom) axis or to the secondary X2 (top) axis.

YAXIS=Y | Y2
: specifies whether data are mapped to the primary Y (left) axis or to the secondary Y2 (right) axis.

Data tip options

ROLENAME=(*role-name-list*)
: specifies user-defined roles that can be used to display information in the data tips.

TIP=(*role-list*) | NONE
: specifies the information to display when the cursor is positioned over a needle line or marker.

TIPFORMAT=(*role-format-list*)
: specifies display formats for tip columns.

TIPLABEL=(*role-label-list*)
: specifies display labels for tip columns.

Label options

DATALABEL=*column*
: specifies labels at the data points.

DATALABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
: specifies the color and font attributes of the data labels.

DATALABELPOSITION=AUTO | TOPRIGHT | TOP | TOPLEFT | LEFT | CENTER | RIGHT | BOTTOMLEFT | BOTTOM | BOTTOMRIGHT
: specifies the location of the data labels relative to the end of the needle lines and markers, if displayed.

DATALABELSPLIT=TRUE | FALSE
: specifies whether to split the data labels at the specified split characters.

DATALABELSPLITCHAR="*character-list*"
: specifies one or more characters on which the data labels can be split if needed.

DATALABELSPLITCHARDROP=TRUE | FALSE
: specifies whether the split characters are included in the data labels.

DATALABELSPLITJUSTIFY=AUTO | CENTER | LEFT | RIGHT
: specifies the justification of the strings that are inside the data label blocks.

LEGENDLABEL="*string*"
: specifies a label to be used in a discrete legend for this plot.

Midpoint options

DISCRETEOFFSET=*number*
: specifies an amount to offset all needle lines and markers from discrete X values when graphing multiple response variables side by side on a common axis.

GROUP=*column* | *discrete-attr-var* | *expression*

creates a distinct set of needle lines, markers, and data labels for each unique group value of the specified column.

GROUPDISPLAY=OVERLAY | CLUSTER
specifies whether grouped needle lines are overlaid or clustered around the category midpoints on a discrete axis or around the intervals on an interval axis.

GROUPORDER=DATA | REVERSEDATA | ASCENDING | DESCENDING
specifies the ordering of the groups within a category.

INCLUDEMISSINGGROUP=TRUE | FALSE
specifies whether missing values of the group variable are included in the plot.

ODS options

URL=*string-column*
specifies an HTML page to display when a needle or marker is selected.

Plot reference options

NAME="*string*"
assigns a name to this plot statement for reference in other template statements.

Required Arguments

X=*column* | *expression*
specifies a column or expression for the X values.

Y=*numeric-column* | *expression*
specifies a numeric column or numeric expression for the Y values.

Optional Arguments

BASELINEATTRS=*style-element* | (*line-options*)
specifies the appearance of the baseline.

Default The COLOR= option in the LINEATTRS= option, if specified. Otherwise, the GraphDataDefault:ContrastColor style reference.

Notes The baseline is always drawn by default.

When *style-element* is specified, only the style element's Color, LineStyle, and LineThickness attributes are used.

Tip To suppress the baseline, set the line thickness to 0:

```
baselineattrs=(thickness=0)
```

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

BASELINEINTERCEPT=*number* | RELATIVE
specifies the Y-intercept for the baseline. Prior to SAS 9.4M5, the baseline is always displayed in the chart, whether for a specified value or for the default

value. Starting with SAS 9.4M5, the baseline display is controlled by the DISPLAYBASELINE= option, which is ON by default.

number
specifies the Y-intercept value to use for the baseline.

Interactions When *number* is specified, the response axis data range is extended if necessary to include the baseline intercept. When a logarithmic response axis is requested and *number* is 0 or a negative value, the response axis reverts to a linear axis. To restore the log axis in that case, set BASELINEINTERCEPT= to a positive value.

When DISPLAYBASELINE=AUTO is in effect, the baseline is not displayed if the baseline intercept is equal to the minimum or maximum value of the response-axis range.

Tips The baseline does not add a tick or a tick value to the axis. To label the baseline, you can overlay a REFERENCELINE statement with the same Y value and use its CURVELABEL option.

The appearance of the baseline is controlled by the BASELINEATTRS= option.

To suppress the baseline, prior to SAS 9.4M5, use the BASELINEATTRS= option to set the line thickness to 0. Starting with SAS 9.4M5, specify DISPLAYBASELINE=OFF.

RELATIVE
places the baseline at the Y-axis tick mark closest to the minimum of the range for the needle data points.

Default 0

CLUSTERWIDTH=*number*
specifies the width of the group clusters as a fraction of the midpoint spacing or bin width.

Default 0.85

Range 0–1, where 0 is the minimum width, which is one pixel wide, and 1 is the maximum possible width

Requirement For this option to take effect, the GROUP= option must also be specified, and the GROUPDISPLAY= option must be set to CLUSTER.

Interaction When markers are displayed for interval data and GROUPDISPLAY=CLUSTER and CLUSTERWIDTH= are in effect, the size of the markers in each cluster might be reduced to no less than 5 pixels in order to display the cluster within the smallest effective midpoint space. If you need larger markers in that case, use the MARKERATTRS= option to specify a larger marker size.

DATALABEL=*column*
specifies labels at the data points.

Default No data labels are displayed

Note The position of the labels is adjusted to prevent the labels from overlapping.

DATALABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font attributes of the data labels.

Defaults For non-grouped data, the GraphDataText style element.

For grouped data, the GraphData1:ContrastColor–GraphDataN:ContrastColor style references.

Interactions For this option to have any effect, the DATALABEL= option must also be specified.

The LINEATTRS= on page 712 COLOR= suboption overrides the default data label color for grouped plots.

Note When the DATALABELPOSITION=AUTO option is in effect, in some cases, the data label font size might be reduced in order to avoid overlapping labels and markers.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Text Options" on page 1606 for available *text-options*.

DATALABELPOSITION=AUTO | TOPRIGHT | TOP | TOPLEFT | LEFT | CENTER | RIGHT | BOTTOMLEFT | BOTTOM | BOTTOMRIGHT
specifies the location of the data labels relative to the end of the needle lines and markers, if displayed.

AUTO
uses a data-label collision avoidance algorithm to position the labels.

Note When AUTO is in effect, in some cases, the data label font size might be reduced in order to avoid overlapping labels and markers.

See "LABELPLACEMENT=AUTO | GREEDY | SA" on page 36

TOPRIGHT
TOP
TOPLEFT
LEFT
CENTER
RIGHT
BOTTOMLEFT
BOTTOM
BOTTOMRIGHT
specifies a location for all of the data labels.

Default AUTO

DATALABELSPLIT=TRUE | FALSE
specifies whether to split the data labels at the specified split characters. When set to TRUE, the data label is split unconditionally at each occurrence of any of the specified split characters.

Default FALSE. The data labels are not split.

Requirement The DATALABEL= option must also be specified.

Interactions The DATALABELSPLITCHAR= option specifies one or more characters on which splits can occur.

This option has no effect when DATALABELPOSITION=AUTO.

See “boolean ” on page xii for other Boolean values that you can use.

DATALABELSPLITCHAR="*character-list*"
specifies one or more characters on which the data labels can be split if needed. When multiple split characters are specified, each character in the list is treated as a separate split character unless the specified characters appear consecutively in the data label. In that case, all of the specified split characters together are treated as a single split character.

When DATALABEL= is specified and DATALABELSPLIT=TRUE, the data label is split unconditionally at each occurrence of any of the specified split characters. If the data label does not contain any of the specified characters, then the label is not split.

"character-list"
one or more characters with no space between each character and enclosed in quotation marks.

Default A blank space

Requirements The list of characters must be enclosed in quotation marks.

Multiple characters must be specified with no space between them. For example, to specify the split characters a, b, and c, use the following option:

```
datalabelsplitchar="abc"
```

The DATALABEL= option and the DATALABELSPLIT=TRUE option must also be specified.

Interactions This option has no effect if DATALABELPOSITION=AUTO.

The DATALABELSPLITCHARDROP= option specifies whether the split characters are included in the data label or are dropped.

Notes When multiple characters are specified, the order of the characters in the list is not significant.

The split characters are case sensitive.

Tip Use the DATALABELSPLITJUSTIFY= option to specify the justification of the strings in the data label block.

DATALABELSPLITCHARDROP=TRUE | FALSE
specifies whether the split characters are included in the data labels.

TRUE
drops the split characters from the data label.

FALSE
includes the split characters in the data label.

When DATALABELSPLIT=TRUE and DATALABELSPLITCHARDROP=FALSE, each split character remains as the last character in the current line. The characters that follow the split character, up to and including the next split character, are then wrapped to the next line.

The following figure shows an example of a data label with the following specifications:

- the data label text for this label is Product*Group*A
- DATALABELSPLIT=TRUE
- DATALABELSPLITCHARDROP=TRUE | FALSE
- DATALABELSPLITCHAR="*"

When DATALABELSPLITCHARDROP=TRUE, the asterisks are removed from the label. When DATALABELSPLITCHARDROP=FALSE, each asterisk remains as the last character in the line prior to the new line.

Default TRUE. The split characters are dropped from the data label.

Requirement The DATALABEL= option and the DATALABELSPLIT=TRUE option must also be specified.

Interaction The DATALABELSPLITCHAR= option specifies the split characters.

See "boolean " on page xii for other Boolean values that you can use.

DATALABELSPLITJUSTIFY=AUTO | CENTER | LEFT | RIGHT
specifies the justification of the strings that are inside the data label blocks.

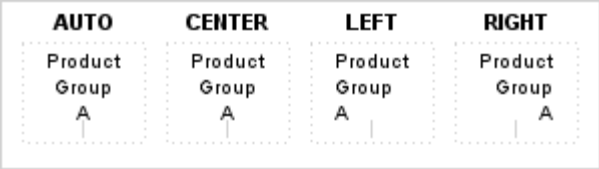
AUTO
justifies the labels based on the DATALABELPOSITION= option.

DATALABELPOSITION= Value	Justification
TOPLEFT, LEFT, or BOTTOMLEFT	RIGHT
TOPRIGHT, RIGHT, or BOTTOMRIGHT	LEFT
TOP, CENTER, or BOTTOM	CENTER

CENTER
LEFT
RIGHT
justifies the labels center, left, or right, as specified.

The following figure shows an example in which DATALABELPOSITION=TOP.

Note: The gray vertical line at the bottom of each label represents the horizontal center of the text box for reference.



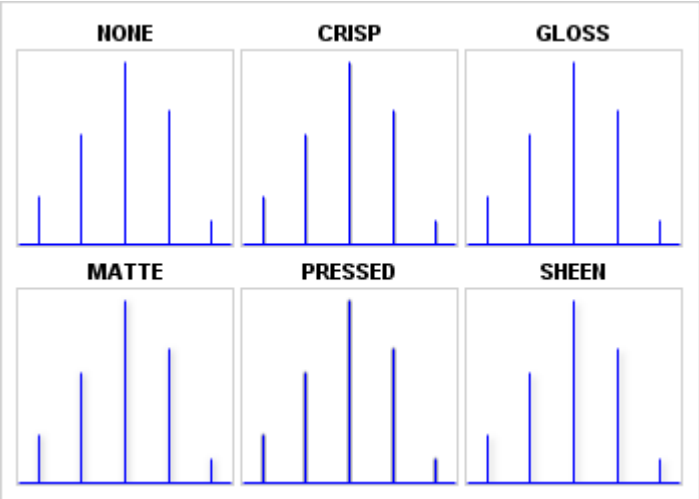
In this case, because DATALABELPOSITION=TOP, AUTO centers the lines of text. The text box is anchored the same way that the unsplit text is anchored. For example, if DATALABELPOSITION=TOP, then the bottom center of the text box is positioned at the top of the marker.

Default AUTO

Requirement The DATALABEL= option and the DATALABELSPLIT=TRUE option must also be specified.

Interaction This option has no effect if DATALABELPOSITION=AUTO.

DATASKIN=NONE | CRISP | GLOSS | MATTE | PRESSED | SHEEN
enhances the visual appearance of the needle plot lines. The following figure shows a needle plot with each of the skins applied.



Default The DATASKIN= option value that is specified in the BEGINGRAPH statement. If that value is not specified, then the GraphSkins:DataSkin style element value is used.

Restriction Starting with SAS 9.4M1, the maximum number of skinned graphical elements is limited to 200 per plot in an OVERLAY or PROTOTYPE layout. When this limit is exceeded for a plot, the specified data skin is not applied to that plot. In that case, use the DATASKINMAX= option in your ODS GRAPHICS statement to increase the maximum limit.

Interaction This option overrides the BEGINGRAPH statement DATASKIN= option.

DATATRANSPARENCY=*number*

specifies the degree of the transparency of the needle lines, markers, and data labels, if displayed.

Default 0

Range 0–1, where 0 is opaque and 1 is entirely transparent

DISCRETEOFFSET=*number*

specifies an amount to offset all needle lines and markers from discrete X values when graphing multiple response variables side by side on a common axis.

Default 0 (no offset, all needle lines and markers are centered on the discrete X values)

Range -0.5 to +0.5, where 0.5 represents half the distance between discrete ticks. A positive offset is to the right. If the parent layout's axis options set REVERSE=TRUE, then the offset direction is also reversed.

Restriction This option applies to discrete axes only. For nondiscrete axes, this option is ignored.

Tip Setting the discrete offset for the plots does not affect the axis minimum and maximum offsets. In some cases, setting a discrete offset can cause clipping at each end of the axis. In those cases, use the OFFSETMIN= and OFFSETMAX= axis options to increase the axis minimum and maximum offsets to accommodate the discrete offset.

DISPLAY=(*display-options*) | STANDARD | ALL
specifies which needle features to display.

(*display-options*)
a space-separated list of one or more options enclosed in parentheses.

Currently, only the MARKERS option is supported, which displays needle lines with markers.

STANDARD
displays needle lines without markers

ALL
displays needle lines with markers

Default STANDARD

Tip Use the MARKERATTRS= and LINEATTRS= options to control the appearance of the line and markers.

DISPLAYBASELINE=ON | OFF | AUTO
specifies whether the baseline is displayed.

Note: This feature applies to SAS 9.4M5 and to later releases.

ON
always displays the baseline.

OFF
does not display the baseline.

AUTO
displays the baseline if the baseline intercept is within the response-axis range, excluding the minimum and maximum axis values.

This is the typical case when the needle plot contains both positive and negative needles, and the default baseline intercept of 0 is used. If the baseline intercept is equal to the minimum or maximum value of the response-axis range, the baseline is not displayed.

Default ON

Tip By default, the baseline intercept is 0. Use the BASELINEINTERCEPT= option to change the baseline intercept.

GROUP=*column* | *discrete-attr-var* | *expression*
creates a distinct set of needle lines, markers, and data labels for each unique group value of the specified column.

discrete-attr-var
specifies a discrete attribute map variable.

The discrete attribute map variable is created by a DISCRETEATTRVAR statement.

Restriction A discrete attribute map variable specification must be a direct reference to the attribute map variable. It cannot be set by a dynamic variable.

Default Each distinct group value might be represented in the plot by a different combination of color, line pattern, and marker symbol. These vary according to the ContrastColor, LineStyle, and MarkerSymbol attributes of the GraphData1–GraphDataN and GraphMissing style elements.

Interactions The group values are mapped in the order of the data, unless the INDEX= option is used to alter the default sequence of marker symbols, colors, and line patterns.

The marker size is set by the MARKERATTRS= option.

The INCLUDEMISSINGGROUP= option controls whether missing group values are considered a distinct group value.

Notes The representations that are used to identify the groups can be overridden. For example, each distinct group value might be represented by a different line pattern, but the LINEATTRS=(PATTERN=*pattern*) option could be used to assign the same line pattern to all of the plot's line patterns, letting line color indicate group values. Likewise, LINEATTRS=(COLOR=*color*) could be used to assign the same color to all lines, letting line pattern indicate group values.

If you specify a column in a SAS data set, the visual attributes for each group value are assigned in data order. If you specify a column in a CAS in-memory table, the visual attributes for each group value are assigned in ascending order of the group column character values or of unformatted numeric values.

Tip By default, ODS Graphics limits the number of groups to 1000. When this limit is exceeded, the GROUP= option is ignored. Use the GROUPMAX= option in the ODS GRAPHICS statement to change the maximum number of groups that can be processed.

See "DISCRETEATTRVAR Statement" on page 1516

GROUPDISPLAY=OVERLAY | CLUSTER
specifies whether grouped needle lines are overlaid or clustered around the category midpoints on a discrete axis or around the intervals on an interval axis.

OVERLAY
centers the needle lines for matching category values on the midpoints.

The needle lines in each set of group values are superimposed on each other.

CLUSTER
clusters the needle lines for matching category values around the midpoints.

Each cluster of group values is centered at the midpoint for the category.

Default OVERLAY

Interaction For this option to take effect, the GROUP= option must also be specified.

Note When you plot a SAS data set, the items for each group value are drawn in data order. When you plot a CAS in-memory table, they are drawn in ascending order of the group column character values or unformatted numeric values.

GROUPORDER=DATA | REVERSEDATA | ASCENDING | DESCENDING
specifies the ordering of the groups within a category.

DATA
orders the groups within a category in the group-column data order.

REVERSEDATA
orders the groups within a category in the reverse group-column data order.

Note: This feature applies to SAS 9.4M2 and to later releases.

Tip This option is useful when you want to reverse the category axis.

ASCENDING
orders the groups within a category in ascending order.

DESCENDING
orders the groups within a category in descending order.

Defaults DATA if the data is a SAS data set.

ASCENDING if the data is a CAS in-memory table. Sorting is based on nonformatted values for numeric group values or on formatted values for character group values.

Interactions This option is ignored if the GROUP= option is not also specified.

By default, the groups in the legend are shown in the order that is specified in GROUPORDER.

Notes When plotting a SAS data set, attributes such as color, symbol, and pattern are assigned to each group in DATA order by default. When plotting a CAS in-memory table, attributes are assigned in ascending order of the group column character values or unformatted numeric values by default.

The ASCENDING and DESCENDING settings linguistically sort the group values within each category (or X value) for display position purposes only. For numeric data, the order is based on the unformatted values. For character data, the order is based on the

formatted values. The data order of the observations and the visual attributes that are assigned to the group values remain unchanged.

In SAS 9.4M6 and earlier releases, when data stored in a CAS in-memory table is used and DATA or REVERSEDATA is specified, unpredictable results might occur. To generate consistent graphs in that case, specify ASCENDING or DESCENDING. Starting with SAS Viya 3.5 and SAS Studio 5.2, when data stored in a CAS in-memory table is used and DATA or REVERSEDATA is specified, it is ignored, and ASCENDING is used instead.

Tips Use the CLUSTERWIDTH= option to control the distance between the group markers in a cluster.

Use the INDEX= option to alter the default sequence of visual attributes that is assigned to the groups.

INCLUDEMISSINGGROUP=TRUE | FALSE

specifies whether missing values of the group variable are included in the plot.

Default TRUE

Interaction For this option to take effect, the GROUP= option must also be specified.

Tip The attributes of the missing group value are determined by the GraphMissing style element unless a discrete attribute map is in effect, the INDEX= option is used, the MISSING= system option changes the default missing character, or a user-defined format is applied to the group value. In those cases, the attributes of the missing group value are determined by a GraphData1–GraphDataN style element instead of by the GraphMissing style element.

See “boolean ” on page xii for other Boolean values that you can use.

INDEX=*positive-integer-column* | *expression*

specifies indices for mapping line attributes (color, marker symbol, and line pattern) to one of the GraphData1–GraphDataN style elements.

Requirements The column or expression value must be an integer value of 1 or greater. Otherwise, this option is ignored.

The positive-integer column must not contain missing values. Otherwise, the entire column is invalidated and this option is ignored.

All of the indexes for a specific group value must be the same. Otherwise, the results are unpredictable.

Interaction For this option to take effect, the GROUP= option must also be specified.

Notes The index values are 1-based indices. For the style attributes in GraphData1–GraphDataN, if the index value is greater than N,

then a modulo operation remaps that index value to a number less than N to determine which style to use.

If you do not use this option, then the group values are mapped in the order of the data.

Tip You can use indexing to collapse the number of groups that are represented in a graph. For more information, see "Remapping Groups for Grouped Data" on page 211.

LEGENDLABEL="*string*"
specifies a label to be used in a discrete legend for this plot.

Default The Y-column label. If a label is not defined, then the Y-column name is used.

Restriction This option applies only to an associated DISCRETELEGEND statement.

Interaction If the GROUP= option is specified, then this option is ignored.

LINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the attributes of the needle lines for the data points.

Defaults For non-grouped data, the GraphDataDefault style element.

For grouped data, the ContrastColor and LineStyle attributes of the GraphData1–GraphDataN style elements, and the LineThickness attribute of the GraphDataDefault style element.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

MARKERATTRS=*style-element* | *style-element* (*marker-options*) | (*marker-options*)
specifies the attributes of the data markers.

Defaults For non-grouped data, GraphDataDefault style element.

For grouped data, the MarkerSymbol and ContrastColor attributes of the GraphData1–GraphDataN style elements, and the GraphDataDefault:MarkerSize style reference.

Interactions This option's COLOR= suboption overrides the default behavior for grouped data. When the COLOR= suboption is specified in that case, all markers have the same color, and the marker symbol alone distinguishes the markers.

This option's SYMBOL= suboption overrides the default behavior for grouped data. When the SYMBOL= suboption is specified in that case, all markers have the same symbol, and the symbol color alone distinguishes the markers.

The TRANSPARENCY= fill option overrides this option's DATATRANSPARENCY= suboption.

This option is ignored if the DISPLAY= option disables the display of the markers.

If the DATASKIN= option is in effect, then the data skin determines the marker outlines. Any outline-related settings from the current ODS style or from the marker attribute options are ignored.

Note When *style-element* is specified, only the style element's MARKERSYMBOL, CONTRASTCOLOR, and MARKERSIZE attributes are used.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Marker Options" on page 1604 for available *marker-options*.

NAME="*string*"
assigns a name to this plot statement for reference in other template statements. The specified name is used primarily in legend statements to coordinate the use of colors and line patterns between the plot and the legend.

Restrictions The *string* is case sensitive, cannot contain spaces, and must define a unique name within the template.

This option does not support variables that are created by the DYNAMIC, MVAR, and NMVAR template statements.

PRIMARY=TRUE | FALSE
specifies that the data columns for this plot and the plot type be used for determining default axis features. This option is needed only when two or more plots within an overlay-type layout contribute to a common axis.

Default FALSE

Restriction This option is ignored if the plot is placed under a GRIDDED or LATTICE layout block.

Note In an OVERLAY layout, only one plot in an overlay can be the primary plot on a per-axis basis. When no plot is designated as the primary plot, the first plot that can be a primary plot is considered the primary plot. If multiple plots specify PRIMARY=TRUE for the same axis, then the last such plot encountered is considered the primary plot.

See "When Plots Share Data and a Common Axis" on page 1046

"boolean " on page xii for other Boolean values that you can use.

ROLENAME=(*role-name-list*)
specifies user-defined roles that can be used to display information in the data tips. This option provides a way to add to the data columns that appear in data tips that are specified by the TIP= option.

(role-name-list)
a space-separated list of *role-name = column* pairs.

Example The following example assigns the column Obs to the user-defined role TIP:

```
ROLENAME=(TIP1=OBS)
```

Default No user-defined roles

Requirement The role names that you choose must be unique and different from the predefined roles X. Y, DATALABEL, INDEX, and GROUP.

TIP=(*role-list*) | NONE
specifies the information to display when the cursor is positioned over a needle line or marker. If this option is used, then it replaces all of the information that is displayed by default. Roles for columns that do not contribute to the needle plot can be specified along with roles that do.

(role-list)
an ordered, space-separated list of unique NEEDLEPLOT and user-defined roles.

NEEDLEPLOT roles include X, Y, DATALABEL, and GROUP.

User-defined roles are defined with the ROLENAME= option.

Example The following example displays data tips for the columns assigned to the roles X and Y as well as the column Obs, which is not assigned to any pre-defined NEEDLEPLOT role. The Obs column must first be assigned a role.

```
ROLENAME=(TIP1=OBS)
TIP=(TIP1 X Y)
```

NONE
suppresses data tips and URLs (if requested) from the plot.

Default The columns assigned to these roles are automatically included in the data tip information: X, Y, DATALABEL, and GROUP.

Requirement To generate data tips in the output, you must include an ODS GRAPHICS ON statement that specifies the IMAGEMAP option, and you must write the output to the ODS HTML destination.

Interaction This option is ignored when the plot statement is in an OVERLAY or PROTOTYPE layout and the INCLUDERANGES= option is specified in the LINEAROPTS= or TIMEOPTS= option for either axis.

Tip The labels and formats for the TIP roles can be controlled with the TIPLABEL= and TIPFORMAT= options.

TIPFORMAT=(*role-format-list*)
specifies display formats for tip columns. This option provides a way to control the formats of columns that appear in data tips.

(role-format-list)
a space-separated list of *role-name* = *format* pairs.

Example
```
ROLENAME=(TIP1=SALARY)
TIP=(TIP1)
TIPFORMAT=(TIP1=DOLLAR12.)
```

Default The column format of the column assigned to the role or BEST6 if no format is assigned to a numeric column.

Restriction Only the roles that appear in the TIP= option are used.

Requirement A column must be assigned to each of the specified roles. (See the ROLENAME= option.)

TIPLABEL=(*role-label-list*)
specifies display labels for tip columns. This option provides a way to control the labels of columns that appear in data tips.

role-label-list
a space-separated list of *rolename* ="*string*" pairs.

Example
```
ROLENAME=(TIP1=PCT)
TIP=(TIP1)
TIPLABEL=(TIP1="Percent")
```

Default The column label or column name of the column assigned to the role.

Restriction Only the roles that appear in the TIP= option are used.

Requirement A column must be assigned to each of the specified roles. (See the ROLENAME= option.)

URL=*string-column*
specifies an HTML page to display when a needle or marker is selected.

string-column
specifies a column that contains a valid HTML page reference (HREF) for each needle that is to have an active link.

Example **`http://www.sas.com`**

Requirement To generate selectable needle lines, you must include an ODS GRAPHICS ON statement that specifies the IMAGEMAP option, and you must write the output to the ODS HTML destination.

Interactions This option has no effect when TIP=NONE.

This option is ignored when the plot statement is in an OVERLAY or PROTOTYPE layout and the INCLUDERANGES= option is specified in the LINEAROPTS= or TIMEOPTS= option for either axis.

Tips

The URL value can be blank for some X and Y pairs, meaning that no action is taken when the corresponding needle or marker is selected.

The URL value can be the same for any X and Y pairs. In that case, the same action is taken when the needle or marker is selected for those X and Y pairs.

By default, drill-down links open in a new browser window (link target _blank). To specify a different target for your drill-down links, such as _self or _parent, add the DRILLTARGET="*target*" option to your ODS GRAPHICS statement. See DRILLTARGET= on page 1568.

XAXIS=X | X2

specifies whether data are mapped to the primary X (bottom) axis or to the secondary X2 (top) axis.

Default X

Interaction The overall plot specification and the layout type determine the axis display. For more information, see "How Axis Features Are Determined" on page 1040.

YAXIS=Y | Y2

specifies whether data are mapped to the primary Y (left) axis or to the secondary Y2 (right) axis.

Default Y

Interaction The overall plot specification and the layout type determine the axis display. For more information, see "How Axis Features Are Determined" on page 1040.

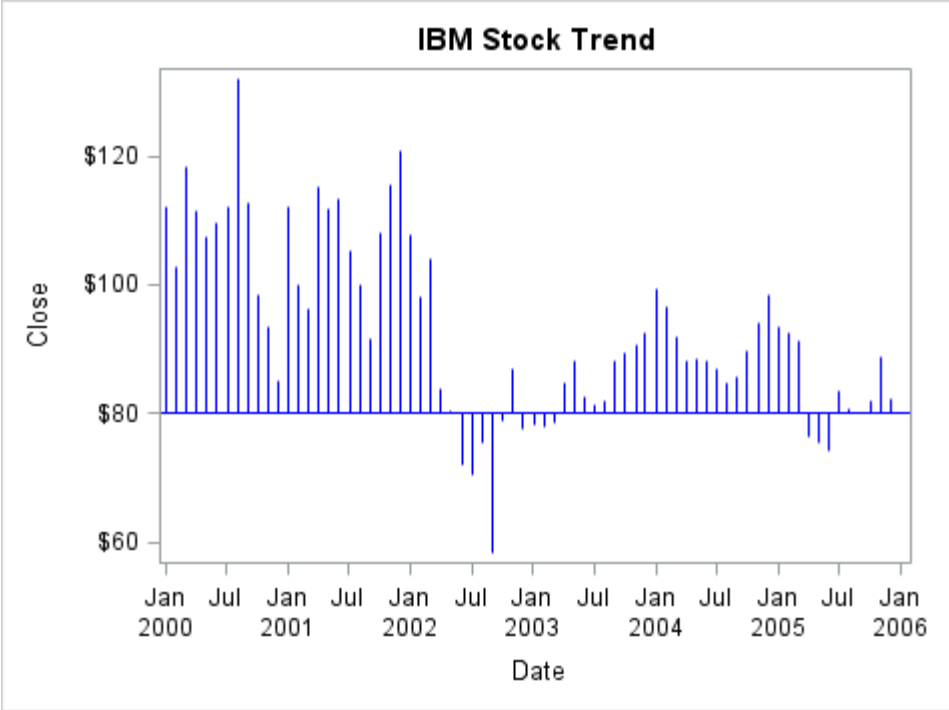
Details

In the NEEDLEPLOT statement, the X column can specify character or numeric values. The Y column must specify numeric values. For character columns, the X axis is always of TYPE=DISCRETE. For numeric columns, the X axis is of TYPE=LINEAR by default.

The Y axis is of TYPE=LINEAR by default.

Example: NEEDLEPLOT Statement

The following graph was generated by the "Example Program" on page 717:



Example Program

```
proc template;
  define statgraph needleplot;
    begingraph;
      entrytitle "IBM Stock Trend";
      layout overlay;
        needleplot x=date y=close /
          baselineintercept=80 lineattrs=(color=blue);
      endlayout;
    endgraph;
  end;
run;

proc sgrender data=sashelp.stocks template=needleplot;
  where stock="IBM" and date > "31dec1999"d;
run;
```

PBSPLINEPLOT Statement

Creates a fitted penalized B-spline curve computed from input data.

Restriction: The PBSPLINEPLOT statement supports only models of one independent and one dependent variable.

Tip: Starting with SAS 9.4M3, subpixel rendering is enabled by default. To disable subpixel rendering, specify SUBPIXEL=OFF in the BEGINGRAPH statement or in an

ODS GRAPHICS statement. For information about the BEGINGRAPH statement SUBPIXEL= option, see SUBPIXEL= on page 39. For information about the ODS GRAPHICS statement SUBPIXEL= option, see "ODS GRAPHICS Statement" on page 1561.

Syntax

PBSPLINEPLOT X=*numeric-column* | *expression*
Y=*numeric-column* | *expression* </<*regression-options*> <*options*>>;

Summary of Optional Arguments

Appearance options

DATATRANSPARENCY=*number*
: specifies the degree of the transparency of the curve and curve label.

INDEX=*positive-integer-column* | *expression*
: specifies indices for mapping line attributes (color and line pattern) to one of the GraphData1–GraphDataN style elements.

LINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
: specifies the line attributes of the spline curve.

Axes options

PRIMARY=TRUE | FALSE
: specifies that the data columns for this plot and the plot type be used for determining default axis features.

XAXIS=X | X2
: specifies whether data are mapped to the primary X (bottom) axis or to the secondary X2 (top) axis.

YAXIS=Y | Y2
: specifies whether data are mapped to the primary Y (left) axis or to the secondary Y2 (right) axis.

Data tip options

TIPFORMAT=(*role-format-list*)
: specifies display formats for tip columns.

TIPLABEL=(*role-label-list*)
: specifies display labels for tip columns.

Label options

CURVELABEL="*string*"
: specifies a label for the spline curve.

CURVELABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
: specifies the color and font attributes of the spline curve labels.

CURVELABELLOCATION=INSIDE | OUTSIDE
: specifies the location of the spline curve label relative to the plot area.

CURVELABELPOSITION=AUTO | MAX | MIN | START | END
specifies the position of the spline curve label relative to the curve line.

CURVELABELSPLIT=TRUE | FALSE
specifies whether to split the curve label at the specified split characters.

CURVELABELSPLITCHAR="*character-list*"
specifies one or more characters on which the curve label can be split if needed.

CURVELABELSPLITCHARDROP=TRUE | FALSE
specifies whether the split characters are included in the curve label text.

CURVELABELSPLITJUSTIFY=AUTO | CENTER | LEFT | RIGHT
specifies the justification of the strings that are inside the curve label block.

LEGENDLABEL="*string*"
specifies a label to be used in a discrete legend for this plot.

Midpoint options

GROUP=*column* | *discrete-attr-var* | *expression*
creates a distinct set of curves from just the observations that correspond to each unique group value of the specified column.

INCLUDEMISSINGGROUP=TRUE | FALSE
specifies whether missing values of the group variable are included in the plot.

Plot reference options

NAME="*string*"
assigns a name to this plot statement for reference in other template statements.

Required Arguments

X=*numeric-column* | *expression*
specifies the column for the X values.

Y=*numeric-column* | *expression*
specifies the column for the Y values.

Optional Arguments

CURVELABEL="*string*"
specifies a label for the spline curve.

Default No curve label is displayed

Interaction This option is not valid when the GROUP= option is specified.

Tip The font and color attributes for the label are specified by the CURVELABELATTRS= option.

CURVELABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font attributes of the spline curve labels.

Default The GraphValueText style element.

Interactions For this option to take effect, the CURVELABEL= option must also be specified.

If the GROUP= option is specified, then this option is ignored.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Text Options" on page 1606 for available *text-options*.

CURVELABELLOCATION=INSIDE | OUTSIDE
specifies the location of the spline curve label relative to the plot area.

INSIDE
locates the labels inside the plot area

OUTSIDE
locates the labels outside the plot area

Default INSIDE

Restriction OUTSIDE cannot be used when the PBSPLINEPLOT is used in multicell layouts such as LATTICE, DATAPANEL, or DATALATTICE, where axes might be external to the grid.

Interactions For this option to take effect, the CURVELABEL= option must also be specified.

This option is used in conjunction with the CURVELABELPOSITION= option to determine where the curve labels appear.

See "Location and Position of Curve Labels" on page 213

CURVELABELPOSITION=AUTO | MAX | MIN | START | END
specifies the position of the spline curve label relative to the curve line.

AUTO
automatically positions the spline curve label near the curve boundary along unused axes whenever possible (typically Y2 and X2) in order to avoid collision with tick values.

Restriction This option is used only when CURVELABELPOSITION=OUTSIDE.

MAX
forces the spline curve label to appear near maximum curve values (typically, upper right)

MIN
forces the spline curve label to appear near minimum curve values (typically, lower left)

START
forces the spline curve label to appear near the beginning of the curve.

Restriction This option is used only when CURVELABELLOCATION=INSIDE.

Tip This option is particularly useful when the curve line has a spiral shape.

END
forces the spline curve label to appear near the end of the curve.

Restriction This option is used only when CURVELABELLOCATION=INSIDE.

Tip This option is particularly useful when the curve line has a spiral shape.

Defaults AUTO when CUVELABELLOCATION=OUTSIDE.

END when CURVELABELLOCATION=INSIDE.

Interactions For this option to take effect, the CURVELABEL= option must also be specified.

The AUTO setting is ignored if CURVELABELLOCATION=INSIDE is specified. The START and END settings are ignored if CURVELABELLOCATION=OUTSIDE is specified.

This option is used in conjunction with the CURVELABELLOCATION= option to determine where the spline curve label appears.

Note When you specify TICKVALUELIST=, VIEWMAX=, or VIEWMIN= in an axis statement, the data points that are used to determine the position of the spline curve label might fall outside of the graph area. In that case, the spline curve label might not be displayed or might be positioned incorrectly.

Tip When END is in effect, no attempt is made to avoid curve label collisions. If your curve labels collide, try using MAX instead.

See “Location and Position of Curve Labels” on page 213

CURVELABELSPLIT=TRUE | FALSE
specifies whether to split the curve label at the specified split characters. When a curve label is split, the label is split on each occurrence of the specified split characters.

Default FALSE. The curve label is not split.

Requirement The CURVELABEL= option must also be specified.

Interactions The CURVELABELSPLITCHAR= option specifies one or more characters on which the splits occur.

This option has no effect when CURVELABELPOSITION=AUTO.

See “boolean ” on page xii for other Boolean values that you can use.

CURVELABELSPLITCHAR="*character-list*"
specifies one or more characters on which the curve label can be split if needed. When multiple split characters are specified, each character in the list is treated as a separate split character unless the specified characters appear consecutively in the curve label. In that case, all of the specified split characters together are treated as a single split character.

When CURVELABEL= is specified and CURVELABELSPLIT=TRUE, the curve label is split unconditionally at each occurrence of any of the specified split characters. If the curve label does not contain any of the specified characters, then the label is not split.

"character-list"
one or more characters with no delimiter between each character and enclosed in quotation marks.

Default A blank space

Requirements The list of characters must be enclosed in quotation marks.

Multiple characters must be specified with no delimiters. For example, to specify the split characters a, b, and c, use the following option:

```
curvelabelsplitchar="abc"
```

The CURVELABEL= option and the CURVELABELSPLIT=TRUE option must also be specified.

Interactions This option has no effect if CURVELABELPOSITION=AUTO.

The CURVELABELSPLITCHARDROP= option specifies whether the split characters are included in the curve label or are dropped.

Notes When multiple characters are specified, the order of the characters in the list is not significant.

The split characters are case sensitive.

Tip Use the CURVELABELSPLITJUSTIFY= option to specify the justification of the strings in the curve label block.

CURVELABELSPLITCHARDROP=TRUE | FALSE
specifies whether the split characters are included in the curve label text.

TRUE
drops the split characters from the curve label text.

FALSE
includes the split characters in the curve label text.

When CURVELABELSPLIT=TRUE and CURVELABELSPLITCHARDROP=FALSE, each split character remains as the last character in the current line. The characters that follow the split character, up to and including the next split character, are then wrapped to the next line.

The following figure shows an example of a curve label with the following specifications:

- CURVELABELPOSITION=MAX
- CURVELABEL="Product*Group*A"
- CURVELABELSPLIT=TRUE
- CURVELABELSPLITCHARDROP=TRUE | FALSE
- CURVELABELSPLITCHAR="*"

Note: The horizontal line to the left of the label represents the maximum end of the curve for reference.

When CURVELABELSPLITCHARDROP=TRUE, the asterisks are removed from the label. When CURVELABELSPLITCHARDROP=FALSE, each asterisk remains as the last character in the line prior to the new line.

Default TRUE. The split characters are dropped from the curve label.

Requirement The CURVELABEL= option and the CURVELABELSPLIT=TRUE option must also be specified.

Interaction The CURVELABELSPLITCHAR= option specifies the split characters.

See "boolean " on page xii for other Boolean values that you can use.

CURVELABELSPLITJUSTIFY=AUTO | CENTER | LEFT | RIGHT
specifies the justification of the strings that are inside the curve label block.

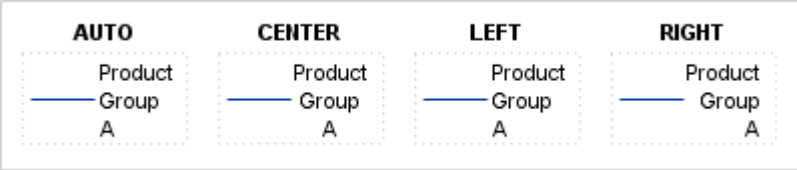
AUTO
justifies the labels based on the CURVELABELPOSITION= option.

CURVELABELPOSITION= Value	Justification
MAX or END	LEFT
MIN or START	RIGHT

CENTER
LEFT
RIGHT
justifies the labels center, left, or right, as specified.

The following figure shows an example in which CURVELABELPOSITION=MAX.

Note: The horizontal line to the left of each label represents the maximum end of the curve for reference.



In this case, because CURVELABELPOSITION=MAX, AUTO left-justifies the lines of text.

Default AUTO

Requirement The CURVELABEL= option and the CURVELABELSPLIT=TRUE option must also be specified.

Interaction This option has no effect if CURVELABELPOSITION=AUTO.

DATATRANSPARENCY=*number*

specifies the degree of the transparency of the curve and curve label.

Default 0

Range 0–1, where 0 is opaque and 1 is entirely transparent

GROUP=*column* | *discrete-attr-var* | *expression*

creates a distinct set of curves from just the observations that correspond to each unique group value of the specified column.

discrete-attr-var

specifies a discrete attribute map variable.

The discrete attribute map variable is created by a DISCRETEATTRVAR statement.

Restriction A discrete attribute map variable specification must be a direct reference to the attribute map variable. It cannot be set by a dynamic variable.

Default Each distinct group value might be represented in the plot by a different combination of color and line pattern. Line colors vary according to the ContrastColor attribute of the GraphData1–GraphDataN and GraphMissing style elements. Line patterns vary according to the LineStyle attribute of the GraphData1–GraphDataN and GraphMissing style elements.

Restriction Starting with SAS 9.4M5, the number of vertices for a patterned line cannot exceed the maximum specified by the ODS GRAPHICS statement option LINEPATTERNOBSMAX=. The default is 10,000. If the limit is exceeded, the plot is not drawn and a note is written to the SAS log stating that the limit has been exceeded. In that

case, increase LINEPATTERNOBSMAX= to the value suggested in the note or change the line pattern to SOLID.

Requirement You must sort the data in ascending order by the specified group column before you plot the data. If the plot data is a CAS in-memory table, you must download the in-memory table to your SAS client, and then sort it locally before you plot it.

Interactions The group values are mapped in the order of the data, unless the INDEX= option is used to alter the default sequence of line colors and line patterns.

The INCLUDEMISSINGGROUP option controls whether missing group values are considered a distinct group value.

Note If you specify a column in a SAS data set, the visual attributes for each group value are assigned in data order. If you specify a column in a CAS in-memory table, the visual attributes for each group value are assigned in ascending order of the group column character values or of unformatted numeric values.

Tips The LINEATTRS= option can be used to override the representations that are used to identify the groups. For example, LINEATTRS=(PATTERN=SOLID) can be used to assign the same pattern to all of the loess curves, letting the line color distinguish group values. Likewise, LINEATTRS=(COLOR=BLACK) can be used to assign the same color to all of the curves, letting the line pattern distinguish group values.

By default, ODS Graphics limits the number of groups to 1000. When this limit is exceeded, the GROUP= option is ignored. Use the GROUPMAX= option in the ODS GRAPHICS statement to change the maximum number of groups that can be processed.

See “DISCRETEATTRVAR Statement” on page 1516

INCLUDEMISSINGGROUP=TRUE | FALSE

specifies whether missing values of the group variable are included in the plot.

Default TRUE

Interaction For this option to take effect, the GROUP= option must also be specified.

Tip The attributes of the missing group value are determined by the GraphMissing style element unless a discrete attribute map is in effect, the INDEX= option is used, the MISSING= system option changes the default missing character, or a user-defined format is applied to the group value. In those cases, the attributes of the missing group value are determined by a GraphData1–GraphDataN style element instead of by the GraphMissing style element.

See “boolean ” on page xii for other Boolean values that you can use.

INDEX=*positive-integer-column* | *expression*
specifies indices for mapping line attributes (color and line pattern) to one of the GraphData1–GraphDataN style elements.

Requirements: The column or expression value must be an integer value of 1 or greater. Otherwise, this option is ignored.

The positive-integer column must not contain missing values. Otherwise, the entire column is invalidated and this option is ignored.

All of the indexes for a specific group value must be the same. Otherwise, the results are unpredictable.

Interaction: For this option to take effect, the GROUP= option must also be specified.

Notes: The index values are 1-based indices. For the style attributes in GraphData1–GraphDataN, if the index value is greater than N, then a modulo operation remaps that index value to a number less than N to determine which style to use.

If you do not use this option, then the group values are mapped in the order of the data.

Tip: You can use indexing to collapse the number of groups that are represented in a graph. For more information, see "Remapping Groups for Grouped Data" on page 211.

LEGENDLABEL="*string*"
specifies a label to be used in a discrete legend for this plot.

Default: The *string* specified on the NAME= option.

Restriction: This option applies only to an associated DISCRETELEGEND statement.

Interaction: If the GROUP= option is specified, then this option is ignored.

LINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the line attributes of the spline curve.

Default: The GraphFit style element.

Restriction: Starting with SAS 9.4M5, the number of vertices for a patterned line cannot exceed the maximum specified by the ODS GRAPHICS statement option LINEPATTERNOBSMAX=. The default is 10,000. If the limit is exceeded, the plot is not drawn and a note is written to the SAS log stating that the limit has been exceeded. In that case, increase LINEPATTERNOBSMAX= to the value suggested in the note or change the line pattern to SOLID.

See: "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

NAME="*string*"
assigns a name to this plot statement for reference in other template statements. The specified name is used primarily in legend statements to coordinate the use of colors and line patterns between the plot and the legend.

Restrictions The *string* is case sensitive, cannot contain spaces, and must define a unique name within the template.

This option does not support variables that are created by the DYNAMIC, MVAR, and NMVAR template statements.

Interaction The *string* is used as the default legend label if the LEGENDLABEL= option is not used.

PRIMARY=TRUE | FALSE
specifies that the data columns for this plot and the plot type be used for determining default axis features. This option is needed only when two or more plots within an overlay-type layout contribute to a common axis.

Default FALSE

Restriction This option is ignored if the plot is placed under a GRIDDED or LATTICE layout block.

Note In an OVERLAY layout, only one plot in an overlay can be the primary plot on a per-axis basis. When no plot is designated as the primary plot, the first plot that can be a primary plot is considered the primary plot. If multiple plots specify PRIMARY=TRUE for the same axis, then the last such plot encountered is considered the primary plot.

See "When Plots Share Data and a Common Axis" on page 1046

"boolean " on page xii for other Boolean values that you can use.

TIPFORMAT=(*role-format-list*)
specifies display formats for tip columns. This option provides a way to control the formats of columns that appear in data tips.

(*role-format-list*)
a space-separated list of *role-name = format* pairs.

Example `TIPFORMAT=(Y=6.2)`

Default The column format of the column assigned to the role or BEST6 if no format is assigned to a numeric column.

Requirement To enable data tips in the output, you must include an ODS GRAPHICS ON statement that specifies the IMAGEMAP option, and you must write the output to the ODS HTML destination.

Note The columns assigned to the X, Y, and GROUP (if assigned) roles are automatically included in the data tip information.

TIPLABEL=(*role-label-list*)
specifies display labels for tip columns. This option provides a way to control the labels of columns that appear in data tips.

role-label-list
a space-separated list of *rolename* ="*string*" pairs.

Example `TIPLABEL=(Y="Curve")`

Default The column label or column name of the column assigned to the role.

Note The columns assigned to the X, Y, and GROUP (if assigned) roles are automatically included in the data tip information.

XAXIS=X | X2
specifies whether data are mapped to the primary X (bottom) axis or to the secondary X2 (top) axis.

Default X

Interaction The overall plot specification and the layout type determine the axis display. For more information, see "How Axis Features Are Determined" on page 1040.

YAXIS=Y | Y2
specifies whether data are mapped to the primary Y (left) axis or to the secondary Y2 (right) axis.

Default Y

Interaction The overall plot specification and the layout type determine the axis display. For more information, see "How Axis Features Are Determined" on page 1040.

PBSPLINE Regression Options

ALPHA=*positive-number*
specifies the confidence level to compute.

Default 0.05

Range 0 < *positive-number* < 1

Tip ALPHA=0.05 represents a 95% confidence level.

CLI="*name*"
produces confidence limits for individual predicted values for each observation.

Interaction *name* is a unique name within the template that is case sensitive and cannot contain spaces. It must be assigned in order for the confidence limits to be computed. To display confidence limits, you

must use this name as the required argument of a MODELBAND statement. See the example in the section "Example: PBSPLINEPLOT Statement" on page 731.

CLM=*"name"*
produces confidence limits for a mean predicted value for each observation.

Interaction *name* is a unique name within the template that is case sensitive and cannot contain spaces. It must be assigned in order for the confidence limits to be computed. To display confidence limits, you must use this name as the required argument of a MODELBAND statement. See the example in the section "Example: PBSPLINEPLOT Statement" on page 731.

DEGREE=*non-negative-integer*
specifies the degree of B-spline.

Default 3

Ranges 0–174 in SAS 9.4M1 and earlier releases.

0–10 starting with SAS 9.4M2.

Restriction Starting with SAS 9.4M2, DEGREE= and NKNOTS= cannot be set to 0 simultaneously. When both are set to 0, an error results.

FREQ=*numeric-column*
specifies a column in the input data set that represents the frequency of occurrence of the current observation, essentially treating the data set as if each observation appeared *n* times, where *n* is the value of the FREQ column for the observation. Noninteger values of the FREQ column are truncated to the largest integer less than the FREQ value. The observation is used in the analysis only if the value of the FREQ column is greater than or equal to 1.

MAXPOINTS=*positive-integer*
specifies the maximum number of predicted points generated for the spline curve as well as any confidence limits.

Default 201

NKNOTS=*non-negative-integer*
specifies the number of evenly spaced internal knots. By default, a large number of knots (100) is specified, which allows for an extreme lack of smoothness in the results. However, the final function is typically much smoother due to the penalty. When SMOOTH=0 is specified, you should typically ask for many fewer knots than the default, since there is no penalty for lack of smoothness. For example, ten or fewer knots is usually enough to follow the functional form found in most data.

Default 100

Restriction Starting with SAS 9.4M2, MKNOTS= and DEGREE= cannot be set to 0 simultaneously. When both are set to 0, an error results.

See example “Penalized B-Splines” in the TRANSREG procedure description in *SAS/STAT User's Guide*.

SMOOTH=AUTO | *non-negative-number*
specifies a smoothing parameter value.

AUTO
automatically selects a smoothing parameter value that minimizes a lack-of-smoothness penalty.

non-negative-number
specifies a smoothing parameter value.

Range [0,1]

Tip Specify SMOOTH=0 for an ordinary B-spline fit.

Default AUTO

See The TRANSREG Procedure in *SAS/STAT User's Guide* for information about the fitting methodology that the PBSPLINEPLOT statement uses.

WEIGHT=*numeric-column*
specifies a column in the input data set that contains values to be used as *a priori* weights for a penalized B-spline fit. If an observation's weight is zero, negative, or missing, then the observation is deleted from the analysis.

Interaction Starting with SAS 9.4M2, when the CLI= option is used with this option, the confidence band for individual predicted values is displayed as a high-low chart instead of a band.

Details

The PBSPLINEPLOT statement supports only models of one independent and one dependent variable. For more information about the fitting methodology, see The TRANSREG Procedure in *SAS/STAT User's Guide*.

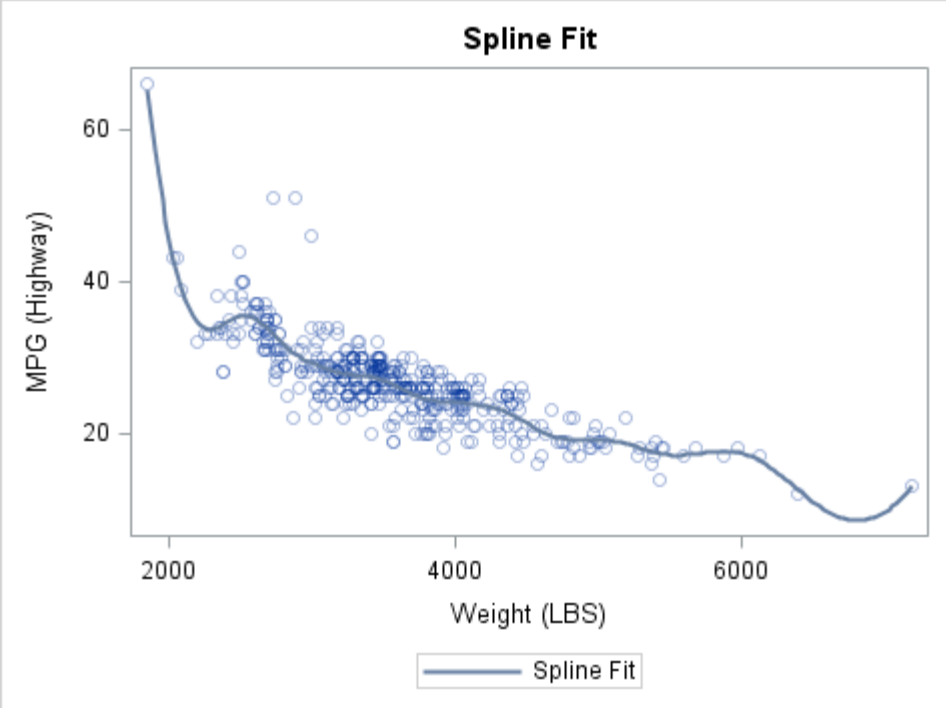
In addition to the penalized B-spline, the PBSPLINEPLOT statement can compute confidence levels for the fitted line. To display the confidence levels,

1 use the CLI= or CLM= option to declare a name for the confidence level

2 use a MODELBAND statement to refer to this name. This statement draws a confidence band from this information. See “MODELBAND Statement” on page 673 for information about how to control the appearance of the confidence band.

Example: PBSPLINEPLOT Statement

The following graph was generated by the "Example Program" on page 731:



Example Program

```
proc template;
 define statgraph pbsplineplot;
  begingraph;
    entrytitle "Spline Fit";
    layout overlay;
      scatterplot x=weight y=mpg_highway /
        datatransparency=0.7;
      pbsplineplot x=weight y=mpg_highway / name="fitline"
        alpha=0.05 legendlabel="Spline Fit";
      discretelegend "fitline";
    endlayout;
  endgraph;
 end;
run;

proc sgrender data=sashelp.cars template=pbsplineplot;
run;
```

PIECHART Statement

Creates a pie chart that is computed from input data.

Requirement: The PIECHART statement must be placed in a LAYOUT REGION, LAYOUT GRIDDED, or LAYOUT LATTICE block. It cannot be placed in an overlay-type layout such as LAYOUT OVERLAY or LAYOUT OVERLAYEQUATED because a pie chart does not have axes.

Note: The PIECHART statement does not honor the ODS GRAPHICS options DISCRETEMAX=, GROUPMAX=, and LABELMAX=.

Syntax

PIECHART CATEGORY=*column* | *discrete-attr-var* | *expression* </*options*>;

PIECHART CATEGORY=*column* | *discrete-attr-var* | *expression*
RESPONSE=*numeric-column* | *expression* </*options*>;

Summary of Optional Arguments

Appearance options

CATEGORYDIRECTION=COUNTERCLOCKWISE | CLOCKWISE
: specifies whether to display the pie slices in counterclockwise or clockwise sequence.

CENTERFIRSTSLICE=TRUE | FALSE
: specifies whether the first pie slice is centered on the starting angle or starts on the starting angle.

DATASKIN=NONE | CRISP | GLOSS | MATTE | PRESSED | SHEEN
: enhances the visual appearance of the filled pie slices.

DATATRANSPARENCY=*number*
: specifies the degree of the transparency of all pie slices, outlines, and text.

DISPLAY=(*display-options*) | STANDARD
: specifies which pie-slice options to display.

FILLATTRS=*style-element* | *style-element* (*fill-options*) | (*fill-options*)
: specifies the appearance of the filled pie slices.

OTHERSLICEOPTS=(*other-slice-options*)
: specifies the properties of the Other slice.

OUTLINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
: specifies the properties of the pie and slice outlines.

START=*degrees*

specifies which degree between 0 and 360 serves as the starting position for the first pie slice.

Data tip options

TIP=(*role-list*) | NONE
specifies the information to display when the cursor is positioned over a pie slice.

TIPFORMAT=(*role-format-list*)
specifies display formats for tip columns.

TIPLABEL=(*role-label-list*)
specifies display labels for tip columns.

Grouping options

GROUP=*column* | *expression*
creates a separate concentric annulus (or stacked cylinders) for each unique group value of the specified column.

GROUPGAP=*dimension*
specifies a dimension for the optional gap that can be displayed between each annulus of a grouped pie.

GROUPLABELOPTS=(*grouplabel-options*)
specifies text attributes, location, and other options for displaying group labels.

INCLUDEMISSINGGROUP=TRUE | FALSE
specifies whether missing values of the Group column are included in the pie.

OTHERSLICE=TRUE | FALSE
specifies whether to consolidate smaller pie slices into a single slice that represents “other” values that are in the data, or whether to display those smaller slices as separate pie slices.

Label options

DATALABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font attributes of the slice labels.

DATALABELCONTENT=ALL | STANDARD | NONE | (*content-options*)
specifies the information to display in the slice labels.

DATALABELLOCATION=AUTO | INSIDE | OUTSIDE | CALLOUT
specifies whether to display the slice labels within the pie slices or outside of the pie circumference.

LABELFITPOLICY=NONE | DROP
specifies the label fitting policy to be used if a particular label does not fit within the pie slice.

ODS options

URL=*string-column*
specifies an HTML page to display when a pie slice is selected.

Plot reference options

NAME=*"string"*

assigns a name to this plot statement for reference in other template statements.

Statistics options

STAT=FREQ | PCT | SUM | MEAN
specifies the statistic to be computed.

Required Argument

CATEGORY=*column* | *discrete-attr-var* | *expression*
specifies the column for the category values. Duplicated values of CATEGORY are summarized into a unique value. All values are treated as discrete.

discrete-attr-var
specifies a discrete attribute map variable.

The discrete attribute map variable is created by a DISCRETEATTRVAR statement.

Restriction A discrete attribute map variable specification must be a direct reference to the attribute map variable. It cannot be set by a dynamic variable.

See "DISCRETEATTRVAR Statement" on page 1516

Optional Arguments

CATEGORYDIRECTION=COUNTERCLOCKWISE | CLOCKWISE
specifies whether to display the pie slices in counterclockwise or clockwise sequence.

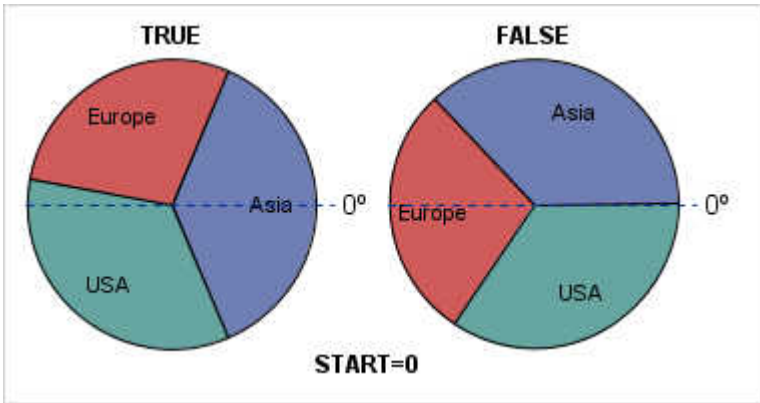
Default COUNTERCLOCKWISE

Tip The START= option controls the starting angle for the first pie slice.

CENTERFIRSTSLICE=TRUE | FALSE
specifies whether the first pie slice is centered on the starting angle or starts on the starting angle.

Note: This option is valid starting in SAS 9.4M1.

The following figure shows the effect of this option on a pie chart in which Asia is the first category slice, the starting angle is 0 degrees, and the category direction is counterclockwise.



Default FALSE

Tips Use the START= option to change the starting angle.

Use the CATEGORYDIRECTION= option to change the category direction.

See "boolean " on page xii for other Boolean values that you can use.

DATALABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font attributes of the slice labels.

Default The GraphValueText style element.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Text Options" on page 1606 for available *text-options*.

DATALABELCONTENT=ALL | STANDARD | NONE | (*content-options*)
specifies the information to display in the slice labels.

ALL
displays all available information

STANDARD
equivalent to specifying the two *content-options* CATEGORY and RESPONSE

NONE
does not display slice labels

(*content-options*)
a space-separated list of one or more of the following options enclosed in parentheses:

CATEGORY
displays the CATEGORY value

PERCENT
displays the PERCENT value when STAT=FREQ or STAT=PCT. When STAT=MEAN or STAT=SUM, it displays nothing

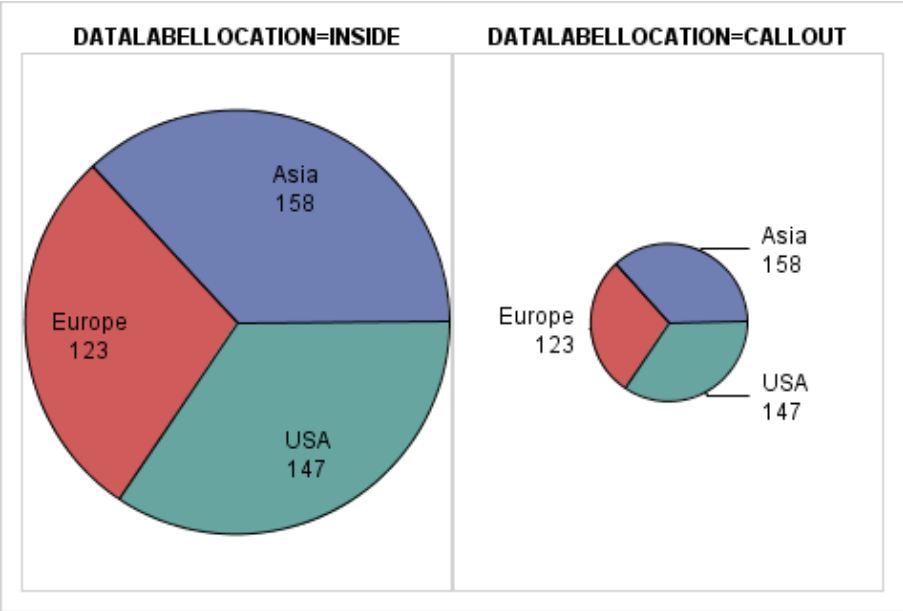
RESPONSE
displays the statistic that is requested in the STAT= option.

Defaults When STAT=PCT, the default is (CATEGORY PERCENT).

Otherwise, the default is STANDARD.

Note The position of the labels is adjusted to prevent the labels from overlapping.

DATALABELLOCATION=AUTO | INSIDE | OUTSIDE | CALLOUT
specifies whether to display the slice labels within the pie slices or outside of the pie circumference.



AUTO
automatically selects either INSIDE, OUTSIDE, or CALLOUT to optimize the label position

INSIDE
locates the slice labels inside the pie slices.

Note: If a particular label does not fit within the pie slice, then the fit policy takes effect (set by the LABELFITPOLICY= option).

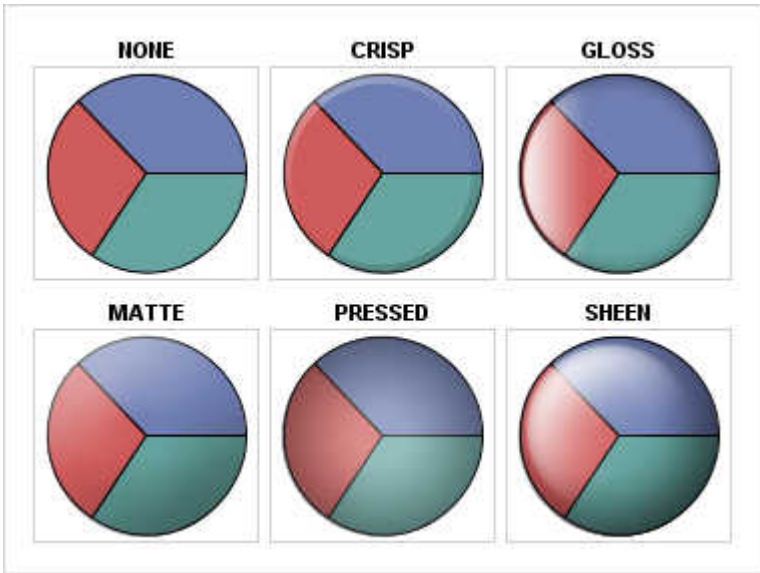
OUTSIDE
locates the slice labels outside of the pie circumference.

CALLOUT
locates the slice labels outside of the pie circumference and draws a line from the label to its slice.

Default AUTO

Note When OUTSIDE or CALLOUT is specified and there is not enough space to display one or more of the labels, the labels are suppressed.

DATASKIN=NONE | CRISP | GLOSS | MATTE | PRESSED | SHEEN
enhances the visual appearance of the filled pie slices. The following figure shows pies with each of the skins applied.



Default The DATASKIN= option value that is specified in the BEGINGRAPH statement. If not specified, then the GraphSkins:DataSkin style element value is used.

Restriction Starting with SAS 9.4M1, the maximum number of skinned graphical elements is limited to 200 per plot in an OVERLAY or PROTOTYPE layout. When this limit is exceeded for a plot, the specified data skin is not applied to that plot. In that case, use the DATASKINMAX= option in your ODS GRAPHICS statement to increase the maximum limit.

Requirement For this option to have any effect, DISPLAY= FILL must be in effect. Otherwise, this option is ignored.

Interactions This option overrides the BEGINGRAPH statement DATASKIN= option.

The appearance of the data skin is based on the FILLATTRS= color.

When a data skin is applied, all slice outlines are set by the skin, and the OUTLINEATTRS= option is ignored.

DATATRANSPARENCY=*number*
specifies the degree of the transparency of all pie slices, outlines, and text.

Default 0

Range 0–1, where 0 is opaque and 1 is entirely transparent

Tip The FILLATTRS= option can be used to set transparency for just the pie slices. The OTHERSLICEOPTS= option can be used to specify transparency for the “other” slice. You can combine this option with FILLATTRS= and with OTHERSLICEOPTS= to set one transparency for

the outlines and text but a different transparency for the pie slices. Example:

```
datatransparency=0.2 fillattrs=(transparency=0.6)
```

DISPLAY=(*display-options*) | STANDARD
specifies which pie-slice options to display.

(*display-options*)
specifies a space-separated list of one or more display options, enclosed in parentheses.

The list can contain one or more of the following options:

OUTLINE
displays the pie-slice outline.

The default outline properties are set by the GraphOutline style element.

FILL
displays the pie-slice fill color.

The default colors are set by the Color attribute of the GraphData1–GraphDataN style elements. The fill color of the "other" slice (if shown) is from the Color attribute of the GraphOther style element. If FILL is not specified, then an opaque pie is drawn using the background color of the containing layout.

STANDARD
specifies OUTLINE and FILL

Default STANDARD

Tip Use the OUTLINEATTRS= and FILLATTRS= options to control the appearance of the pie slices.

FILLATTRS=*style-element* | *style-element* (*fill-options*) | (*fill-options*)
specifies the appearance of the filled pie slices. Prior to SAS 9.4M3, this option specifies the color and transparency of all of the pie slices, excluding the Other slice. Starting with SAS 9.4M3, this option specifies the transparency for the Other slice as well.

Default The GraphDataDefault:Color style reference.

Interaction For this option to have any effect, the fill must be enabled by the ODS style or the DISPLAY= option.

Tips The FILLATTRS= suboption of the OTHERSLICEOPTS= option specifies the color and transparency of the Other slice.

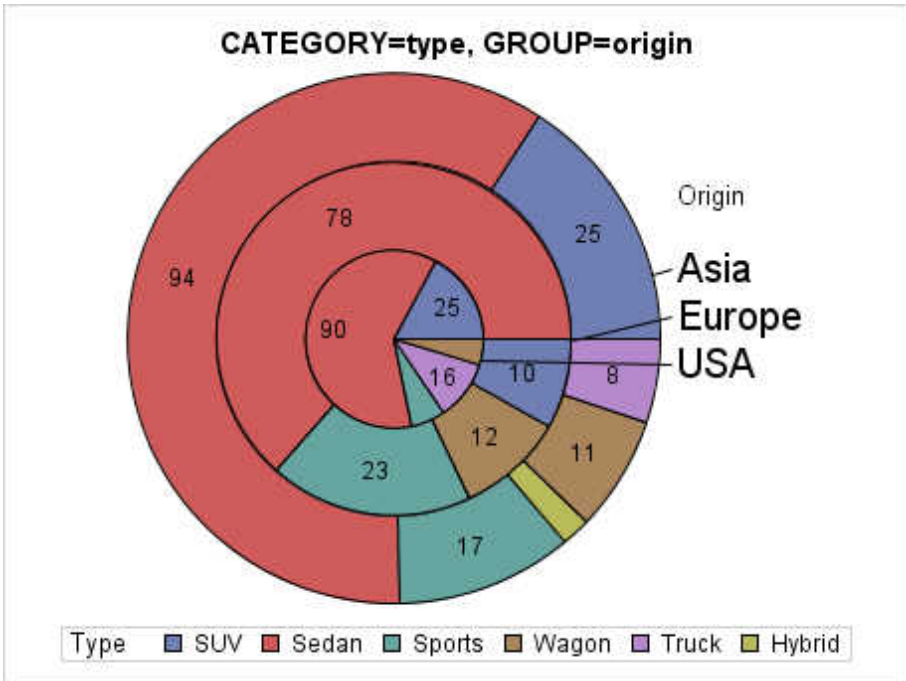
The DATATRANSPARENCY= option sets the transparency for all pie slices, outlines, and text. You can combine this option with DATATRANSPARENCY= to set one transparency for the outlines and text but a different transparency for the pie slices. Example:

```
datatransparency=0.2 fillattrs=(transparency=0.6)
```

See "General Syntax for Attribute Options" on page 1599 for the syntax for using a *style-element* value.

"Fill Color Options" on page 1600 for available *fill-options* values.

GROUP=*column* | *expression*
creates a separate concentric annulus (or stacked cylinders) for each unique group value of the specified column. The grouped rings are displayed in data order.



Restriction The PIECHART GROUP= option does not honor the ODS GRAPHICS statement GROUPMAX= option.

Interactions When this option is used, the unique column values are found and then the slice colors are taken from the GraphData1–GraphDataN style elements.

Missing values in the data can affect the group order. You can use the INCLUDEMISSINGGROUP= option to manage missing group values. In addition, you can use INCLUDEMISSINGDISCRETE=TRUE in the BEGINGRAPH statement to create pie slices for missing CATEGORY values.

Note If you specify a column in a SAS data set, the visual attributes for each group value are assigned in data order. If you specify a column in a CAS in-memory table, the visual attributes for each group value are assigned in ascending order of the group column character values or of unformatted numeric values.

Tips This option creates only rings of pies. To create a grid of pies, specify the PIECHART statement within a LAYOUT LATTICE, LAYOUT DATALATTICE, or LAYOUT DATAPANEL statements.

By default, ODS Graphics limits the number of groups to 1000. When this limit is exceeded, the GROUP= option is ignored. Use the GROUPMAX= option in the ODS GRAPHICS statement to change the maximum number of groups that can be processed.

See FILLATTRS=

GROUPGAP=

GROUPLABELOPTS=

GROUPGAP=*dimension*
specifies a dimension for the optional gap that can be displayed between each annulus of a grouped pie.

Default 0

Restriction For this option to take effect, the GROUP= option must also be specified.

Interaction If the specified *dimension* is too large for the area that is available to the pie chart, then the results might be unexpected.

Note The size of the inner pie remains the same regardless of the GROUPGAP= value.

See "dimension" on page xiii

GROUPLABELOPTS=(*grouplabel-options*)
specifies text attributes, location, and other options for displaying group labels. The following *grouplabel-options* are available. One or more options can be specified as space-separated *name = value* pairs.

LABEL=AUTO | NONE | *"string"*
specifies a descriptive label for the Group column

AUTO
specifies the column label of the GROUP= column or the column name of the GROUP= column, if no column label exists.

NONE
specifies that no label is displayed

"string"
specifies a string to use as the label

Default AUTO

LABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the text properties of the group label.

Default The GraphLabelText style element.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Text Options" on page 1606 for available *text-options*.

LOCATION=RIGHT | LEFT
specifies whether the block of text for group labeling appears to the right or left of the pie.

Default RIGHT

VALUEATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the text properties of the group values.

Default The GraphValueText style element.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Text Options" on page 1606 for available *text-options*.

Default The group label and values are shown as a block of text to the right or left of the pie. Slice labels are moved to the inside of the pie slices. A line is drawn from each group value to its annulus (or cylinder).

Restriction For this option to take effect, the GROUP= option must also be specified.

INCLUDEMISSINGGROUP=TRUE | FALSE
specifies whether missing values of the Group column are included in the pie.

Default TRUE

Restriction For this option to take effect, the GROUP= option must also be specified.

See "boolean " on page xii for other Boolean values that you can use.

LABELFITPOLICY=NONE | DROP
specifies the label fitting policy to be used if a particular label does not fit within the pie slice.

NONE
draws each label regardless of whether it fits within the slice region.

DROP
drops labels that do not fit within the slice region, but draws labels that do fit.

Default NONE

Tip This option determines how labels are managed when DATALABELLOCATION= INSIDE and a particular label does not fit within the pie slice.

NAME="*string*"
assigns a name to this plot statement for reference in other template statements. The specified name is used primarily in legend statements to coordinate the use of colors and line patterns between the plot and the legend.

Restrictions The *string* is case sensitive, cannot contain spaces, and must define a unique name within the template.

This option does not support variables that are created by the DYNAMIC, MVAR, and NMVAR template statements.

OTHERSLICE=TRUE | FALSE
specifies whether to consolidate smaller pie slices into a single slice that represents "other" values that are in the data, or whether to display those smaller slices as separate pie slices. If this option is set to FALSE, then all unique category values appear as slices. If this option is set to TRUE, then some of the smaller slices might be combined into a single slice, referred to as the Other slice.

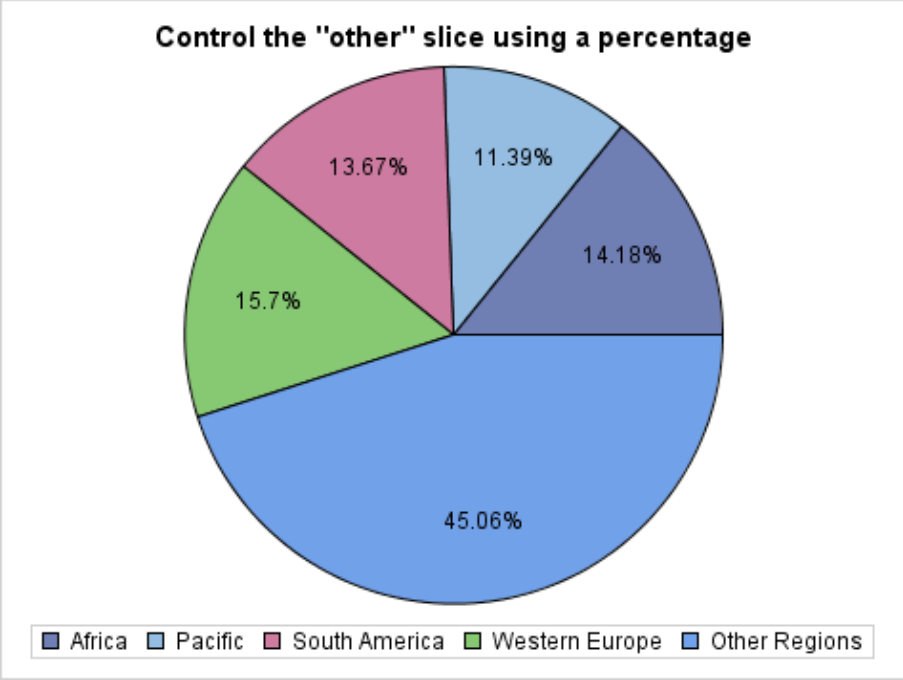
Default TRUE

Tip To set the properties of the "other" slice, use the OTHERSLICEOPTS= option.

See "boolean " on page xii for other Boolean values that you can use.

OTHERSLICEOPTS=(*other-slice-options*)
specifies the properties of the Other slice. Example:

```
piechart category=region / name="p"
  datalabelcontent=(percent) datalabellocation=inside
  otherslice=true
  othersliceopts=(type=percent percent=11 label="Other Regions") ;
```



The following *other-slice-options* values are available. You can specify one or more options as space-separated *name = value* pairs.

TYPE=PERCENT | MAXSLICES
specifies which method to use to determine the size of the Other slice.

PERCENT
uses the percentage that is set by the PERCENT= suboption.

MAXSLICES
uses the count that is set by the MAXSLICES= suboption.

Default PERCENT

MAXSLICES=*positive-integer*
specifies the maximum number of category values to represent with pie slices.

Any remaining values are consolidated into the Other slice.

Default 10

Interactions For this option to have any effect, TYPE=MAXSLICES must also be specified among the suboptions for OTHERSLICEOPTS=.

The slices are counted in the order in which they are displayed. This order is affected by the CATEGORYDIRECTION= option.

PERCENT=*percent-of-total*
collects all category values with response values less than or equal to the specified *percent-of-total* value into the Other slice.

Default 4. Any original slice that represents 4% or less of the total is put in the Other category.

Range 0–100

Interaction For this option to have any effect, TYPE=PERCENT must also be specified among the suboptions for OTHERSLICEOPTS=.

LABEL="*string*"
specifies a label for the Other slice.

Default "OTHER"

FILLATTRS=*style-element* | *style-element* (*fill-options*) | (*fill-options*)
specifies the appearance of the area fill for the Other slice.

This option does not affect the appearance of the area fill for the remaining slices.

Default The GraphOther style element.

Interactions Suboption TRANSPARENCY= in this option overrides the DATATRANSPARENCY= option for the other slice only.

Starting with SAS 9.4M3, suboption TRANSPARENCY= in this option overrides suboption TRANSPARENCY= in option FILLATTRS= in the PIECHART statement only for the Other slice.

See "General Syntax for Attribute Options" on page 1599 for the syntax for using a *style-element* value.

"Fill Color Options" on page 1600 for available *fill-options* values.

Interaction This option is ignored if OTHERSLICE=FALSE.

OUTLINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the properties of the pie and slice outlines.

Default The GraphOutlines style element.

Interactions For this option to have any effect, outlines must be enabled by the ODS style or the DISPLAY= option.

If the DATASKIN= option applies a data skin, then this option is ignored.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

START=*degrees*
specifies which degree between 0 and 360 serves as the starting position for the first pie slice. A value of 0 degrees corresponds to the three o'clock position. Degrees can be either positive or negative. Positive values move the starting position counterclockwise, and negative values move the starting position clockwise. From the starting point specified by this option, the slices are drawn in the direction specified by the CATEGORYDIRECTION= option.

Default 0

Range 0 to 360

STAT=FREQ | PCT | SUM | MEAN
specifies the statistic to be computed. For pie charts with no RESPONSE= column:

FREQ frequency count

PCT percentages between 0 and 100

For pie charts with a RESPONSE= column:

SUM

MEAN

Defaults SUM for pie charts that specify the RESPONSE= argument

FREQ for pie charts that do not specify the RESPONSE= argument

TIP=(*role-list*) | NONE
specifies the information to display when the cursor is positioned over a pie slice. If this option is used, then it replaces all of the information that is displayed by default.

(role-list)
an ordered, space-separated list of unique PIECHART roles.

PIECHART roles include CATEGORY, RESPONSE, and GROUP. The RESPONSE role represents the computed statistic for the CATEGORY value, based on the statistic that is set by the STAT= option.

Example The following example displays data tips for the columns assigned to the roles CATEGORY and RESPONSE.

```
TIP=(CATEGORY RESPONSE)
```

NONE
suppresses data tips and URLs (if requested) from the plot.

Default The columns assigned to these roles are automatically included in the data tip information: CATEGORY and RESPONSE .

Requirement To generate data tips in the output, you must include an ODS GRAPHICS ON statement that specifies the IMAGEMAP option, and you must write the output to the ODS HTML destination.

Tip The labels and formats for the TIP roles can be controlled with the TIPLABEL= and TIPFORMAT= options.

TIPFORMAT=(*role-format-list*)
specifies display formats for tip columns. This option provides a way to control the formats of columns that appear in data tips.

(role-format-list)
a space-separated list of *role-name* = *format* pairs.

Example

```
TIP=(RESPONSE)
TIPFORMAT=(RESPONSE=DOLLAR12.)
```

Default The column format of the column assigned to the role or BEST6 if no format is assigned to a numeric column.

Restriction Only the roles that appear in the TIP= option are used.

Requirement A column must be assigned to each of the specified roles.

TIPLABEL=(*role-label-list*)
specifies display labels for tip columns. This option provides a way to control the labels of columns that appear in data tips.

role-label-list
a space-separated list of *rolename* ="*string*" pairs.

Example
```
TIP=(RESPONSE)
TIPLABEL=(RESPONSE="Average Sales")
```

Default The column label or column name of the column assigned to the role.

Restriction Only the roles that appear in the TIP= option are used.

Requirement A column must be assigned to each of the specified roles.

URL=*string-column*
specifies an HTML page to display when a pie slice is selected.

string-column
specifies a column that contains a valid HTML page reference (HREF) for each pie slice that is to have an active link.

Example **`http://www.sas.com`**

Restriction A generated Other slice does not have a URL. See OTHERSLICE=.

Requirement To generate a plot with selectable pie slices, you must include an ODS GRAPHICS ON statement that specifies the IMAGEMAP option, and you must write the output to the ODS HTML destination.

Interaction This option has no effect when TIP=NONE.

Tips The URL value can be blank for some pie slices, meaning that no action is taken when the corresponding slice is selected.

The URL value can be the same for any CATEGORY and RESPONSE pairs. In that case, the same action is taken when the pie slices for those pairs are selected.

By default, drill-down links open in a new browser window (link target _blank). To specify a different target for your drill-down links, such as _self or _parent, add the DRILLTARGET="*target*" option to your ODS GRAPHICS statement. See DRILLTARGET= on page 1568.

Optional Response Argument

RESPONSE=*numeric-column* | *expression*
specifies response values that are read from a numeric column or an expression.

Details

The input data for the PIECHART statement is raw, unsummarized input data. The PIECHART performs discrete binning for the Category column and calculates

appropriate summarization statistics (sum, mean, and so on) based on the setting for the STAT= option.

The fill color of each pie slice is derived from the Color attribute of the GraphData1–GraphDataN style elements as described in "Attribute Rotation Patterns" in *SAS Graph Template Language: User's Guide*. The default order of the pie slices depends on the data type of the CATEGORY values:

- For numeric data, the slices appear in the ascending order of the unformatted data values.
- For discrete data, the slices appear in data order.

You can use the START= and CATEGORYDIRECTION= options to control the pie slice positions and display order.

By default, the pie slices are labeled with the CATEGORY and RESPONSE values, which are displayed inside the slices. You can use the DATALABELLOCATION= and DATALABELCONTENT= options to control where the pie slices are labeled and the label content.

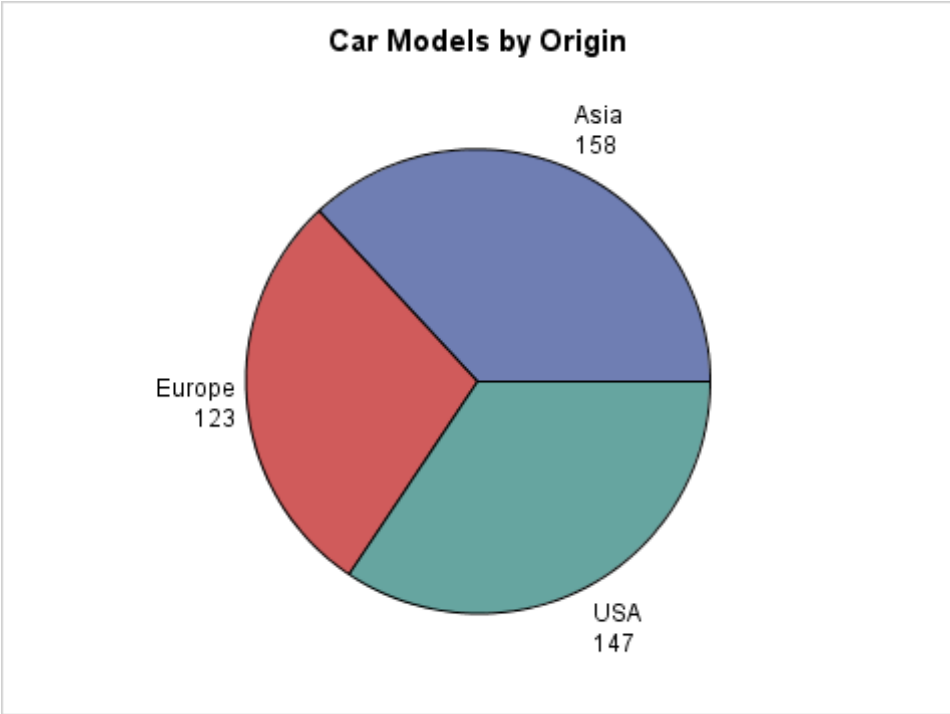
By default, if two or more slices take up less than 4% of a pie, then an "other" slice is created by consolidating those small slices. To change the default criteria, use the OTHERSLICE= and OTHERSLICEOPTS= options. The calculated "other" slice is displayed as the last slice in the pie, and as the last legend entry for the pie. If a category value is the same as the "other" slice label, then two slices might be displayed with the same label ("Other" by default) and different fill attributes. In that case, both slices are represented in the pie legend.

To create a pie slice for missing CATEGORY values, specify INCLUDEMISSINGDISCRETE=TRUE in the BEGINGRAPH statement. The fill color of the missing category slice is assigned the fill color from the GraphMissing style element except when a user-defined format is applied to the category value. In that case, the missing category slice is assigned the fill color from a GraphData1–GraphdDataN style element in data order instead.

Note: The PIECHART statement does not honor the MISSING= system option. Regardless of the MISSING= system option value, unless a user-defined format is applied to the value, the default missing-numeric-value character (.) is used to depict missing numeric values.

Example: PIECHART Statement

The following graph was generated by the "Example Program" on page 748 :



Example Program

```
proc template;
define statgraph simplepie;
  begingraph;
    entrytitle "Car Models by Origin";
    layout region;
      piechart category=origin / datalabellocation=outside;
    endlayout;
  endgraph;
end;
run;
proc sgrender data=sashelp.cars
              template=simplepie;
run;
```

POLYGONPLOT Statement

Draws a polygon from data that is stored in a data set.

Restriction: The POLYGONPLOT statement does not support CAS in-memory tables. If the polygon plot data is stored in a CAS table, the polygon plot is not drawn.

Note: This statement is valid starting in SAS 9.4M1.

Tip: Starting with SAS 9.4M3, you can use subpixel rendering with this statement. It is enabled by default. To disable subpixel rendering, specify SUBPIXEL=OFF in the

BEGINGRAPH statement or in an ODS GRAPHICS statement. For information about the BEGINGRAPH statement SUBPIXEL= option, see SUBPIXEL= on page 39. For information about the ODS GRAPHICS statement SUBPIXEL= option, see "ODS GRAPHICS Statement" on page 1561.

Syntax

POLYGONPLOT X=*column* | *expression* Y=*column* | *expression* ID=*column* | *expression*< */options(s)* >

Summary of Optional Arguments

Appearance options

ANTIALIAS=AUTO | OFF
: specifies whether anti-aliasing is turned off for this plot.

BACKLIGHT=*number* | AUTO
: specifies a back-light effect for the polygon label text.

COLORMODEL=*color-ramp-style-element* | (*color-list*)
: specifies a color ramp to use with the COLORRESPONSE= option.

COLORRESPONSE=*numeric-column* | *range-attr-var* | *expression*
: specifies the numeric column or range attribute map variable to use to determine the polygon colors.

DATASKIN=NONE | CRISP | GLOSS | MATTE | PRESSED | SHEEN
: enhances the visual appearance of filled polygons.

DATATRANSPARENCY=*number*
: specifies the degree of the transparency of the polygon fill, outline, and label, when these attributes are displayed.

DISPLAY=(*display-options*) | STANDARD | ALL
: specifies which polygon features to display.

FILLATTRS=*style-element* | *style-element* (*fill-options*) | (*fill-options*)
: specifies the appearance of the filled polygon areas.

FILLPATTERNATTRS=*style-element* | (*fill-pattern-options*)
: specifies the appearance of the pattern-filled areas.

OUTLINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
: specifies the appearance of the polygon outline.

REVERSECOLORMODEL=TRUE | FALSE
: specifies whether to reverse the gradient (color ramp) that is defined by either the ODS style that is in effect or by the COLORMODEL= option.

ROTATE=*numeric-column* | *numeric-constant* | *expression*
: specifies the angle of rotation for the polygon, measured in degrees.

ROTATELABEL=AUTO | NONE | VERTICAL
: specifies the rotation of the polygon label with respect to the rotation of the polygon.

Axes options

PRIMARY=TRUE | FALSE
: specifies that the data columns for this plot and the plot type be used for determining default axis features.

XAXIS=X | X2
: specifies whether data are mapped to the primary X (bottom) axis or to the secondary X2 (top) axis.

YAXIS=Y | Y2
: specifies whether data are mapped to the primary Y (left) axis or to the secondary Y2 (right) axis.

Data tip options

ROLENAME=(*role-name-list*)
: specifies user-defined roles that can be used to display information in the data tips.

TIP=(*role-list*) | NONE
: specifies the information to display when the cursor is positioned over the polygon.

TIPFORMAT=(*role-format-list*)
: specifies display formats for tip columns.

TIPLABEL=(*role-label-list*)
: specifies display labels for tip columns.

Label options

LABEL=*column* | *expression*
: specifies the label for the polygon.

LABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
: specifies the color and font attributes of the polygon label.

LABELLOCATION=INSIDEBBOX | OUTSIDEBBOX | OUTSIDE
: specifies the location of the polygon label.

LABELPOSITION=CENTER | XMIN | XMAX | YMIN | YMAX
: specifies the position of the polygon label with respect to the label location.

LABELSPLIT=TRUE | FALSE
: specifies whether to split the polygon label at the specified split characters.

LABELSPLITCHAR="*character-list*"
: specifies one or more characters on which the polygon label can be split if needed.

LABELSPLITCHARDROP=TRUE | FALSE
: specifies whether the split characters are included in the polygon label.

LABELSPLITJUSTIFY=AUTO | CENTER | LEFT | RIGHT
: specifies the justification of the strings that are inside the polygon label blocks.

LEGENDLABEL="*string*"
: specifies a label to be used in a discrete legend for this plot.

Midpoint options

GROUP=*column* | *discrete-attr-var* | *expression*

creates a separate and visually distinctive polygon for each unique grouping value.

INCLUDEMISSINGGROUP=TRUE | FALSE
specifies whether missing values of the group variable are included in the plot.

XOFFSET=*numeric-column* | *expression*
specifies an individual offset from the discrete X value on each vertex of the polygon.

YOFFSET=*numeric-column* | *expression*
specifies an individual offset from the discrete Y value on each vertex of the polygon.

ODS options

URL=*string-column*
specifies an HTML page that is displayed when the polygon is selected.

Plot reference options

NAME="*string*"
assigns a name to this plot statement for reference in other template statements.

Required Arguments

X=*column* | *expression*
specifies the column for the X values.

Note A missing value in the X column signals the start of the data for a hole in the polygon. See "Drawing Holes in a Polygon" on page 773.

Y=*column* | *expression*
specifies the column for the Y values.

Note A missing value in the Y column signals the start of the data for a hole in the polygon. See "Drawing Holes in a Polygon" on page 773.

ID=*column* | *expression*
specifies the column that contains the ID value that is associated with each polygon.

Restriction Only unformatted values in the ID= column are used.

Requirements All of the observations for a single polygon must have the same ID value.

When multiple polygons are defined in the same data set, all of the observations for a given ID must be defined contiguously. Interspersing the ID observations in the data set can produce unexpected results.

Note Observations that have a missing value in the ID column are ignored by the POLYGONPLOT statement.

Optional Arguments

ANTIALIAS=AUTO | OFF
specifies whether anti-aliasing is turned off for this plot.

Note: This feature applies to SAS 9.4M2 and to later releases.

AUTO
specifies that anti-aliasing is controlled by the ANTIALIAS= option in the ODS GRAPHICS statement.

OFF
specifies that anti-aliasing is always disabled for this plot.

Default AUTO

Interaction This option overrides the ANTIALIAS= option in the ODS GRAPHICS statement.

BACKLIGHT=*number* | AUTO
specifies a back-light effect for the polygon label text.

Note: This feature applies to SAS 9.4M2 and to later releases.

The effect is applied only to the polygon label text.

number
specifies the degree of the back-light effect.

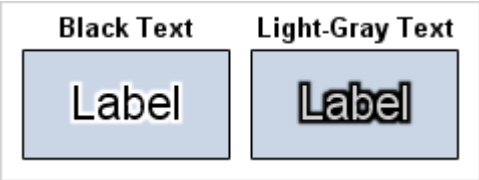
Range 0–1, where 0 specifies no effect and 1 specifies maximum effect

AUTO
the system selects an appropriate level for the back-light effect.

If the GROUP= or COLORRESPONSE= option is in effect, BACKLIGHT=0.75. Otherwise, BACKLIGHT=0.5.

The following figure shows the effect on a polygon label located inside the polygon bounding box.

The back light is based on text color. For dark colors, a contrasting white back-light effect is used. For lighter colors, a contrasting black back-light effect is used. The following figure shows the two back-light types when BACKLIGHT=1.



Default 0 (no back-light effect)

Restriction Vector graphics output cannot be generated when the back-light effect is applied. If you request vector graphics output and enable the back-light effect, an image is generated instead.

Interaction The LABEL= option must be specified for this option to have any effect.

Note If the background color is white, the white backlight effect for dark text colors is not visible. Conversely, if the background color is black, the black backlight effect for light text colors is not visible.

Tip The BACKLIGHT= option is most effective when the text color has a low level of contrast with the background or when the background is cluttered.

COLORMODEL=*color-ramp-style-element* | (*color-list*)
specifies a color ramp to use with the COLORRESPONSE= option.

color-ramp-style-element
specifies the name of a color-ramp style element.

The style element should contain these style attributes:

STARTCOLOR
specifies the color for the smallest data value of the COLORRESPONSE= column.

NEUTRALCOLOR
specifies the color for the midpoint of the range of the COLORRESPONSE= column.

ENDCOLOR
specifies the color for the highest data value of the COLORRESPONSE= column.

(*color-list*)
specifies a space-separated list of colors to use in the color ramp. You can use style attribute references such as GraphData3:Color, color names, or RGB, CMYK, HLS, and HSV (HSB) color codes to specify a color. The list can contain a mix of style attribute references, color names, and color codes.

Requirement The list of colors must be enclosed in parentheses.

See “color ” on page xii

Defaults For a filled polygon, the ThreeColorRamp style element

For an unfilled polygon, the ThreeColorAltRamp style element

Interaction For this option to take effect, the COLORRESPONSE= option must also be specified.

Tip To reverse the start and end colors of the ramp that is assigned to the color model, use the REVERSECOLORMODEL= option.

COLORRESPONSE=*numeric-column* | *range-attr-var* | *expression*
specifies the numeric column or range attribute map variable to use to determine the polygon colors.

range-attr-var
specifies a range attribute map variable that is defined in a RANGEATTRVAR statement.

"RANGEATTRVAR Statement"

Restriction A range attribute map variable specification must be a direct reference to the attribute map variable. It cannot be set as a dynamic variable.

See "RANGEATTRVAR Statement" on page 1531

When a numeric column or expression is specified, the range of column or expression values are linearly mapped to the color ramp that is specified by the COLORMODEL= option. When a range attribute map variable is specified, the colors that are defined in the associated range attribute map are used instead.

Requirement The COLORRESPONSE= value should remain constant for the same ID value. Otherwise, unexpected results might occur.

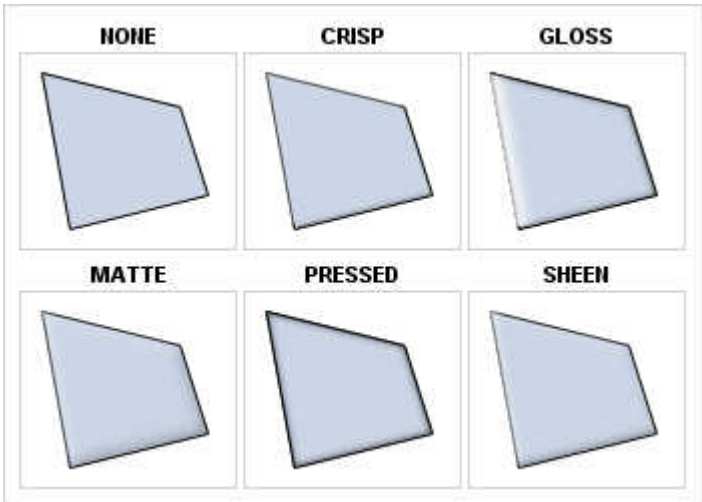
Interactions Prior to SAS 9.4M5, when the GROUP= option is specified with the COLORRESPONSE= option, the GROUP= option is ignored. Starting with SAS 9.4M5, the COLORRESPONSE= option controls the color of the group fill patterns when the fill patterns are displayed.

When fill is displayed, this option overrides suboption COLOR= in the FILLATTRS= option and varies the fill color according to the color gradient or the attribute map.

When only the outline is displayed, this option overrides suboption COLOR= in the OUTLINEATTRS= option and varies the outline color according to the color gradient or the attribute map.

Tip To display a legend with this option in effect, use a CONTINUOUSLEGEND statement.

DATASKIN=NONE | CRISP | GLOSS | MATTE | PRESSED | SHEEN
enhances the visual appearance of filled polygons. The following figure shows a polygon with each of the skins applied.



Default The DATASKIN= option value that is specified in the BEGINGRAPH statement. If not specified, then the GraphSkins:DataSkin style element value is used.

Restriction Starting with SAS 9.4M1, the maximum number of skinned graphical elements is limited to 200 per plot in an OVERLAY or PROTOTYPE layout. When this limit is exceeded for a plot, the specified data skin is not applied to that plot. In that case, use the DATASKINMAX= option in your ODS GRAPHICS statement to increase the maximum limit.

Requirement For this option to have any effect, the DISPLAY= option must include FILL.

Interactions This option overrides the BEGINGRAPH statement DATASKIN= option.

The appearance of the data skin is based on the FILLATTRS= color.

When a data skin is applied, all polygon outlines are set by the skin and the OUTLINEATTRS= option is ignored.

DATATRANSPARENCY=*number*

specifies the degree of the transparency of the polygon fill, outline, and label, when these attributes are displayed.

Default 0

Range 0–1, where 0 is opaque and 1 is entirely transparent

Restriction The specified transparency is not applied to missing values. Missing values are always opaque.

Tip You can use the FILLATTRS= option to set transparency for just the filled polygon areas. You can combine this option with FILLATTRS= to set one transparency for the polygon outline and label and a different transparency for the polygon fill. Example:

```
datatransparency=0.2 fillattrs=(transparency=0.6)
```

DISPLAY=(*display-options*) | STANDARD | ALL
specifies which polygon features to display.

(*display-options*)
specifies a space-separated list of one or more display options enclosed in parentheses.

The list can include one or more of the following options:

FILL
displays the polygon fill

FILLPATTERN
displays a pattern-filled polygon

Note This feature applies to SAS 9.4M5 and to later releases.

Tip By default, this option has no effect if the active ODS style does not specify a fill pattern. To display a fill pattern in that case, select an ODS style that supports fill patterns or use the FILLPATTERNATTRS= option to specify a fill pattern for the polygon.

OUTLINE
displays the polygon outline

STANDARD
specifies OUTLINE only

ALL
specifies all features: FILL, FILLPATTERN, and OUTLINE

Defaults In SAS 9.4M4 and in earlier releases, STANDARD

Starting in SAS 9.4M5, the GraphPolygon:DisplayOpts style reference, if defined in the active ODS style. Otherwise, STANDARD.

Tip Use the OUTLINEATTRS= and FILLATTRS= options to control the appearance of the polygon outline and fill color. Starting with SAS 9.4M5, use the FILLPATTERNATTRS= on page 757 option to control the appearance of the polygon fill pattern.

FILLATTRS=*style-element* | *style-element* (*fill-options*) | (*fill-options*)
specifies the appearance of the filled polygon areas.

Defaults For non-grouped data, the GraphDataDefault:Color style reference.

For grouped data, the Color attribute of GraphData1–GraphDataN style elements.

Interactions For this option to have any effect, the fill must be enabled by the ODS style or by the DISPLAY= option.

When COLORRESPONSE= is in effect and the DISPLAY= option enables FILL display, the FILLATTRS= suboption COLOR= is ignored, and the polygon fill colors vary according to the gradient.

Tip The DATATRANSPARENCY= option sets the transparency for the polygon fill and outline. You can combine this option with DATATRANSPARENCY= to set one transparency for the outlines but a different transparency for the fills. Example:

```
datatransparency=0.2 fillattrs=(transparency=0.6)
```

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Fill Color Options" on page 1600 for available *fill-options*.

FILLPATTERNATTRS=*style-element* | (*fill-pattern-options*)
specifies the appearance of the pattern-filled areas.

Note: This feature applies to SAS 9.4M5 and to later releases.

Defaults For non-grouped data, the ContrastColor and FillPattern attributes of GraphDataDefault.

For grouped data, the ContrastColor and FillPattern attributes of GraphData1–GraphDataN.

Interactions For this option to take effect, the DISPLAY= option must include FILLPATTERN among the display options.

Starting with SAS 9.4M5, when COLORRESPONSE= is in effect and the DISPLAY= option enables FILLPATTERN display, the FILLPATTERNATTRS= suboption COLOR= is ignored, and the fill-pattern colors vary according to the gradient.

Tip In order to change the fill pattern for each group value in ODS styles such as HTMLBlue that use color-priority attribute rotation, specify ATTRPRIORITY=NONE in an ODS GRAPHICS statement or in the BEGINGRAPH statement in your graph template. For more information, see "Attribute Rotation Patterns" in *SAS Graph Template Language: User's Guide*.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Fill Pattern Options" on page 1601 for available *fill-pattern-options*.

GROUP=*column* | *discrete-attr-var* | *expression*
creates a separate and visually distinctive polygon for each unique grouping value.

discrete-attr-var
specifies a discrete attribute map variable.

The discrete attribute map variable is created by a DISCRETEATTRVAR statement.

Restriction A discrete attribute map variable specification must be a direct reference to the attribute map variable. It cannot be set by a dynamic variable.

A distinct polygon is created for each group value by varying the visual attributes of the polygon display features. The display features are controlled by the current ODS style or by the DISPLAY= option. The default group appearance for each display feature is shown in the following table.

Display Feature [1]	Style Attributes That Control Default Group Appearance
Fill color	Color attribute of a GraphData1–GraphDataN style element or the GraphMissing style element.
Fill pattern [2]	FillPattern and ContrastColor attributes of a GraphData1–GraphDataN style element or the GraphMissing style element. The ContrastColor attribute controls the color of the fill pattern.
Outline	■ if the outline is enabled with fill color, fill pattern, or both, ContrastColor attribute of a GraphData1–GraphDataN style element or the GraphMissing style element with a solid line style ■ if the outline is the only display feature enabled, ContrastColor and LineStyle attributes of a GraphData1–GraphDataN style element or the GraphMissing style element

1 Fill color and the outline are displayed by default.
2 Fill patterns are valid for polygon plots starting with SAS 9.4M5.

Requirement The group value must remain constant for the same ID value. Otherwise, the results are unpredictable.

Interactions This option is ignored if the COLORRESPONSE= option is also used.

If a discrete attribute map variable is specified, then the colors and outline patterns are mapped according to the associated DISCRETEATTRMAP statement. See "DISCRETEATTRMAP Statement" on page 1505. Otherwise, the colors and outline patterns are mapped according to data order.

The INCLUDEMISSINGGROUP= option controls whether missing group values are considered a distinct group value.

Note The group values should remain constant for the same ID value.

Tip By default, ODS Graphics limits the number of groups to 1000. When this limit is exceeded, the GROUP= option is ignored. Use the GROUPMAX= option in the ODS GRAPHICS statement to change the maximum number of groups that can be processed.

See "DISCRETEATTRVAR Statement" on page 1516

INCLUDEMISSINGGROUP=TRUE | FALSE
specifies whether missing values of the group variable are included in the plot.

Default TRUE

Restriction This option is ignored and missing group values are not displayed when ID= and GROUP= specify the same values.

Interaction For this option to take effect, the GROUP= option must also be specified.

Tip The attributes of the missing group value are determined by the GraphMissing style element unless a discrete attribute map is in effect, the INDEX= option is used, the MISSING= system option changes the default missing character, or a user-defined format is applied to the group value. In those cases, the attributes of the missing group value are determined by a GraphData1–GraphDataN style element instead of by the GraphMissing style element.

See "boolean " on page xii for other Boolean values that you can use.

LABEL=*column* | *expression*
specifies the label for the polygon.

Default No label is displayed for the polygon

Note The label text should be the same for all of the observations for a polygon ID. When different labels are specified for the same ID, the label that is specified in the first observation for that ID is used.

Tips The default label text color is based on the use of polygon fill and outline colors, and on whether the GROUP= or COLORRESPONSE= option is specified. To change the label text color and font, use the LABELATTRS= option.

Use the LABELLOCATION= and LABELPOSITION= options to change the location of the polygon label.

For long labels, use the LABELSPLIT=, LABELSPLITCHAR=, LABELSPLITCHARTDROP=, and LABELSPLITJUSTIFY= options to split the label into multiple lines.

LABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font attributes of the polygon label.

Defaults For non-grouped data, the GraphDataText style element, unless COLORRESPONSE= is specified. When COLORRESPONSE= is specified, the label color is determined by the outline color when

outlines are displayed, or by the GraphDataText style element Color attribute when outlines are not displayed. All other text attributes are derived from the GraphDataText style element.

For grouped data, the GraphData1–GraphDataN style elements. The label color is determined by the contrast color attribute.

Interaction If one or more text options are specified and they do not include all of the font properties (such as color, family, size, weight, and style), then the non-specified properties are derived from the GraphLabelText style element or from a GraphData1–GraphDataN style element.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Text Options" on page 1606 for available *text-options*.

LABELLOCATION=INSIDEBBOX | OUTSIDEBBOX | OUTSIDE
specifies the location of the polygon label.

INSIDEBBOX
locates the label inside the bounding box of the polygon.

OUTSIDEBBOX
locates the label outside the bounding box of the polygon but inside the plot area.

OUTSIDE
locates the label outside the plot area.

Default INSIDEBBOX

Restriction OUTSIDE cannot be used when the POLYGONPLOT statement is used in multi-cell layouts such as LATTICE, DATAPANEL, or DATALATTICE in which the axes might be external to the grid.

Interaction The LABEL= option must be specified for this option to have any effect.

Tip The label's exact position is relative to the polygon's X and Y data ranges and is determined by the combination of this option and the LABELPOSITION= option.

LABELPOSITION=CENTER | XMIN | XMAX | YMIN | YMAX
specifies the position of the polygon label with respect to the label location.

CENTER
centers the label in the polygon's bounding box

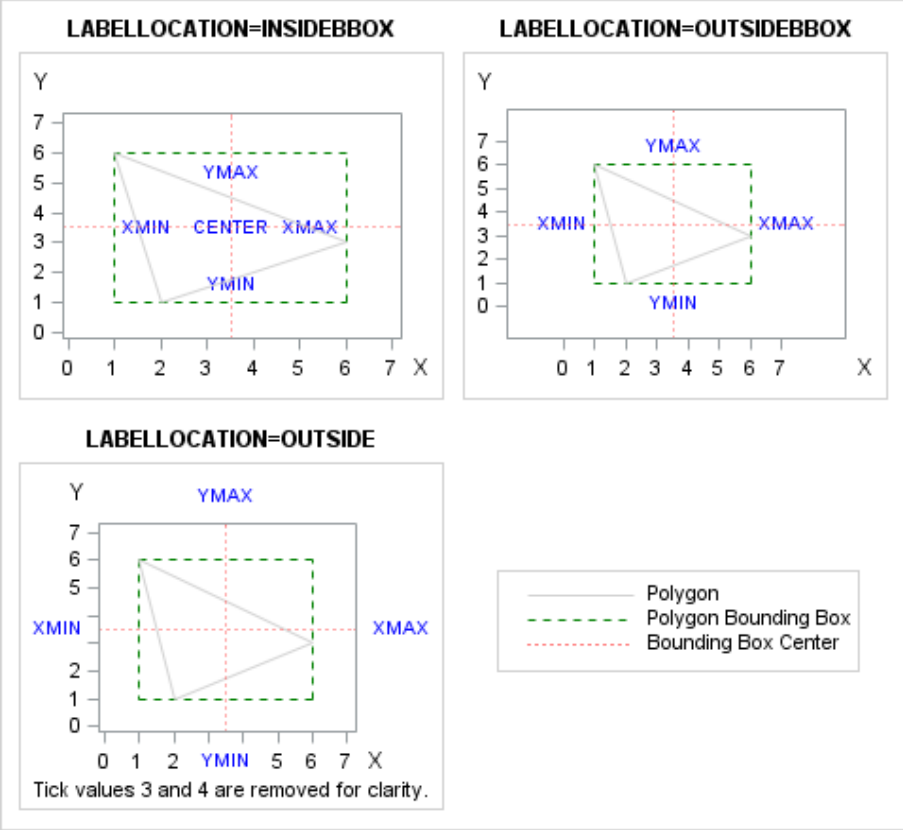
XMIN
positions the label at the polygon's minimum X value and centers it in the Y-value range

XMAX
positions the label at the maximum X value and centers it in the Y-value range

YMIN
positions the label at the minimum Y value and centers it in the X-value range

YMAX
positions the label at the maximum Y value and centers it in the X-value range

The following figure shows the label positions for each of the label locations that are specified by the LABELLOCATION= option.



Defaults CENTER when LABELLOCATION=INSIDEBBOX

YMAX when LABELLOCATION=OUTSIDEBBOX or LABELLOCATION=OUTSIDE

Restriction CENTER is valid only when LABELLOCATION=INSIDEBBOX.

Interaction When LABELLOCATION=OUTSIDE, increasing label length might cause the available plot area to decrease.

Tip When LABELLOCATION=OUTSIDE, the polygon label might collide with the axis tick values on the orthogonal axis. In that case, if the secondary orthogonal axis is not being used, specify the opposite end of the axis. Otherwise, change LABELLOCATION= to INSIDEBBOX or OUTSIDEBBOX.

LABELSPLIT=TRUE | FALSE
specifies whether to split the polygon label at the specified split characters. When this option is set to TRUE, the polygon label is split unconditionally at each occurrence of any of the specified split characters.

Default FALSE. The polygon label is not split.

Requirement The LABEL= option must also be specified.

Interaction The LABELSPLITCHAR= option specifies one or more characters on which splits can occur.

See "boolean " on page xii for other Boolean values that you can use.

LABELSPLITCHAR="*character-list*"
specifies one or more characters on which the polygon label can be split if needed. When multiple split characters are specified, each character in the list is treated as a separate split character unless the specified characters appear consecutively in the polygon label. In that case, all of the specified split characters together are treated as a single split character.

When LABEL= is specified and LABELSPLIT=TRUE, the polygon label is split unconditionally at each occurrence of any of the specified split characters. If the polygon label does not contain any of the specified characters, then the label is not split.

"character-list"
one or more characters with no space between each character and enclosed in quotation marks.

Default A blank space

Requirements The list of characters must be enclosed in quotation marks.

Multiple characters must be specified with no space between them. For example, to specify the split characters a, b, and c, use the following option:

```
labelsplitchar="abc"
```

The LABEL= option and the LABELSPLIT=TRUE option must also be specified.

Interaction The LABELSPLITCHARDROP= option specifies whether the split characters are included in the polygon label or are dropped.

Notes When multiple characters are specified, the order of the characters in the list is not significant.

The split characters are case sensitive.

Tip Use the LABELSPLITJUSTIFY= option to specify the justification of the strings in the polygon label block.

LABELSPLITCHARDROP=TRUE | FALSE
specifies whether the split characters are included in the polygon label.

TRUE
drops the split characters from the polygon label.

FALSE
includes the split characters in the polygon label.

When LABELSPLIT=TRUE and LABELSPLITCHARDROP=FALSE, each split character remains as the last character in the current line. The characters that follow the split character, up to and including the next split character, are then wrapped to the next line.

The following figure shows an example of polygon label Product*Group*A split on * when LABELSPLITCHARDROP=TRUE and LABELSPLITCHARDROP=FALSE.

Default TRUE. The split characters are dropped from the polygon label.

Requirement The LABEL= option and the LABELSPLIT=TRUE option must also be specified.

Interaction The LABELSPLITCHAR= option specifies the split characters.

See “boolean ” on page xii for other Boolean values that you can use.

LABELSPLITJUSTIFY=AUTO | CENTER | LEFT | RIGHT
specifies the justification of the strings that are inside the polygon label blocks.

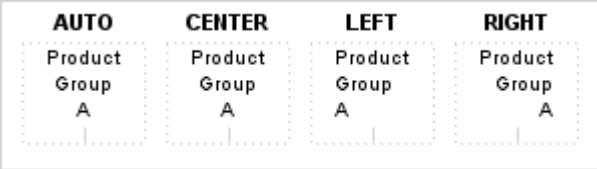
AUTO
justifies the labels based on the LABELPOSITION= option.

LABELPOSITION= Value	Justification
XMIN	RIGHT
XMAX	LEFT
CENTER, YMAX, or YMIN	CENTER

CENTER
LEFT
RIGHT
justifies the labels center, left, or right, as specified.

The following figure shows an example in which LABELPOSITION=YMAX.

Note: The gray vertical line at the bottom of each label represents the horizontal center of the text box for reference.



In this case, because LABELPOSITION=YMAX, AUTO centers the lines of text. The text box is anchored the same way that the unsplit text is anchored.

Default AUTO

Requirement The LABEL= option and the LABELSPLIT=TRUE option must also be specified.

LEGENDLABEL="*string*"
specifies a label to be used in a discrete legend for this plot.

Default The *string* specified on the NAME= option.

Restriction This option applies only to an associated DISCRETELEGEND statement.

Interaction If the GROUP= option is specified, then this option is ignored.

NAME="*string*"
assigns a name to this plot statement for reference in other template statements. The specified name is used primarily in legend statements to coordinate the use of colors and line patterns between the plot and the legend.

Restrictions The *string* is case sensitive, cannot contain spaces, and must define a unique name within the template.

This option does not support variables that are created by the DYNAMIC, MVAR, and NMVAR template statements.

Interaction The *string* is used as the default legend label if the LEGENDLABEL= option is not used.

OUTLINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the appearance of the polygon outline.

Defaults For non-grouped data, the GraphOutlines style element.

For grouped data, unfilled polygons use both the CONTRASTCOLOR and PATTERN attributes of the GraphData1–GraphDataN style elements. Filled polygons use only the ContrastColor attribute.

Interactions For this option to have any effect, outlines must be enabled by the ODS style or by the DISPLAY= option.

If the DATASKIN= option applies a data skin, then this option is ignored.

When the COLORRESPONSE= and DISPLAY=(OUTLINE) options are in effect, the OUTLINEATTRS= suboption COLOR= is ignored, and the polygon outline colors vary according to the gradient.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

PRIMARY=TRUE | FALSE
specifies that the data columns for this plot and the plot type be used for determining default axis features. This option is needed only when two or more plots within an overlay-type layout contribute to a common axis.

Default FALSE

Restriction This option is ignored if the plot is placed under a GRIDDED or LATTICE layout block.

Note In an OVERLAY layout, only one plot in an overlay can be the primary plot on a per-axis basis. When no plot is designated as the primary plot, the first plot that can be a primary plot is considered the primary plot. If multiple plots specify PRIMARY=TRUE for the same axis, then the last such plot encountered is considered the primary plot.

See "When Plots Share Data and a Common Axis" on page 1046

"boolean " on page xii for other Boolean values that you can use.

REVERSECOLORMODEL=TRUE | FALSE
specifies whether to reverse the gradient (color ramp) that is defined by either the ODS style that is in effect or by the COLORMODEL= option.

Default FALSE

See COLORMODEL=

"boolean " on page xii for other Boolean values that you can use.

ROLENAME=(*role-name-list*)
specifies user-defined roles that can be used to display information in the data tips. This option provides a way to add to the data columns that appear in data tips that are specified by the TIP= option.

(*role-name-list*)
a space-separated list of *role-name = column* pairs.

Example The following example assigns the column Obs to the user-defined role TIP:

```
ROLENAME=(TIP1=OBS)
```

Default No user-defined roles

Requirement The role names that you choose must be unique and different from the predefined roles ID, COLORRESPONSE, GROUP, LABEL, and URL.

ROTATE=*numeric-column* | *numeric-constant* | *expression*
specifies the angle of rotation for the polygon, measured in degrees. Positive angles rotate the image counter clockwise, and negative angles rotate the image clockwise. The angle specification can exceed 360 degrees in absolute value.

Default 0. No rotation is performed.

Interaction When this option is specified, the LABELLOCATION= and LABELPOSITION= options are overridden with LABELLOCATION=INSIDEBOX and LABELPOSITION=CENTER.

Notes The rotation angle is measured in screen coordinates.

A missing value in the rotation data is treated as 0.

Rotating a polygon does not change data ranges that are reported to the axes. As a result, clipping might occur in some cases.

ROTATELABEL=AUTO | NONE | VERTICAL
specifies the rotation of the polygon label with respect to the rotation of the polygon.

AUTO
rotates the label with the rotation of the polygon.

NONE
does not rotate the label with the rotation of the polygon.

The label position remains fixed regardless of the polygon rotation.

VERTICAL
rotates the label to a vertical position.

Restriction VERTICAL is valid only when the polygon is not rotated (ROTATE=0). When the polygon is rotated, ROTATELABEL=VERTICAL is ignored, and the default (AUTO) is used instead.

Default AUTO

Interaction The LABEL= option must be specified for this option to have any effect.

TIP=(*role-list*) | NONE
specifies the information to display when the cursor is positioned over the polygon. If you use this option, it replaces all of the information that is displayed by default. You can specify roles for columns that do not contribute to the polygon plot along with roles that do.

(*role-list*)
an ordered, space-separated list of unique POLYGONPLOT and user-defined roles.

POLYGONPLOT roles include ID, COLORRESPONSE, GROUP, LABEL, and URL.

Tip User-defined roles are defined with the ROLENAME= option.

Example The following example displays the columns that are assigned to the roles ID and URL, and the columns XOffset and YOffset in the data tips. The XOffset and YOffset columns are not assigned to any predefined POLYGONPLOT role, so they must first be assigned a role:

```
ROLENAME=(TIP1=XOFFSET TIP2=YOFFSET)
TIP=(ID TIP1 TIP2 URL)
```

NONE
suppresses data tips and URLs (if requested) from the plot.

Default The columns that are assigned to the following roles are automatically included in the data tip information: ID, COLORRESPONSE or GROUP, LABEL, and URL.

Requirement To generate data tips in the output, you must include an ODS GRAPHICS ON statement that specifies the IMAGEMAP option, and you must write the output to the ODS HTML destination.

Interaction This option is ignored when the plot statement is in an OVERLAY or PROTOTYPE layout and the INCLUDERANGES= option is specified in the LINEAROPTS= or TIMEOPTS= option for either axis.

Tip You can control the labels and formats for the TIP roles with the TIPLABEL= and TIPFORMAT= options.

TIPFORMAT=(*role-format-list*)
specifies display formats for tip columns. This option provides a way to control the formats of columns that appear in data tips.

(*role-format-list*)
a space-separated list of *role-name* = *format* pairs.

Example
```
ROLENAME=(TIP1=SALARY)
TIP=(TIP1)
TIPFORMAT=(TIP1=DOLLAR12.)
```

Default The column format of the column assigned to the role or BEST6 if no format is assigned to a numeric column.

Restriction Only the roles that appear in the TIP= option are used.

Requirement A column must be assigned to each of the specified roles. (See the ROLENAME= option.)

TIPLABEL=(*role-label-list*)
specifies display labels for tip columns. This option provides a way to control the labels of columns that appear in data tips.

role-label-list
a space-separated list of *rolename* ="*string*" pairs.

Example
```
ROLENAME=(TIP1=PCT)
TIP=(TIP1)
TIPLABEL=(TIP1="Percent")
```

Default The column label or column name of the column assigned to the role.

Restriction Only the roles that appear in the TIP= option are used.

URL=*string-column*
specifies an HTML page that is displayed when the polygon is selected.

string-column
specifies a column that contains a valid HTML page reference (HREF) for each polygon that is to have an active link.

Example **`http://www.sas.com`**

Requirement To generate a plot with selectable polygons, you must include an ODS GRAPHICS ON statement that specifies the IMAGEMAP option, and you must write the output to the ODS HTML destination.

Interactions This option has no effect when TIP=NONE.

This option is ignored when the plot statement is in an OVERLAY or PROTOTYPE layout and the INCLUDERANGES= option is specified in the LINEAROPTS= or TIMEOPTS= option for either axis.

Note The URL values should remain constant for the same ID value.

Tip By default, drill-down links open in a new browser window (link target _blank). To specify a different target for your drill-down links, such as _self or _parent, add the DRILLTARGET="*target*" option to your ODS GRAPHICS statement. See DRILLTARGET= on page 1568.

XAXIS=X | X2
specifies whether data are mapped to the primary X (bottom) axis or to the secondary X2 (top) axis.

Default X

Interaction The overall plot specification and the layout type determine the axis display. For more information, see "How Axis Features Are Determined" on page 1040.

XOFFSET=*numeric-column* | *expression*
specifies an individual offset from the discrete X value on each vertex of the polygon.

Default 0 (all polygon vertices are centered on the discrete X values)

Range −0.5 to +0.5, where 0.5 represents half the distance between discrete ticks. A positive offset is to the right on discrete X values. If option REVERSE=TRUE is specified in the layout's X-axis options, then the offset direction is also reversed.

Restriction This option applies to discrete axes only. For nondiscrete axes, this option is ignored.

Interaction This option overrides the DISCRETEOFFSET= option.

Tip Setting the discrete offset for the plots does not affect the axis minimum offset and maximum offset. In some cases, setting a discrete offset can cause clipping at each end of the axis. In those cases, use the OFFSETMIN= and OFFSETMAX= axis options to increase the axis minimum and maximum offsets in order to accommodate the discrete offset.

YAXIS=Y | Y2
specifies whether data are mapped to the primary Y (left) axis or to the secondary Y2 (right) axis.

Default Y

Interaction The overall plot specification and the layout type determine the axis display. For more information, see "How Axis Features Are Determined" on page 1040.

YOFFSET=*numeric-column* | *expression*
specifies an individual offset from the discrete Y value on each vertex of the polygon.

Default 0 (all polygon vertices are centered on the discrete Y values)

Range −0.5 to +0.5, where 0.5 represents half the distance between discrete ticks. A positive offset is up on discrete Y values. If option REVERSE=TRUE is specified in the layout's Y-axis options, then the offset direction is also reversed.

Restriction This option applies to discrete axes only. For nondiscrete axes, this option is ignored.

Interaction This option overrides the DISCRETEOFFSET= option.

Tip Setting the discrete offset for the plots does not affect the axis minimum offset and maximum offset. In some cases, setting a discrete offset can cause clipping at each end of the axis. In those cases, use the OFFSETMIN= and OFFSETMAX= axis options to increase the axis minimum and maximum offsets in order to accommodate the discrete offset.

Details

Overview

The POLYGONPLOT statement draws a polygon from a series of X-Y value pairs that are stored in a SAS data set. The first X-Y value pair defines the starting point of the polygon. The next X-Y pair in the data specifies the coordinates of the first vertex. A line segment is drawn from the starting point to the first vertex. For subsequent X-Y pairs, a line segment is drawn from the previous vertex to the current vertex. This pattern repeats until all of the segments have been drawn. If the last segment does not close the polygon, then the POLYGONPLOT statement automatically draws a segment from the last vertex back to the starting point in order to close the polygon.

Using the POLYGONPLOT statement, you can draw any data-driven shape on your graph, which enables you to highlight data features, outline data boundaries, and so on. Unlike DRAW statements in a BEGINPLOYGON block, the following conditions apply to the POLYGONPLOT statement:

- you need to modify only the polygon data in the graph data set to modify the polygon. You do not need to modify the template code. (See "BEGINPOLYGON Statement" on page 1405.)
- you can draw polygons between plots. The BEGINPOLYGON block and DRAW statements can draw polygons only on top of or behind the graph.

Requirements for the Polygon Data Set

In the simplest case of a single polygon, your data set must provide an X, Y, and ID column that stores the X-Y values and the ID for your polygon. The X-Y values in the first data-set observation must specify the starting point of your polygon. The X-Y values in the subsequent observations must provide the coordinates of each vertex in the order in which the polygon is to be drawn. There should be no gaps in the data. If your last observation does not close the polygon, then the POLYGONPLOT statement automatically draws a segment from your last vertex back to the starting point in order to close the polygon.

If you want to draw multiple polygons, then your ID column must specify a unique identifier value for each polygon. The identifier value associates the observations in the data set with a specific polygon. All of the observations for each individual polygon must be grouped together by ID and must be arranged in the order in which the polygon segments are to be drawn.

The following table shows additional columns that you can use to customize your polygon plot.

Column[1]	Type	Description
COLORRESPONSE (p. 754)	Numeric	Specifies the numeric column or range attribute map variable that is used to determine the polygon colors.

Column[1]	Type	Description
GROUP (p. 757)	Numeric or character	Creates a separate polygon color, outline pattern, or both for each unique grouping that is specified.
LABEL (p. 759)	Numeric or character	Specifies the label for the polygon.
URL (p. 768)	Character	Specifies an HTML page that is displayed when the polygon is selected.
XOFFSET (p. 769)	Numeric	Specifies an individual offset from the discrete X value on each vertex of the polygon.
YOFFSET (p. 769)	Numeric	Specifies an individual offset from the discrete Y value on each vertex of the polygon.

1 You can specify any valid column name for these columns in your data set.

Drawing a Single Polygon

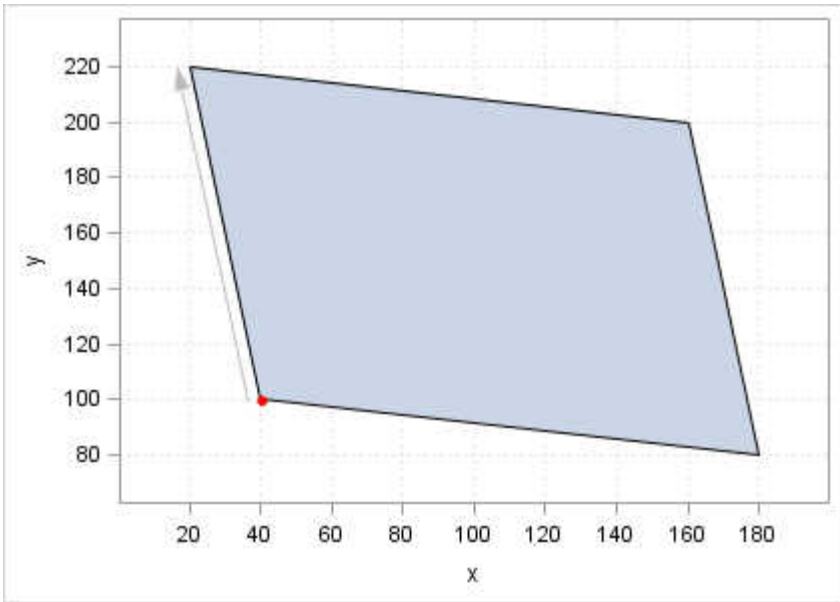
For a single polygon, the polygon data set contains an X column and Y column that define the polygon vertices, and an ID column that specifies a constant value. The polygon segments are drawn in the order in which they occur in the data. If the polygon overlaps any graphics elements that were drawn earlier, those elements are obscured. In that case, you can use transparency to enable the underlying graphics elements to show through.

Here is example data for a simple four-sided polygon that is identified as P1 and that starts at point X=40, Y=100.

Polygon Data

Obs	id	x	y
1	P1	40	100
2	P1	20	220
3	P1	160	200
4	P1	180	80
5	P1	40	100

The following figure shows how the polygon is drawn. Grid lines are provided to help you locate the polygon vertices in the output.



The polygon starting point is X=40, Y=100 (shown in red). From the starting point, the segments are drawn in data order. Data order is in a clockwise direction, as indicated by the gray arrow. Although the last observation (X=40, Y=100) is provided in this example, it is not required. If the last observation is not provided in the data, then the POLYGONPLOT statement draws the last segment automatically in order to close the polygon.

For an example, see "Example 1: Drawing a Simple Polygon That Highlights Data" on page 775.

Drawing Multiple Polygons

For multiple polygons, the POLYGONPLOT data ID column specifies a unique identifier for all of the observations that are associated with each polygon. The X and Y columns specify the polygon vertices. The polygons are overlaid on the graph in the order in which they occur in the data. For overlapping polygons, each polygon obscures part or all of the polygons and graphics elements that were drawn before it. In that case, you can use transparency to enable the underlying polygons and graphics elements to show through.

Here is example data for three separate polygons.

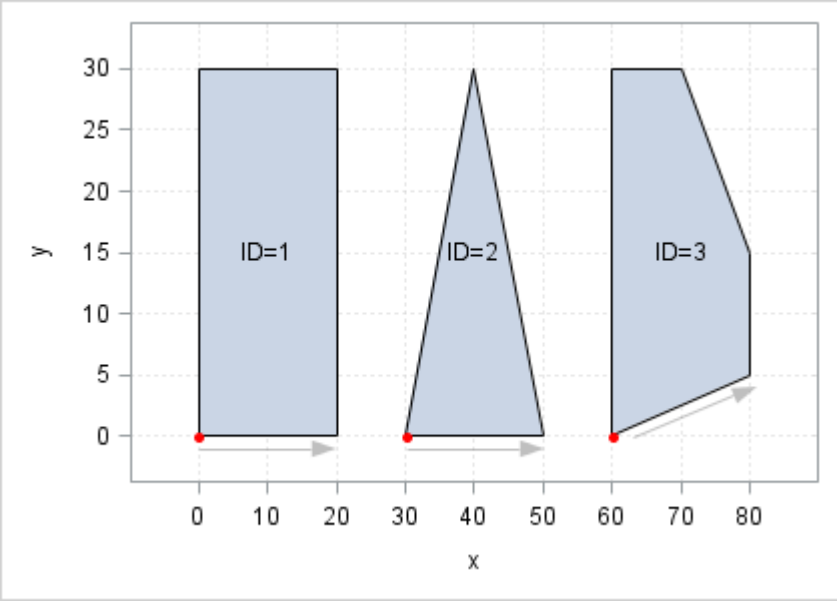
Polygon Data

Obs	id	x	y	label
1	1	0	0	ID=1
2	1	20	0	
3	1	20	30	
4	1	0	30	
5	1	0	0	
6	2	30	0	ID=2
7	2	50	0	
8	2	40	30	
9	2	30	0	
10	3	60	0	ID=3

11	3	80	5
12	3	80	15
13	3	70	30
14	3	60	30
15	3	60	0

In addition to the ID column, X column, and Y column, the Label column is added to label the polygons in the output. Notice that the observations for each ID value are grouped together in the data set. The observations for each ID must occur contiguously in the data. Otherwise, unexpected results might occur.

The following figure shows how the polygons are drawn from this data. Grid lines are provided to help you locate the polygon vertices in the output.



The polygons are drawn in the order in which they appear in the data: rectangle (ID=1), triangle (ID=2), and polygon (ID=3). The red dot on each shape indicates the starting point for that shape. The gray arrow indicates the direction in which the segments are drawn for each shape.

Drawing Holes in a Polygon

Using the POLYGONPLOT statement, you can draw one or more holes inside a polygon. To create data for a polygon with one or more holes:

1. Specify the X and Y values for the outer polygon.
2. To start the data for a hole, add an observation that has missing X and Y values. The missing X and Y values signal the POLYGONPLOT statement that the observations that follow define the data for a hole.
3. Specify the X and Y values for the hole polygon.
4. Repeat Steps 2 and 3 for each additional hole.

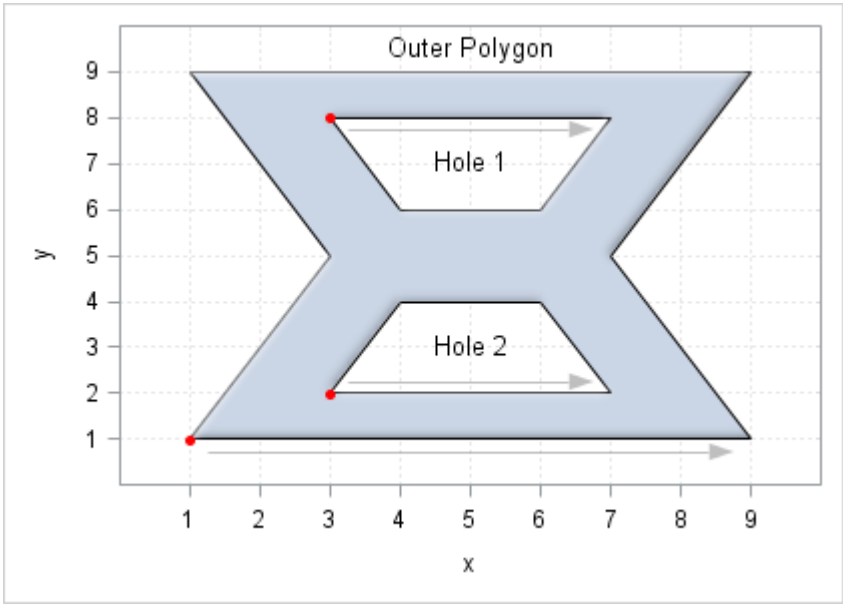
Here is example data for a simple polygon that has two holes.

```
Polygon Data
```

Obs	id	x	y
1	1	1	1
2	1	9	1
3	1	7	5
4	1	9	9
5	1	1	9
6	1	3	5
7	1	1	1
8	1	.	.
9	1	3	8
10	1	7	8
11	1	6	6
12	1	4	6
13	1	3	8
14	1	.	.
15	1	3	2
16	1	7	2
17	1	6	4
18	1	4	4
19	1	3	2

Observations 1–7 specify the data for the outer polygon. In observation 8, the X and Y values are missing, which indicates the start of the data for the first hole. Observations 9–13 define the data for the first hole polygon. Observation 14 indicates the start of the data for the second hole, which is defined by observations 15–19.

The following figure shows how the polygon is drawn from this data. Grid lines are provided to help you locate the polygon vertices in the output.



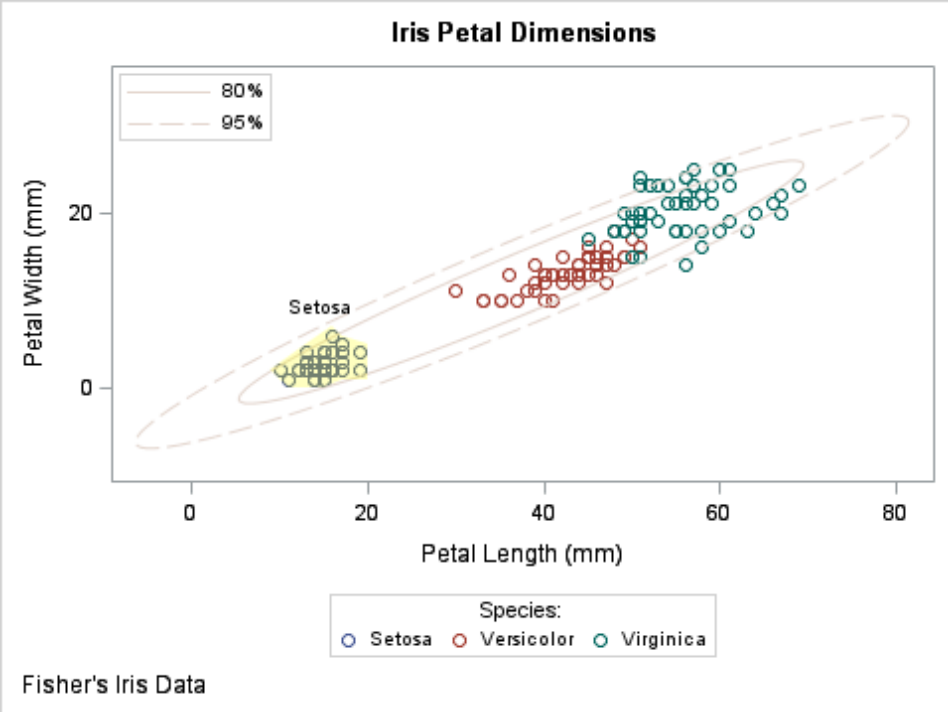
The outer polygon is drawn first, starting at point X=1, Y=1. The segments are drawn in data order, which is in a counterclockwise direction as indicated by the gray arrow. The first hole is drawn next, starting at point X=3, Y=8. Its segments are

drawn in a clockwise direction. The second hole is drawn last, starting at point X=3, Y=2. Its segments are drawn in a counterclockwise direction.

Examples

Example 1: Drawing a Simple Polygon That Highlights Data

This example shows you how to use the POLYGONPLOT statement to draw a filled polygon that highlights data in an iris petal dimension scatter plot. The polygon surrounds the markers for the Setosa species in order to highlight the data for that species. This example is a modified version of the example in "Example: BEGINPOLYGON Statement" on page 1412. This version uses the POLYGONPLOT statement instead of a BEGINPOLYGON block so that you can compare the two methods. The following figure shows the output for this example.



Here is the SAS code for this example.

```
/* Generate the data for the polygon */
data polydata;
   input polyID polyX polyY label $8-40;
datalines;
1  9 2    Setosa
1 13 5
1 16 7
1 17 6
1 20 5
1 20 1
1 17 1
1 15 0
1 14 0
```

```
1 11 0
;
run;

/* Concatenate the SASHELP.IRIS and polygon data into
   data set IRIS */
data iris;
   set sashelp.iris polydata;
run;

/* Create the template for the graph */
proc template;
  define statgraph discretelegend;
    begingraph / drawspace=datavalue;
      entrytitle "Iris Petal Dimensions";
      layout overlayequated / equatetype=equate;
        scatterplot x=petallength y=petalwidth / name="s"
          group=species includemissinggroup=false;
        ellipse x=petallength y=petalwidth / type=predicted  alpha=.2
          name="p80" legendlabel="80%" outlineattrs=graphconfidence;
        ellipse x=petallength y=petalwidth / type=predicted  alpha=.05
          name="p95" legendlabel="95%" outlineattrs=graphconfidence2;
        polygonplot x=polyX y=polyY id=polyID / display=(fill)
          fillattrs=(color=yellow transparency=0.75)
          label=label labellocation=outsidebbox labelposition=ymax;
        discretelegend "s" / title="Species:";
        discretelegend "p80" "p95" /across=1 autoalign=(topleft)
           location=inside;
      endlayout;
      entryfootnote halign=left "Fisher's Iris Data" ;
    endgraph;
  end;
run;

/* Generate the graph */
proc sgrender data=iris template=discretelegend;
run;
```

Details

To draw a single polygon, the data set must provide an X column, a Y column, and an ID column. The data specifies the polygon vertices around the Setosa data in a clockwise direction. A Label column is added to provide a label for the polygon in the plot output. Concatenation of the Polydata and Sashelp.Iris data sets results in missing values for the SCATTERPLOT statement grouping variable in the Iris data set. By default, the SCATTERPLOT statement includes missing group values. To exclude the missing group values, the INCLUDEMISSINGGROUP=FALSE option is added to the SCATTERPLOT statement.

In the POLYGONPLOT statement, the DISPLAY= option specifies the polygon fill only. The FILLATTRS= option specifies the fill color as yellow and a fill transparency of 0.75. Rather than using draw statements to draw an annotation for the polygon, this example uses the POLYGONPLOT statement label feature to

label the polygon. The LABEL= option specifies the column in the data set that contains the polygon label text. The LABELLOCATION= and LABELPOSITION= options place the polygon label outside of and above the polygon's bounding box.

To draw the polygon, the POLYGONPLOT statement starts at X=9, Y=2, and draws a segment between each vertex in data order. The last vertex, X=11, Y=0, does not close the polygon. To close the polygon, the POLYGONPLOT statement draws a segment between X=11, Y=0 and X=9, Y=2 automatically.

If you want to highlight the Versicolor data instead of the Setosa data, then you need only modify the data in the Polydata data set to draw a polygon around the Versicolor data instead. You do not have to make any changes to the template code.

Example 2: Drawing a Geographical Boundary

This example shows you how to use the POLYGONPLOT statement to draw an outline of Wake County in North Carolina. The polygon data is extracted from data set Maps.Counties using state ID 37 for North Carolina and county ID 183 for Wake County. The GPROJECT procedure is then used to project the data before it is plotted with the POLYGONPLOT statement. The Maps.Counties data set is installed with SAS/GRAPH. If SAS/GRAPH is not installed at your site, you can download data set Maps.Counties from SAS Maps Online. For more information, see "Map Data Sets, Map Preparation Procedures, and Tools Provided by SAS" in *SAS/GRAPH and Base SAS: Mapping Reference*.

The following figure shows the output for this example.

Here is the SAS code for this example.

```
/* Extract the map data for Wake County, NC. */
data wakecounproj;
   set maps.counties(where=(state=37 and county=183));
   label="Wake County, NC";
run;
```

```
/* Project the data */
proc gproject data=wakecounproj out=wakeco dupok;
id state county;
run;

/* Draw the county border */
proc template;
   define statgraph wakecounty;
      begingraph;
         layout overlay / walldisplay=(fill)
            xaxisopts=(display=none offsetmin=0.05 offsetmax=0.05)
            yaxisopts=(display=none offsetmin=0.05);
            polygonplot x=x y=y id=state / display=(outline fill)
               fillattrs=(color=cxd1d1d1)
               outlineattrs=(color=darkgreen thickness=2px)
               label=label labelattrs=(weight=bold color=darkgreen
size=16pt);
         endlayout;
      endgraph;
   end;
run;

proc sgrender data=wakeco template=wakecounty;
run;
```

REFERENCELINE Statement

Creates a horizontal or vertical reference line.

Requirement: A REFERENCELINE statement can be used within a 2-D layout (OVERLAY, OVERLAYEQUATED, DATALATTICE, or DATAPANEL) only.

Note: Specifying the X= option creates a line perpendicular to the X axis at an X-intercept. Specifying the Y= option creates a line perpendicular to the Y axis at a Y-intercept.

Syntax

REFERENCELINE X=*x-axis-value* | *column* | *expression* <*/options*>;

REFERENCELINE Y=*y-axis-value* | *column* | *expression* <*/options*>;

Summary of Optional Arguments

Appearance options

CLIP=TRUE | FALSE
: specifies whether the reference line data is to be considered when determining the data range for the axis.

DATASKIN=NONE | CRISP | GLOSS | MATTE | PRESSED | SHEEN
enhances the visual appearance of the reference lines.

DATATRANSPARENCY=*number*
specifies the degree of the transparency of the reference line.

DISCRETELINETHICKNESS=*number*
specifies the line thickness as a fraction of the midpoint spacing.

LINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the attributes of the reference line.

USEDISCRETETHICKNESS=TRUE | FALSE
specifies that the line thickness should be based on a fraction of the midpoint spacing that is set by the DISCRETELINETHICKNESS= option.

Axes options

XAXIS=X | X2
specifies whether data are mapped to the primary X (bottom) axis or to the secondary X2 (top) axis.

YAXIS=Y | Y2
specifies whether data are mapped to the primary Y (left) axis or to the secondary Y2 (right) axis.

Label options

CURVELABEL="*string*" | *column* | *expression*
specifies a label for the reference line or lines.

CURVELABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font attributes of the reference line label(s).

CURVELABELLOCATION=INSIDE | OUTSIDE
specifies the location of the reference line label relative to the plot area.

CURVELABELPOSITION=AUTO | MAX | MIN
specifies the position of the reference line label relative to the reference line.

CURVELABELSPLIT=TRUE | FALSE
specifies whether to split the reference line label at the specified split characters.

CURVELABELSPLITCHAR="*character-list*"
specifies one or more characters on which the reference line label can be split if needed.

CURVELABELSPLITCHARDROP=TRUE | FALSE
specifies whether the split characters are included in the reference line label text.

CURVELABELSPLITJUSTIFY=AUTO | CENTER | LEFT | RIGHT
specifies the justification of the strings that are inside the reference line label block.

LEGENDLABEL="*string*"
specifies a label to be used in a discrete legend for this plot.

Midpoint options

DISCRETEOFFSET=*number*

specifies an amount to offset all reference lines from the specified values when the X or Y axis is discrete.

Plot reference options

NAME="*string*"

assigns a name to this plot statement for reference in other template statements.

Required Arguments

You must use either the X= or the Y= argument in the REFERENCELINE statement.

X=*x-axis-value* | *column* | *expression*

specifies the X intercept of the reference line or lines.

Requirements: If X is not specified, then Y must be specified.

Values must be the same type as the data type of the X axis. For example, you should use numeric SAS date or time values (or SAS date/time constants) for a time axis.

Unformatted numeric values do not map to a formatted discrete axis. When the X axis is a discrete axis, the X-axis value must be the formatted value that appears on the X axis. If a column is specified for the values in that case, then the specified column must use the same format that is used for the X axis.

Note: When a character value is specified, leading blanks are honored and trailing blanks are ignored when the specified value is compared with the data values.

Tips: By default, if the value that is specified for the X= argument is outside of the data range, then the data range is extended to include the specified intercept. You can change this behavior with the CLIP= option.

You can use the COLN() or COLC() function in an EVAL() expression to specify multiple reference lines on the X axis. See "GTL Functions Used with the EVAL Function" on page 1547.

Y=*y-axis-value* | *column* | *expression*

specifies the Y intercept of the reference line or lines.

Requirements: If Y is not specified, then X must be specified.

Values must be the same type as the data type of the Y axis.

Unformatted numeric values do not map to a formatted discrete axis. When the Y axis is a discrete axis, Y-axis value must be the formatted value that appears on the Y axis. If a column is specified for the values in that case, then the specified column must use the same format that is used for the Y axis.

Note When a character value is specified, leading blanks are honored and trailing blanks are ignored when the specified value is compared with the data values.

Tips By default, if the value that is specified for the Y= argument is outside of the data range, then the data range is extended to include the specified intercept. You can change this behavior with the CLIP= option.

You can use the COLN() or COLC() function in an EVAL() expression to specify multiple reference lines on the Y axis. See "GTL Functions Used with the EVAL Function" on page 1547.

Optional Arguments

CLIP=TRUE | FALSE

specifies whether the reference line data is to be considered when determining the data range for the axis.

FALSE

specifies that the reference line values are to be considered when the axis range is determined. The reference lines are drawn as follows based on the axis type:

- For a discrete axis, the reference line values that are not already on the axis are added to the end of the axis data list. When applicable, the axis values are then sorted:
  - If the axis values are numeric values, then they are sorted ordinally.
  - If the axis values are character values and a sorting option is applied to the axis, then they are sorted as specified by the sorting option.

  Reference lines are then drawn at the specified locations.
- For a linear, log, or time axis, a new axis data list is created by performing a mathematical union of the data values and the reference line values. The reference lines are then drawn at the locations specified.

TRUE

specifies that the reference line values are not to be considered when the axis range is determined. The reference lines are drawn as follows based on the axis type:

- For a discrete axis, if the reference line value exactly matches a value on the axis, a reference line is drawn at that location. Otherwise, the reference line is not drawn.

  Note: If the axis values are formatted, then the reference line value must exactly match the formatted axis value in order for the line to be drawn.
- For a linear, log, or time axis, if the reference line value is within the axis data range, then the reference line is drawn at the specified location. Otherwise, the reference line is not drawn.

Default FALSE

See "boolean " on page xii for other Boolean values that you can use.

CURVELABEL="*string*" | *column* | *expression*
specifies a label for the reference line or lines.

Requirement If you use the COLN() or COLC() function in the X= or Y= option to specify multiple reference line intercepts, then you must use the COLC() function in the CURVELABEL= option to specify exactly one label for each reference line intercept. Otherwise, this option is ignored. See "GTL Functions Used with the EVAL Function" on page 1547.

Interactions If the X or Y argument specifies a value, then use "*string*".

If the X or Y argument specifies a column, then use a *column* to define the label for each value.

Tip The font and color attributes for the label are specified by the CURVELABELATTRS= option.

CURVELABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font attributes of the reference line label(s).

Default The GraphValueText style element.

Interaction For this option to take effect, the CURVELABEL= option must also be used.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Text Options" on page 1606 for available *text-options*.

CURVELABELLOCATION=INSIDE | OUTSIDE
specifies the location of the reference line label relative to the plot area.

INSIDE locates the labels inside the plot area

OUTSIDE locates the labels outside the plot area

Default OUTSIDE

Restriction OUTSIDE cannot be used when the REFERENCELINE is used in multicell layouts such as LATTICE, DATAPANEL, or DATALATTICE, where axes might be external to the grid.

Interactions For this option to take effect, the CURVELABEL= option must also be specified.

This option is used in conjunction with the CURVELABELPOSITION= option to determine where the line labels appear.

See "Location and Position of Curve Labels" on page 213

CURVELABELPOSITION=AUTO | MAX | MIN
specifies the position of the reference line label relative to the reference line.

AUTO
automatically positions the line label near the line boundary along unused axes whenever possible (typically Y2 and X2) in order to avoid collision with tick values.

Restriction This option is used only when CURVELABELLOCATION= OUTSIDE.

MAX
forces the line label to appear near maximum line values (typically, the top or right).

MIN
forces the line label to appear near minimum line values (typically, the bottom or left).

Defaults AUTO when CUVELABELLOCATION=OUTSIDE.

MAX when CURVELABELLOCATION=INSIDE.

Restriction The AUTO setting is ignored if CURVELABELLOCATION= INSIDE is specified.

Interactions For this option to take effect, the CURVELABEL= option must also be specified.

This option is used in conjunction with the CURVELABELLOCATION= option to determine where the line label appears.

Note When you specify TICKVALUELIST=, VIEWMAX=, or VIEWMIN= in an axis statement, the data points that are used to determine the position of the reference line label might fall outside of the graph area. In that case, the reference line label might not be displayed or might be positioned incorrectly.

See "Location and Position of Curve Labels" on page 213

CURVELABELSPLIT=TRUE | FALSE
specifies whether to split the reference line label at the specified split characters. When a reference line label is split, the label is split on each occurrence of the specified split characters.

Default FALSE. The reference line label is not split.

Requirement The CURVELABEL= option must also be specified.

Interactions The CURVELABELSPLITCHAR= option specifies one or more characters on which the splits occur.

This option has no effect when CURVELABELPOSITION=AUTO.

See "boolean " on page xii for other Boolean values that you can use.

CURVELABELSPLITCHAR="*character-list*"
specifies one or more characters on which the reference line label can be split if needed. When multiple split characters are specified, each character in the list is treated as a separate split character unless the specified characters appear consecutively in the reference line label. In that case, all of the specified split characters together are treated as a single split character.

When CURVELABEL= is specified and CURVELABELSPLIT=TRUE, the reference line label is split unconditionally at each occurrence of any of the specified split characters. If the reference line label does not contain any of the specified characters, then the label is not split.

"character-list"
a list of one or more characters with no spaces between them enclosed in quotation marks.

Example To specify the split characters a, b, and c:
```
curvelabelsplitchar="abc"
```

Default A blank space

Requirement The CURVELABEL= option and the CURVELABELSPLIT=TRUE option must also be specified.

Interactions This option has no effect if CURVELABELPOSITION=AUTO.

The CURVELABELSPLITCHARDROP= option specifies whether the split characters are included in the reference line label or are dropped.

Notes When multiple characters are specified, the order of the characters in the list is not significant.

The split characters are case sensitive.

Tip Use the CURVELABELSPLITJUSTIFY= option to specify the justification of the strings in the reference line label block.

CURVELABELSPLITCHARDROP=TRUE | FALSE
specifies whether the split characters are included in the reference line label text.

TRUE
drops the split characters from the reference line label text.

FALSE
includes the split characters in the reference line label text. When CURVELABELSPLIT=TRUE and CURVELABELSPLITCHARDROP=FALSE, each split character remains as the last character in the current line. The characters that follow the split character, up to and including the next split character, are then wrapped to the next line.

The following figure shows an example of a Y-axis reference line label with the following specifications:

- CURVELABELPOSITION=MAX
- CURVELABEL="Product*Group*A"
- CURVELABELSPLIT=TRUE
- CURVELABELSPLITCHARDROP=TRUE | FALSE
- CURVELABELSPLITCHAR="*"

Note: The horizontal line to the left of the label represents the maximum end of the reference line for reference.

When CURVELABELSPLITCHARDROP=TRUE, the asterisks are removed from the label. When CURVELABELSPLITCHARDROP=FALSE, each asterisk remains as the last character in the line prior to the new line.

Default TRUE. The split characters are dropped from the reference line label.

Requirement The CURVELABEL= option and the CURVELABELSPLIT=TRUE option must also be specified.

Interaction The CURVELABELSPLITCHAR= option specifies the split characters.

See "boolean " on page xii for other Boolean values that you can use.

CURVELABELSPLITJUSTIFY=AUTO | CENTER | LEFT | RIGHT
specifies the justification of the strings that are inside the reference line label block.

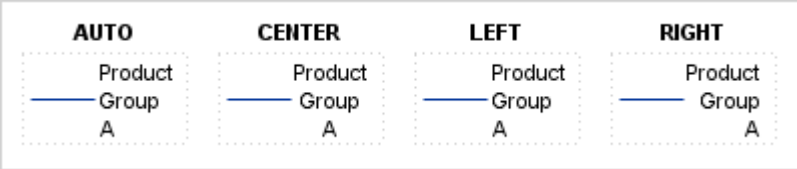
AUTO
justifies the labels based on the CURVELABELPOSITION= option, as shown in the following table.

CURVELABELPOSITION= Value	Justification
MAX or END	LEFT
MIN or START	RIGHT

CENTER
LEFT
RIGHT
justifies the labels center, left, or right, as specified.

The following figure shows an example in which CURVELABELPOSITION=MAX.

Note: The horizontal line to the left of each label represents the maximum end of the reference line for reference.



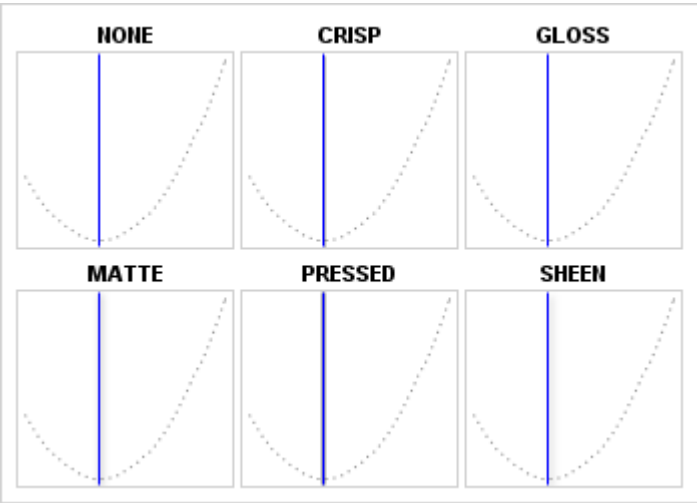
In this case, because CURVELABELPOSITION=MAX, AUTO left-justifies the lines of text.

Default AUTO

Requirement The CURVELABEL= option and the CURVELABELSPLIT=TRUE option must also be specified.

Interaction This option has no effect if CURVELABELPOSITION=AUTO.

DATASKIN=NONE | CRISP | GLOSS | MATTE | PRESSED | SHEEN
enhances the visual appearance of the reference lines. The following figure shows a blue reference line with each of the skins applied.



Default The DATASKIN= option value that is specified in the BEGINGRAPH statement. If that value is not specified, then the GraphSkins:DataSkin style element value is used.

Restriction Starting with SAS 9.4M1, the maximum number of skinned graphical elements is limited to 200 per plot in an OVERLAY or PROTOTYPE layout. When this limit is exceeded for a plot, the specified data skin is not applied to that plot. In that case, use the

DATASKINMAX= option in your ODS GRAPHICS statement to increase the maximum limit.

Interactions This option overrides the BEGINGRAPH statement DATASKIN= option.

The data skin appearance is based on the LINEATTRS= color.

DATATRANSPARENCY=*number*
specifies the degree of the transparency of the reference line.

Default 0

Range 0–1, where 0 is opaque and 1 is entirely transparent

Note This option does not affect the reference line label.

DISCRETELINETHICKNESS=*number*
specifies the line thickness as a fraction of the midpoint spacing.

Note: This feature applies to SAS 9.4M5 and to later releases.

Default 1 (100%)

Range 0–1

Requirement The axis must be discrete and USEDISCRETETHICKNESS=TRUE must be in effect. Otherwise, this option is ignored.

DISCRETEOFFSET=*number*
specifies an amount to offset all reference lines from the specified values when the X or Y axis is discrete.

Default 0 (no offset, all reference lines are centered on discrete X or Y values)

Range -0.5 to +0.5 where 0.5 represents half the distance between discrete ticks. A positive offset is to the right for a vertical reference line and up for a horizontal reference line. If the layout's axis options set REVERSE=TRUE, then the offset direction is also reversed.

Restriction This option applies to discrete axes only. For nondiscrete axes, this option is ignored.

Tip Setting the discrete offset for the plots does not affect the axis minimum and maximum offsets. In some cases, setting a discrete offset can cause clipping at each end of the axis. In those cases, use the OFFSETMIN= and OFFSETMAX= axis options to increase the axis minimum and maximum offsets to accommodate the discrete offset.

LEGENDLABEL="*string*"
specifies a label to be used in a discrete legend for this plot.

Default The *string* specified on the NAME= option.

Restriction This option applies only to an associated DISCRETELEGEND statement.

LINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the attributes of the reference line.

Default The GraphReference style element.

Interaction This option is ignored when USEDISCRETETHICKNESS=TRUE is in effect.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*

."Line Options" on page 1602 for available *line-options*.

NAME="*string*"
assigns a name to this plot statement for reference in other template statements. The specified name is used primarily in legend statements to coordinate the use of colors and line patterns between the plot and the legend.

Restrictions The *string* is case sensitive, cannot contain spaces, and must define a unique name within the template.

This option does not support variables that are created by the DYNAMIC, MVAR, and NMVAR template statements.

Interaction The *string* is used as the default legend label if the LEGENDLABEL= option is not used.

USEDISCRETETHICKNESS=TRUE | FALSE
specifies that the line thickness should be based on a fraction of the midpoint spacing that is set by the DISCRETELINETHICKNESS= option.

Note: This feature applies to SAS 9.4M5 and to later releases.

Default FALSE

Requirement The axis type must be discrete. Otherwise, this option is ignored.

Interaction When this option is set to TRUE, the LINEATTRS THICKNESS= option is ignored.

Tips Use USEDISCRETETHICKNESS=TRUE with DISCRETELINETHICKNESS=1, for example, to place custom bands behind the midpoint values.

Use the LINEATTRS COLOR= option to specify the color.

Use DATATRANSPARENCY= to specify the transparency.

See DISCRETELINETHICKNESS= on page 787

XAXIS=X | X2
specifies whether data are mapped to the primary X (bottom) axis or to the secondary X2 (top) axis.

Default X

Restriction Another plot that establishes a data range for the designed axis must be included.

Interactions This option is ignored if the X= argument is not specified.

The overall plot specification and the layout type determine the axis display. For more information, see "How Axis Features Are Determined" on page 1040.

YAXIS=Y | Y2
specifies whether data are mapped to the primary Y (left) axis or to the secondary Y2 (right) axis.

Default Y

Restriction Another plot that establishes a data range for the designed axis must be included.

Interactions This option is ignored if the Y= argument is not specified.

The overall plot specification and the layout type determine the axis display. For more information, see "How Axis Features Are Determined" on page 1040.

Details

Reference lines are always drawn perpendicular to the axes. They are drawn from one axis boundary to the companion boundary (X to X2 or Y to Y2). Axis offsets do not apply to reference lines.

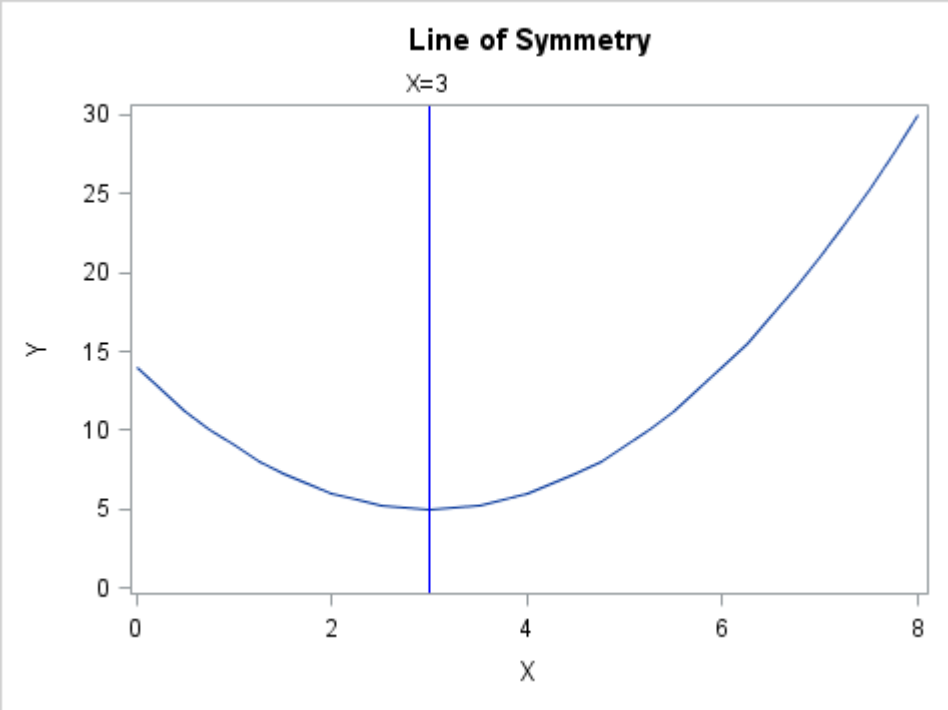
A REFERENCELINE statement can be used only within 2-D overlay-type layouts (OVERLAY, OVERLAYEQUATED, or PROTOTYPE). A standalone plot statement that provides a sufficient data range for determining axis extents must be included in the layout. For example, a REFERENCELINE statement can be used with a scatter plot or a histogram.

If a column is used to generate multiple reference lines, then the column type (numeric or string) must agree with the type of data presented on the axis.

Examples

Example 1: Specifying a Single Reference Line

This example shows you how to draw a reference line using the REFERENCELINE statement. The follow figure shows the output for this example.



Example Program

Here is the SAS code for this example.

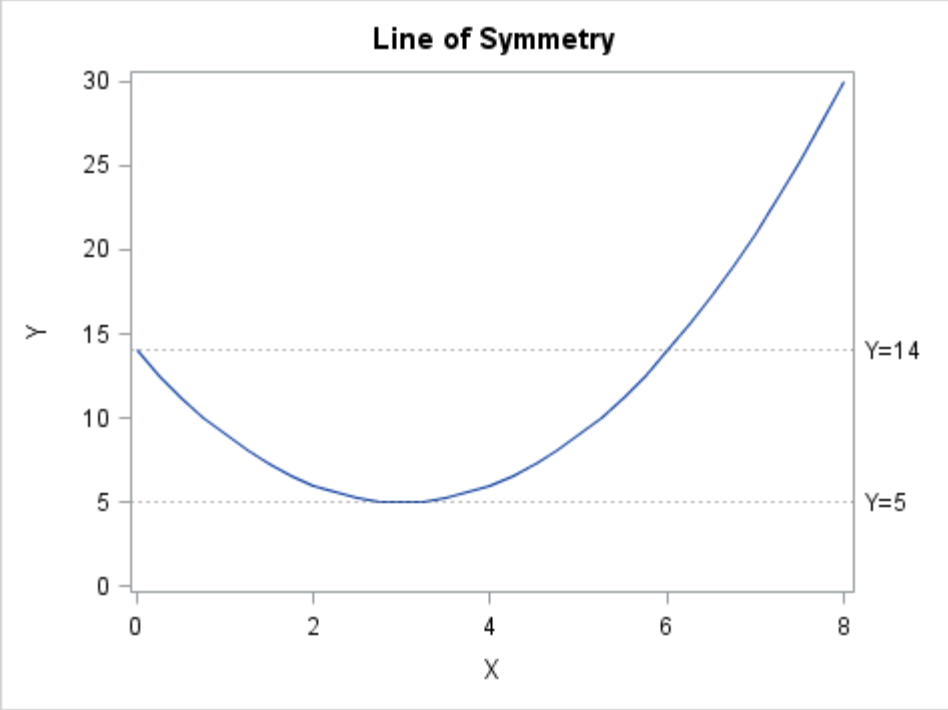
```
/* Create the template for the graph */
proc template;
  define statgraph referenceline;
    begingraph;
      entrytitle "Line of Symmetry";
      layout overlay / yaxisopts=(linearopts=(viewmin=0));
        seriesplot x=x y=y;
        referenceline x=3 /
          lineattrs=(color=blue) curvelabel="X=3";
      endlayout;
   endgraph;
  end;
run;

/* Generate the plot data */
data test;
  do X=0 to 8 by 0.25;
    Y=(x-3)*(x-3) + 5;
```

```
    output;
  end;
run;

/* Generate the graph */
proc sgrender data=test template=referenceline;
run;
```

Example 2: Specifying Reference Lines Using Data Columns

This example shows you how to specify the reference-line intercept values for multiple reference lines using columns in the data set for the graph. The following figure shows the output for this example.

Output 6.1 *Multiple Reference Lines in a Graph*



Example Program

Here is the SAS code for this example.

```
/* Define the template for the graph */
proc template;
  define statgraph referenceline;
    begingraph;
      entrytitle "Line of Symmetry";
      layout overlay / yaxisopts=(linearopts=(viewmin=0));
        seriesplot x=x y=y;
        referenceline y=yR / curvelabel=label
          lineattrs=(color=gray pattern=dot);
```

```
      endlayout;
   endgraph;
  end;
run;

/* Generate the graph data */
data graphdata;
   /* Plot data */
   do X=0 to 8 by 0.25;
      Y=(x-3)*(x-3) + 5;
      output;
   end;
   /* Reference line data */
   x=.; y=.; yR=14; label='Y=14'; output;
   x=.; y=.; yR=5;  label='Y=5'; output;
run;

/* Generate the graph */
proc sgrender data=graphdata template=referenceline;
run;
```

Example 3: Specifying Reference Lines Using the COLN and COLC Functions

This example shows you how to use the COLN() and COLC() functions to specify multiple intercept values directly in the REFERENCELINE statement. This approach is an alternative to including the reference line data in the plot data.The output is shown in "Example 2: Specifying Reference Lines Using Data Columns" on page 791.

Example Program

Here is the SAS code for this example.

```
/* Create the template for the graph */
proc template;
  define statgraph referencelines;
    begingraph;
      entrytitle "Line of Symmetry";
      layout overlay / yaxisopts=(linearopts=(viewmin=0));
        seriesplot x=x y=y;
        /* Use COLN() to specify the intercept values */
        referenceline y=eval(coln(14, 5)) /
          /* Use COLC() to specify a label for each reference line */
          curvelabel=eval(colc("Y=14", "Y=5"))
          lineattrs=(color=gray pattern=dot);
      endlayout;
   endgraph;
  end;
run;

/* Generate the plot data */
data test;
```

```
  do X=0 to 8 by 0.25;
    Y=(x-3)*(x-3) + 5;
    output;
  end;
run;

/* Generate the graph */
proc sgrender data=test template=referencelines;
run;
```

REGRESSIONPLOT Statement

Creates a fitted regression line or curve computed from input data.

Restriction: The REGRESSIONPLOT statement supports only models of one independent and one dependent variable.

Tip: Starting with SAS 9.4M3, subpixel rendering is enabled by default. To disable subpixel rendering, specify SUBPIXEL=OFF in the BEGINGRAPH statement or in an ODS GRAPHICS statement. For information about the BEGINGRAPH statement SUBPIXEL= option, see SUBPIXEL= on page 39. For information about the ODS GRAPHICS statement SUBPIXEL= option, see "ODS GRAPHICS Statement" on page 1561.

Syntax

REGRESSIONPLOT X=*numeric-column* | *expression*
Y=*numeric-column* | *expression* </<*regression-options*> <*options*>>;

Summary of Optional Arguments

Appearance options

DATATRANSPARENCY=*number*
: specifies the degree of the transparency of the regression line and line label.

INDEX=*positive-integer-column* | *expression*
: specifies indices for mapping line attributes (color and line pattern) to one of the GraphData1–GraphDataN style elements.

LINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
: specifies the attributes of the regression line.

Axes options

PRIMARY=TRUE | FALSE
: specifies that the data columns for this plot and the plot type be used for determining default axis features.

XAXIS=X | X2

specifies whether data are mapped to the primary X (bottom) axis or to the secondary X2 (top) axis.

YAXIS=Y | Y2
specifies whether data are mapped to the primary Y (left) axis or to the secondary Y2 (right) axis.

Data tip options

TIPFORMAT=(*role-format-list*)
specifies display formats for tip columns.

TIPLABEL=(*role-label-list*)
specifies display labels for tip columns.

Label options

CURVELABEL="*string*"
specifies a label for the regression line.

CURVELABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font attributes of the regression line labels.

CURVELABELLOCATION=INSIDE | OUTSIDE
specifies the location of the regression line label relative to the plot area.

CURVELABELPOSITION=AUTO | MAX | MIN | START | END
specifies the position of the regression line label relative to the regression line.

CURVELABELSPLIT=TRUE | FALSE
specifies whether to split the regression line label at the specified split characters.

CURVELABELSPLITCHAR="*character-list*"
specifies one or more characters on which the regression line label can be split if needed.

CURVELABELSPLITCHARDROP=TRUE | FALSE
specifies whether the split characters are included in the regression line label text.

CURVELABELSPLITJUSTIFY=AUTO | CENTER | LEFT | RIGHT
specifies the justification of the strings that are inside the regression line label block.

LEGENDLABEL="*string*"
specifies a label to be used in a discrete legend for this plot.

Midpoint options

GROUP=*column* | *discrete-attr-var* | *expression*
creates a distinct set of regression lines from just the observations that correspond to each unique group value of the specified column.

INCLUDEMISSINGGROUP=TRUE | FALSE
specifies whether missing values of the group variable are included in the plot.

Plot reference options

NAME="*string*"

assigns a name to this plot statement for reference in other template statements.

Required Arguments

X=*numeric-column* | *expression*
specifies the column for the X values.

Y=*numeric-column* | *expression*
specifies the column for the Y values.

Optional Arguments

CURVELABEL=*"string"*
specifies a label for the regression line.

Defaults No regression line label is displayed

This option is not valid when the GROUP= option is specified.

Tip The font and color attributes for the label are specified by the CURVELABELATTRS= option.

CURVELABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font attributes of the regression line labels.

Default The GraphValueText style element.

Interactions For this option to take effect, the CURVELABEL= option must also be used.

If the GROUP= option is specified, then this option is ignored.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Text Options" on page 1606 for available *text-options*.

CURVELABELLOCATION=INSIDE | OUTSIDE
specifies the location of the regression line label relative to the plot area.

INSIDE
locates the labels inside the plot area

OUTSIDE
locates the labels outside the plot area

Default INSIDE

Restriction OUTSIDE cannot be used when the REGRESSIONPLOT is used in multi-cell layouts such as LATTICE, DATAPANEL, or DATALATTICE, where axes might be external to the grid.

Interactions For this option to take effect, the CURVELABEL= option must also be specified.

This option is used in conjunction with the CURVELABELPOSITION= option to determine where the line labels appear.

See "Location and Position of Curve Labels" on page 213

CURVELABELPOSITION=AUTO | MAX | MIN | START | END
specifies the position of the regression line label relative to the regression line.

AUTO
automatically positions the line label near the line boundary along unused axes whenever possible (typically Y2 and X2) in order to avoid collision with tick values.

Restriction This option is used only when CURVELABELLOCATION= OUTSIDE.

MAX
forces the line label to appear near maximum line values (typically, upper right).

MIN
forces the line label to appear near minimum line values (typically, lower left).

START
forces the line label to appear near the beginning of the regression line.

Restriction This option is used only when CURVELABELLOCATION=INSIDE.

Tip This option is particularly useful when the regression line has a spiral shape.

END
forces the line label to appear near the end of the regression line.

Restriction This option is used only when CURVELABELLOCATION=INSIDE.

Tip This option is particularly useful when the regression line has a spiral shape.

Defaults AUTO when CUVELABELLOCATION=OUTSIDE.

END when CURVELABELLOCATION=INSIDE.

Restriction The AUTO setting is ignored if CURVELABELLOCATION=INSIDE is specified. The START and END settings are ignored if CURVELABELLOCATION=OUTSIDE is specified.

Interactions For this option to take effect, the CURVELABEL= option must also be specified.

This option is used in conjunction with the CURVELABELLOCATION= option to determine where the line label appears.

Note When you specify TICKVALUELIST=, VIEWMAX=, or VIEWMIN= in an axis statement, the data points that are used to determine the position of the label might fall outside of the graph area. In that case, the regression-line label might not be displayed or might be positioned incorrectly.

Tip When END is in effect, no attempt is made to avoid curve label collisions. If your curve labels collide, try using MAX instead.

See "Location and Position of Curve Labels" on page 213

CURVELABELSPLIT=TRUE | FALSE
specifies whether to split the regression line label at the specified split characters. When a regression line label is split, the label is split on each occurrence of the specified split characters.

Default FALSE. The regression line label is not split.

Requirement The CURVELABEL= option must also be specified.

Interactions The CURVELABELSPLITCHAR= option specifies one or more characters on which the splits occur.

This option has no effect when CURVELABELPOSITION=AUTO.

See "boolean " on page xii for other Boolean values that you can use.

CURVELABELSPLITCHAR="*character-list*"
specifies one or more characters on which the regression line label can be split if needed. When multiple split characters are specified, each character in the list is treated as a separate split character unless the specified characters appear consecutively in the regression line label. In that case, all of the specified split characters together are treated as a single split character.

When CURVELABEL= is specified and CURVELABELSPLIT=TRUE, the regression line label is split unconditionally at each occurrence of any of the specified split characters. If the regression line label does not contain any of the specified characters, then the label is not split.

"character-list"
one or more characters with no delimiter between each character and enclosed in quotation marks.

Default A blank space

Requirements The list of characters must be enclosed in quotation marks.

Multiple characters must be specified with no delimiters. For example, to specify the split characters a, b, and c, use the following option:

```
curvelabelsplitchar="abc"
```

The CURVELABEL= option and the CURVELABELSPLIT=TRUE option must also be specified.

Interactions This option has no effect if CURVELABELPOSITION=AUTO.

The CURVELABELSPLITCHARDROP= option specifies whether the split characters are included in the regression line label or are dropped.

Notes When multiple characters are specified, the order of the characters in the list is not significant.

The split characters are case sensitive.

Tip Use the CURVELABELSPLITJUSTIFY= option to specify the justification of the strings in the regression line label block.

CURVELABELSPLITCHARDROP=TRUE | FALSE
specifies whether the split characters are included in the regression line label text.

TRUE
drops the split characters from the regression line label text.

FALSE
includes the split characters in the regression line label text. When CURVELABELSPLIT=TRUE and CURVELABELSPLITCHARDROP=FALSE, each split character remains as the last character in the current line. The characters that follow the split character, up to and including the next split character, are then wrapped to the next line.

The following figure shows an example of a regression line label with the following specifications:

- CURVELABELPOSITION=MAX
- CURVELABEL="Product*Group*A"
- CURVELABELSPLIT=TRUE
- CURVELABELSPLITCHARDROP=TRUE | FALSE
- CURVELABELSPLITCHAR="*"

Note: The horizontal line to the left of the label represents the maximum end of the regression line for reference.

When CURVELABELSPLITCHARDROP=TRUE, the asterisks are removed from the label. When CURVELABELSPLITCHARDROP=FALSE, each asterisk remains as the last character in the line prior to the new line.

Default TRUE. The split characters are dropped from the regression line label.

Requirement The CURVELABEL= option and the CURVELABELSPLIT=TRUE option must also be specified.

Interaction The CURVELABELSPLITCHAR= option specifies the split characters.

See "boolean " on page xii for other Boolean values that you can use.

CURVELABELSPLITJUSTIFY=AUTO | CENTER | LEFT | RIGHT
specifies the justification of the strings that are inside the regression line label block.

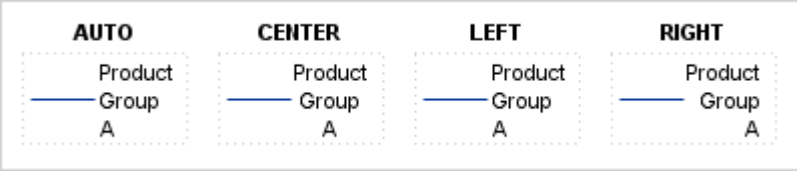
AUTO
justifies the labels based on the CURVELABELPOSITION= option, as shown in the following table.

CURVELABELPOSITION= Value	Justification
MAX or END	LEFT
MIN or START	RIGHT

CENTER
LEFT
RIGHT
justifies the labels center, left, or right, as specified.

The following figure shows an example in which CURVELABELPOSITION=MAX.

Note: The horizontal line to the left of each label represents the maximum end of the regression line for reference.



In this case, because CURVELABELPOSITION=MAX, AUTO left-justifies the lines of text.

Default AUTO

Requirement The CURVELABEL= option and the CURVELABELSPLIT=TRUE option must also be specified.

Interaction This option has no effect if CURVELABELPOSITION=AUTO.

DATATRANSPARENCY=*number*
specifies the degree of the transparency of the regression line and line label.

Default 0

Range 0–1, where 0 is opaque and 1 is entirely transparent

GROUP=*column* | *discrete-attr-var* | *expression*
creates a distinct set of regression lines from just the observations that correspond to each unique group value of the specified column.

discrete-attr-var
specifies a discrete attribute map variable.

The discrete attribute map variable is created by a DISCRETEATTRVAR statement.

Restriction A discrete attribute map variable specification must be a direct reference to the attribute map variable. It cannot be set by a dynamic variable.

Default Each distinct group value might be represented in the plot by a different combination of line color and line pattern. Line colors vary according to the ContrastColor attribute of the GraphData1–GraphDataN and GraphMissing style elements. Line patterns vary according to the LineStyle attribute of the GraphData1–GraphDataN style elements.

Requirement You must sort the data in ascending order by the specified group column before you plot the data. If the plot data is a CAS in-memory table, you must download the in-memory table to your SAS client, and then sort it locally before you plot it.

Interactions The group values are mapped in the order of the data, unless the INDEX= option is used to alter the default sequence of line colors and line patterns.

The INCLUDEMISSINGGROUP option controls whether missing group values are considered a distinct group value.

Note If you specify a column in a SAS data set, the visual attributes for each group value are assigned in data order. If you specify a column in a CAS in-memory table, the visual attributes for each group value are assigned in ascending order of the group column character values or of unformatted numeric values.

Tips The LINEATTRS= option can be used to override the representations that are used to identify the groups. For example, LINEATTRS=(PATTERN=SOLID) can be used to assign the same pattern to all of the lines, letting the line color distinguish group values. Likewise, LINEATTRS=(COLOR=BLACK) can be used to assign the same color to all of the lines, letting the line pattern distinguish group values.

By default, ODS Graphics limits the number of groups to 1000. When this limit is exceeded, the GROUP= option is ignored. Use the GROUPMAX= option in the ODS GRAPHICS statement to change the maximum number of groups that can be processed.

See "DISCRETEATTRVAR Statement" on page 1516

INCLUDEMISSINGGROUP=TRUE | FALSE

specifies whether missing values of the group variable are included in the plot.

Default TRUE

Interaction For this option to take effect, the GROUP= option must also be specified.

Tip The attributes of the missing group value are determined by the GraphMissing style element unless a discrete attribute map is in effect, the INDEX= option is used, the MISSING= system option changes the default missing character, or a user-defined format is applied to the group value. In those cases, the attributes of the missing group value are determined by a GraphData1–GraphDataN style element instead of by the GraphMissing style element.

See "boolean " on page xii for other Boolean values that you can use.

INDEX=*positive-integer-column* | *expression*

specifies indices for mapping line attributes (color and line pattern) to one of the GraphData1–GraphDataN style elements.

Requirements The column or expression value must be an integer value of 1 or greater. Otherwise, this option is ignored.

The positive-integer column must not contain missing values. Otherwise, the entire column is invalidated and this option is ignored.

All of the indexes for a specific group value must be the same. Otherwise, the results are unpredictable.

Interaction For this option to take effect, the GROUP= option must also be specified.

Notes The index values are 1-based indices. For the style attributes in GraphData1–GraphDataN, if the index value is greater than N, then a modulo operation remaps that index value to a number less than N to determine which style to use.

If you do not use this option, then the group values are mapped in the order of the data.

Tip You can use indexing to collapse the number of groups that are represented in a graph. For more information, see "Remapping Groups for Grouped Data" on page 211.

LEGENDLABEL="*string*"
specifies a label to be used in a discrete legend for this plot.

Default The *string* specified on the NAME= option.

Restriction This option applies only to an associated DISCRETELEGEND statement.

Interaction If the GROUP= option is specified, then this option is ignored.

LINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the attributes of the regression line.

Default The GraphFit style element.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

NAME="*string*"
assigns a name to this plot statement for reference in other template statements. The specified name is used primarily in legend statements to coordinate the use of colors and line patterns between the plot and the legend.

Restrictions The *string* is case sensitive, cannot contain spaces, and must define a unique name within the template.

This option does not support variables that are created by the DYNAMIC, MVAR, and NMVAR template statements.

Interaction The *string* is used as the default legend label if the LEGENDLABEL= option is not used.

PRIMARY=TRUE | FALSE
specifies that the data columns for this plot and the plot type be used for determining default axis features. This option is needed only when two or more plots within an overlay-type layout contribute to a common axis.

Default FALSE

Restriction This option is ignored if the plot is placed under a GRIDDED or LATTICE layout block.

Note In an OVERLAY layout, only one plot in an overlay can be the primary plot on a per-axis basis. When no plot is designated as the primary plot, the first plot that can be a primary plot is considered the primary plot. If multiple plots specify PRIMARY=TRUE for the same axis, then the last such plot encountered is considered the primary plot.

See "When Plots Share Data and a Common Axis" on page 1046

"boolean " on page xii for other Boolean values that you can use.

TIPFORMAT=(*role-format-list*)
specifies display formats for tip columns. This option provides a way to control the formats of columns that appear in data tips.

(role-format-list)
a space-separated list of *role-name = format* pairs.

Example `TIPFORMAT=(Y=6.2)`

Default The column format of the column assigned to the role or BEST6 if no format is assigned to a numeric column.

Requirement To enable data tips in the output, you must include an ODS GRAPHICS ON statement that specifies the IMAGEMAP option, and you must write the output to the ODS HTML destination.

Note The columns assigned to the X, Y, and GROUP (if assigned) roles are automatically included in the data tip information.

TIPLABEL=(*role-label-list*)
specifies display labels for tip columns. This option provides a way to control the labels of columns that appear in data tips.

role-label-list
a space-separated list of *rolename ="string"* pairs.

Example `TIPLABEL=(Y="Curve")`

Default The column label or column name of the column assigned to the role.

Note The columns assigned to the X, Y, and GROUP (if assigned) roles are automatically included in the data tip information.

XAXIS=X | X2
specifies whether data are mapped to the primary X (bottom) axis or to the secondary X2 (top) axis.

Default X

Interaction The overall plot specification and the layout type determine the axis display. For more information, see "How Axis Features Are Determined" on page 1040.

YAXIS=Y | Y2
specifies whether data are mapped to the primary Y (left) axis or to the secondary Y2 (right) axis.

Default Y

Interaction The overall plot specification and the layout type determine the axis display. For more information, see "How Axis Features Are Determined" on page 1040.

Regression Options

ALPHA=*positive-number*
specifies the confidence level to compute.

Default 0.05

Range 0 < *positive-number* < 1

Tip ALPHA=0.05 represents a 95% confidence level.

CLI=*"name"*
produces confidence limits for individual predicted values for each observation. The confidence level is set by the ALPHA= option.

Interaction *name* is a unique name within the template that is case sensitive and cannot contain spaces. It must be assigned in order for the confidence limits to be computed. To display confidence limits, you must use this name as the required argument of a MODELBAND statement. See the example in "Example: REGRESSIONPLOT Statement" on page 805 .

CLM=*"name"*
produces confidence limits for a mean predicted value for each observation. The confidence level is set by the ALPHA= option.

Interaction *name* is a unique name within the template that is case sensitive and cannot contain spaces. It must be assigned in order for the confidence limits to be computed. To display confidence limits, you must use this name as the required argument of a MODELBAND statement. See the example in "Example: REGRESSIONPLOT Statement" on page 805 .

DEGREE=*non-negative-integer*
specifies the degree of the polynomial.

The default value, DEGREE=1, produces a linear fit, DEGREE=2 produces a quadratic fit, DEGREE=3 produces a cubic fit, and so on.

The value of the DEGREE=*d* option corresponds to one of the following TRANSREG procedure specifications for the independent variable: SPLINE(X / DEGREE=*d*) or PBSPLINE(X / DEGREE=*d* LAMBDA=0).

Default 1

Ranges 0–174 in SAS 9.4M1 and earlier releases.

1–10 starting with SAS 9.4M2.

FREQ=*numeric-column*
specifies a column in the input data set that represents the frequency of occurrence of the current observation, essentially treating the data set as if each observation appeared *n* times, where *n* is the value of the FREQ column for the observation. Noninteger values of the FREQ column are truncated to the

largest integer less than the FREQ value. The observation is used in the analysis only if the value of the FREQ column is greater than or equal to 1.

MAXPOINTS=*positive-integer*
specifies the maximum number of predicted points generated for the regression curve as well as any confidence limits.

Default 201

WEIGHT=*numeric-column*
specifies a column in the input data set that contains values to be used as *a priori* weights for a regression fit. If an observation's weight is zero, negative, or missing, then the observation is deleted from the analysis.

Interaction Starting with SAS 9.4M2, when the CLI= option is used with this option, the confidence band for individual predicted values is displayed as a high-low chart instead of a band.

Details

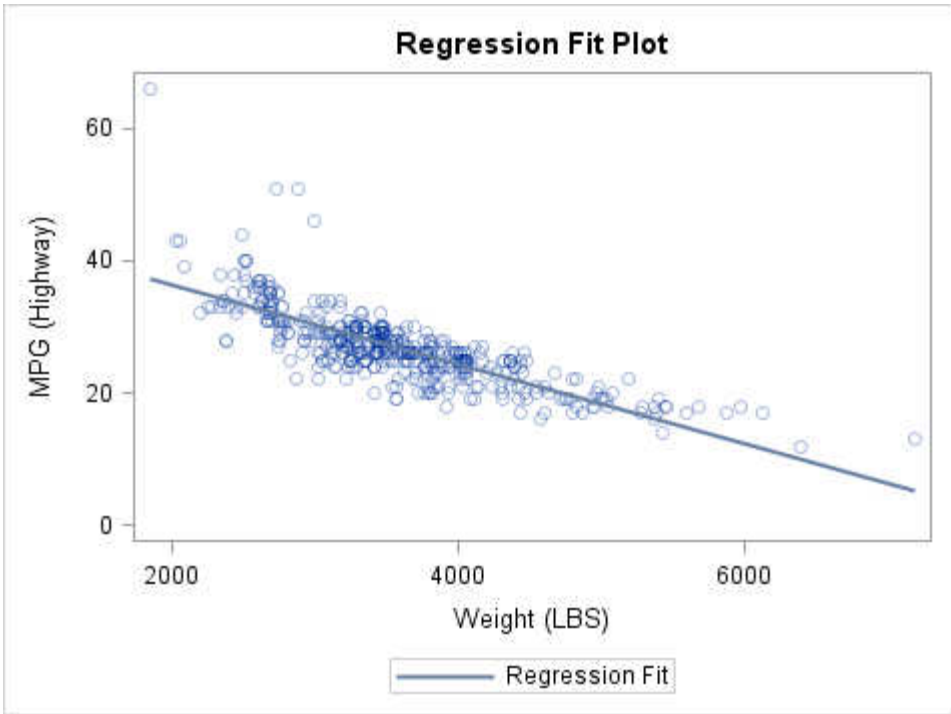
The REGRESSIONPLOT statement creates a fitted regression line or curve computed from input data. It supports only models of one independent and one dependent variable. Information about the fitting methodology that the REGRESSIONPLOT statement uses can be found in The TRANSREG Procedure in *SAS/STAT User's Guide*.

In addition to the regression line, the REGRESSIONPLOT statement can compute confidence levels for the fitted line. To display the confidence levels:

1. Use the CLI= or CLM= regression option(s) to declare a name for each confidence level.
2. Use MODELBAND statements to refer to the name(s) and draw a confidence band(s) from this information.

Example: REGRESSIONPLOT Statement

The following graph was generated by the "Example Program" on page 806:



Example Program

```
proc template;
  define statgraph regressionplot;
    begingraph;
      entrytitle "Regression Fit Plot";
      layout overlay;
        scatterplot x=weight y=mpg_highway /
          datatransparency=0.7;
        regressionplot x=weight y=mpg_highway /
          name="fitline"
          alpha=0.05 legendlabel="Regression Fit";
        discretelegend "fitline";
      endlayout;
   endgraph;
  end;
run;

proc sgrender data=sashelp.cars template=regressionplot;
run;
```

SCATTERPLOT Statement

Creates a scatter plot of input data.

Syntax

SCATTERPLOT X=*column* | *expression*
Y=*column* | *expression* < */options* >;

Summary of Optional Arguments

Appearance options

CLUSTERWIDTH=*number*
: on a discrete axis, specifies the width of the group clusters as a fraction of the midpoint spacing. On an interval axis, specifies the width of the group clusters as a fraction of the minimum interval between adjacent data values.

COLORMODEL=*style-element* | (*color-list*)
: specifies a color ramp that is to be used with the COLORRESPONSE= or MARKERCOLORGRADIENT= option.

COLORRESPONSE=*numeric-column* | *range-attr-var* | *expression*
: starting with SAS 9.4M2, specifies the column or range attribute map variable to use to determine the marker colors.

CONTRIBUTEOFFSETS=ALL | NONE | (*axis-offset-list*)
: specifies whether space requirements for this plot contribute to the calculation of the axis offsets.

DATASKIN=NONE | CRISP | GLOSS | MATTE | PRESSED | SHEEN
: enhances the visual appearance of the plot markers.

DATATRANSPARENCY=*number*
: specifies the degree of the transparency of the markers, data labels, and error bars, when displayed.

DISCRETEMARKERSIZE=*number*
: specifies the size of a marker as a fraction of the tick spacing.

ERRORBARATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
: specifies the attributes of the error bars that are associated with the data points.

ERRORBARCAPSCALE=*positive-number*
: specifies a positive number to use as a multiplier for determining the default width of the error-bar caps.

ERRORBARCAPSHAPE=SERIF | NONE
: specifies whether the error bars have a serif cap.

FILLEDOUTLINEDMARKERS=TRUE | FALSE
: specifies whether markers are drawn with both fill and an outline.

INDEX=*positive-integer-column* | *expression*
: specifies indices for mapping marker attributes (color and symbol) to one of the GraphData1–GraphDataN style elements.

LABELSTRIP=TRUE | FALSE
: specifies whether leading and trailing blanks are stripped from marker characters or data labels that have a fixed position before they are displayed in the plot.

MARKERATTRS=*style-element* | *style-element* (*marker-options*) | (*marker-options*)
: specifies the attributes of the data markers.

MARKERCHARACTER=*column* | *expression*
: specifies a column that defines strings that are to be used instead of marker symbols.

MARKERCHARACTERATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
: specifies the color and font attributes of the marker character specified on the MARKERCHARACTER= option.

MARKERCHARACTERPOSITION=CENTER | TOP | BOTTOM | LEFT | RIGHT | TOPLEFT | TOPRIGHT | BOTTOMLEFT | BOTTOMRIGHT
: specifies the justification of the marker characters.

MARKERCOLORGRADIENT=*numeric-column* | *range-attr-var* | *expression*
: in SAS 9.4M1 and earlier releases, specifies the column or range attribute map variable that is used to determine the marker colors.

MARKERFILLATTRS=*style-element* | (*fill-options*)
: specifies the appearance of the filled markers.

MARKEROUTLINEATTRS=*style-element* | (*line-options*)
: specifies the appearance of the marker outlines.

MARKERSIZEMAX=*dimension*
: for SAS 9.4M1 and for earlier releases, specifies a drawing size for the largest marker when the marker size represents response values.

MARKERSIZEMIN=*dimension*
: for SAS 9.4M1 and for earlier releases, specifies a drawing size for the smallest marker when the marker size represents response values.

MARKERSIZERESPONSE=*numeric-column* | *expression*
: for SAS 9.4M1 and for earlier releases, specifies a column that is used to map the drawing size of the markers.

OUTLINEDMARKERCHARACTERS=TRUE | FALSE
: specifies whether the characters that are used as marker symbols are outlined in order to enhance their appearance in the graph.

REVERSECOLORMODEL=TRUE | FALSE
: specifies whether to reverse the gradient (color ramp) that is defined by either the ODS style that is in effect or by the COLORMODEL= option.

SIZEMAX=*dimension*
: starting with SAS 9.4M2, specifies a drawing size for the largest marker when the marker size represents response values.

SIZEMIN=*dimension*
: starting with SAS 9.4M2, specifies a drawing size for the smallest marker when the marker size represents response values.

SIZERESPONSE=*numeric-column* | *expression*
: starting with SAS 9.4M2, specifies a column that is used to map the drawing size of the markers.

SUBPIXEL=AUTO | OFF
: specifies whether subpixel rendering is used for image output when the scatter plot is rendered.

USEDISCRETESIZE=TRUE | FALSE

specifies that the marker size should be based on fraction of the midpoint spacing that is set by the DISCRETEMARKERSIZE= option.

XERRORLOWER=*numeric-column* | *expression*
specifies values for the lower endpoints on the X error bars. The error bars are drawn from the markers to the endpoints.

XERRORUPPER=*numeric-column* | *expression*
specifies values for the upper endpoints on the X error bars.

YERRORLOWER=*numeric-column* | *expression*
specifies values for the lower endpoints on the Y error bars.

YERRORUPPER=*numeric-column* | *expression*
specifies values for the upper endpoints on the Y error bars.

Axes options

CLUSTERAXIS=AUTO | X | Y
specifies the axis to use for clustering groups when GROUPDISPLAY=CLUSTER.

PRIMARY=TRUE | FALSE
specifies that the data columns for this plot and the plot type be used for determining default axis features.

XAXIS=X | X2
specifies whether data are mapped to the primary X (bottom) axis or to the secondary X2 (top) axis.

YAXIS=Y | Y2
specifies whether data are mapped to the primary Y (left) axis or to the secondary Y2 (right) axis.

Data tip options

ROLENAME=(*role-name-list*)
specifies user-defined roles that can be used to display information in the data tips.

TIP=(*role-list*) | NONE
specifies the information to display when the cursor is positioned over the scatter points.

TIPFORMAT=(*role-format-list*)
specifies display formats for tip columns.

TIPLABEL=(*role-label-list*)
specifies display labels for tip columns.

Label options

DATALABEL=*column* | *expression*
specifies a column for marker labels. The label positions are adjusted to prevent them from overlapping.

DATALABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font attributes of the data labels.

DATALABELPOSITION=AUTO | TOPRIGHT | TOP | TOPLEFT | LEFT | CENTER | RIGHT | BOTTOMLEFT | BOTTOM | BOTTOMRIGHT
specifies the location of the data labels relative to the markers.

DATALABELSPLIT=TRUE | FALSE

specifies whether to split the data labels at the specified split characters.

DATALABELSPLITCHAR="*character-list*"
specifies one or more characters on which the data labels can be split if needed.

DATALABELSPLITCHARDROP=TRUE | FALSE
specifies whether the split characters are included in the data labels.

DATALABELSPLITJUSTIFY=AUTO | CENTER | LEFT | RIGHT
specifies the justification of the strings that are inside the data label blocks.

LEGENDLABEL="*string*"
specifies a label to be used in a discrete legend for this plot.

Midpoint options

DISCRETEOFFSET=*number*
specifies an amount to offset all markers from discrete X values, or discrete Y values, or both.

GROUP=*column* | *discrete-attr-var* | *expression*
creates a separate marker type for each unique group value of the specified column.

GROUPDISPLAY=OVERLAY | CLUSTER
specifies how marker groups are positioned for the coordinate pairs.

GROUPORDER=DATA | REVERSEDATA | ASCENDING | DESCENDING
specifies the ordering of the groups within a category.

INCLUDEMISSINGGROUP=TRUE | FALSE
specifies whether missing values of the group variable are included in the plot.

JITTER=NONE | AUTO
specifies whether to jitter data markers.

JITTEROPTS=(*jitter-options*)
specifies options for managing jittering.

ODS options

URL=*string-column*
specifies an HTML page to display when a point is selected.

Plot reference options

NAME="*string*"
assigns a name to this plot statement for reference in other template statements.

Statistics options

FREQ=*numeric-column* | *expression*
specifies a numeric column that provides frequencies for each observation that is read.

Required Arguments

X=*column* | *expression*
specifies the column for the X values.

Y=*column* | *expression*
specifies the column for the Y values.

Optional Arguments

CLUSTERAXIS=AUTO | X | Y
specifies the axis to use for clustering groups when GROUPDISPLAY=CLUSTER.

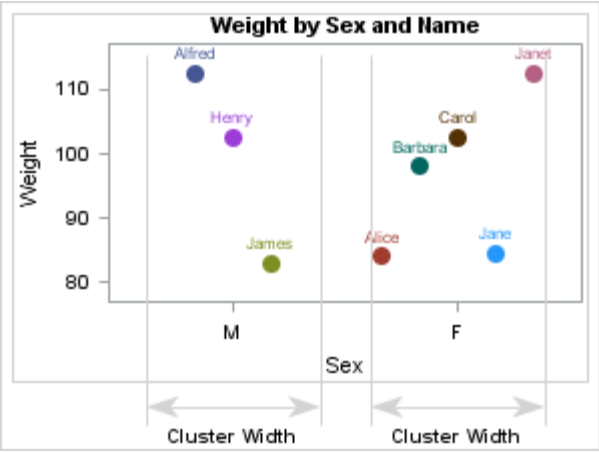
AUTO
uses the discrete axis for clustering groups when only one axis is discrete. Uses the X axis for clustering if both axes are discrete or interval.

X
Y
uses the X or Y axis for clustering groups.

Default AUTO

Interaction The GROUPDISPLAY= option must be set to CLUSTER for this option to have any effect.

CLUSTERWIDTH=*number*
on a discrete axis, specifies the width of the group clusters as a fraction of the midpoint spacing. On an interval axis, specifies the width of the group clusters as a fraction of the minimum interval between adjacent data values.



Default 0.85

Range 0–1, where 0 is the minimum width, which is one pixel wide, and 1 is the maximum possible width

Interactions For this option to take effect, the GROUP= option must also be specified, and the GROUPDISPLAY= option must be set to CLUSTER.

When GROUPDISPLAY=CLUSTER and CLUSTERWIDTH= are in effect for interval data, the size of the markers in each cluster might be reduced to no less than 5 pixels in order to display the cluster within the smallest effective midpoint space. If you need larger

markers in that case, use the MARKERATTRS= option to specify a larger marker size.

COLORMODEL=*style-element* | (*color-list*)
specifies a color ramp that is to be used with the COLORRESPONSE= or MARKERCOLORGRADIENT= option.

style-element
specifies the name of a style element.

The style element should contain these style attributes:

STARTCOLOR	specifies the color for the smallest data value of the COLORRESPONSE= or MARKERCOLORGRADIENT= column.
NEUTRALCOLOR	specifies the color for the midpoint of the range of the COLORRESPONSE= or MARKERCOLORGRADIENT= column.
ENDCOLOR	specifies the color for the highest data value of the COLORRESPONSE= or MARKERCOLORGRADIENT= column.

(*color-list*)
specifies a space-separated list of colors to use in the color ramp.

You can use style attribute references such as GraphData3:Color, color names, or RGB, CMYK, HLS, and HSV (HSB) color codes to specify a color. The list can contain a mix of style attribute references, color names, and color codes.

Requirement The list of colors must be enclosed in parentheses.

See “color ” on page xii

Default The ThreeColorAltRamp style element.

Interaction For this option to take effect, the COLORRESPONSE= or MARKERCOLORGRADIENT= option must also be specified.

Tip The REVERSECOLORMODEL= option can be used to reverse the start and end colors of the ramp assigned to the color model.

COLORRESPONSE=*numeric-column* | *range-attr-var* | *expression*
starting with SAS 9.4M2, specifies the column or range attribute map variable to use to determine the marker colors.

Note: Starting with SAS 9.4M2, the COLORRESPONSE= option replaces the MARKERCOLORGRADIENT= option. The syntax and functionality are the same. The MARKERCOLORGRADIENT= option is still honored, but the COLORRESPONSE= option is preferred.

range-attr-var

specifies a range attribute map variable that is defined in a RANGEATTRVAR statement.

"RANGEATTRVAR Statement"

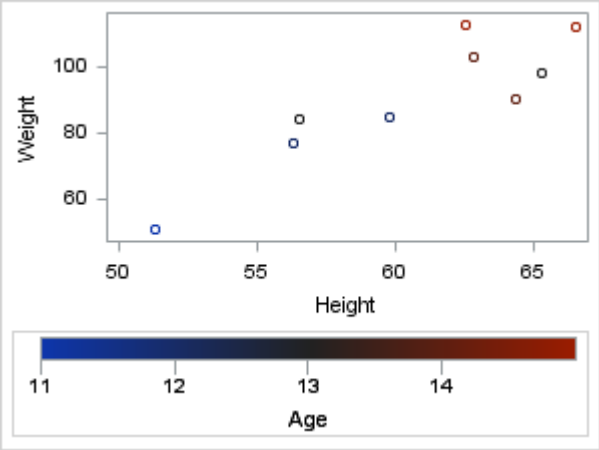
Restriction A range attribute map variable specification must be a direct reference to the attribute map variable. It cannot be set as a dynamic variable.

Tip For each range in the attribute map, the RANGEALTCOLOR= or RANGEALTCOLORMODEL= option in the RANGE statement determines the marker colors.

See "RANGEATTRVAR Statement" on page 1531

When a numeric column or expression is specified, the range of column or expression values are linearly mapped to the color ramp that is specified by the COLORMODEL= option. When a range attribute map variable is specified, the colors that are defined in the associated range attribute map are used instead.

You can use this option to add a second response variable to an analysis. For example, in an analysis of weight by height, you can specify an age column by using the COLORRESPONSE= or MARKERCOLORGRADIENT= option so that the change in the gradient color of the markers reflects the change in age.



Requirement For a grouped plot, the COLORRESPONSE values should remain constant for each group value. If the COLORRESPONSE column has multiple values for a single GROUP value, unexpected results might occur.

Interactions When the GROUP= option is specified with the COLORRESPONSE= option, the color attributes are controlled by the COLORRESPONSE= option.

Suboption COLOR= in the DATALABELATTRS= option overrides this option for the data label color attribute.

This option overrides suboption COLOR= in the MARKERATTRS= option and in the MARKERCHARACTERATTRS= option and varies

the marker color according to the color gradient or the attribute map.

Note You can use MARKERCOLORGRADIENT= as an alternative to COLORRESPONSE=. However, if you use MARKERCOLORGRADIENT=, be aware that the TIP=, TIPFORMAT=, and TIPLABEL= options recognize MARKERCOLORGRADIENT as the color role, not COLORRESPONSE.

Tips To display a legend with this option in effect, use a CONTINUOUSLEGEND statement.

Starting with SAS 9.4M2, when this option is in effect and error bars are displayed, the error bars derive their color from the markers. To set a fixed color for the error bars, use the ERRORBARATTRS= option.

If the MARKERCHARACTER= option is also specified, then the gradients that would be applied to the markers are applied to the text strings.

CONTRIBUTEOFFSETS=ALL | NONE | (*axis-offset-list*)
specifies whether space requirements for this plot contribute to the calculation of the axis offsets.

Note: This feature applies to SAS 9.4M2 and to later releases.

This plot's layout container queries each of its plots for a preferred offset and includes all of the offsets in the axis offset calculations. If the DATALABEL= or MARKERCHARACTER= option is specified for this plot, this plot might request a preferred offset that prevents the clipping of any data labels or marker character strings that appear at the ends of the axes. The requested offset is based on the longest string. If the label or marker character lengths vary significantly, the result is wasted space when the shorter strings appear near the ends of the axes. In that case, you can use the CONTRIBUTEOFFSETS= option to modify or eliminate this plot's contribution to the offset calculations in order to reclaim that space.

ALL
the space requirements for this plot are contributed to the axis offset calculations.

NONE
the space requirements for this plot are not contributed to the axis offset calculations.

(*axis-offset-list*)
a space-delimited list of specific contributions that this plot makes to the axis offset calculations.

The list is one or more of the following values, enclosed in parentheses:

XMAX
the space requirements for this plot are contributed to the X-axis offset calculation for the maximum end.

XMIN
the space requirements for this plot are contributed to the X-axis offset calculation for the minimum end.

YMAX
the space requirements for this plot are contributed to the Y-axis offset calculation for the maximum end.

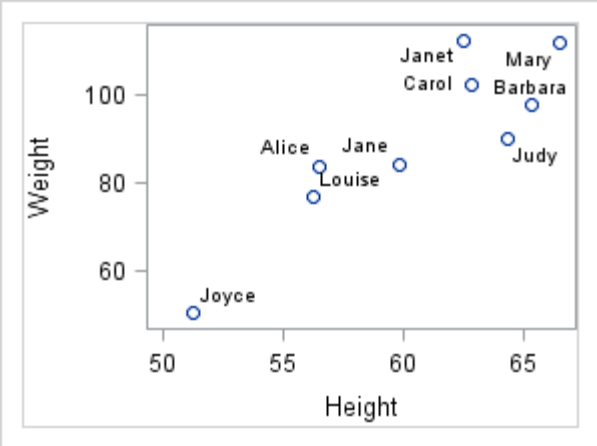
YMIN
the space requirements for this plot are contributed to the Y-axis offset calculation for the minimum end.

Default ALL

Interaction Offsets that are set in the layout axis options are always honored, regardless of the setting on this option.

Note This option does not affect offset requests from other plots.

DATALABEL=*column* | *expression*
specifies a column for marker labels. The label positions are adjusted to prevent them from overlapping.



Default No data labels are displayed

Interactions If a numeric *column* is specified and the column has no format, then a BEST6 format is applied.

This option is ignored if the MARKERCHARACTER= option is used, which displays labels instead of the markers.

Tip Use this option to display labels for the markers. The position of the labels is adjusted to prevent the labels from overlapping. If you want labels displayed instead of markers, then use the MARKERCHARACTER= option.

DATALABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font attributes of the data labels.

Defaults For non-grouped data, the GraphDataText style element.

For grouped data, the GraphData1:ContrastColor–GraphDataN:ContrastColor style references.

Interactions For this option to take effect, the DATALABEL= option must also be specified.

This option is ignored if the MARKERCHARACTER= option is specified.

Note When the DATALABELPOSITION=AUTO option is in effect, in some cases, the data label font size might be reduced in order to avoid overlapping labels and markers.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*

"Text Options" on page 1606 for available *text-options*.

DATALABELPOSITION=AUTO | TOPRIGHT | TOP | TOPLEFT | LEFT | CENTER | RIGHT | BOTTOMLEFT | BOTTOM | BOTTOMRIGHT
specifies the location of the data labels relative to the markers.

AUTO
uses a data-label collision avoidance algorithm to position the labels.

Note When AUTO is in effect, in some cases, the data label font size might be reduced in order to avoid overlapping labels and markers.

See "LABELPLACEMENT=AUTO | GREEDY | SA" on page 36

TOPRIGHT
TOP
TOPLEFT
LEFT
CENTER
RIGHT
BOTTOMLEFT
BOTTOM
BOTTOMRIGHT
specifies a location for all of the data labels.

Default AUTO

DATALABELSPLIT=TRUE | FALSE
specifies whether to split the data labels at the specified split characters.

Default FALSE

Interactions The DATALABELSPLITCHAR= option specifies one or more characters on which splits can occur.

This option has no effect when DATALABELPOSITION=AUTO.

See "boolean " on page xii for other Boolean values that you can use.

DATALABELSPLITCHAR="*character-list*"
specifies one or more characters on which the data labels can be split if needed. When multiple split characters are specified, each character in the list is treated as a separate split character unless the specified characters appear consecutively in the data label. In that case, all of the specified split characters together are treated as a single split character.

When DATALABEL= is specified and DATALABELSPLIT=TRUE, the data label is split unconditionally at each occurrence of any of the specified split characters. If the data label does not contain any of the specified characters, then the label is not split.

"character-list"
one or more characters with no space between each character and enclosed in quotation marks.

Default A blank space

Requirements The list of characters must be enclosed in quotation marks.

Multiple characters must be specified with no space between them. For example, to specify the split characters a, b, and c, use the following option:

```
datalabelsplitchar="abc"
```

Interactions This option has no effect if DATALABELPOSITION=AUTO or if DATALABELSPLIT=FALSE.

The DATALABELSPLITCHARDROP= option specifies whether the split characters are included in the data label or are dropped.

Notes When multiple characters are specified, the order of the characters in the list is not significant.

The split characters are case sensitive.

Tip Use the DATALABELSPLITJUSTIFY= option to specify the justification of the strings in the data label block.

DATALABELSPLITCHARDROP=TRUE | FALSE
specifies whether the split characters are included in the data labels. The split characters are specified by the DATALABELSPLITCHAR= option.

TRUE
drops the split characters from the data label.

FALSE
includes the split characters in the data label.

When DATALABELSPLIT=TRUE and DATALABELSPLITCHARDROP=FALSE, each split character remains as the last character in the current line. The

characters that follow the split character, up to and including the next split character, are then wrapped to the next line.

The following figure shows an example of a data label with the following specifications:

- the data label text for this label is Product*Group*A
- DATALABELSPLIT=TRUE
- DATALABELSPLITCHARDROP=TRUE | FALSE
- DATALABELSPLITCHAR="*"

When DATALABELSPLITCHARDROP=TRUE, the asterisks are removed from the label. When DATALABELSPLITCHARDROP=FALSE, each asterisk remains as the last character in the line prior to the new line.

Default TRUE. The split characters are dropped from the data label.

Interactions This option has no effect unless DATALABELSPLIT=TRUE.

The DATALABELSPLITCHAR= option specifies the split characters.

See "boolean " on page xii for other Boolean values that you can use.

DATALABELSPLITJUSTIFY=AUTO | CENTER | LEFT | RIGHT
specifies the justification of the strings that are inside the data label blocks.

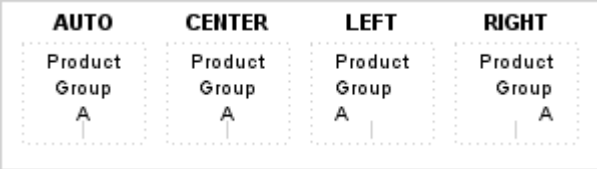
AUTO
justifies the labels based on the DATALABELPOSITION= option.

DATALABELPOSITION= Value	Justification
TOPLEFT, LEFT, or BOTTOMLEFT	RIGHT
TOPRIGHT, RIGHT, or BOTTOMRIGHT	LEFT
TOP, CENTER, or BOTTOM	CENTER

CENTER
LEFT
RIGHT
justifies the labels center, left, or right, as specified.

The following figure shows an example in which DATALABELPOSITION=TOP.

Note: The gray vertical line at the bottom of each label represents the horizontal center of the text box for reference.

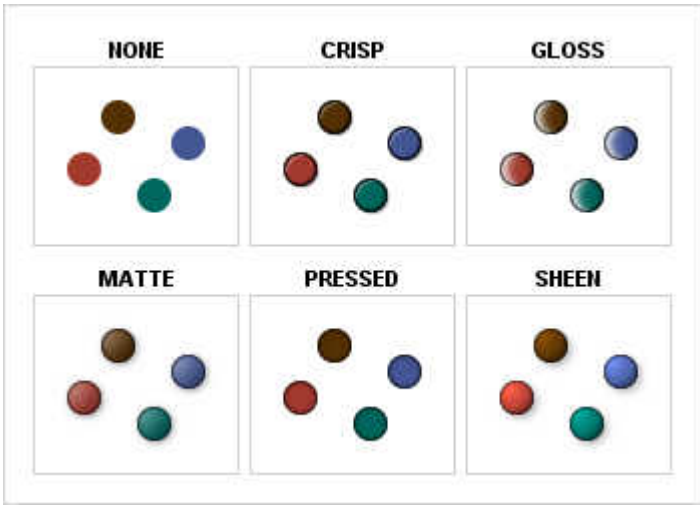


In this case, because DATALABELPOSITION=TOP, AUTO centers the lines of text. The text box is anchored the same way that the unsplit text is anchored. For example, if DATALABELPOSITION=TOP, then the bottom center of the text box is positioned at the top of the marker.

Default AUTO

Interaction This option has no effect if DATALABELPOSITION=AUTO or if DATALABELSPLIT=FALSE.

DATASKIN=NONE | CRISP | GLOSS | MATTE | PRESSED | SHEEN
enhances the visual appearance of the plot markers. The following figure shows large CIRCLEFILLED markers with each of the skins applied.



Default The DATASKIN= option value that is specified in the BEGINGRAPH statement. If not specified, then the GraphSkins:DataSkin style element value is used.

Restriction Starting with SAS 9.4M1, the maximum number of skinned graphical elements is limited to 200 per plot in an OVERLAY or PROTOTYPE layout. When this limit is exceeded for a plot, the specified data skin is not applied to that plot. In that case, use the DATASKINMAX= option in your ODS GRAPHICS statement to increase the maximum limit.

Interactions This option overrides the BEGINGRAPH statement DATASKIN= option.

When a data skin is applied, all marker outlines are set by the skin, and the outline settings are ignored from the ODS style or from MARKERATTRS= option.

DATATRANSPARENCY=*number*
specifies the degree of the transparency of the markers, data labels, and error bars, when displayed.

Default 0

Range 0–1, where 0 is opaque and 1 is entirely transparent

Restriction The specified transparency is not applied to missing values. Missing values are always opaque.

DISCRETEMARKERSIZE=*number*
specifies the size of a marker as a fraction of the tick spacing.

Default 0.5

Range 0 to 1

Requirement For this option to take effect, at least one of the axes must be discrete.

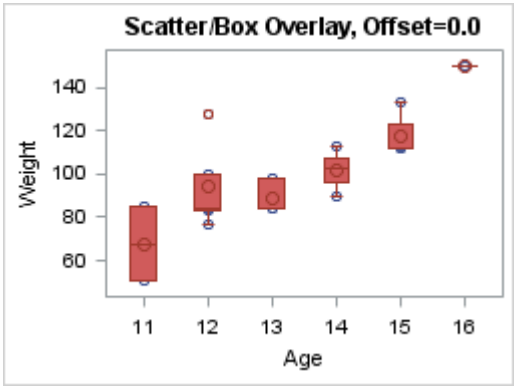
Interactions If both of the axes are discrete, then the marker size is a fraction of the smaller tick spacing.

If the X axis is a numeric interval axis and the GROUPDISPLAY=CLUSTER option is in effect, then the marker size is a fraction of the interval between the two closest but not identical points in the X direction.

For this option to take effect, the USEDISCRETESIZE= option must be set to TRUE (the default is FALSE).

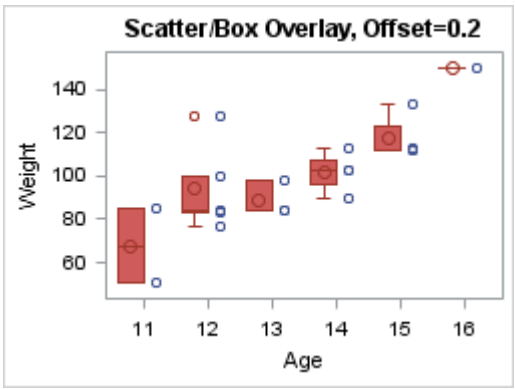
DISCRETEOFFSET=*number*
specifies an amount to offset all markers from discrete X values, or discrete Y values, or both. This feature is useful for graphing multiple response variables side by side on a common axis. By default within an overlay-type layout, if a SCATTERPLOT is used with other plots with a discrete axis, then the markers are centered on the discrete X values, or discrete Y values, or both. Depending on the data, the markers might be superimposed over other graph data. The following code fragment shows the default positioning when a SCATTERPLOT is used with a BOXPLOT:

```
layout overlay / cycleattrs=true
     xaxisopts=(type=discrete);

  scatterplot x=age y=weight;
  boxplot x=age y=weight;

endlayout;
```



To avoid superimposed plots, you can assign a different offset to each plot statement:

```
layout overlay / cycleattrs=true
        xaxisopts=(type=discrete);
  scatterplot x=age y=weight /
    discreteoffset=0.2;
  boxplot x=age y=weight /
    discreteoffset=-0.2;
endlayout;
```



Default 0 (no offset, all markers are centered on the discrete X values, or discrete Y values, or both)

Range −0.5 to +0.5, where 0.5 represents half the distance between discrete ticks. A positive offset is to the right on discrete X values and up on discrete Y values. If the layout's axis options set REVERSE=TRUE, then the offset direction is also reversed.

Restriction This option applies to discrete axes only. For nondiscrete axes, this option is ignored.

Tip Setting the discrete offset for the plots does not affect the axis minimum and maximum offsets. In some cases, setting a discrete offset can cause clipping at each end of the axis. In those cases, use the OFFSETMIN= and OFFSETMAX= axis options to increase the axis minimum and maximum offsets to accommodate the discrete offset.

ERRORBARATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the attributes of the error bars that are associated with the data points.

Defaults For ungrouped data, the GraphError style element attributes ContrastColor, LineStyle, and LineThickness.

For grouped data, the LineStyle and LineThickness attributes from the GraphError style element, and the ContrastColor attribute from the GraphData1–GraphDataN style elements.

Interaction For this option to take effect, error bars must be displayed by the XERRORLOWER= , XERRORUPPER= , YERRORLOWER= , or YERRORUPPER= options.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

ERRORBARCAPSCALE=*positive-number*
specifies a positive number to use as a multiplier for determining the default width of the error-bar caps.

Note: This feature applies to SAS 9.4M5 and to later releases.

Default 1

Interaction This option is ignored when ERRORBARCAPSHAPE=NONE is in effect.

Tips Use the ERRORBARCAPSHAPE= option to specify the cap shape.

The thickness (height) of the SERIF, LINE, and BRACKET is determined by the thickness specified in the ERRORBARATTRS= option. The cap line pattern is always solid.

Examples Double the size of the error-bar caps:

```
errorbarcapscale=2
```

Reduce the size of the error-bar caps by 50%:

```
errorbarcapscale=0.5
```

ERRORBARCAPSHAPE=SERIF | NONE
specifies whether the error bars have a serif cap.

Defaults SERIF in SAS 9.4M5 and earlier releases.

Starting with SAS 9.4M2, GraphError:CapStyle style reference. If attribute CapStyle is not defined in the active style, then SERIF is the default value.

Interaction Starting with SAS 9.4M5, when ERRORBARCAPSCALE= is in effect, the display width for SERIF caps is the cap's default width multiplied by the value specified in ERRORBARCAPSCALE=.

Tip The appearance of the error bars is controlled by the ERRORBARATTRS= option.

FILLEDOUTLINEDMARKERS=TRUE | FALSE

specifies whether markers are drawn with both fill and an outline.

TRUE

draws filled markers (marker symbols with the suffix FILLED) using both fill and an outline.

When this option is TRUE, the fill color and outline color for filled markers are determined in the following ways:

- If the GROUP= option is specified, then by default, the fill color is derived from the GraphData1–GraphDataN style elements Color attribute, and the marker outlined color is derived from the GraphData1–GraphDataN style elements ContrastColor attribute.
- If the GROUP= option is not specified, then by default, the fill color is derived from the GraphDataDefault style elements Color attribute, and the marker outlined color is derived from the GraphOutline style elements ContrastColor attribute.
- If the COLORRESPONSE= MARKERCOLORGRADIENT= option is specified, then the marker fill is drawn by using the mapped color that is computed from the value of the COLORRESPONSE= or MARKERCOLORGRADIENT= option for that observation. The marker outline is drawn by using the MARKEROUTLINEATTRS= specification.

FALSE

draws the markers using fill or an outline, but not both.

Default FALSE

Tip To specify the marker fill and outline colors for a non-grouped plot, set this option to TRUE, and then use the MARKERFILLATTRS= and MARKEROUTLINEATTRS= options to specify the colors.

See GROUP= on page 824

MARKERFILLATTRS= on page 835

MARKEROUTLINEATTRS= on page 835

COLORRESPONSE= on page 812

"boolean " on page xii for other Boolean values that you can use.

FREQ=*numeric-column* | *expression*
specifies a numeric column that provides frequencies for each observation that is read.

Default All observations have a frequency count of 1.

Restriction If the value of *numeric-column* is missing or is less than 1 for an observation, then that observation is not used in the analysis. If the value is not an integer, then only the integer portion is used.

Note If *n* is the value of the numeric column for a given observation, then that observation is used *n* times for the purposes of any statistical computation. The marker for that observation is drawn *n* times, which increases the marker weight slightly with frequency.

GROUP=*column* | *discrete-attr-var* | *expression*
creates a separate marker type for each unique group value of the specified column.

discrete-attr-var
specifies a discrete attribute map variable.

The discrete attribute map variable is created by a DISCRETEATTRVAR statement.

Restriction A discrete attribute map variable specification must be a direct reference to the attribute map variable. It cannot be set by a dynamic variable.

Default Each distinct group value might be represented in the plot by a different combination of color and marker symbol. Markers vary according to the ContrastColor and MarkerSymbol attributes of the GraphData1–GraphDataN and GraphMissing style elements.

Interactions The group values are mapped in the order of the data, unless the INDEX= option is used to alter the default sequence of markers and colors.

The INCLUDEMISSINGGROUP option controls whether missing group values are considered a distinct group value.

The marker size is set by the MARKERATTRS= option.

The MARKERCHARACTER= , COLORRESPONSE= , and MARKERCOLORGRADIENT= options override the group settings for the marker symbol and marker color.

The SIZERESPONSE= and MARKERSIZERESPONSE= options override this option's SIZE= setting.

Note If you specify a column in a SAS data set, the visual attributes for each group value are assigned in data order. If you specify a column in a CAS in-memory table, the visual attributes for each group value are assigned in ascending order of the group column character values or of unformatted numeric values.

Tips The representations that are used to identify the groups can be overridden. For example, each distinct group value is represented by a different marker symbol, but the MARKERATTRS=(SYMBOL=*marker*) option could be used to assign the same symbol to all of the plot's marker symbols, letting marker color indicate group values. Likewise, MARKERATTRS=(COLOR=*color*) could be used to assign the same color to all markers, letting marker symbol indicate group values.

By default, ODS Graphics limits the number of groups to 1000. When this limit is exceeded, the GROUP= option is ignored. Use the GROUPMAX= option in the ODS GRAPHICS statement to change the maximum number of groups that can be processed.

See "DISCRETEATTRVAR Statement" on page 1516

GROUPDISPLAY=OVERLAY | CLUSTER
specifies how marker groups are positioned for the coordinate pairs.

OVERLAY
draws markers for a given group value at the exact coordinate.

Depending on the data, markers at a given coordinate might overlap.

CLUSTER
draws markers for a given group value adjacent to each other.

Default OVERLAY

Note When you plot a SAS data set, the items for each group value are drawn in data order. When you plot a CAS in-memory table, they are drawn in ascending order of the group column character values or unformatted numeric values.

Tip Use the CLUSTERWIDTH= option to control the width of the clusters when CLUSTER is in effect.

GROUPORDER=DATA | REVERSEDATA | ASCENDING | DESCENDING
specifies the ordering of the groups within a category.

DATA
orders the groups within a category in the group-column data order.

REVERSEDATA
orders the groups within a category in the reverse group-column data order.

Note: This feature applies to SAS 9.4M2 and to later releases.

Tip This option is useful when you want to reverse the category axis.

ASCENDING
orders the groups within a category in ascending order.

DESCENDING
orders the groups within a category in descending order.

Defaults DATA if the data is a SAS data set.

ASCENDING if the data is a CAS in-memory table. Sorting is based on nonformatted values for numeric group values or on formatted values for character group values.

Interactions This option is ignored if the GROUP= option is not also specified.

By default, the groups in the legend are shown in the order that is specified in GROUPORDER.

Notes When plotting a SAS data set, attributes such as color, symbol, and pattern are assigned to each group in DATA order by default. When plotting a CAS in-memory table, attributes are assigned in ascending order of the group column character values or unformatted numeric values by default.

The ASCENDING and DESCENDING settings linguistically sort the group values within each category (or X value) for display position purposes only. For numeric data, the order is based on the unformatted values. For character data, the order is based on the formatted values. The data order of the observations and the visual attributes that are assigned to the group values remain unchanged.

In SAS 9.4M6 and earlier releases, when data stored in a CAS in-memory table is used and DATA or REVERSEDATA is specified, unpredictable results might occur. To generate consistent graphs in that case, specify ASCENDING or DESCENDING. Starting with SAS Viya 3.5 and SAS Studio 5.2, when data stored in a CAS in-memory table is used and DATA or REVERSEDATA is specified, it is ignored, and ASCENDING is used instead.

Tips Use the CLUSTERWIDTH= option to control the distance between the group markers in a cluster.

Use the INDEX= option to alter the default sequence of visual attributes that is assigned to the groups.

INCLUDEMISSINGGROUP=TRUE | FALSE
specifies whether missing values of the group variable are included in the plot.

Default TRUE

Interaction For this option to take effect, the GROUP= option must also be specified.

Tip The attributes of the missing group value are determined by the GraphMissing style element unless a discrete attribute map is in effect, the INDEX= option is used, the MISSING= system option changes the default missing character, or a user-defined format is applied to the group value. In those cases, the attributes of the missing group value are determined by a GraphData1–GraphDataN style element instead of by the GraphMissing style element.

See "boolean " on page xii for other Boolean values that you can use.

INDEX=*positive-integer-column* | *expression*
specifies indices for mapping marker attributes (color and symbol) to one of the GraphData1–GraphDataN style elements.

Requirements The column or expression value must be an integer value of 1 or greater. Otherwise, this option is ignored.

The positive-integer column must not contain missing values. Otherwise, the entire column is invalidated and this option is ignored.

All of the indexes for a specific group value must be the same. Otherwise, the results are unpredictable.

Interactions For this option to take effect, the GROUP= option must also be specified.

The MARKERCHARACTER=, COLORRESPONSE=, and MARKERCOLORGRADIENT= options override the group settings for the marker symbol and marker color.

Notes The index values are 1-based indices. For the style attributes in GraphData1–GraphDataN, if the index value is greater than N, then a modulo operation remaps that index value to a number less than N to determine which style to use.

If you do not use this option, then the group values are mapped in the order of the data.

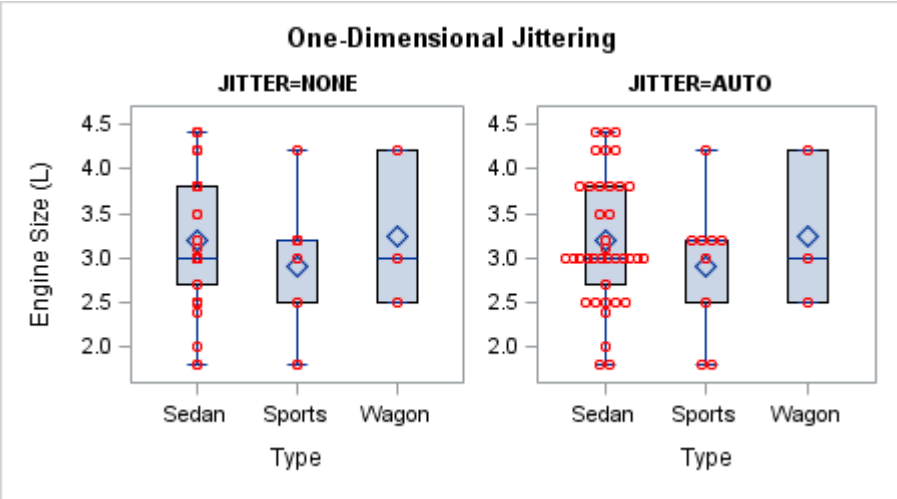
Tip You can use indexing to collapse the number of groups that are represented in a graph. For more information, see "Remapping Groups for Grouped Data" on page 211.

JITTER=NONE | AUTO
specifies whether to jitter data markers.

NONE
does not offset the data markers.

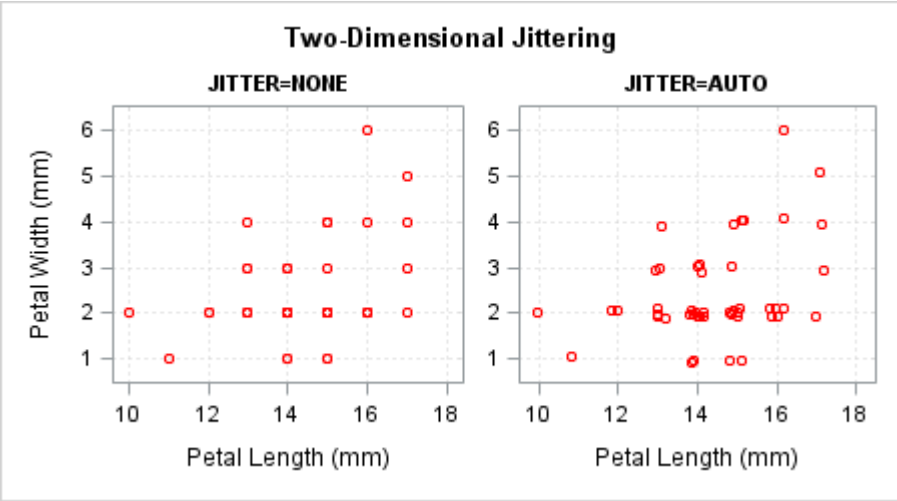
AUTO
the system determines the best way to display the data markers, based on the settings specified by the JITTEROPTS= option.

The following figures show a side-by-side comparison of a BOXPLOT and SCATTERPLOT in which the JITTER=NONE and JITTER=AUTO options are specified in the SCATTERPLOT statements. The first figure shows the case in which the Y axis is linear and the X axis is discrete.



In this case, when jittering is disabled (JITTER=NONE), markers that represent the same Y value are overlaid, which results in some markers being obscured. When jittering is enabled (JITTER=AUTO), one-dimensional systematic jittering occurs along the X axis. The markers that represent approximately the same Y value are offset along the X axis from the midpoint of that value in order to make all of the markers visible.

The next figure shows the case in which both axes are linear.



In this case, when jittering is disabled (JITTER=NONE), markers that represent the same X and Y bin value are overlaid as in the previous case, which results in some markers being obscured. However, unlike the previous case, when jittering is enabled (JITTER=AUTO), two-dimensional random jittering occurs along the X and the Y axes. The markers are offset randomly along both the X and Y axes in order to make all of the markers visible.

Default NONE

Restrictions In SAS 9.4, jittering is not supported when GROUPDISPLAY=CLUSTER. Starting with SAS 9.4M1, this restriction is removed.

One-dimensional systematic jittering is not supported when the MARKERCHARACTER= or the MARKERSIZERESPONSE= option is in effect. Random jittering is supported in those cases when both the X and Y axes are interval axes.

Interactions When jittering is enabled, the FREQ= option is ignored.

If this option is set to AUTO and both axes are discrete, then one-dimensional systematic jittering occurs along the X axis.

Notes Jittering changes the default axis offsets, but it does not change the axis data range.

When jittering is requested on a discrete axis and a large amount of data is plotted, the jittering process can become resource-intensive. In that case, it might take longer to render the plot.

You should not overlay a jittered scatter plot and a box plot with outliers because their jittering offsets differ. A scatterplot's points are jittered when the numeric values are close enough whereas a box plot's points are jittered only when the numeric values are identical.

JITTEROPTS=(*jitter-options*)
specifies options for managing jittering. The jitter options can be one or more of the following values, separated by a space:

AXIS=AUTO | X | Y | BOTH
specifies the axis to use for jittering the data markers.

AUTO
the system determines the axis.

The axis is determined as follows:

- If the X axis is discrete, then one-dimensional systematic jittering is applied along the X axis.
- If the Y axis is discrete and the X axis is interval, then one-dimensional systematic jittering is applied along the Y axis.
- If the X and Y axes are interval, then random jittering is applied along both the X and Y axes.

X
jittering is on the X axis.

If the X axis is discrete, then 1-dimensional systematic jittering is applied. Otherwise, 1-dimensional random jittering is applied.

Note If both the X and Y axes are discrete, then specifying BOTH is equivalent to specifying X.

Y
jittering is applied on the Y axis.

If the Y axis is discrete, then 1-dimensional systematic jittering is applied. Otherwise, 1-dimensional random jittering is applied.

BOTH
specifies that random jittering is applied on both the X and Y axes.

This option applies only when both the X and Y axes are interval.

Tip When the X or Y axis is discrete, specifying BOTH is equivalent to specifying AUTO.

Default AUTO

Restriction When the MARKERCHARACTER= or the MARKERSIZERESPONSE= option is in effect, 1-dimensional systematic jittering is not supported. Random jittering is supported in those cases when both the X and Y axes are interval axes.

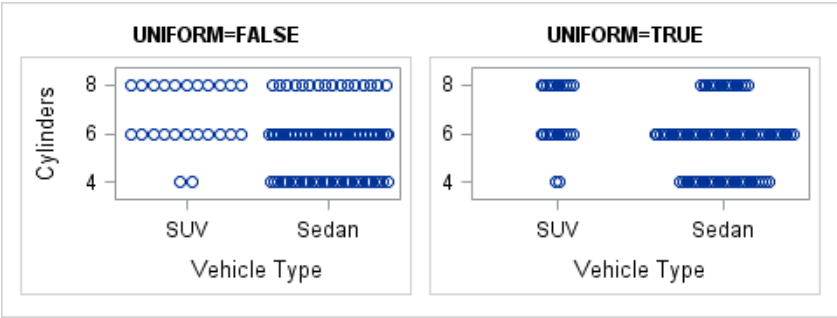
UNIFORM=TRUE | FALSE
specifies whether the jitter offsets are uniform across all category values or are varied as needed.

Note: This feature applies to SAS 9.4M5 and to later releases.

When the markers for a category value do not fit the jittering space, the jittering offsets are reduced in order to fit the markers for that category value within the jittering space.

TRUE
uses a uniform jittering offset across all category values. The offset used is the minimum offset that is required across all of the category values.

FALSE
varies the jittering offset only when the markers for a category value do not fit the jittering space. The offset is varied as needed to fit the markers for each case individually.



Default FALSE

Restriction This option applies to discrete-type jittering only.

Note When UNIFORM=TRUE is specified for a scatter plot within a LAYOUT DATALATTICE or LAYOUT DATAPANEL, the jittering is uniform across all potential category and group combinations.

WIDTH=*positive-number*
specifies the width of the jittering space as a fraction of either the midpoint spacing or of the minimal interval width.

Defaults 0.85 for 1-dimensional systematic jittering

0.4 for random jittering on one or both axes.

Note For a discrete axis, this option takes effect only if the jittered markers still overlap. Setting WIDTH= to a higher value increases the jittering space up to the specified width or to a width sufficient to eliminate overlap if it is less than the specified width. In the latter case, increasing the value further has no effect.

Tip The specified number can be greater than 1.

Interaction This option is ignored when JITTER=NONE.

LABELSTRIP=TRUE | FALSE
specifies whether leading and trailing blanks are stripped from marker characters or data labels that have a fixed position before they are displayed in the plot. The MARKERCHARACTER= option specifies the column that provides the marker strings that are to be used in place of marker symbols.

Default FALSE

Interactions This option effects marker strings only when the MARKERCHARACTER= option is specified.

This option effects data labels only when DATALABEL= is specified and DATALABELPOSITION= is not AUTO.

Tip Stripping the blanks from the numeric value strings helps center each string relative to its data point. Stripping is useful when you want to overlay the data values near or inside the markers for a plot.

See “boolean ” on page xii for other Boolean values that you can use.

LEGENDLABEL="*string*"
specifies a label to be used in a discrete legend for this plot.

Default The Y-column label. If a label is not defined, then the Y-column name is used.

Restriction This option applies only to an associated DISCRETELEGEND statement.

Interaction If the GROUP= option is specified, then this option is ignored.

MARKERATTRS=*style-element* | *style-element* (*marker-options*) | (*marker-options*)
specifies the attributes of the data markers.

Defaults For non-grouped data, GraphDataDefault style element.

For grouped data, the MarkerSymbol and ContrastColor attributes of the GraphData1–GraphDataN style elements, and the GraphDataDefault:MarkerSize style reference.

Interactions

If the COLORRESPONSE= or MARKERCOLORGRADIENT= option is specified, then this option's COLOR= suboption is ignored.

If the MARKERCHARACTER= option is specified, then this option's SYMBOL= and WEIGHT= suboptions are ignored.

If the MARKERSIZERESPONSE= option is specified, then this option's WEIGHT= suboption is ignored.

If FILLEDOUTLINEDMARKERS=TRUE, then this option's COLOR= suboption is ignored. In that case, to specify the marker fill color, use the MARKERFILLATTRS= option instead.

This option's COLOR= suboption overrides the default behavior for grouped data. When the COLOR= suboption is specified in that case, all markers have the same color, and the marker symbol alone distinguishes the markers.

This option's SYMBOL= suboption overrides the default behavior for grouped data. When the SYMBOL= suboption is specified in that case, all markers have the same symbol, and the symbol color alone distinguishes the markers.

The TRANSPARENCY= fill option overrides this option's DATATRANSPARENCY= suboption.

Note

When *style-element* is specified, only the style element's MARKERSYMBOL, CONTRASTCOLOR, and MARKERSIZE attributes are used.

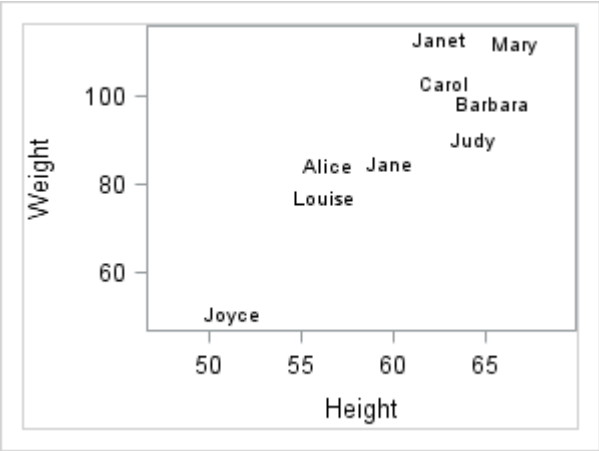
See

"General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Marker Options" on page 1604 for available *marker-options*.

MARKERCHARACTER=*column* | *expression*

specifies a column that defines strings that are to be used instead of marker symbols.



Each string is centered horizontally and vertically at the data point. The data point positions are not adjusted to prevent text overlap.

Interactions This option overrides the DATALABEL= option.

If the GROUP= option is also used, then color is displayed for a DISCRETE legend, but the character is not displayed in the legend. For text strings, the same colors are applied to the text strings as would have been applied to markers.

One-dimensional systematic jittering is not supported when this option is in effect. Random jittering is supported when this option is in effect and both the X and Y axes are interval axes. See JITTER= on page 827.

Note If a numeric column is used, then its values are converted to strings using the format associated with the column or using BEST6 if no format is defined.

Tips You can use the MARKERCHARACTERPOSITION= option to change the justification of the marker character.

You can use the OUTLINEDMARKERCHARACTERS= option to enhance the appearance of the marker characters.

You can use the LABELSTRIP= option to strip the leading and trailing blanks from numeric value strings in order to center each string on its data point.

If the MARKERCHARACTER= variable contains one or more long character strings, large axis offsets might result. In that case, use the OFFSETMIN= and OFFSETMAX= suboptions in the XAXISOPTS= and YAXISOPTS= axis options to override the automatic axis offsets.

MARKERCHARACTERATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font attributes of the marker character specified on the MARKERCHARACTER= option.

Defaults For non-grouped data, the GraphDataText style element.

For grouped data, GraphData1:ContrastColor–GraphDataN:ContrastColor style references.

Interactions For this option to take effect, the MARKERCHARACTER= option must also be used.

When the GROUP= option is also specified, each distinct group value might be represented by a different color (depending on the ODS style setting or the setting on the INDEX= option). The marker character that is associated with the group is assigned the group color.

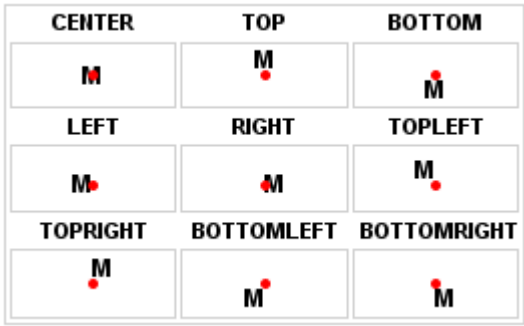
This option's COLOR= suboption can be used to specify a single color for all marker characters in a grouped plot, without affecting items that have a group color, such as error bars and marker symbols.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Text Options" on page 1606 for available *text-options*.

MARKERCHARACTERPOSITION=CENTER | TOP | BOTTOM | LEFT | RIGHT | TOPLEFT | TOPRIGHT | BOTTOMLEFT | BOTTOMRIGHT

specifies the justification of the marker characters. The following figure shows the effect of each of the values on the position of marker character M.



Note: The red dots represent the center in each case for reference.

Default CENTER

Interaction This option is ignored if the MARKERCHARACTER= option is not specified.

Tip You can use the LABELSTRIP= option to strip the leading and trailing blanks from value strings in order to properly justify each string on its data point.

MARKERCOLORGRADIENT=*numeric-column* | *range-attr-var* | *expression*
in SAS 9.4M1 and earlier releases, specifies the column or range attribute map variable that is used to determine the marker colors.

Note: Starting with SAS 9.4M2, the MARKERCOLORGRADIENT= option is deprecated and replaced with the COLORRESPONSE= option. The syntax and functionality are the same. The MARKERCOLORGRADIENT= option is still honored, but the COLORRESPONSE= option is preferred.

Note Starting with SAS 9.4M2, if you use the MARKERCOLORGRADIENT= option, then be aware that the TIP=, TIPFORMAT=, and TIPLABEL= options recognize the MARKERCOLORGRADIENT role and not the COLORRESPONSE role.

See COLORRESPONSE= on page 812

MARKERFILLATTRS=*style-element* | (*fill-options*)
specifies the appearance of the filled markers.

Defaults For non-grouped data, the Color attribute of the GraphDataDefault style element

For grouped data, the Color attribute of a GraphData1–GraphDataN style element

Restriction The TRANSPARENCY= fill option is ignored. Use the MARKERATTRS= option to set the marker transparency.

Interactions This option is in effect only when FILLEDOUTLINEDMARKERS=TRUE and the DISPLAY= option enables fill display.

When the COLORRESPONSE= or MARKERCOLORGRADIENT= option is in effect, this option's COLOR= specification is ignored.

Note When *style-element* is specified, only the style element's Color attribute is used.

See "General Syntax for Attribute Options" on page 1599

"Fill Color Options" on page 1600

MARKEROUTLINEATTRS=*style-element* | (*line-options*)
specifies the appearance of the marker outlines.

Defaults For non-grouped data, the GraphOutlines style element.

For grouped data, the LineThickness attritube of the GraphOutlines style element and the ContrastColor attribute of a GraphData1–GraphDataN style element.

Restriction The line style of the marker outline is always solid.

Interaction This option is ignored when a data skin is applied by the current style or by the DATASKIN= option. In the latter case, the outline is set by the data skin.

Note When *style-element* is specified, only the style element's CONTRASTCOLOR and LINETHICKNESS attributes are used.

See "General Syntax for Attribute Options" on page 1599

"Line Options" on page 1602

MARKERSIZEMAX=*dimension*
for SAS 9.4M1 and for earlier releases, specifies a drawing size for the largest marker when the marker size represents response values.

Note: Starting with SAS 9.4M2, the SIZEMAX= option replaces the MARKERSIZEMAX= option. The syntax and functionality are the same. The MARKERSIZEMAX= option is still honored, but the SIZEMAX= option is preferred.

See SIZEMAX= on page 839

"dimension" on page xiii

MARKERSIZEMIN=*dimension*
for SAS 9.4M1 and for earlier releases, specifies a drawing size for the smallest marker when the marker size represents response values.

Note: Starting with SAS 9.4M2, the SIZEMIN= option replaces the MARKERSIZEMIN= option. The syntax and functionality are the same. The MARKERSIZEMIN= option is still honored, but the SIZEMIN= option is preferred.

See SIZEMIN= on page 839

"dimension" on page xiii

MARKERSIZERESPONSE=*numeric-column* | *expression*
for SAS 9.4M1 and for earlier releases, specifies a column that is used to map the drawing size of the markers.

Note: Starting with SAS 9.4M2, the SIZERESPONSE= option replaces the MARKERSIZERESPONSE= option. The syntax and functionality are the same. The MARKERSIZERESPONSE= option is still honored, but the SIZERESPONSE= option is preferred.

Interaction One-dimensional systematic jittering is not supported when this option is in effect. Random jittering is supported when this option is

in effect and both the X and Y axes are interval axes. See JITTER= on page 827.

NAME="*string*"
assigns a name to this plot statement for reference in other template statements. The specified name is used primarily in legend statements to coordinate the use of colors and line patterns between the plot and the legend.

Restrictions The *string* is case sensitive, cannot contain spaces, and must define a unique name within the template.

This option does not support variables that are created by the DYNAMIC, MVAR, and NMVAR template statements.

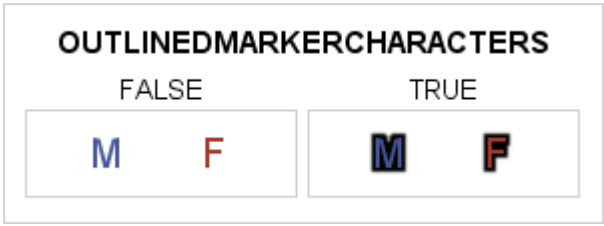
Interaction The *string* is used as the default legend label if the LEGENDLABEL= option is not used.

OUTLINEDMARKERCHARACTERS=TRUE | FALSE
specifies whether the characters that are used as marker symbols are outlined in order to enhance their appearance in the graph.

Note: This option is valid starting in SAS 9.4M1.

Note: This feature is deprecated starting with SAS 9.4M2. The OUTLINEDMARKERCHARACTERS= option is still honored, but the TEXTPLOT statement is now the preferred method of creating a scatter plot using text markers.

The following figure shows the marker characters M and F displayed when OUTLINEDMARKERCHARACTERS=FALSE (default) and when OUTLINEDMARKERCHARACTERS=TRUE.



Default FALSE

Restriction Outline marker characters are not supported in vector graphics output. When this option is set and vector graphics output is requested, the graph is converted into an image instead. A note indicating the conversion is written to the SAS log. To restore the vector graphics output in that case, remove the OUTLINEDMARKERCHARACTERS= option from the SCATTERPLOT statement.

Interaction The MARKERCHARACTER= option must be specified for this option to have any effect.

See "boolean " on page xii for other Boolean values that you can use.

PRIMARY=TRUE | FALSE
specifies that the data columns for this plot and the plot type be used for determining default axis features. This option is needed only when two or more plots within an overlay-type layout contribute to a common axis.

Default FALSE

Restriction This option is ignored if the plot is placed under a GRIDDED or LATTICE layout block.

Note In an OVERLAY layout, only one plot in an overlay can be the primary plot on a per-axis basis. When no plot is designated as the primary plot, the first plot that can be a primary plot is considered the primary plot. If multiple plots specify PRIMARY=TRUE for the same axis, then the last such plot encountered is considered the primary plot.

See "When Plots Share Data and a Common Axis" on page 1046

"boolean " on page xii for other Boolean values that you can use.

REVERSECOLORMODEL=TRUE | FALSE
specifies whether to reverse the gradient (color ramp) that is defined by either the ODS style that is in effect or by the COLORMODEL= option.

Default FALSE

See COLORMODEL=

"boolean " on page xii for other Boolean values that you can use.

ROLENAME=(*role-name-list*)
specifies user-defined roles that can be used to display information in the data tips. This option provides a way to add to the data columns that appear in data tips that are specified by the TIP= option.

(*role-name-list*)
a space-separated list of *role-name = column* pairs.

Example The following example assigns the column Obs to the user-defined role TIP:

```
ROLENAME=(TIP1=OBS)
```

Default No user-defined roles

Requirement The role names that you choose must be unique and different from the predefined roles X, Y, DATALABEL, MARKERCHARACTER, COLORRESPONSE or MARKERCOLORGRADIENT, XERRORLOWER, XERRORUPPER, YERRORLOWER, YERRORUPPER, GROUP, and INDEX.

SIZEMAX=*dimension*
starting with SAS 9.4M2, specifies a drawing size for the largest marker when the marker size represents response values.

Note: Starting with SAS 9.4M2, the SIZEMAX= option replaces the MARKERSIZEMAX= option. The syntax and functionality are the same. The MARKERSIZEMAX= option is still honored, but the SIZEMAX= option is preferred.

Default: Three times the GraphDataDefault:MarkerSize setting (typically 7px) or 21px.

Restriction: The SIZEMAX= value must be greater than the SIZEMIN= or MARKERSIZEMIN= value.

Interactions: For this option to take effect, the SIZERESPONSE= or MARKERSIZERESPONSE= option must also be used.

This option is ignored when the MARKERCHARACTER= option is used. To manage the size of marker characters in a scatter plot, use the TEXTPLOT statement.

Tip: If you specify this size as a percent, then the specified value is interpreted as a percent of the graph's height. You can control the height by using the DESIGNHEIGHT= option of the BEGINGRAPH statement, or by using the HEIGHT= option of the ODS GRAPHICS statement. For a standard 640px by 480px output size, a percentage value of 4.5% sets a maximum size of about 21px, which is approximately the same marker size that would result from this option's typical default setting.

See "dimension" on page xiii

SIZEMIN=*dimension*
starting with SAS 9.4M2, specifies a drawing size for the smallest marker when the marker size represents response values.

Note: Starting with SAS 9.4M2, the SIZEMIN= option replaces the MARKERSIZEMIN= option. The syntax and functionality are the same. The MARKERSIZEMIN= option is still honored, but the SIZEMIN= option is preferred.

Default: The GraphDataDefault:MarkerSize setting, which is typically 7px.

Restriction: The SIZEMIN= value must be less than the SIZEMAX= or MARKERSIZEMAX= value.

Interactions: For this option to take effect, you must also specify the SIZERESPONSE= or MARKERSIZERESPONSE= option.

This option is ignored when the MARKERCHARACTER= option is used. To manage the size of marker characters in a scatter plot, use the TEXTPLOT statement.

Tip If you specify this size as a percent, then the specified value is interpreted as a percent of the graph's height. You can control the height by using the DESIGNHEIGHT= option of the BEGINGRAPH statement, or by using the HEIGHT= option of the ODS GRAPHICS statement. For a standard 640px by 480px output size, a percentage value of 1.5% sets a minimum size of about 7px, which is approximately the same marker size that would result from this option's typical default setting.

See "dimension" on page xiii

SIZERESPONSE=*numeric-column* | *expression*
starting with SAS 9.4M2, specifies a column that is used to map the drawing size of the markers.

Note: Starting with SAS 9.4M2, the SIZERESPONSE= option replaces the MARKERSIZERESPONSE= option. The syntax and functionality are the same. The MARKERSIZERESPONSE= option is still honored, but the SIZERESPONSE= option is preferred.

By default, the minimum and maximum values of this column establish a range over which the marker sizes vary in linear proportion. The actual drawing size of the smallest marker and the largest marker is set automatically.

Default The GraphDataDefault:MarkerSize setting, which is typically 7px.

Interactions This option overrides the SIZE= setting in the MARKERATTRS= option.

This option is ignored when the MARKERCHARACTER= option is used. To manage the size of marker characters in a scatter plot, use the TEXTPLOT statement.

Tip You can adjust the smallest and largest marker size with the SIZEMIN= and SIZEMAX= options, or with the MARKERSIZEMIN= and MARKERSIZEMAX= options.

SUBPIXEL=AUTO | OFF
specifies whether subpixel rendering is used for image output when the scatter plot is rendered.

Note: This feature applies to SAS 9.4M3 and to later releases.

AUTO
sets subpixel rendering OFF, unless SUBPIXEL=ON is specified in the BEGINGRAPH statement or in an ODS GRAPHICS statement. In that case, subpixel rendering is ON.

OFF
disables subpixel rendering for image output only for this scatter plot.

Default AUTO

Requirement Anti-aliasing must be enabled for this option to have any effect.

Notes This option affects subpixel rendering only for this plot. Subpixel rendering for other plots in the graph is not affected.

For vector-graphics output, this option is ignored, and subpixel rendering is always enabled.

When subpixel rendering is used for the graph but is turned OFF for this scatter plot, some elements in the scatter plot such as the plot markers might be offset a half pixel. This can make the plot markers appear blurry in the image output.

Tips Anti-aliasing is enabled by default. If anti-aliasing has been disabled, use the ANTIALIAS=ON option in the ODS GRAPHICS statement to re-enable it.

Anti-aliasing is disabled automatically for this plot when the resources required to anti-alias it exceed a preset threshold. When anti-aliasing is disabled for this or any other plot in the graph, subpixel rendering is disabled for the entire graph. A note is written to the SAS log that provides information about how to use the ANTIALIASMAX= option in an ODS GRAPHICS statement to re-enable anti-aliasing.

See "Using Subpixel Rendering" in *SAS Graph Template Language: User's Guide*

"ODS GRAPHICS Statement" on page 1561 for information about the ANTIALIAS=, ANTIALIASMAX=, and SUBPIXEL= options.

TIP=(*role-list*) | NONE
specifies the information to display when the cursor is positioned over the scatter points. If this option is used, then it replaces all of the information that is displayed by default. Roles for columns that do not contribute to the scatter plot can be specified along with roles that do.

(*role-list*)
an ordered, space-separated list of unique SCATTERPLOT and user-defined roles.

SCATTERPLOT roles include X , Y , DATALABEL , MARKERCHARACTER , COLORRESPONSE or MARKERCOLORGRADIENT , XERRORLOWER , XERRORUPPER , YERRORLOWER , YERRORUPPER , GROUP , and INDEX .

User-defined roles are defined with the ROLENAME= option.

Requirement If you use the COLORRESPONSE= option, you must specify the COLORRESPONSE role for the color values. Likewise, if you use the MARKERCOLORGRADIENT= option, you must specify the MARKERCOLORGRADIENT role for the color values.

Although they are functionally the same, you cannot mix the COLORRESPONSE= and MARKERCOLORGRADIENT= options, and their corresponding roles.

Example The following example displays data tips for the columns assigned to the roles X, XERRORUPPER, and XERRORLOWER, as well as the column Obs, which is not assigned to any pre-defined SCATTERPLOT role. The Obs column must first be assigned a role.

```
ROLENAME=(TIP1=OBS)
TIP=(TIP1 X XERRORUPPER XERRORLOWER)
```

NONE
suppresses data tips and URLs (if requested) from the plot.

Default The columns assigned to these roles are automatically included in the data tip information: X , Y , DATALABEL , MARKERCHARACTER , COLORRESPONSE or MARKERCOLORGRADIENT , XERRORLOWER , XERRORUPPER , YERRORLOWER , YERRORUPPER , FREQ , and GROUP .

Requirement To generate data tips in the output, you must include an ODS GRAPHICS ON statement that specifies the IMAGEMAP option, and you must write the output to the ODS HTML destination.

Interaction This option is ignored when the plot statement is in an OVERLAY or PROTOTYPE layout and the INCLUDERANGES= option is specified in the LINEAROPTS= or TIMEOPTS= option for either axis.

Tip The labels and formats for the TIP roles can be controlled with the TIPLABEL= and TIPFORMAT= options.

TIPFORMAT=(*role-format-list*)
specifies display formats for tip columns. This option provides a way to control the formats of columns that appear in data tips.

(*role-format-list*)
a space-separated list of *role-name* = *format* pairs.

Example
```
ROLENAME=(TIP1=SALARY)
TIP=(TIP1)
TIPFORMAT=(TIP1=DOLLAR12.)
```

Default The column format of the column assigned to the role or BEST6 if no format is assigned to a numeric column.

Restriction Only the roles that appear in the TIP= option are used.

Requirement A column must be assigned to each of the specified roles. (See the ROLENAME= option.)

TIPLABEL=(*role-label-list*)
specifies display labels for tip columns. This option provides a way to control the labels of columns that appear in data tips.

role-label-list
a space-separated list of *rolename* ="*string*" pairs.

Example
```
ROLENAME=(TIP1=PCT)
TIP=(TIP1)
TIPLABEL=(TIP1="Percent")
```

Default The column label or column name of the column assigned to the role.

Restriction Only the roles that appear in the TIP= option are used.

Requirement A column must be assigned to each of the specified roles. (See the ROLENAME= option.)

URL=*string-column*
specifies an HTML page to display when a point is selected.

string-column
specifies a column that contains a valid HTML page reference (HREF) for each marker that is to have an active link.

Example **`http://www.sas.com`**

Requirement To generate selectable markers, you must include an ODS GRAPHICS ON statement that specifies the IMAGEMAP option, and you must write the output to the ODS HTML destination.

Interactions This option has no effect when TIP=NONE.

This option is ignored when the plot statement is in an OVERLAY or PROTOTYPE layout and the INCLUDERANGES= option is specified in the LINEAROPTS= or TIMEOPTS= option for either axis.

Tips The URL value can be blank for some X and Y pairs, meaning that no action is taken when the corresponding point is selected.

The URL value can be the same for any X and Y pairs. In that case, the same action is taken when the points for those X and Y pairs are selected.

By default, drill-down links open in a new browser window (link target _blank). To specify a different target for your drill-down links, such as _self or _parent, add the DRILLTARGET="*target*" option to your ODS GRAPHICS statement. See DRILLTARGET= on page 1568.

USEDISCRETESIZE=TRUE | FALSE
specifies that the marker size should be based on fraction of the midpoint spacing that is set by the DISCRETEMARKERSIZE= option.

Default FALSE

See DISCRETEMARKERSIZE=

"boolean " on page xii for other Boolean values that you can use.

XAXIS=X | X2
specifies whether data are mapped to the primary X (bottom) axis or to the secondary X2 (top) axis.

Default X

Interactions This option is ignored if the X= argument is not specified.

The overall plot specification and the layout type determine the axis display. For more information, see "How Axis Features Are Determined" on page 1040.

XERRORLOWER=*numeric-column* | *expression*
specifies values for the lower endpoints on the X error bars. The error bars are drawn from the markers to the endpoints.

Default The lower segment of the error bars is not drawn.

Note The values are actual values, not relative values.

Tips The appearance of the error bars is controlled by the ERRORBARATTRS= option.

If markers are displayed in the plot, then the markers overlay the error bars. Large filled markers can obscure short error bars. To enable the error bars to show through the markers in that case, you can use the MARKERATTRS= option to specify a degree of transparency for the filled markers.

XERRORUPPER=*numeric-column* | *expression*
specifies values for the upper endpoints on the X error bars. The error bars are drawn from the markers to the endpoints.

Default The upper segment of the error bars is not drawn.

Note The values are actual values, not relative values.

Tips The appearance of the error bars is controlled by the ERRORBARATTRS= option.

If markers are displayed in the plot, then the markers overlay the error bars. Large filled markers can obscure short error bars. To enable the error bars to show through the markers in that case, you can use the MARKERATTRS= option to specify a degree of transparency for the filled markers.

YAXIS=Y | Y2
specifies whether data are mapped to the primary Y (left) axis or to the secondary Y2 (right) axis.

Default Y

Interactions This option is ignored if the Y= argument is not specified.

The overall plot specification and the layout type determine the axis display. For more information, see "How Axis Features Are Determined" on page 1040.

YERRORLOWER=*numeric-column* | *expression*
specifies values for the lower endpoints on the Y error bars. The error bars are drawn from the markers to the endpoints.

Default The lower segment of the error bars is not drawn.

Note The values are actual values, not relative values.

Tips The appearance of the error bars is controlled by the ERRORBARATTRS= option.

If markers are displayed in the plot, then the markers overlay the error bars. Large filled markers can obscure short error bars. To enable the error bars to show through the markers in that case, you can use the MARKERATTRS= option to specify a degree of transparency for the filled markers.

YERRORUPPER=*numeric-column* | *expression*
specifies values for the upper endpoints on the Y error bars. The error bars are drawn from the markers to the endpoints.

Default The upper segment of the error bars is not drawn.

Note The values are actual values, not relative values.

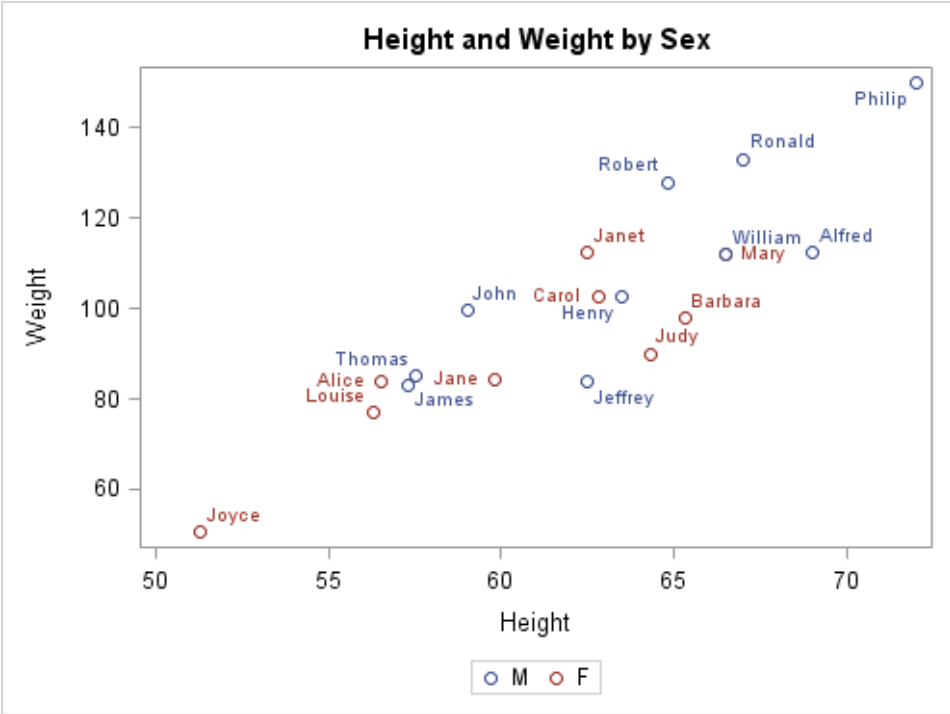
Tips The appearance of the error bars is controlled by the ERRORBARATTRS= option.

If markers are displayed in the plot, then the markers overlay the error bars. Large filled markers can obscure short error bars. To enable the error bars to show through the markers in that case, you can use the MARKERATTRS= option to specify a degree of transparency for the filled markers.

Examples

Example 1: Grouped Scatter Plot

The following graph was generated by the "Example Program" on page 846:

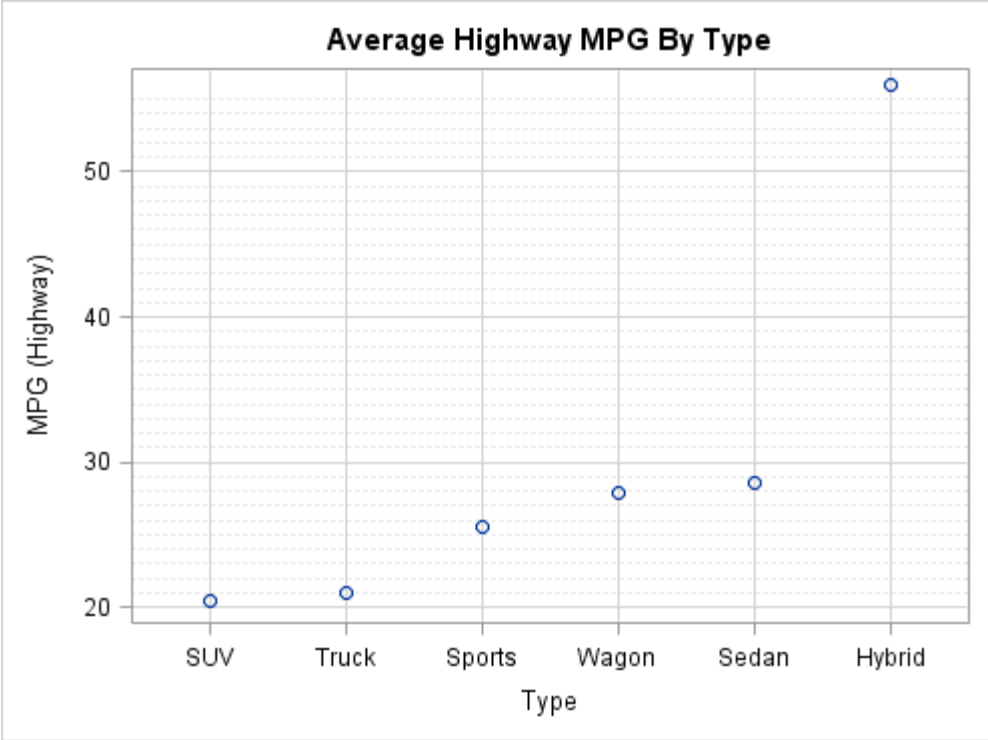


Example Program

```
proc template;
  define statgraph scatterplot;
    begingraph;
      entrytitle "Height and Weight by Sex";
      layout overlay;
        scatterplot x=height y=weight /
          group=sex name="scatter" datalabel=name;
        discretelegend "scatter";
      endlayout;
    endgraph;
  end;
run;

proc sgrender data=sashelp.class template=scatterplot;
run;
```

Example 2: Discrete Scatter Plot

The following graph was generated by the “Example Program” on page 847:



Example Program

```
/* Summarize SASHELP.CARS for mean MPG_HIGHWAY */
proc summary data=sashelp.cars nway;
  class type;
  var mpg_highway;
  output out=mileage mean=mean;
run;

/* Sort by mileage */
proc sort data=mileage;
  by mean;
run;

/* Define the graph template */
proc template;
  define statgraph scatterplot;
    begingraph;
      entrytitle "Average Highway MPG By Type";
      layout overlay /
        xaxisopts=(griddisplay=on gridattrs=(color=lightgray))
        yaxisopts=(griddisplay=on gridattrs=(color=lightgray)
          linearopts=(minorgrid=true minortickcount=9
            minorgridattrs=(color=lightgray pattern=dot)));
        scatterplot x=type y=mean /
          group=type groupdisplay=cluster
          markerattrs=graphDataDefault;
      endlayout;
    endgraph;
```

```
  end;
run;

/* Render the graph */
proc sgrender data=mileage template=scatterplot;
run;
```

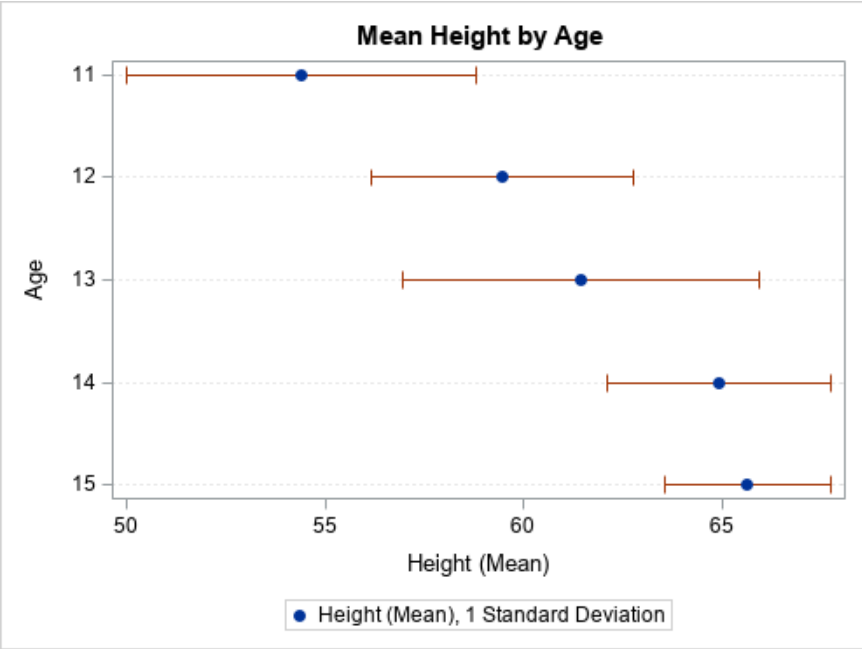
Details

This example creates a scatter plot of average highway mileage by vehicle type. The SUMMARY procedure is used to compute the mean highway mileage for each vehicle type. The SORT procedure is then used to sort the data by mileage in ascending order. Normally, when you plot discrete values using the SCATTERPLOT statement, the values at each end of the category axis are offset to accommodate the width of the largest marker. When a small symbol is used, this can result in the minimum and maximum symbols being placed very close to the edge of the axis. You can use the OFFSETMAX= and OFFSETMIN= axis options to specify offsets for each end of the category axis. However, you have to determine an appropriate offset value.

In this example, the GROUP= and GROUPDISPLAY= options are used to create offsets automatically. The GROUP= option creates a group for each category value. The GROUPDISPLAY=CLUSTER option displays the group values in a cluster and automatically offsets the end values by one-half of the available midpoint spacing, which is similar to the offsets that are used in bar charts. To restore the default colors and symbols that are used for ungrouped data, the MARKERATTRS= option is used to set the marker attributes to the graphDataDefault style element.

Example 3: Dot Plot

The following graph was generated by the “Example Program” on page 847:



Example Program

```
proc summary data=sashelp.class nway;
   var height;
   class age;
   output out=classSum mean=mean std=std;
run;

proc template;
   define statgraph dotplot;
      begingraph;
         entrytitle "Mean Height by Age";
         layout overlay /
            xaxisopts=(label="Height (Mean)")
            yaxisopts=(griddisplay=on
               gridattrs=(color=lightgray pattern=dot)
               reverse=true);
            scatterplot x=mean y=age / name="scatter"
               markerattrs=(symbol=circlefilled)
               xerrorupper=eval(mean + std)
               xerrorlower=eval(mean - std)
               legendlabel="Height (Mean), 1 Standard Deviation";
            discretelegend "scatter";
         endlayout;
      endgraph;
   end;
run;

proc sgrender data=classSum template=dotplot;
   where age < 16;
run;
```

Details

This example uses the SCATTERPLOT statement to create a dot plot from data computed by the SUMMARY procedure. The SUMMARY procedure computes the mean and standard deviation for variable Height by variable Age in data set Sashelp.Class, and stores the results in data set Work.classSum. In the graph template code, the SCATTERPLOT statement plots variables Mean and Age in data set Work.classSum. The MARKERATTRS= option specified filled circles as the plot dots. The XERRORUPPER= and XERRORLOWER= options specify the statistic limits. The EVAL function computes the limits from variables Mean and Std.

SCATTERPLOTMATRIX Statement

Creates a matrix of all pairwise scatter plots of the specified columns.

Restriction: The SCATTERPLOTMATRIX statement cannot appear within a LAYOUT OVERLAY, LAYOUT OVERLAY3D, or LAYOUT OVERLAYEQUATED block. It is typically placed in a LAYOUT GRIDDED block.

Syntax

SCATTERPLOTMATRIX *numeric-column-list* </*options*>;

Summary of Optional Arguments

Appearance options

COLORMODEL=*style-element* | (*color-list*)
: specifies a color ramp that is to be used with the COLORRESPONSE= or MARKERCOLORGRADIENT= option.

COLORRESPONSE=*numeric-column* | *range-attr-var* | *expression*
: starting with SAS 9.4M2, specifies the column or range attribute map variable to use to determine the marker colors.

DATASKIN=NONE | CRISP | GLOSS | MATTE | PRESSED | SHEEN
: enhances the visual appearance of the plot markers.

DATATRANSPARENCY=*number*
: specifies the degree of the transparency of the markers and data labels.

DIAGONAL=LABEL | (*graph-list*)
: specifies whether the diagonal cells of the matrix are labeled with the labels (names) of the required arguments, or with a plot.

INDEX=*positive-integer-column* | *expression*

specifies indices for mapping marker attributes (color and symbol) to one of the GraphData1–GraphDataN style elements.

LABELSTRIP=TRUE | FALSE
specifies whether leading and trailing blanks are stripped from marker characters or data labels that have a fixed position before they are displayed in the plot.

MARKERATTRS=*style-element* | *style-element* (*marker-options*) | (*marker-options*)
specifies the attributes of the data markers.

MARKERCHARACTER=*column* | *expression*
specifies a column that defines strings that are to be used instead of marker symbols.

MARKERCHARACTERATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font attributes of the marker character specified on the MARKERCHARACTER= option.

MARKERCHARACTERPOSITION=CENTER | TOP | BOTTOM | LEFT | RIGHT | TOPLEFT | TOPRIGHT | BOTTOMLEFT | BOTTOMRIGHT
specifies the justification of the marker characters.

MARKERCOLORGRADIENT=*numeric-column* | *range-attr-var* | *expression*
in SAS 9.4M1 and earlier releases, specifies the column or range attribute map variable that is used to determine the marker colors.

MATRIXTYPE=FULL | UPPERTRIANGLE | LOWERTRIANGLE
specifies whether to display the full matrix, or just the upper or lower triangle of the matrix.

REVERSECOLORMODEL=TRUE | FALSE
specifies whether to reverse the gradient (color ramp) that is defined by either the ODS style that is in effect or by the COLORMODEL= option.

START=TOPLEFT | BOTTOMLEFT
specifies whether to start populating the matrix from the top left or bottom left corner.

SUBPIXEL=AUTO | OFF
specifies whether subpixel rendering is used for image output when the scatter plots are rendered.

WALLCOLOR=*style-reference* | *color*
specifies the fill color of the plot wall area.

WALLDISPLAY=STANDARD | ALL | NONE | (*display-options*)
specifies whether the plot's wall and wall outline are displayed.

Confidence options

ELLIPSE=(<*ellipse-suboptions*>)
specifies that a confidence ellipse be included in each cell containing a scatter plot.

Data tip options

ROLENAME=(*role-name-list*)
specifies user-defined roles that can be used to display information in the data tips.

TIP=(*role-list*) | NONE

specifies the information to display when the cursor is positioned over the scatter points.

TIPFORMAT=(*role-format-list*)
specifies display formats for tip columns.

TIPLABEL=(*role-label-list*)
specifies display labels for tip columns.

Inset options

INSET=(*info-options*)
specifies what information is displayed in an inset.

INSETOPTS=(*appearance-options*)
specifies location and appearance options for the inset information.

Label options

DATALABEL=*column*
specifies a column for marker labels.

DATALABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font attributes of the data labels.

DATALABELPOSITION=AUTO | TOPRIGHT | TOP | TOPLEFT | LEFT | CENTER | RIGHT | BOTTOMLEFT | BOTTOM | BOTTOMRIGHT
specifies the location of the data labels relative to the markers.

DATALABELSPLIT=TRUE | FALSE
specifies whether to split the data labels at the specified split characters.

DATALABELSPLITCHAR="*character-list*"
specifies one or more characters on which the data labels can be split if needed.

DATALABELSPLITCHARDROP=TRUE | FALSE
specifies whether the split characters are included in the data labels.

DATALABELSPLITJUSTIFY=AUTO | CENTER | LEFT | RIGHT
specifies the justification of the strings that are inside the data label blocks.

Midpoint options

GROUP=*column* | *discrete-attr-var* | *expression*
creates a distinct set of scatter markers, error bars, and data labels for each unique group value of the specified column.

INCLUDEMISSINGGROUP=TRUE | FALSE
specifies whether missing values of the group variable are included in the plot.

Plot reference options

NAME="*string*"
assigns a name to this plot statement for reference in other template statements.

Statistics options

CORROPTS=(*correlation-options*)

specifies options for computing measures of association between pairs of columns.

FREQ=*numeric-column | expression*
specifies a numeric column that provides frequencies for each observation that is read.

ROWVARS=(*numeric-column-list*)
specifies a secondary list of numeric columns to be paired with the required column list that is specified by the SCATTERPLOTMATRIX statement.

Required Argument

numeric-column-list
specifies a list of numeric columns to plot.

Requirements There must be at least two columns to produce a useful matrix.

All of the columns must be numeric.

Note The default width is 640px, and the default height is 480px. The graph size is not automatically adjusted to accommodate a large number of columns.

Tips To change the graph size for the current template, use the DESIGNHEIGHT= and DESIGNWIDTH= options in the BEGINGRAPH statement.

To change the graph size for all templates in the current SAS session, use the HEIGHT= and WIDTH= options in the ODS GRAPHICS statement. Size settings in the ODS GRAPHICS statement override size settings in the BEGINGRAPH statement.

You can also limit the number of columns in the matrix (perhaps to seven in each dimension, for example) so that the resulting graphs are not too small to be useful.

Optional Arguments

COLORMODEL=*style-element* | (*color-list*)
specifies a color ramp that is to be used with the COLORRESPONSE= or MARKERCOLORGRADIENT= option.

style-element
specifies the name of a style element.

The style element should contain these style attributes:

STARTCOLOR specifies a color for the smallest data value of the COLORRESPONSE= or MARKERCOLORGRADIENT= column.

NEUTRALCOLOR specifies a color for the midpoint of the range of the COLORRESPONSE= or MARKERCOLORGRADIENT= column.

ENDCOLOR specifies a color for the highest data value of the COLORRESPONSE= or MARKERCOLORGRADIENT= column.

(color-list)
specifies a space-separated list of colors to use in the color ramp.

You can use style attribute references such as GraphData3:Color, color names, or RGB, CMYK, HLS, and HSV (HSB) color codes to specify a color. The list can contain a mix of style attribute references, color names, and color codes.

Requirement The list of colors must be enclosed in parentheses.

See "color " on page xii

Default The ThreeColorAltRamp style element.

Interactions For this option to take effect, the COLORRESPONSE= or MARKERCOLORGRADIENT= option must also be specified.

The REVERSECOLORMODEL= option can be used to reverse the start and end colors of the ramp assigned to the color model.

COLORRESPONSE=*numeric-column* | *range-attr-var* | *expression*
starting with SAS 9.4M2, specifies the column or range attribute map variable to use to determine the marker colors.

Note: Starting with SAS 9.4M2, the COLORRESPONSE= option replaces the MARKERCOLORGRADIENT= option. The syntax and functionality are the same. The MARKERCOLORGRADIENT= option is still honored, but the COLORRESPONSE= option is preferred.

range-attr-var
specifies a range attribute map variable that is defined in a RANGEATTRVAR statement.

"RANGEATTRVAR Statement"

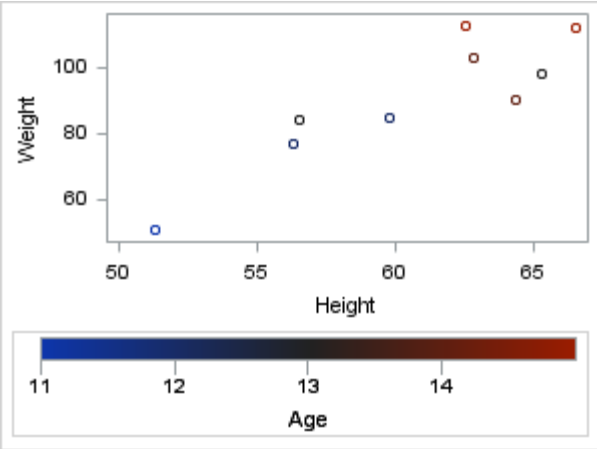
Restriction A range attribute map variable specification must be a direct reference to the attribute map variable. It cannot be set as a dynamic variable.

Tip For each range in the attribute map, the RANGEALTCOLOR= or RANGEALTCOLORMODEL= option in the RANGE statement determines the marker colors.

See "RANGEATTRVAR Statement" on page 1531

When a numeric column or expression is specified, the range of column or expression values are linearly mapped to the color ramp that is specified by the COLORMODEL= option. When a range attribute map variable is specified, the colors that are defined in the associated range attribute map are used instead.

You can use this option to add a second response variable to an analysis. For example, in an analysis of weight by height, you can specify an age column by using the COLORRESPONSE= or MARKERCOLORGRADIENT= option so that the change in the gradient color of the markers reflects the change in age.



Requirement For a grouped plot, the COLORRESPONSE values should remain constant for each group value. If the COLORRESPONSE column has multiple values for a single GROUP value, unexpected results might occur.

Interactions When the GROUP= option is specified with the COLORRESPONSE= option, the color attributes are controlled by the COLORRESPONSE= option.

Suboption COLOR= in the DATALABELATTRS= option overrides this option for the data label color attribute.

Suboption COLOR= in the MARKERATTRS= option or in the MARKERCHARACTERATTRS= option overrides this option for the marker colors.

Note You can use MARKERCOLORGRADIENT= as an alternative to COLORRESPONSE=. However, if you use MARKERCOLORGRADIENT=, be aware that the TIP=, TIPFORMAT=, and TIPLABEL= options recognize MARKERCOLORGRADIENT as the color role, not COLORRESPONSE.

Tips To display a legend with this option in effect, use a CONTINUOUSLEGEND statement.

If the MARKERCHARACTER= option is also specified, then the gradients that would be applied to the markers are applied to the text strings.

CORROPTS=(*correlation-options*)

specifies options for computing measures of association between pairs of columns. The following *correlation-options* are available:

EXCLNPWGT=TRUE | FALSE
specifies whether observations with non-positive weight values are excluded (TRUE) from the analysis.

Default FALSE (observations with negative weights are treated like those with zero weights and counted in the total number of observations).

See "boolean " on page xii for other Boolean values that you can use.

NOMISS=TRUE | FALSE
specifies whether observations with missing values are excluded (TRUE) from the analysis.

Default FALSE (correlation statistics are computed using all of the nonmissing pairs of columns).

Note Using NOMISS=TRUE is computationally more efficient.

See "boolean " on page xii for other Boolean values that you can use.

WEIGHT=*numeric-column*
specifies a weighting column to use in the calculation of Pearson weighted product-moment correlation.

The observations with missing weights are excluded from the analysis. If you use this WEIGHT correlation option, then consider which value of the VARDEF=correlation option is appropriate.

Default For observations with non-positive weights, the weights are set to zero and the observations are included in the analysis.

Tip You can include EXCLNPWGT among the correlation options to exclude observations with negative or zero weights from the analysis.

VARDEF=DF | N | WDF | WEIGHT
specifies the variance divisor in the calculation of variances and covariances.

DF
Degrees of Freedom (N – 1)

N
number of observations

WDF
sum of weights minus 1 (WEIGHT – 1)

WEIGHT
sum of weights

Default DF

Interaction This option has effect only when the INSET= option is also used.

See the CORR procedure information in *Base SAS Procedures Guide: Statistical Procedures* for the statistical and computational details of these options.

DATALABEL=*column*
specifies a column for marker labels. The label positions are adjusted to prevent the labels from overlapping.

Interactions If a numeric *column* is specified and the column has no format, then a BEST6 format is applied.

This option is ignored if the MARKERCHARACTER= option is used.

Note The position of the labels are adjusted to prevent the labels from overlapping.

DATALABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font attributes of the data labels.

Defaults For non-grouped data, the GraphDataText style element.

For grouped data, the GraphData1:ContrastColor–GraphDataN:ContrastColor style references.

Interactions For this option to take effect, the DATALABEL= option must also be specified.

This option is ignored if the MARKERCHARACTER= option is specified.

Note When the DATALABELPOSITION=AUTO option is in effect, in some cases, the data label font size might be reduced in order to avoid overlapping labels and markers.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Text Options" on page 1606 for available *text-options*.

DATALABELPOSITION=AUTO | TOPRIGHT | TOP | TOPLEFT | LEFT | CENTER | RIGHT | BOTTOMLEFT | BOTTOM | BOTTOMRIGHT
specifies the location of the data labels relative to the markers.

AUTO
uses a data-label collision avoidance algorithm to position the labels.

Note When AUTO is in effect, in some cases, the data label font size might be reduced in order to avoid overlapping labels and markers.

See "LABELPLACEMENT=AUTO | GREEDY | SA" on page 36

TOPRIGHT
TOP
TOPLEFT
LEFT
CENTER
RIGHT
BOTTOMLEFT
BOTTOM
BOTTOMRIGHT
specifies a location for all of the data labels.

Default AUTO

DATALABELSPLIT=TRUE | FALSE
specifies whether to split the data labels at the specified split characters.

Default FALSE. The data labels are not split.

Requirement The DATALABEL= option must also be specified.

Interactions The DATALABELSPLITCHAR= option specifies one or more characters on which splits can occur.

This option has no effect when DATALABELPOSITION=AUTO.

See “boolean ” on page xii for other Boolean values that you can use.

DATALABELSPLITCHAR="*character-list*"
specifies one or more characters on which the data labels can be split if needed. When multiple split characters are specified, each character in the list is treated as a separate split character unless the specified characters appear consecutively in the data label. In that case, all of the specified split characters together are treated as a single split character.

When DATALABEL= is specified and DATALABELSPLIT=TRUE, the data label is split unconditionally at each occurrence of any of the specified split characters. If the data label does not contain any of the specified characters, then the label is not split.

"character-list"
one or more characters with no space between each character and enclosed in quotation marks.

Default A blank space

Requirements The list of characters must be enclosed in quotation marks.

Multiple characters must be specified with no space between them. For example, to specify the split characters a, b, and c, use the following option:

```
datalabelsplitchar="abc"
```

The DATALABEL= option and the DATALABELSPLIT=TRUE option must also be specified.

Interactions This option has no effect if DATALABELPOSITION=AUTO.

The DATALABELSPLITCHARDROP= option specifies whether the split characters are included in the data label or are dropped.

Notes When multiple characters are specified, the order of the characters in the list is not significant.

The split characters are case sensitive.

Tip Use the DATALABELSPLITJUSTIFY= option to specify the justification of the strings in the data label block.

DATALABELSPLITCHARDROP=TRUE | FALSE

specifies whether the split characters are included in the data labels.

TRUE

drops the split characters from the data label.

FALSE

includes the split characters in the data label.

When DATALABELSPLIT=TRUE and DATALABELSPLITCHARDROP=FALSE, each split character remains as the last character in the current line. The characters that follow the split character, up to and including the next split character, are then wrapped to the next line.

The following figure shows an example of a data label with the following specifications:

- the data label text for this label is Product*Group*A
- DATALABELSPLIT=TRUE
- DATALABELSPLITCHARDROP=TRUE | FALSE
- DATALABELSPLITCHAR="*"

When DATALABELSPLITCHARDROP=TRUE, the asterisks are removed from the label. When DATALABELSPLITCHARDROP=FALSE, each asterisk remains as the last character in the line prior to the new line.

Default TRUE. The split characters are dropped from the data label.

Requirement The DATALABEL= option and the DATALABELSPLIT=TRUE option must also be specified.

Interaction The DATALABELSPLITCHAR= option specifies the split characters.

See "boolean " on page xii for other Boolean values that you can use.

DATALABELSPLITJUSTIFY=AUTO | CENTER | LEFT | RIGHT
specifies the justification of the strings that are inside the data label blocks.

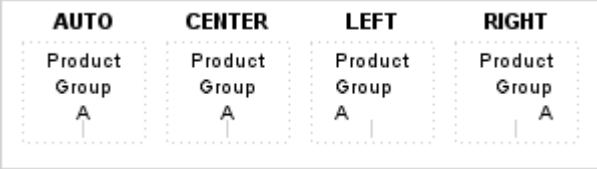
AUTO
justifies the labels based on the DATALABELPOSITION= option.

DATALABELPOSITION= Value	Justification
TOPLEFT, LEFT, or BOTTOMLEFT	RIGHT
TOPRIGHT, RIGHT, or BOTTOMRIGHT	LEFT
TOP, CENTER, or BOTTOM	CENTER

CENTER
LEFT
RIGHT
justifies the labels center, left, or right, as specified.

The following figure shows an example in which DATALABELPOSITION=TOP.

Note: The gray vertical line at the bottom of each label represents the horizontal center of the text box for reference.



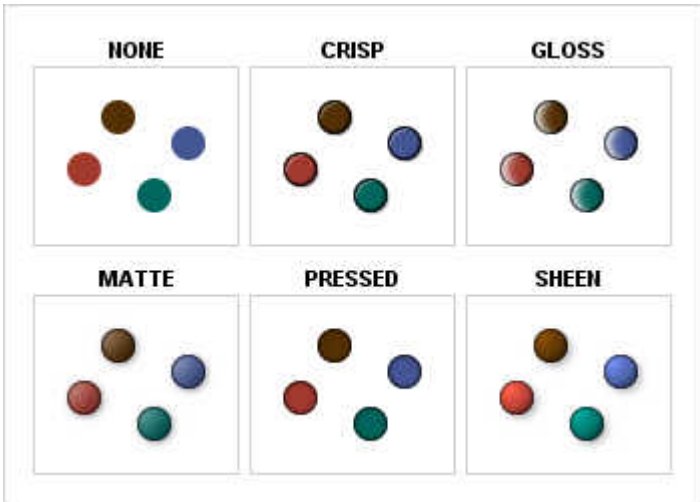
In this case, because DATALABELPOSITION=TOP, AUTO centers the lines of text. The text box is anchored the same way that the unsplit text is anchored. For example, if DATALABELPOSITION=TOP, then the bottom center of the text box is positioned at the top of the marker.

Default AUTO

Requirement The DATALABEL= option and the DATALABELSPLIT=TRUE option must also be specified.

Interaction This option has no effect if DATALABELSPLIT=FALSE, or if DATALABELSPLIT=TRUE and DATALABELPOSITION=AUTO.

DATASKIN=NONE | CRISP | GLOSS | MATTE | PRESSED | SHEEN
enhances the visual appearance of the plot markers. The following figure shows large CIRCLEFILLED markers with each of the skins applied.



Default The DATASKIN= option value that is specified in the BEGINGRAPH statement. If that value is not specified, then the GraphSkins:DataSkin style element value is used.

Restriction Starting with SAS 9.4M1, the maximum number of skinned graphical elements is limited to 200 per plot in an OVERLAY or PROTOTYPE layout. When this limit is exceeded for a plot, the specified data skin is not applied to that plot. In that case, use the DATASKINMAX= option in your ODS GRAPHICS statement to increase the maximum limit.

Interactions This option overrides the BEGINGRAPH statement DATASKIN= option.

When a data skin is applied, all marker outlines are set by the skin, and the outline settings from the ODS style or from the MARKERATTRS= option are ignored.

DATATRANSPARENCY=*number*
specifies the degree of the transparency of the markers and data labels.

Default 0

Range 0–1, where 0 is opaque and 1 is entirely transparent

Restriction The specified transparency is not applied to missing values. Missing values are always opaque.

Note This option does not apply to the HISTOGRAM, DENSITY, and NORMAL plots in the scatter-plot matrix.

DIAGONAL=LABEL | (*graph-list*)
specifies whether the diagonal cells of the matrix are labeled with the labels (names) of the required arguments, or with a plot. The plot for each diagonal cell consists of an overlay combination of a histogram, normal, or kernel curves.

LABEL
labels the diagonal cells of the matrix with the names of the required arguments.

(*graph-list*)
specifies the plots that are displayed in the diagonal cells of the matrix.

The *graph-list* is a space-separated list of one or more of the following:

HISTOGRAM
specifies a histogram.

NORMAL
specifies a normal density curve.

KERNEL
specifies a kernel density estimate.

Default LABEL. Column labels (or names) are displayed in the diagonal cells.

Requirement When specifying multiple graphs in the *graph-list*, you must separate the values with a space. For example, the following specification requests both a histogram and a normal density curve in each diagonal cell:

```
DIAGONAL=(HISTOGRAM NORMAL)
```

Interactions The computation for HISTOGRAM, NORMAL, and KERNEL is always computed on all the data for the current column (including the FREQ= column, if used). The GROUP= option is not considered in any of these computations.

This option is ignored if the ROWVARS= option is used.

Notes When this option is specified, the labels are drawn around the outside of the matrix, and the matrix axes are dropped.

When NORMAL and KERNEL are specified, both curves have the same visual attributes.

ELLIPSE=(<*ellipse-suboptions*>)
specifies that a confidence ellipse be included in each cell containing a scatter plot. The ellipse is always drawn behind the scatter points. *Ellipse-suboptions* can include one or more of the following:

ALPHA=*positive-number*
specifies the confidence level to compute for each ellipse.

Default 0.05

Range 0 < *number* < 1

Tip ALPHA=0.05 represents a 95% confidence level.

CLIP=TRUE | FALSE
specifies whether the X and Y values for the ellipse are considered when determining the data ranges for the axes.

TRUE
the X and Y values for the ellipses are ignored when the axis ranges are determined.

Clipping occurs if the X and Y values for an ellipse exceed the axis range.

FALSE
the X and Y values for the ellipses contribute to the data range for each axis.

If necessary, each axis is extended in order to display the entire ellipse.

Default FALSE

See "boolean " on page xii for other Boolean values that you can use.

TYPE=MEAN | PREDICTED
specifies the type of ellipse.

MEAN
specifies a confidence ellipse of the mean

PREDICTED
specifies a prediction ellipse of the data

Default MEAN

See "ELLIPSE Statement" on page 504 for statistical details about how the ellipse is calculated.

Default TYPE=MEAN ALPHA=0.05 You can set defaults by specifying the option without arguments: ELLIPSE=( ).

Interactions The ellipse might be clipped by the data range for the scatter points.

The ellipse is always computed on all the data for the current pair of X and Y columns (including the FREQ= column, if used). The GROUP= option is not considered when computed the ellipse.

Tip The display properties of each ellipse are controlled by the style elements. The GraphDataDefault element controls the outline and fill properties, and the GraphEllipse element controls whether the outline, fill, or both are shown.

FREQ=*numeric-column* | *expression*
specifies a numeric column that provides frequencies for each observation that is read.

Default All observations have a frequency count of 1.

Restriction If the value of *numeric-column* is missing or is less than 1 for an observation, then that observation is not used in the analysis. If the value is not an integer, then only the integer portion is used.

Note If *n* is the value of the numeric column for a given observation, then that observation is used *n* times for the purposes of any statistical

computation. The marker for that observation is drawn *n* times, which increases the marker weight slightly with frequency.

GROUP=*column* | *discrete-attr-var* | *expression*
creates a distinct set of scatter markers, error bars, and data labels for each unique group value of the specified column.

discrete-attr-var
specifies a discrete attribute map variable.

The discrete attribute map variable is created by a DISCRETEATTRVAR statement.

Restriction A discrete attribute map variable specification must be a direct reference to the attribute map variable. It cannot be set by a dynamic variable.

Default Each distinct group value might be represented in the graph by a different combination of color and marker symbol. Markers vary according to the ContrastColor and MarkerSymbol attributes of the GraphData1–GraphDataN and GraphMissing style elements.

Interactions The group values are mapped in the order of the data, unless the INDEX= option is used to alter the default sequence of markers and colors.

The marker size is set by the MARKERATTRS= option.

The MARKERCHARACTER= , COLORRESPONSE= , and MARKERCOLORGRADIENT= options override the group settings for the marker symbol and marker color.

The INCLUDEMISSINGGROUP= option controls whether missing group values are considered a distinct group value.

Note If you specify a column in a SAS data set, the visual attributes for each group value are assigned in data order. If you specify a column in a CAS in-memory table, the visual attributes for each group value are assigned in ascending order of the group column character values or of unformatted numeric values.

Tips The representations that are used to identify the groups can be overridden. For example, each distinct group value is represented by a different marker symbol, but the MARKERATTRS=(SYMBOL=*marker*) option could be used to assign the same symbol to all of the plot's marker symbols, letting marker color indicate group values. Likewise, MARKERATTRS=(COLOR=*color*) could be used to assign the same color to all markers, letting marker symbol indicate group values.

By default, ODS Graphics limits the number of groups to 1000. When this limit is exceeded, the GROUP= option is ignored. Use the GROUPMAX= option in the ODS GRAPHICS statement to change the maximum number of groups that can be processed.

See "DISCRETEATTRVAR Statement" on page 1516

INCLUDEMISSINGGROUP=TRUE | FALSE
specifies whether missing values of the group variable are included in the plot.

Default TRUE

Interaction For this option to take effect, the GROUP= option must also be specified.

Tip The attributes of the missing group value are determined by the GraphMissing style element unless a discrete attribute map is in effect, the INDEX= option is used, the MISSING= system option changes the default missing character, or a user-defined format is applied to the group value. In those cases, the attributes of the missing group value are determined by a GraphData1–GraphDataN style element instead of by the GraphMissing style element.

See "boolean " on page xii for other Boolean values that you can use.

INDEX=*positive-integer-column* | *expression*
specifies indices for mapping marker attributes (color and symbol) to one of the GraphData1–GraphDataN style elements.

Requirements The column or expression value must be an integer value of 1 or greater. Otherwise, this option is ignored.

The positive-integer column must not contain missing values. Otherwise, the entire column is invalidated and this option is ignored.

All of the indexes for a specific group value must be the same. Otherwise, the results are unpredictable.

Interactions For this option to take effect, the GROUP= option must also be specified.

The MARKERCHARACTER=, COLORRESPONSE=, and MARKERCOLORGRADIENT= options override the group settings for the marker symbol and marker color.

Notes The index values are 1-based indices. For the style attributes in GraphData1–GraphDataN, if the index value is greater than N, then a modulo operation remaps that index value to a number less than N to determine which style to use.

If you do not use this option, then the group values are mapped in the order of the data.

Tip You can use indexing to collapse the number of groups that are represented in a graph. For more information, see "Remapping Groups for Grouped Data" on page 211.

INSET=(*info-options*)
specifies what information is displayed in an inset. Insets appear in all cells of the matrix except the diagonal and are displayed as a small table of *name-value* pairs. The following *info-options* are available:

NOBS
displays the total number of observations where both the X and Y columns have nonmissing values.

If the FREQ= option is used, then this number is adjusted accordingly. The value of NOBS can be further adjusted by the use of the NOMISS=, WEIGHT=, and EXCLNPWGT= suboptions of the CORROPTS= option.

PEARSON
displays the Pearson product-moment correlation.

The computation of the correlation is affected by the FREQ= and CORROPTS= options. The computation is not done on a per group value when GROUP= is used.

PEARSONPVAL
displays the probability value for the Pearson product-moment correlation.

Tip The location and appearance of the inset is controlled by the INSETOPTS= option.

See PROC CORR in the documentation for Base SAS for statistical and computational details of these options.

Example Here is an example of a typical inset:

```
N      150
r 0.96287
p(r)  <.0001
```

In this example, NOBS is represented by N, PEARSON is represented by r, and PEARSONPVAL is represented by p(r).

INSETOPTS=(*appearance-options*)
specifies location and appearance options for the inset information. The appearance options can be any one or more of the settings that follow. The options must be enclosed in parentheses, and each option is specified as a *name=value* pair.

AUTOALIGN=NONE | AUTO | (*location-list*)
specifies whether the inset is automatically aligned within the layout.

NONE
does not automatically align the inset.

The inset's position is therefore set by the HALIGN= and VALIGN=*appearance-options*.

AUTO
attempts to center the inset in the area that is farthest from any surrounding markers.

Data cells might have different inset placements.

(*location-list*)
restricts the inset's possible locations to those locations in the specified *location-list*, and uses the *location-list* position that least collides with the data cell's other graphics features.

The *location-list* is space-separated and can contain any of these locations: TOPLEFT TOP TOPRIGHT LEFT CENTER RIGHT BOTTOMLEFT BOTTOM BOTTOMRIGHT. Example: AUTOALIGN=(TOPRIGHT TOPLEFT)

Default NONE

Interaction When AUTOALIGN=AUTO or (*location-list*), the enclosing layout statement's HALIGN= and VALIGN=*appearance-options* are ignored.

BACKGROUNDCOLOR=*style-reference* | *color*
specifies the color of the inset background

style-reference
specifies a style reference in the form *style-element : style-attribute*.

Only the style-attribute named COLOR or CONTRASTCOLOR is used.

Default GraphWalls:Color style reference

BORDER=TRUE | FALSE
specifies whether a border is displayed around the inset.

Default FALSE

See "boolean " on page xii for other Boolean values that you can use.

HALIGN=LEFT | CENTER | RIGHT
specifies the horizontal alignment of the inset.

Default LEFT

Interaction This option is ignored when AUTOALIGN= is not NONE and the parent layout is an overlay-type layout.

OPAQUE=TRUE | FALSE
specifies whether the inset background is opaque (TRUE) or transparent (FALSE).

Default FALSE

Interaction When this option is set to FALSE, the background color is not used.

See "boolean " on page xii for other Boolean values that you can use.

TEXTATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the text properties of the entire inset.

Default The GraphDataText style element.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Text Options" on page 1606 for available *text-options*.

TITLE="*string*"
specifies a title for the inset.

The title is added at the top of the inset and spans the full inset width.

Note Space is not reserved for the title when this option is not set

Tip Text properties for the title string can be set with TITLEATTRS=.

TITLEATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the text properties of the inset's title string.

Default The GraphValueText style element.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Text Options" on page 1606 for available *text-options*.

VALIGN=TOP | CENTER | BOTTOM
specifies the vertical alignment of the inset.

Default TOP

Interaction This option is ignored when AUTOALIGN= is not NONE and the parent layout is an overlay-type layout.

LABELSTRIP=TRUE | FALSE
specifies whether leading and trailing blanks are stripped from marker characters or data labels that have a fixed position before they are displayed in the plot. The MARKERCHARACTER= option specifies the column that provides the marker strings that are to be used in place of marker symbols.

Default FALSE

Interactions This option effects marker strings only when the MARKERCHARACTER= option is specified.

This option effects data labels only when DATALABEL= is specified and DATALABELPOSITION= is not AUTO.

Tip Stripping the blanks from the numeric value strings helps center each string relative to its data point. Stripping is useful when you want to overlay the data values near or inside the markers for a plot.

See "boolean " on page xii for other Boolean values that you can use.

MARKERATTRS=*style-element* | *style-element* (*marker-options*) | (*marker-options*)
specifies the attributes of the data markers.

Defaults For non-grouped data, GraphDataDefault style element.

For grouped data, the MarkerSymbol and ContrastColor attributes of the GraphData1–GraphDataN style elements, and the GraphDataDefault:MarkerSize style reference.

Interactions If the COLORRESPONSE= or MARKERCOLORGRADIENT= option is specified, then this option's COLOR= suboption is ignored.

If the MARKERCHARACTER= option is specified, then this option's SYMBOL= and WEIGHT= suboptions are ignored.

This option's COLOR= suboption overrides the default behavior for grouped data. When the COLOR= suboption is specified in that case, all markers have the same color, and the marker symbol alone distinguishes the markers.

This option's SYMBOL= suboption overrides the default behavior for grouped data. When the SYMBOL= suboption is specified in that case, all markers have the same symbol, and the symbol color alone distinguishes the markers.

The TRANSPARENCY= fill option overrides this option's DATATRANSPARENCY= suboption.

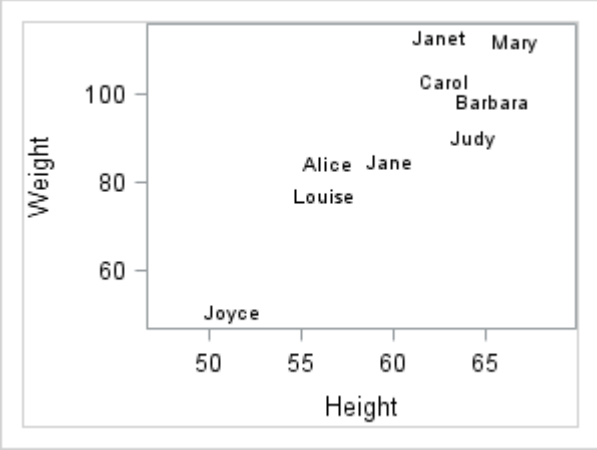
Note When *style-element* is specified, only the style element's MARKERSYMBOL, CONTRASTCOLOR, and MARKERSIZE attributes are used.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Marker Options" on page 1604 for available *marker-options*.

MARKERCHARACTER=*column* | *expression*

specifies a column that defines strings that are to be used instead of marker symbols.



Each string is centered horizontally and vertically at the data point. The data point positions are not adjusted to prevent text overlap.

Interactions This option overrides the DATALABEL= option.

If the GROUP= option is also used, then color is displayed for a DISCRETE legend, but the character is not displayed in the legend. For text strings, the same colors are applied to the text strings as would have been applied to markers.

Note If a numeric column is used, then its values are converted to strings using the format associated with the column or using BEST6 if no format is defined.

Tips You can use the MARKERCHARACTERPOSITION= option to change the justification of the marker character.

You can use the LABELSTRIP= option to strip the leading and trailing blanks from numeric value strings in order to center each string on its data point.

If the MARKERCHARACTER= variable contains one or more long character strings, large axis offsets might result. In that case, use the OFFSETMIN= and OFFSETMAX= suboptions in the XAXISOPTS= and YAXISOPTS= axis options to override the automatic axis offsets.

MARKERCHARACTERATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)

specifies the color and font attributes of the marker character specified on the MARKERCHARACTER= option.

Defaults For non-grouped data, the GraphDataText style element.

For grouped data, GraphData1:ContrastColor–GraphDataN:ContrastColor style references.

Interactions For this option to take effect, the MARKERCHARACTER= option must also be used.

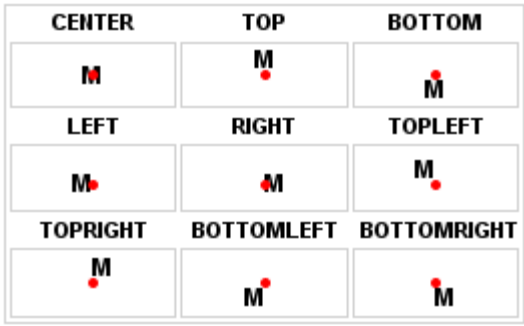
When the GROUP= option is also specified, each distinct group value might be represented by a different color (depending on the ODS style setting or the setting on the INDEX= option). The marker character that is associated with the group is assigned the group color.

This option's COLOR= suboption can be used to specify a single color for all marker characters in a grouped plot, without affecting items that have a group color, such as error bars and marker symbols.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Text Options" on page 1606 for available *text-options*.

MARKERCHARACTERPOSITION=CENTER | TOP | BOTTOM | LEFT | RIGHT | TOPLEFT | TOPRIGHT | BOTTOMLEFT | BOTTOMRIGHT
specifies the justification of the marker characters. The following figure shows the effect of each of the values on the position of marker character M.



Note: The red dots represent the center in each case for reference.

Default CENTER

Interaction This option is ignored if the MARKERCHARACTER= option is not specified.

Tip You can use the LABELSTRIP= option to strip the leading and trailing blanks from value strings in order to properly justify each string on its data point.

MARKERCOLORGRADIENT=*numeric-column* | *range-attr-var* | *expression*
in SAS 9.4M1 and earlier releases, specifies the column or range attribute map variable that is used to determine the marker colors.

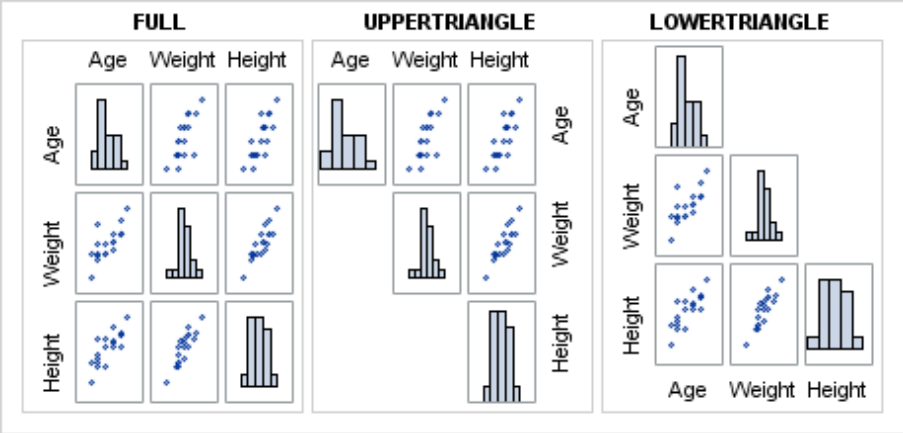
Note: Starting with SAS 9.4M2, the MARKERCOLORGRADIENT= option is deprecated and replaced with the COLORRESPONSE= option. The syntax and functionality are the same. The MARKERCOLORGRADIENT= option is still honored, but the COLORRESPONSE= option is preferred.

Note Starting with SAS 9.4M2, if you use the MARKERCOLORGRADIENT= option, then be aware that the TIP=, TIPFORMAT=, and TIPLABEL= options recognize the MARKERCOLORGRADIENT role and not the COLORRESPONSE role.

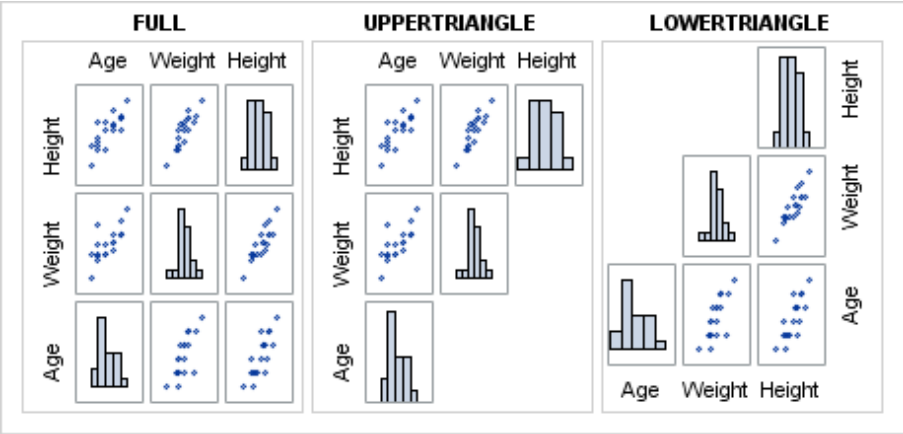
See COLORRESPONSE= on page 854

MATRIXTYPE=FULL | UPPERTRIANGLE | LOWERTRIANGLE
specifies whether to display the full matrix, or just the upper or lower triangle of the matrix. By default, the full matrix is displayed. The cells in the grid are filled beginning with the cell that is specified by the START= option. When you display only the upper or lower triangle, you can use the START= option to control the orientation of the triangle. The following figure shows the effect of

the MATRIXTYPE= option when START=TOPLEFT and DIAGONAL=(HISTOGRAM).



The next figure shows the effect of the START=BOTTOMLEFT option on the previous graph.



Default FULL

Interactions This option is ignored if the ROWVARS= option is used.

The START= option specifies the corner where the matrix fill begins.

The DIAGONAL= option specifies the content of the diagonal cells.

NAME="*string*"

assigns a name to this plot statement for reference in other template statements. The specified name is used primarily in legend statements to coordinate the use of colors and line patterns between the plot and the legend.

Restrictions The *string* is case sensitive, cannot contain spaces, and must define a unique name within the template.

This option does not support variables that are created by the DYNAMIC, MVAR, and NMVAR template statements.

REVERSECOLORMODEL=TRUE | FALSE
specifies whether to reverse the gradient (color ramp) that is defined by either the ODS style that is in effect or by the COLORMODEL= option.

Default FALSE

See COLORMODEL=

"boolean " on page xii for other Boolean values that you can use.

ROLENAME=(*role-name-list*)
specifies user-defined roles that can be used to display information in the data tips. This option provides a way to add to the data columns that appear in data tips that are specified by the TIP= option.

(*role-name-list*)
a space-separated list of *role-name = column* pairs.

Example The following example assigns the column Obs to the user-defined role TIP:

```
ROLENAME=(TIP1=OBS)
```

Default No user-defined roles

Requirement The role names that you choose must be unique and different from the predefined roles X, Y, DATALABEL, MARKERCHARACTER, COLORRESPONSE or MARKERCOLORGRADIENT, GROUP, and INDEX.

ROWVARS=(*numeric-column-list*)
specifies a secondary list of numeric columns to be paired with the required column list that is specified by the SCATTERPLOTMATRIX statement. The labels for the columns appear vertically on the left side of the matrix.

Requirement All of the columns must be numeric.

Interaction When this option is specified, the DIAGONAL= and MATRIXTYPE= options are ignored.

START=TOPLEFT | BOTTOMLEFT
specifies whether to start populating the matrix from the top left or bottom left corner.

Default TOPLEFT

SUBPIXEL=AUTO | OFF
specifies whether subpixel rendering is used for image output when the scatter plots are rendered.

Note: This feature applies to SAS 9.4M3 and to later releases.

AUTO
sets subpixel rendering OFF, unless SUBPIXEL=ON is specified in the BEGINGRAPH statement or in an ODS GRAPHICS statement. In that case, subpixel rendering is ON.

OFF
disables subpixel rendering for image output only for the scatter plots in this scatter-plot matrix.

Default AUTO

Restriction This option applies only to the scatter plots in the matrix. It does not affect the confidence ellipses.

Requirement Anti-aliasing must be enabled for this option to have any effect.

Notes This option affects subpixel rendering for the scatter plots only in this scatter-plot matrix. Subpixel rendering for other plots in the graph is not affected.

For vector-graphics output, this option is ignored, and subpixel rendering is always enabled.

When subpixel rendering is used for the graph but is turned OFF for this scatter-plot matrix, some elements in the scatter plots such as the plot markers might be offset a half pixel, which can make them appear blurry in the image output.

Tips Anti-aliasing is enabled by default. If anti-aliasing has been disabled, use the ANTIALIAS=ON option in the ODS GRAPHICS statement to re-enable it.

Anti-aliasing is disabled automatically for this plot when the resources required to anti-alias it exceed a preset threshold. When anti-aliasing is disabled for this or any other plot in the graph, subpixel rendering is disabled for the entire graph. A note is written to the SAS log that provides information about how to use the ANTIALIASMAX= option in an ODS GRAPHICS statement to re-enable anti-aliasing.

To disable subpixel rendering for the scatter plots and the ellipses, specify SUBPIXEL=OFF in the template's BEGINGRAPH statement or in an ODS GRAPHICS statement.

See "Using Subpixel Rendering" in *SAS Graph Template Language: User's Guide*

"ODS GRAPHICS Statement" on page 1561 for information about the ANTIALIAS=, ANTIALIASMAX=, and SUBPIXEL= options.

TIP=(*role-list*) | NONE
specifies the information to display when the cursor is positioned over the scatter points. If this option is used, then it replaces all of the information that is displayed by default. Roles for columns that do not contribute to the scatter plot can be specified along with roles that do.

(*role-list*)
an ordered, space-separated list of unique SCATTERPLOTMATRIX and user-defined roles.

SCATTERPLOT roles include: X, Y, GROUP, DATALABEL, MARKERCHARACTER, and COLORRESPONSE or MARKERCOLORGRADIENT.

User-defined roles are defined with the ROLENAME= option.

Requirement If you use the COLORRESPONSE= option, you must specify the COLORRESPONSE role for the color values. Likewise, if you use the MARKERCOLORGRADIENT= option, you must specify the MARKERCOLORGRADIENT role for the color values. Although they are functionally the same, you cannot mix the COLORRESPONSE= and MARKERCOLORGRADIENT= options, and their corresponding roles.

Example The following example displays data tips for the columns assigned to the roles TIP1, TIP2, TIP3, and TIP4:

```
ROLENAME=(TIP1=ID TIP2=AGE TIP3=HEIGHT TIP4=WEIGHT)
TIP=(TIP1 TIP2 TIP3 TIP4)
```

NONE
suppresses data tips from the plot.

Default The columns assigned to these roles are automatically included in the data tip information: current X, current Y, MARKERCHARACTER, COLORGROUP or MARKERCOLORGRADIENT, and GROUP.

Requirement To enable data tips in the output, you must include an ODS GRAPHICS ON statement that specifies the IMAGEMAP option, and you must write the output to the ODS HTML destination.

Interaction This option is ignored when the plot statement is in an OVERLAY or PROTOTYPE layout and the INCLUDERANGES= option is specified in the LINEAROPTS= or TIMEOPTS= option for either axis.

Tip The labels and formats for the TIP roles can be controlled with the TIPLABEL= and TIPFORMAT= options.

TIPFORMAT=(*role-format-list*)
specifies display formats for tip columns. This option provides a way to control the formats of columns that appear in data tips.

(*role-format-list*)
a space-separated list of *role-name* = *format* pairs.

Example
```
ROLENAME=(TIP1=SALARY)
TIP=(TIP1)
TIPFORMAT=(TIP1=DOLLAR12.)
```

Default The column format of the column assigned to the role or BEST6 if no format is assigned to a numeric column.

Restriction Only the roles that appear in the TIP= option are used.

Requirement A column must be assigned to each of the specified roles. (See the ROLENAME= option.)

TIPLABEL=(*role-label-list*)
specifies display labels for tip columns. This option provides a way to control the labels of columns that appear in data tips.

role-label-list
a space-separated list of *rolename* ="*string*" pairs.

Example
```
ROLENAME=(TIP1=PCT)
TIP=(TIP1)
TIPLABEL=(TIP1="Percent")
```

Default The column label or column name of the column assigned to the role.

Restriction Only the roles that appear in the TIP= option are used.

Requirement A column must be assigned to each of the specified roles. (See the ROLENAME= option.)

WALLCOLOR=*style-reference* | *color*
specifies the fill color of the plot wall area.

style-reference
specifies a style reference in the form *style-element:style-attribute*.

Only the style- attribute named COLOR or CONTRASTCOLOR is used.

Default The GraphWalls:Color style reference.

Interaction This option is ignored if WALLDISPLAY=NONE or WALLDISPLAY=(OUTLINE).

WALLDISPLAY=STANDARD | ALL | NONE | (*display-options*)
specifies whether the plot's wall and wall outline are displayed.

STANDARD
displays a filled wall.

The setting of the FRAMEBORDER=ON | OFF attribute of the GraphWalls style element determines whether the wall outline is displayed.

ALL
displays a filled, outlined wall.

NONE
displays no wall, no wall outline.

(*display-options*)
a space-separated list of one or more display options enclosed in parentheses.

The list can include one or both of the following options:

OUTLINE
displays the wall outline.

FILL
displays a filled wall area.

Default STANDARD

Tips Use the WALLCOLOR= option to control the fill color of the wall.

The appearance attributes of the wall fill and outline are set by the GraphWalls style element.

Details

By default, the SCATTERPLOTMATRIX statement produces a symmetric scatter plot matrix. For *n* columns, it produces an *n* columns by *n* rows matrix of scatter plots. By default, the columns of the matrix are in the same left-to-right order as the order of the *numeric-column-list*. The rows of the matrix are in the same bottom-to-top order as the *numeric-column-list*. You can reverse the direction of the diagonal by setting START=TOPLEFT.

To produce a rectangular matrix of scatter plots, use the ROWVARS= option. Specifying *n* columns in the SCATTERPLOTMATRIX statement and *m* columns on the ROWVARS= option produces an n-columns by m-rows matrix of scatter plots. For example, the following statement specifies 2 columns on SCATTERPLOTMATRIX and 3 columns on the ROWVARS= option to produce the 2-columns by 3-rows matrix:

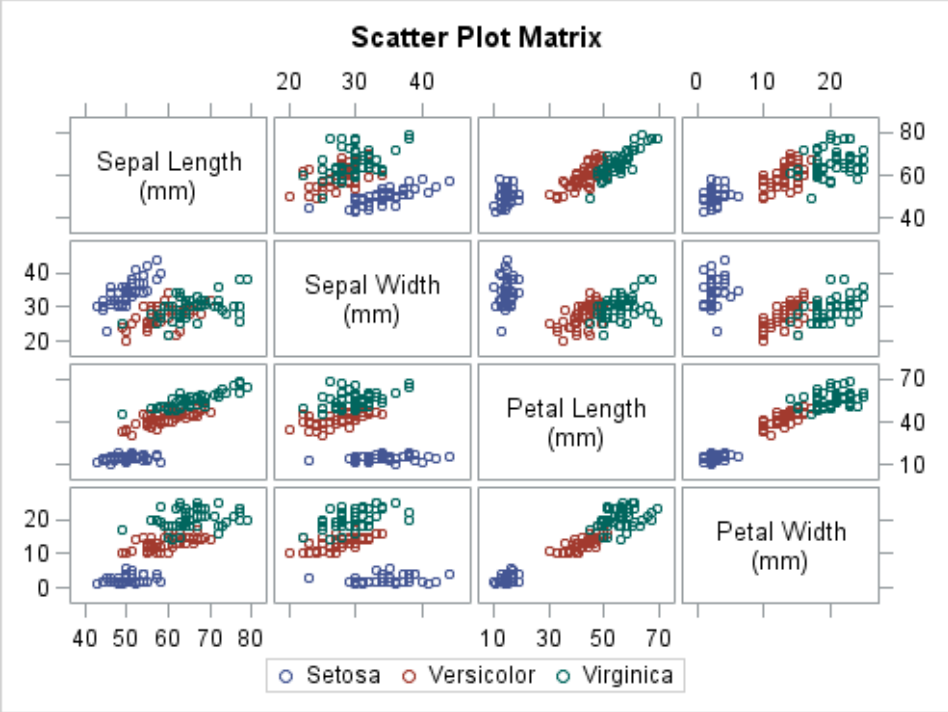
```
SCATTERPLOTMATRIX Height Weight
   / ROWVARS=(Age Height Weight);
```

The SCATTERPLOTMATRIX statement cannot appear within an overlay-type layout. It generates its own matrix of plots and is typically placed in a LAYOUT GRIDDED block.

If there are missing values in a column or a row, then all of the points that can be plotted are plotted in each scatter plot.

Example: SCATTERPLOTMATRIX Statement

The following graph was generated by the "Example Program" on page 878:



Example Program

```
proc template;
  define statgraph scatterplotmatrix;
    begingraph;
      entrytitle "Scatter Plot Matrix";
      layout gridded;
        scatterplotmatrix
          sepallength sepalwidth petallength petalwidth /
          group=species name="matrix";
        discretelegend "matrix";
      endlayout;
    endgraph;
  end;
run;

proc sgrender data=sashelp.iris template=scatterplotmatrix;
run;
```

SERIESPLOT Statement

Displays a series of line segments that connect observations of input data.

Note: The SERIESPLOT statement plots data in data order. For this reason, the input data set should be sorted by the X variable. Otherwise, unexpected results might occur.

If the data is not sorted, you can specify CONNECTORDER=XAXIS in the SERIESPLOT statement. See CONNECTORDER= on page 887.

Tip: Starting with SAS 9.4M3, subpixel rendering is enabled by default. To disable subpixel rendering, specify SUBPIXEL=OFF in the BEGINGRAPH statement or in an ODS GRAPHICS statement. For information about the BEGINGRAPH statement SUBPIXEL= option, see SUBPIXEL= on page 39. For information about the ODS GRAPHICS statement SUBPIXEL= option, see "ODS GRAPHICS Statement" on page 1561.

Syntax

SERIESPLOT X=*column* | *expression*
Y=*column* | *expression* <*/options*>;

Summary of Optional Arguments

Appearance options

ARROWHEADPOSITION= NONE | START | END | BOTH | *column*
: specifies a position for arrowheads.

ARROWHEADSCALE=*positive-number* | *numeric-column* | *expression*
: specifies an arrowhead scale factor based on the thickness of the arrow line.

ARROWHEADSHAPE= OPEN | FILLED | BARBED | *column*
: specifies a shape for arrowheads.

BREAK=TRUE | FALSE
: breaks the plot line at missing values of the Y variable.

CLUSTERWIDTH=*number*
: on a discrete axis, specifies the width of the group clusters as a fraction of the midpoint spacing. On an interval axis, specifies the width of the group clusters as a fraction of the minimum interval between adjacent data values.

COLORMODEL=*color-ramp-style-element* | (*color-list*)
: specifies a color ramp to use with the COLORRESPONSE= option.

COLORRESPONSE=*numeric-column* | *range-attr-var* | *expression*
: specifies the column or range attribute variable to use to map the line and marker colors.

DATASKIN=NONE | CRISP | GLOSS | MATTE | PRESSED | SHEEN
: enhances the visual appearance of the series lines.

DATATRANSPARENCY=*number*
: specifies the degree of the transparency of the line, markers, line label, and data labels, when displayed.

DISPLAY=(*display-options*) | STANDARD | ALL
: specifies which series-line features to display.

ERRORBARATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)

specifies the attributes of the error bars that are associated with the data points.

ERRORBARCAPSCALE=*positive-number*
specifies a positive number to use as a multiplier for determining the default width of the error-bar caps.

ERRORBARCAPSHAPE=SERIF | NONE
specifies whether the error bars have a serif cap.

FILLEDOUTLINEDMARKERS=TRUE | FALSE
specifies whether markers are drawn with both fill and an outline.

INDEX=*positive-integer-column* | *expression*
specifies indices for mapping line attributes (color, marker symbol, and line pattern) to one of the GraphData1–GraphDataN style elements.

LINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the attributes of the series line.

LINECOLORGROUP=*column* | *discrete-attr-var* | *expression*
specifies a column that determines the line colors for a grouped plot independently of the GROUP= column.

LINEJOIN= MITER | ROUND | BEVEL
specifies how to shape the vertices of the series line.

LINEPATTERNGROUP=*column* | *discrete-attr-var* | *expression*
specifies a column that determines the line patterns for a grouped plot independently of the GROUP= column.

LINETHICKNESSMAX=*dimension*
specifies the maximum line thickness when a response variable is used to determine the line thickness.

LINETHICKNESSMAXRESPONSE=*numeric* | *scalar-numeric-expression*
specifies the response value that corresponds to the maximum line thickness.

LINETHICKNESSMIN=*dimension*
specifies the minimum line thickness when a response variable is used to determine the line thickness.

LINETHICKNESSRESPONSE=*numeric-column* | *expression*
specifies a response column or range attribute variable that is used to map a line thickness to each group value.

MARKERATTRS=*style-element* | *style-element* (*marker-options*) | (*marker-options*)
specifies the attributes of the data markers.

MARKERCOLORGROUP=*column* | *discrete-attr-var* | *expression*
specifies a column that determines the marker colors for a grouped plot independently of the GROUP= column.

MARKERFILLATTRS=*style-element* | (*fill-options*)
specifies the appearance of the filled markers.

MARKEROUTLINEATTRS=*style-element* | (*line-options*)
specifies the appearance of the marker outlines.

MARKERSYMBOLGROUP=*column* | *discrete-attr-var* | *expression*
specifies a column that determines the marker symbols for a grouped plot independently of the GROUP= column.

SMOOTHCONNECT=TRUE | FALSE

specifies that a smoothed line passes through all vertices.

SPLINEPOINTS=*positive-integer*
specifies a multiplier to apply to the time interval that is in effect for the INTERVAL= axis option.

SPLINETYPE=NONE | QUADRATICBEZIER
specifies the type of spline interpolation that is used to draw the series line.

XERRORLOWER=*numeric-column* | *expression*
specifies values for the lower endpoints on the X error bars. The error bars are drawn from the markers to the endpoints.

XERRORUPPER=*numeric-column* | *expression*
specifies values for the upper endpoints on the X error bars.

YERRORLOWER=*numeric-column* | *expression*
specifies values for the lower endpoints on the Y error bars.

YERRORUPPER=*numeric-column* | *expression*
specifies values for the upper endpoints on the Y error bars.

Axes options

CLUSTERAXIS=AUTO | X | Y
specifies the axis to use for clustering groups when GROUPDISPLAY=CLUSTER.

PRIMARY=TRUE | FALSE
specifies that the data columns for this plot and the plot type be used for determining default axis features.

XAXIS=X | X2
specifies whether data are mapped to the primary X (bottom) axis or to the secondary X2 (top) axis.

YAXIS=Y | Y2
specifies whether data are mapped to the primary Y (left) axis or to the secondary Y2 (right) axis.

Connect options

CONNECTORDER=XVALUES | XAXIS
specifies how to connect the data points to form the series line.

Data tip options

ROLENAME=(*role-name-list*)
specifies user-defined roles that can be used to display information in the data tips.

TIP=(*role-list*) | NONE
specifies the information to display when the cursor is positioned over the series line.

TIPFORMAT=(*role-format-list*)
specifies display formats for tip columns.

TIPLABEL=(*role-label-list*)
specifies display labels for tip columns.

Label options

CURVELABEL=*"string"* | *column* | *expression*

specifies a label for the series line.

CURVELABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font attributes of the series-line labels.

CURVELABELLOCATION=INSIDE | OUTSIDE
specifies the location of the series-line label relative to the plot area.

CURVELABELPOSITION=AUTO | MAX | MIN | START | END
specifies the position of the series-line label relative to the series line.

CURVELABELSPLIT=TRUE | FALSE
specifies whether to split the series-line label at the specified split characters.

CURVELABELSPLITCHAR="*character-list*"
specifies one or more characters on which the series-line label can be split if needed.

CURVELABELSPLITCHARDROP=TRUE | FALSE
specifies whether the split characters are included in the series-line label text.

CURVELABELSPLITJUSTIFY=AUTO | CENTER | LEFT | RIGHT
specifies the justification of the strings that are inside the series-line label block.

DATALABEL=*column* | *expression*
specifies a column that supplies values for the data point labels.

DATALABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font attributes of the data labels.

DATALABELPOSITION=AUTO | TOPRIGHT | TOP | TOPLEFT | LEFT | CENTER | RIGHT | BOTTOMLEFT | BOTTOM | BOTTOMRIGHT
specifies the location of the data labels relative to the vertices of the series line and the markers, when displayed.

DATALABELSPLIT=TRUE | FALSE
specifies whether to split the data labels at the specified split characters.

DATALABELSPLITCHAR="*character-list*"
specifies one or more characters on which the data labels can be split if needed.

DATALABELSPLITCHARDROP=TRUE | FALSE
specifies whether the split characters are included in the data labels.

DATALABELSPLITJUSTIFY=AUTO | CENTER | LEFT | RIGHT
specifies the justification of the strings that are inside the data label blocks.

LEGENDLABEL="*string*"
specifies a label to be used in a discrete legend for this plot.

Midpoint options

DISCRETEOFFSET=*number*
specifies an amount to offset all series lines and markers from discrete X values, or discrete Y values, or both.

GROUP=*column* | *discrete-attr-var* | *expression*

creates a separate series plot for each unique group value in the specified column.

GROUPDISPLAY=OVERLAY | CLUSTER
specifies how marker groups are positioned for the coordinate pairs.

GROUPORDER=DATA | REVERSEDATA | ASCENDING | DESCENDING
specifies the ordering of the groups within a category.

INCLUDEMISSINGGROUP=TRUE | FALSE
specifies whether missing values of the group variable are included in the plot.

ODS options

URL=*string-column*
specifies an HTML page to display when a point or a segment of the curve is selected.

Plot reference options

NAME="*string*"
assigns a name to this plot statement for reference in other template statements.

Required Arguments

X=*column* | *expression*
specifies the column for the X values.

Y=*column* | *expression*
specifies the column for the Y values.

Optional Arguments

ARROWHEADPOSITION= NONE | START | END | BOTH | *column*
specifies a position for arrowheads.

Note: This feature applies to SAS 9.4M3 and to later releases.

NONE
no arrowheads are displayed.

START
an arrowhead is displayed at the starting point of each line.

END
an arrowhead is displayed at the ending point of each line.

BOTH
an arrowhead is displayed at each end of each line.

column
specifies a column that provides an arrowhead position for each group value.

Default NONE

Restriction When you specify a column and the GROUP= option is in effect, the arrowhead position values are assumed to be constant for each group value. If the column has multiple values for a single group value, then only one of the arrowhead position values is used for that group.

See "Example 3: Series Plot with Line-Thickness Response and Arrowheads" on page 922 for an example of how to use this option.

ARROWHEADSCALE=*positive-number* | *numeric-column* | *expression*
specifies an arrowhead scale factor based on the thickness of the arrow line.

Note: This feature applies to SAS 9.4M3 and to later releases.

Default 1.0

Restriction The arrowhead scale values are assumed to be constant for each line. If a column or expression provides multiple values for a line, only one of the values is used.

Interaction This option is ignored when ARROWHEADPOSITION=NONE is in effect.

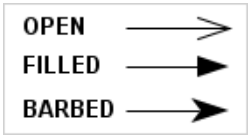
Tip Use a factor greater than 1.0 to make a larger arrowhead.

See "Example 3: Series Plot with Line-Thickness Response and Arrowheads" on page 922 for an example of how to use this option.

ARROWHEADSHAPE= OPEN | FILLED | BARBED | *column*
specifies a shape for arrowheads.

Note: This feature applies to SAS 9.4M3 and to later releases.

The following figure shows each of the arrowhead shapes.



Default OPEN

Restriction When you specify a column and the GROUP= option is in effect, the arrowhead shape values are assumed to be constant for each group value. If the column has multiple values for a single group value, only one of the arrowhead shape values is used for that group.

Interaction This option is ignored when ARROWHEADPOSITION=NONE is in effect.

See "Example 3: Series Plot with Line-Thickness Response and Arrowheads" on page 922 for an example of how to use this option.

BREAK=TRUE | FALSE
breaks the plot line at missing values of the Y variable.

Default FALSE

Interaction This option is ignored when the Y axis is discrete and option INCLUDEMISSINGDISCRETE=TRUE is specified in the BEGINGRAPH statement. To break the line in that case, remove INCLUDEMISSINGDISCRETE=TRUE from the BEGINGRAPH statement.

Note When this option is set to FALSE, missing values are skipped and a continuous line is drawn.

See "boolean " on page xii for other Boolean values that you can use.

CLUSTERAXIS=AUTO | X | Y
specifies the axis to use for clustering groups when GROUPDISPLAY=CLUSTER.

AUTO
uses the discrete axis for clustering groups when only one axis is discrete. Uses the X axis for clustering if both axes are discrete or interval.

X
Y
uses the X or Y axis for clustering groups.

Default AUTO

Interaction The GROUPDISPLAY= option must be set to CLUSTER for this option to have any effect.

CLUSTERWIDTH=*number*
on a discrete axis, specifies the width of the group clusters as a fraction of the midpoint spacing. On an interval axis, specifies the width of the group clusters as a fraction of the minimum interval between adjacent data values.

Default 0.85

Range 0–1, where 0 is the minimum width, which is one pixel wide, and 1 is the maximum possible width

Interactions For this option to take effect, the GROUP= option must also be specified, and the GROUPDISPLAY= option must be set to CLUSTER.

When markers are displayed for interval data and GROUPDISPLAY=CLUSTER and CLUSTERWIDTH= are in effect, the size of the markers in each cluster might be reduced to no less than 5 pixels in order to display the cluster within the smallest effective midpoint space. If you need larger markers in that case, use the MARKERATTRS= option to specify a larger marker size.

COLORMODEL=*color-ramp-style-element* | (*color-list*)
specifies a color ramp to use with the COLORRESPONSE= option.

color-ramp-style-element
specifies the name of a color-ramp style element.

The style element should contain these style attributes:

STARTCOLOR
specifies the color for the smallest data value of the COLORRESPONSE= column.

NEUTRALCOLOR
specifies the color for the midpoint of the range of the COLORRESPONSE= column.

ENDCOLOR
specifies the color for the highest data value of the COLORRESPONSE= column.

(*color-list*)
specifies a space-separated list of colors to use in the color ramp. You can use style attribute references such as GraphData3:Color, color names, or RGB, CMYK, HLS, and HSV (HSB) color codes to specify a color. The list can contain a mix of style attribute references, color names, and color codes.

Requirement The list of colors must be enclosed in parentheses.

See "color " on page xii

Default The ThreeColorAltRamp style element.

Interaction For this option to take effect, the COLORRESPONSE= option must also be specified.

COLORRESPONSE=*numeric-column* | *range-attr-var* | *expression*
specifies the column or range attribute variable to use to map the line and marker colors.

Note: This feature applies to SAS 9.4M3 and to later releases.

range-attr-var
specifies a range attribute map variable that is defined in a RANGEATTRVAR statement.

"RANGEATTRVAR Statement"

Restriction A range attribute map variable specification must be a direct reference to the attribute map variable. It cannot be set as a dynamic variable.

See "RANGEATTRVAR Statement" on page 1531

When a numeric column or expression is specified, the range of column or expression values are linearly mapped to the color ramp that is specified by the COLORMODEL= option. When a range attribute map variable is specified, the colors that are defined in the associated range attribute map are used instead.

Requirement The COLORRESPONSE values should remain constant for each group value in a grouped plot and for the entire plot in an ungrouped plot. If the COLORRESPONSE column has multiple values for a single GROUP value or for a non-grouped plot, unexpected results might occur.

Interactions When this option is specified without the GROUP= option, only a single line is generated for the plot, and the line color is derived from the COLORRESPONSE= value.

When the GROUP= option, LINECOLORGROUP= option, and MARKERCOLORGROUP= options are used with the COLORRESPONSE= option, the COLORRESPONSE= option controls the color attributes.

Suboption COLOR= in the DATALABELATTRS= option overrides this option for the data label color attribute.

This option overrides suboption COLOR= in the LINEATTRS= option and varies the line color according to the color gradient or the attribute map.

Suboption COLOR= in the MARKERATTRS= option or in the FILLEDOUTLINEDMARKERS= option overrides this option for the marker colors.

Tips To display a legend with this option in effect, use a CONTINUOUSLEGEND statement.

For a numeric column or expression, the ThreeColorAltRamp style element defines the line color gradient.

CONNECTORDER=XVALUES | XAXIS

specifies how to connect the data points to form the series line.

XVALUES

connects data points in the order read from the X column.

Note In SAS 9.4M6 and earlier releases, unexpected results might occur when XVALUES is specified and data stored in a CAS in-memory table is used. In that case, use XAXIS instead. Starting with SAS Viya 3.5 and SAS Studio 5.2, XVALUES is ignored when data stored in a CAS in-memory table is used.

XAXIS

connects data points as they occur min-to-max along the X axis.

Defaults XVALUES if the data is a SAS data set

XAXIS if the data is a CAS in-memory table

Tip For certain types of series lines (for example, time series) when the input data might not be sorted by the X column, set this option to XAXIS to assure the expected connect order.

CURVELABEL=*"string"* | *column* | *expression*
specifies a label for the series line.

Default No series-line label is displayed

Restrictions When the GROUP= option is specified, *"string"* and *expression* are not valid. Use *column* in that case.

When the GROUP= option is not specified, *column* is not valid. Use *"string"* or *expression* in that case.

The line label for missing values is ignored.

Tip The font and color attributes for the label are specified by the CURVELABELATTRS= option.

See GROUP= on page 900

CURVELABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font attributes of the series-line labels. When the GROUP= option is used, each distinct group value might be represented by a different color. The series-line label that is associated with the group is assigned the group color. This option can be used to specify a single color for all series-line labels in a plot, without affecting items that have the group color, such as lines and marker symbols.

Defaults For non-grouped data, the GraphValueText style element.

For grouped data, text color is derived from the GraphData1:ContrastColor–GraphDataN:ContrastColor style references. The font is derived from the GraphValueText style element.

Interactions For this option to take effect, the CURVELABEL= option must also be used.

This option's COLOR= setting overrides the colors indicated by the GROUP= option.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Text Options" on page 1606 for available *text-options*.

CURVELABELLOCATION=INSIDE | OUTSIDE
specifies the location of the series-line label relative to the plot area.

INSIDE
locates the labels inside the plot area

OUTSIDE
locates the labels outside the plot area

Default INSIDE

Restriction OUTSIDE cannot be used when the SERIESPLOT is used in multicell layouts such as LATTICE, DATAPANEL, or DATALATTICE, where axes might be external to the grid.

Interactions For this option to take effect, the CURVELABEL= option must also be specified.

This option is used in conjunction with the CURVELABELPOSITION= option to determine where the series-line labels appear. For more information, see "Location and Position of Curve Labels" on page 213.

CURVELABELPOSITION=AUTO | MAX | MIN | START | END
specifies the position of the series-line label relative to the series line.

AUTO
automatically locates the series-line label near the end series line along unused axes whenever possible (typically Y2 or X2) in order to avoid collision with tick values.

Restriction This option is used only when CURVELABELLOCATION= OUTSIDE.

MAX
forces the series-line label to appear near maximum series values (typically, to the right)

MIN
forces the series-line label to appear near minimum series values (typically, to the left)

START
forces the series-line label to appear near the beginning of the series line.

Restriction This option is used only when CURVELABELLOCATION=INSIDE.

Tip This option is particularly useful when the series line has a spiral shape.

END
forces the series-line label to appear near the end of the series line.

Restriction This option is used only when CURVELABELLOCATION=INSIDE.

Tip This option is particularly useful when the series line has a spiral shape.

Defaults AUTO when CURVELABELLOCATION=OUTSIDE.

END when CURVELABELLOCATION=INSIDE.

Restriction The AUTO setting is ignored if CURVELABELLOCATION=INSIDE is specified. The START and END settings are ignored if CURVELABELLOCATION=OUTSIDE is specified.

Interactions For this option to take effect, the CURVELABEL= option must also be specified.

This option is used in conjunction with the CURVELABELLOCATION= option to determine where the series-line label appears. For more information, see "Location and Position of Curve Labels" on page 213.

Note When you specify TICKVALUELIST=, VIEWMAX=, or VIEWMIN= in an axis statement, the data points that are used to determine the position of the series-line label might fall outside of the graph area. In that case, the series-line label might not be displayed or might be positioned incorrectly.

Tip When END is in effect, no attempt is made to avoid curve label collisions. If your curve labels collide, try using MAX instead.

CURVELABELSPLIT=TRUE | FALSE

specifies whether to split the series-line label at the specified split characters. When a series-line label is split, the label is split on each occurrence of the specified split characters.

Default FALSE. The series-line label is not split.

Requirement The CURVELABEL= option must also be specified.

Interactions The CURVELABELSPLITCHAR= option specifies one or more characters on which the splits occur.

This option has no effect when CURVELABELPOSITION=AUTO.

See "boolean " on page xii for other Boolean values that you can use.

CURVELABELSPLITCHAR="*character-list*"

specifies one or more characters on which the series-line label can be split if needed. When multiple split characters are specified, each character in the list is treated as a separate split character unless the specified characters appear consecutively in the series-line label. In that case, all of the specified split characters together are treated as a single split character.

When CURVELABEL= is specified and CURVELABELSPLIT=TRUE, the series-line label is split unconditionally at each occurrence of any of the specified split characters. If the series-line label does not contain any of the specified characters, then the label is not split.

"character-list"

one or more characters with no delimiter between each character and enclosed in quotation marks.

Default A blank space

Requirements The list of characters must be enclosed in quotation marks.

Multiple characters must be specified with no delimiters. For example, to specify the split characters a, b, and c, use the following option:

```
curvelabelsplitchar="abc"
```

The CURVELABEL= option and the CURVELABELSPLIT=TRUE option must also be specified.

Interactions This option has no effect if CURVELABELPOSITION=AUTO.

The CURVELABELSPLITCHARDROP= option specifies whether the split characters are included in the series-line label or are dropped.

Notes When multiple characters are specified, the order of the characters in the list is not significant.

The split characters are case sensitive.

Tip Use the CURVELABELSPLITJUSTIFY= option to specify the justification of the strings in the series-line label block.

CURVELABELSPLITCHARDROP=TRUE | FALSE

specifies whether the split characters are included in the series-line label text.

TRUE

drops the split characters from the series-line label text.

FALSE

includes the split characters in the series-line label text.

When CURVELABELSPLIT=TRUE and CURVELABELSPLITCHARDROP=FALSE, each split character remains as the last character in the current line. The characters that follow the split character, up to and including the next split character, are then wrapped to the next line.

The following figure shows an example of a series-line label with the following specifications:

- CURVELABELPOSITION=MAX
- CURVELABEL="Product*Group*A"
- CURVELABELSPLIT=TRUE
- CURVELABELSPLITCHARDROP=TRUE | FALSE
- CURVELABELSPLITCHAR="*"

Note: The horizontal line to the left of the label represents the maximum end of the series line for reference.

When CURVELABELSPLITCHARDROP=TRUE, the asterisks are removed from the label. When CURVELABELSPLITCHARDROP=FALSE, each asterisk remains as the last character in the line prior to the new line.

Default TRUE. The split characters are dropped from the series-line label.

Requirement The CURVELABEL= option and the CURVELABELSPLIT=TRUE option must also be specified.

Interaction The CURVELABELSPLITCHAR= option specifies the split characters.

See "boolean " on page xii for other Boolean values that you can use.

CURVELABELSPLITJUSTIFY=AUTO | CENTER | LEFT | RIGHT
specifies the justification of the strings that are inside the series-line label block.

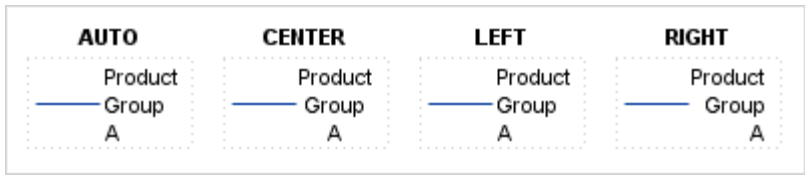
AUTO
justifies the labels based on the CURVELABELPOSITION= option.

CURVELABELPOSITION= Value	Justification
MAX or END	LEFT
MIN or START	RIGHT

CENTER
LEFT
RIGHT
justifies the labels center, left, or right, as specified.

The following figure shows an example in which CURVELABELPOSITION=MAX.

Note: The horizontal line to the left of each label represents the maximum end of the series line for reference.



In this case, because CURVELABELPOSITION=MAX, AUTO left-justifies the lines of text.

Default AUTO

Requirement The CURVELABEL= option and the CURVELABELSPLIT=TRUE option must also be specified.

Interaction This option has no effect if CURVELABELPOSITION=AUTO.

DATALABEL=*column* | *expression*
specifies a column that supplies values for the data point labels.

Default No data labels are displayed

Note The label positions are adjusted to prevent the labels from overlapping.

DATALABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font attributes of the data labels.

Defaults For non-grouped data, the GraphDataText style element.

For grouped data, the GraphData1:ContrastColor–GraphDataN:ContrastColor style references.

Interactions For this option to take effect, the DATALABEL= option must also be specified.

This option's COLOR= setting overrides the colors indicated by the GROUP= option.

Note When the DATALABELPOSITION=AUTO option is in effect, in some cases, the data label font size might be reduced in order to avoid overlapping labels and markers.

Tip When the GROUP= option is used, each distinct group value might be represented by a different color. The data label that is associated with the group is assigned the group color. This option can be used to specify a single color for all data labels in a plot, without affecting items that have the group color, such as error bars and marker symbols.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Text Options" on page 1606 for available *text-options*.

DATALABELPOSITION=AUTO | TOPRIGHT | TOP | TOPLEFT | LEFT | CENTER | RIGHT | BOTTOMLEFT | BOTTOM | BOTTOMRIGHT
specifies the location of the data labels relative to the vertices of the series line and the markers, when displayed.

AUTO
uses a data-label collision avoidance algorithm to position the labels.

Note When AUTO is in effect, in some cases, the data label font size might be reduced in order to avoid overlapping labels and markers.

See "LABELPLACEMENT=AUTO | GREEDY | SA" on page 36

TOPRIGHT
TOP
TOPLEFT
LEFT
CENTER
RIGHT
BOTTOMLEFT
BOTTOM
BOTTOMRIGHT
specifies a location for all of the data labels.

Default AUTO

DATALABELSPLIT=TRUE | FALSE
specifies whether to split the data labels at the specified split characters.

Default FALSE. The data labels are not split.

Requirement The DATALABEL= option must also be specified.

Interactions The DATALABELSPLITCHAR= option specifies one or more characters on which splits can occur.

This option has no effect when DATALABELPOSITION=AUTO.

See "boolean " on page xii for other Boolean values that you can use.

DATALABELSPLITCHAR="*character-list*"
specifies one or more characters on which the data labels can be split if needed. When multiple split characters are specified, each character in the list is treated as a separate split character unless the specified characters appear consecutively in the data label. In that case, all of the specified split characters together are treated as a single split character.

When DATALABEL= is specified and DATALABELSPLIT=TRUE, the data label is split unconditionally at each occurrence of any of the specified split characters. If the data label does not contain any of the specified characters, then the label is not split.

"character-list"
one or more characters with no space between each character and enclosed in quotation marks.

Default A blank space

Requirements The list of characters must be enclosed in quotation marks.

Multiple characters must be specified with no space between them. For example, to specify the split characters a, b, and c, use the following option:

```
datalabelsplitchar="abc"
```

The DATALABEL= option and the DATALABELSPLIT=TRUE option must also be specified.

Interactions This option has no effect if DATALABELPOSITION=AUTO.

The DATALABELSPLITCHARDROP= option specifies whether the split characters are included in the data label or are dropped.

Notes When multiple characters are specified, the order of the characters in the list is not significant.

The split characters are case sensitive.

Tip Use the DATALABELSPLITJUSTIFY= option to specify the justification of the strings in the data label block.

DATALABELSPLITCHARDROP=TRUE | FALSE

specifies whether the split characters are included in the data labels.

TRUE

drops the split characters from the data label.

FALSE

includes the split characters in the data label.

When DATALABELSPLIT=TRUE and DATALABELSPLITCHARDROP=FALSE, each split character remains as the last character in the current line. The characters that follow the split character, up to and including the next split character, are then wrapped to the next line.

The following figure shows an example of a data label with the following specifications:

- the data label text for this label is Product*Group*A
- DATALABELSPLIT=TRUE
- DATALABELSPLITCHARDROP=TRUE | FALSE
- DATALABELSPLITCHAR="*"

When DATALABELSPLITCHARDROP=TRUE, the asterisks are removed from the label. When DATALABELSPLITCHARDROP=FALSE, each asterisk remains as the last character in the line prior to the new line.

Default TRUE. The split characters are dropped from the data label.

Requirement The DATALABEL= option and the DATALABELSPLIT=TRUE option must also be specified.

Interaction The DATALABELSPLITCHAR= option specifies the split characters.

See "boolean " on page xii for other Boolean values that you can use.

DATALABELSPLITJUSTIFY=AUTO | CENTER | LEFT | RIGHT
specifies the justification of the strings that are inside the data label blocks.

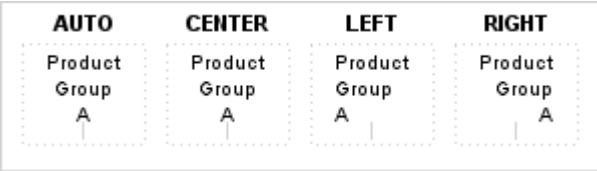
AUTO
justifies the labels based on the DATALABELPOSITION= option.

DATALABELPOSITION= Value	Justification
TOPLEFT, LEFT, or BOTTOMLEFT	RIGHT
TOPRIGHT, RIGHT, or BOTTOMRIGHT	LEFT
TOP, CENTER, or BOTTOM	CENTER

CENTER
LEFT
RIGHT
justifies the labels center, left, or right, as specified.

The following figure shows an example in which DATALABELPOSITION=TOP.

Note: The gray vertical line at the bottom of each label represents the horizontal center of the text box for reference.



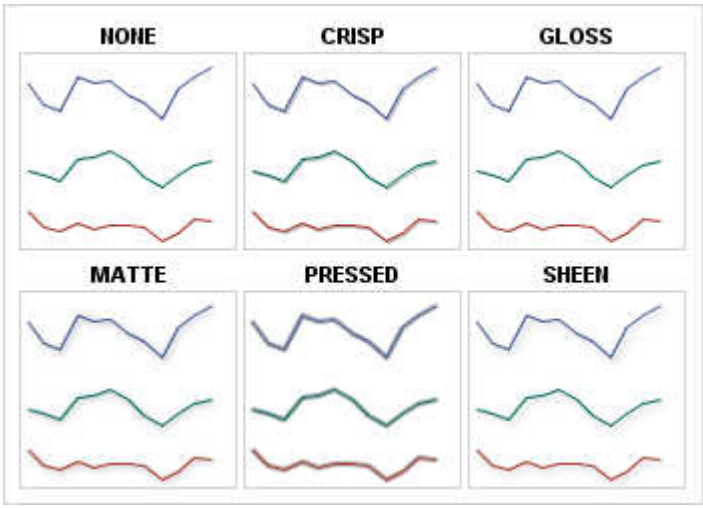
In this case, because DATALABELPOSITION=TOP, AUTO centers the lines of text. The text box is anchored the same way that the unsplit text is anchored. For example, if DATALABELPOSITION=TOP, then the bottom center of the text box is positioned at the top of the marker.

Default AUTO

Requirement The DATALABEL= option and the DATALABELSPLIT=TRUE option must also be specified.

Interaction This option has no effect if DATALABELPOSITION=AUTO.

DATASKIN=NONE | CRISP | GLOSS | MATTE | PRESSED | SHEEN
enhances the visual appearance of the series lines. The following figure shows a grouped series plot with each of the skins applied.



Default The DATASKIN= option value that is specified in the BEGINGRAPH statement. If that value is not specified, then the GraphSkins:DataSkin style element value is used.

Restriction Starting with SAS 9.4M1, the maximum number of skinned graphical elements is limited to 200 per plot in an OVERLAY or PROTOTYPE layout. When this limit is exceeded for a plot, the specified data skin is not applied to that plot. In that case, use the DATASKINMAX= option in your ODS GRAPHICS statement to increase the maximum limit.

Interactions This option overrides the BEGINGRAPH statement DATASKIN= option.

The data skin appearance is based on the LINEATTRS= color.

DATATRANSPARENCY=*number*
specifies the degree of the transparency of the line, markers, line label, and data labels, when displayed.

Default 0

Range 0–1, where 0 is opaque and 1 is entirely transparent

Restriction The specified transparency is not applied to missing values. Missing values are always opaque.

DISCRETEOFFSET=*number*
specifies an amount to offset all series lines and markers from discrete X values, or discrete Y values, or both. This option is useful when graphing multiple response variables side by side on a common axis

Default 0 (no offset, all series lines and markers are centered on the discrete X values, or discrete Y values, or both)

Range -0.5 to +0.5, where 0.5 represents half the distance between discrete ticks. A positive offset is to the right on discrete X values and up on discrete Y values. If the layout's axis options set REVERSE=TRUE, then the offset direction is also reversed.

Restriction This option applies to discrete axes only. For nondiscrete axes, this option is ignored.

Tip Setting the discrete offset for the plots does not affect the axis minimum and maximum offsets. In some cases, setting a discrete offset can cause clipping at each end of the axis. In those cases, use the OFFSETMIN= and OFFSETMAX= axis options to increase the axis minimum and maximum offsets to accommodate the discrete offset.

DISPLAY=(*display-options*) | STANDARD | ALL
specifies which series-line features to display.

(display-options)
a space-separated list of one or more options enclosed in parentheses.

Currently, only the MARKERS option is supported, which displays a series line with markers.

STANDARD
displays a series line without markers.

ALL
displays a series line with markers.

Default STANDARD

Tip Use the MARKERATTRS= and LINEATTRS= options to control the appearance of the line and markers.

ERRORBARCAPSCALE=*positive-number*
specifies a positive number to use as a multiplier for determining the default width of the error-bar caps.

Note: This feature applies to SAS 9.4M5 and to later releases.

Default 1

Interaction This option is ignored when ERRORBARCAPSHAPE=NONE is in effect.

Tips Use the ERRORBARCAPSHAPE= option to specify the cap shape.

The thickness (height) of the SERIF, LINE, and BRACKET is determined by the thickness specified in the ERRORBARATTRS= option. The cap line pattern is always solid.

Examples Double the size of the error-bar caps:

```
errorbarcapscale=2
```

Reduce the size of the error-bar caps by 50%:
`errorbarcapscale=0.5`

ERRORBARATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the attributes of the error bars that are associated with the data points.

Note: This feature applies to SAS 9.4M5 and to later releases.

Defaults For ungrouped data, the GraphError style element ContrastColor, LineStyle, and LineThickness attributes.

For grouped data, a GraphData1–GraphDataN style element ContrastColor attribute, and the GraphDataDefault style elemement LineStyle and LineThickness attributes.

Interaction For this option to take effect, error bars must be displayed by the XERRORLOWER= , XERRORUPPER= , YERRORLOWER= , or YERRORUPPER= options.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

ERRORBARCAPSHAPE=SERIF | NONE
specifies whether the error bars have a serif cap.

Note: This feature applies to SAS 9.4M5 and to later releases.

Default The GraphError:CapStyle style reference. If attribute CapStyle is not defined in the active style, then SERIF is the default value.

Interaction Starting with SAS 9.4M5, when ERRORBARCAPSCALE= is in effect, the display width for SERIF caps is the cap's default width multiplied by the value specified in ERRORBARCAPSCALE=.

Tip The appearance of the error bars is controlled by the ERRORBARATTRS= option.

FILLEDOUTLINEDMARKERS=TRUE | FALSE
specifies whether markers are drawn with both fill and an outline.

TRUE
draws filled markers (marker symbols with the suffix FILLED) using both fill and an outline.

When this option is TRUE, the fill color and outline color for filled markers are determined in the following ways:

- If the GROUP= option is specified, then by default, the fill color is derived from the GraphData1–GraphDataN style elements Color attribute, and the marker outlined color is derived from the GraphData1–GraphDataN style elements ContrastColor attribute.
- If the GROUP= option is not specified, then the marker fill is drawn by using the MARKERFILLATTRS= specification, and the outline is drawn by using the MARKEROUTLINEATTRS= specification.

FALSE
draws the markers using fill or an outline, but not both.

Default FALSE

Tip To specify the marker fill and outline colors for a non-grouped plot, set this option to TRUE, and then use the MARKERFILLATTRS= and MARKEROUTLINEATTRS= options to specify the colors.

See GROUP= on page 900

MARKERFILLATTRS= on page 911

MARKEROUTLINEATTRS= on page 911

"boolean " on page xii for other Boolean values that you can use.

GROUP=*column* | *discrete-attr-var* | *expression*
creates a separate series plot for each unique group value in the specified column.

discrete-attr-var
specifies a discrete attribute map variable.

The discrete attribute map variable is created by a DISCRETEATTRVAR statement.

Restriction A discrete attribute map variable specification must be a direct reference to the attribute map variable. It cannot be set by a dynamic variable.

Default Each distinct group value might be represented in the plot by a different combination of color, line pattern, and marker symbol. Lines and markers vary according to the ContrastColor, LineStyle, and MarkerSymbol attributes of the GraphData1–GraphDataN and GraphMissing style elements. Line thickness (for grouped and ungrouped data) is controlled by the LINEATTRS= option.

Restriction Starting with SAS 9.4M5, the number of vertices for a patterned line cannot exceed the maximum specified by the ODS GRAPHICS statement option LINEPATTERNOBSMAX=. The default is 10,000. If the limit is exceeded, the plot is not drawn and a note is written to the SAS log stating that the limit has been exceeded. In that

case, increase LINEPATTERNOBSMAX= to the value suggested in the note or change the line pattern to SOLID.

Interactions

The group values are mapped in the order of the data, unless the INDEX= option is used to alter the default sequence of marker symbols, colors, and line patterns.

The marker size is set by the MARKERATTRS= option.

The INCLUDEMISSINGGROUP= option controls whether missing group values are considered a distinct group value.

When both the GROUP= and the COLORRESPONSE= options are specified, the color attributes are controlled by the COLORRESPONSE= option.

Note

If you specify a column in a SAS data set, the visual attributes for each group value are assigned in data order. If you specify a column in a CAS in-memory table, the visual attributes for each group value are assigned in ascending order of the group column character values or of unformatted numeric values.

Tips

The representations that are used to identify the groups can be overridden. For example, each distinct group value is often represented by a different line pattern, but you can use the LINEATTRS=(PATTERN=*pattern*) option to assign the same line pattern to all of the plot's line patterns, letting line color indicate group values. Likewise, you could use LINEATTRS=(COLOR= color) to assign the same color to all lines, letting line pattern indicate group values.

Starting with SAS 9.4M2, you can use the LINECOLORGROUP=, LINEPATTERNGROUP=, MARKERCOLORGROUP=, and MARKERSYMBOL= options to assign line colors, line patterns, marker colors, and marker symbols based on a different group column.

By default, ODS Graphics limits the number of groups to 1000. When this limit is exceeded, the GROUP= option is ignored. Use the GROUPMAX= option in the ODS GRAPHICS statement to change the maximum number of groups that can be processed.

See

"DISCRETEATTRVAR Statement" on page 1516

GROUPDISPLAY=OVERLAY | CLUSTER

specifies how marker groups are positioned for the coordinate pairs.

OVERLAY

draws markers for a given group value at the exact coordinate.

Depending on the data, markers at a given coordinate might overlap.

CLUSTER

draws markers for a given group value adjacent to each other.

Tip Use the CLUSTERWIDTH= option to control the width of the clusters when CLUSTER is in effect.

Default OVERLAY

Interaction For this option to take effect, the GROUP= option must also be specified.

Note When you plot a SAS data set, the items for each group value are drawn in data order. When you plot a CAS in-memory table, they are drawn in ascending order of the group column character values or unformatted numeric values.

GROUPORDER=DATA | REVERSEDATA | ASCENDING | DESCENDING
specifies the ordering of the groups within a category.

DATA
orders the groups within a category in the group-column data order.

REVERSEDATA
orders the groups within a category in the reverse group-column data order.

Note: This feature applies to SAS 9.4M2 and to later releases.

Tip This option is useful when you want to reverse the category axis.

ASCENDING
orders the groups within a category in ascending order.

DESCENDING
orders the groups within a category in descending order.

Defaults DATA if the data is a SAS data set.

ASCENDING if the data is a CAS in-memory table. Sorting is based on nonformatted values for numeric group values or on formatted values for character group values.

Interactions This option is ignored if the GROUP= option is not also specified.

By default, the groups in the legend are shown in the order that is specified in GROUPORDER.

Notes When plotting a SAS data set, attributes such as color, symbol, and pattern are assigned to each group in DATA order by default. When plotting a CAS in-memory table, attributes are assigned in ascending order of the group column character values or unformatted numeric values by default.

The ASCENDING and DESCENDING settings linguistically sort the group values within each category (or X value) for display position purposes only. For numeric data, the order is based on the unformatted values. For character data, the order is based on the

formatted values. The data order of the observations and the visual attributes that are assigned to the group values remain unchanged.

In SAS 9.4M6 and earlier releases, when data stored in a CAS in-memory table is used and DATA or REVERSEDATA is specified, unpredictable results might occur. To generate consistent graphs in that case, specify ASCENDING or DESCENDING. Starting with SAS Viya 3.5 and SAS Studio 5.2, when data stored in a CAS in-memory table is used and DATA or REVERSEDATA is specified, it is ignored, and ASCENDING is used instead.

Tips Use the CLUSTERWIDTH= option to control the distance between the group markers in a cluster.

Use the INDEX= option to alter the default sequence of visual attributes that is assigned to the groups.

INCLUDEMISSINGGROUP=TRUE | FALSE

specifies whether missing values of the group variable are included in the plot.

Default TRUE

Interaction For this option to take effect, the GROUP= option must also be specified.

Tip The attributes of the missing group value are determined by the GraphMissing style element unless a discrete attribute map is in effect, the INDEX= option is used, the MISSING= system option changes the default missing character, or a user-defined format is applied to the group value. In those cases, the attributes of the missing group value are determined by a GraphData1–GraphDataN style element instead of by the GraphMissing style element.

See “boolean ” on page xii for other Boolean values that you can use.

INDEX=*positive-integer-column* | *expression*

specifies indices for mapping line attributes (color, marker symbol, and line pattern) to one of the GraphData1–GraphDataN style elements.

Requirements The column or expression value must be an integer value of 1 or greater. Otherwise, this option is ignored.

The positive-integer column must not contain missing values. Otherwise, the entire column is invalidated and this option is ignored.

All of the indexes for a specific group value must be the same. Otherwise, the results are unpredictable.

Interaction For this option to take effect, the GROUP= option must also be specified.

Notes The index values are 1-based indices. For the style attributes in GraphData1–GraphDataN, if the index value is greater than N,

then a modulo operation remaps that index value to a number less than N to determine which style to use.

If you do not use this option, then the group values are mapped in the order of the data.

Tip You can use indexing to collapse the number of groups that are represented in a graph. For more information, see "Remapping Groups for Grouped Data" on page 211.

LEGENDLABEL="*string*"
specifies a label to be used in a discrete legend for this plot.

Default The Y-column label. If a label is not defined, then the Y-column name is used.

Restriction This option applies only to an associated DISCRETELEGEND statement.

Interaction If the GROUP= option is specified, then this option is ignored.

LINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the attributes of the series line.

Defaults For non-grouped data, the GraphDataDefault style element.

For grouped data, the ContrastColor and LineStyle attributes of the GraphData1–GraphDataN style elements, and the GraphDataDefault:LineThickness style reference.

Restriction Starting with SAS 9.4M5, the number of vertices for a patterned line cannot exceed the maximum specified by the ODS GRAPHICS statement option LINEPATTERNOBSMAX=. The default is 10,000. If the limit is exceeded, the plot is not drawn and a note is written to the SAS log stating that the limit has been exceeded. In that case, increase LINEPATTERNOBSMAX= to the value suggested in the note or change the line pattern to SOLID.

Interactions This option's COLOR= suboption overrides the default behavior for grouped data when the LINECOLORGROUP= option and the COLORRESPONSE= option are not specified. When the COLOR= suboption is specified without the LINECOLORGROUP= and COLORRESPONSE= options, all lines have the same color.

The LINECOLORGROUP= option and the COLORRESPONSE= option override this option's COLOR= suboption.

This option's PATTERN= suboption overrides the default behavior for grouped data when the LINEPATTERNGROUP= option is not specified. When the PATTERN= suboption is specified without the LINEPATTERNGROUP= option, all lines have the same pattern.

The LINEPATTERNGROUP= option overrides this option's PATTERN= suboption.

Tip If you specify a thickness of 2 pixels or greater for the series line, use the LINEJOIN= option to shape the line vertices so that the line does not extend beyond the marker symbols.

See "General Syntax for Attribute Options" on page 1599 for the syntax for using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

LINECOLORGROUP=*column* | *discrete-attr-var* | *expression*
specifies a column that determines the line colors for a grouped plot independently of the GROUP= column.

Note: This feature applies to SAS 9.4M2 and to later releases.

discrete-attr-var
specifies a discrete attribute map variable.

The discrete attribute map variable is created by a DISCRETEATTRVAR statement.

Restriction A discrete attribute map variable specification must be a direct reference to the attribute map variable. It cannot be set by a dynamic variable.

Note A discrete attribute map variable is valid for this option starting with SAS 9.4M3.

When this option is specified with the GROUP= option, the series line colors are selected from the GraphData1–GraphDataN style elements based on the LINECOLORGROUP= column instead of on the GROUP= column.

Default The line colors are selected based on the GROUP= column.

Requirement The column value must be the same for all of the points that define a series line.

Interactions The GROUP= option must be specified for this option to have any effect.

This option overrides the COLOR= suboption of the LINEATTRS= option.

The COLORRESPONSE= option overrides this option.

Note If you specify a column in a SAS data set, colors are mapped to group values in data order. If you specify a column in a CAS in-memory table, colors are mapped to group values in ascending order of the group column character values or unformatted numeric values.

Tip Use the LINEATTRS= option to set the line thickness.

See GROUP= on page 900

LINEATTRS=

LINEJOIN= MITER | ROUND | BEVEL
specifies how to shape the vertices of the series line.

Note: This feature applies to SAS 9.4M4 and to later releases.

MITER
joins the line vertices without adjustment.

ROUND
rounds the apex of each line vertex, effectively smoothing the apex edges.

BEVEL
bevels the apex of each line vertex, effectively trimming the apex to remove any part of the line that extends beyond the apex point.

The following figure shows the effect each value of LINEJOIN= on the vertex of two segments of a 10-point line. The red dot depicts the data point at the vertex.

Default MITER

Tip Use this option when the series line thickness is 2 pixels or greater to prevent the line from extending beyond the marker symbols at points where large slope changes occur.

LINEPATTERNGROUP=*column* | *discrete-attr-var* | *expression*
specifies a column that determines the line patterns for a grouped plot independently of the GROUP= column.

Note: This feature applies to SAS 9.4M2 and to later releases.

discrete-attr-var
specifies a discrete attribute map variable.

The discrete attribute map variable is created by a DISCRETEATTRVAR statement.

Restriction A discrete attribute map variable specification must be a direct reference to the attribute map variable. It cannot be set by a dynamic variable.

Note A discrete attribute map variable is valid for this option starting with SAS 9.4M3.

When this option is specified with the GROUP= option, the series line patterns are selected from the GraphData1–GraphDataN style elements based on the LINECOLORGROUP= column instead of on the GROUP= column.

Default The line patterns are selected based on the GROUP= column.

Requirement The column value must be the same for all of the points that define a series line.

Interactions The GROUP= option must be specified for this option to have any effect.

This option overrides the PATTERN= suboption of the LINEATTRS= option.

Note If you specify a column in a SAS data set, the group-value line patterns are assigned in data order. If you specify a column in a CAS in-memory table, group-value line patterns are assigned in ascending order of the group column character values or unformatted numeric values.

Tip Use the LINEATTRS= option to set the line thickness.

See GROUP= on page 900

LINEATTRS=

LINETHICKNESSMAX=*dimension*

specifies the maximum line thickness when a response variable is used to determine the line thickness. By default, this option determines the thickness of the line that represents the maximum response column value.

Note: This feature applies to SAS 9.4M3 and to later releases.

Default Ten times the thickness that is specified by the GraphDataDefault style element LineThickness attribute.

Interactions The LINETHICKNESSRESPONSE= option must be specified for this option to have any effect.

The LINETHICKNESSMAXRESPONSE= option specifies the response value at which this maximum line thickness is reached. The line thickness for response values that exceed the LINETHICKNESSMAXRESPONSE= value are set to the value that is specified by this option.

If the line thickness that is calculated from the LINETHICKNESSMIN=, LINETHICKNESSMAX=, and LINETHICKNESSMAXRESPONSE= option values is less than 0.5 for a line, that line is not drawn.

Tip Use the LINETHICKNESSMIN= option to specify the minimum line thickness.

See "dimension" on page xiii

"Example 3: Series Plot with Line-Thickness Response and Arrowheads" on page 922 for an example of how to use this option.

LINETHICKNESSMAXRESPONSE=*numeric* | *scalar-numeric-expression*
specifies the response value that corresponds to the maximum line thickness.

Note: This feature applies to SAS 9.4M3 and to later releases.

Default The maximum value in the response column that is specified in the LINETHICKNESSRESPONSE= option.

Interactions The LINETHICKNESSRESPONSE= option must be specified for this option to have any effect.

The thickness for all lines that exceed the maximum response value is set to the value specified in the LINETHICKNESSMAX= option.

If the line thickness that is calculated from the LINETHICKNESSMIN=, LINETHICKNESSMAX=, and LINETHICKNESSMAXRESPONSE= option values is less than 0.5 for a line, that line is not drawn.

LINETHICKNESSMIN=*dimension*
specifies the minimum line thickness when a response variable is used to determine the line thickness.

Note: This feature applies to SAS 9.4M3 and to later releases.

Default The thickness specified by the GraphDataDefault style element LineThickness attribute.

Interactions The LINETHICKNESSRESPONSE= option must be specified for this option to have any effect.

If the line thickness that is calculated from the LINETHICKNESSMIN=, LINETHICKNESSMAX=, and LINETHICKNESSMAXRESPONSE= option values is less than 0.5 for a line, that line is not drawn.

Tip Use the LINETHICKNESSMAX= option to specify the maximum line thickness.

See "dimension" on page xiii

"Example 3: Series Plot with Line-Thickness Response and Arrowheads" on page 922 for an example of how to use this option.

LINETHICKNESSRESPONSE=*numeric-column* | *expression*
specifies a response column or range attribute variable that is used to map a line thickness to each group value.

Note: This feature applies to SAS 9.4M3 and to later releases.

Default The GraphDataDefault style element LineThickness attribute.

Interactions When the column values are all zero, all negative, or all missing, this option is ignored. In these cases, the default line thickness is used for all of the lines.

This option overrides suboption THICKNESS= in the LINEATTRS= option.

Notes The line thicknesses are not reflected in a discrete legend.

The LINETHICKNESSRESPONSE= values are assumed to be constant for each group value in a grouped plot and for the entire plot in an ungrouped plot. If the LINETHICKNESSRESPONSE column has multiple values for a single GROUP value or ungrouped plot, unpredictable results might occur.

See "Example 3: Series Plot with Line-Thickness Response and Arrowheads" on page 922 for an example of how to use this option.

MARKERATTRS=*style-element* | *style-element* (*marker-options*) | (*marker-options*)
specifies the attributes of the data markers.

Defaults For non-grouped data, GraphDataDefault style element.

For grouped data, the MarkerSymbol and ContrastColor attributes of the GraphData1–GraphDataN style elements, and the GraphDataDefault:MarkerSize style reference.

Interactions If FILLEDOUTLINEDMARKERS=TRUE, then this option's COLOR= suboption is ignored. In that case, to specify the marker fill color, use the MARKERFILLATTRS= option instead.

This option's COLOR= suboption overrides the default behavior for grouped data when the MARKERCOLORGROUP= option is not specified. When the COLOR= suboption is specified without the MARKERCOLORGROUP option, all markers have the same color, and the marker symbol alone distinguishes the markers.

The MARKERCOLORGROUP= option and theCOLORRESPONSE= option override this option's COLOR= suboption.

This option's SYMBOL= suboption overrides the default behavior for grouped data when the MARKERSYMBOLGROUP= option is not specified. When the SYMBOL= suboption is specified without the

MARKERSYMBOLGROUP= option, all markers have the same symbol, and the symbol color alone distinguishes the markers.

The MARKERSYMBOLGROUP= option overrides this option's SYMBOL= suboption.

The TRANSPARENCY= fill option overrides this option's DATATRANSPARENCY= suboption.

This option is ignored if the DISPLAY= option disables the display of the markers.

If the DATASKIN= option is in effect, then the data skin determines the marker outlines. Any outline-related settings from the current ODS style or from the marker attribute options are ignored.

Note When *style-element* is specified, only the style element's MARKERSYMBOL, CONTRASTCOLOR, and MARKERSIZE attributes are used.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Marker Options" on page 1604 for available *marker-options*.

MARKERCOLORGROUP=*column* | *discrete-attr-var* | *expression*
specifies a column that determines the marker colors for a grouped plot independently of the GROUP= column.

Note: This feature applies to SAS 9.4M2 and to later releases.

discrete-attr-var
specifies a discrete attribute map variable.

The discrete attribute map variable is created by a DISCRETEATTRVAR statement.

Restriction A discrete attribute map variable specification must be a direct reference to the attribute map variable. It cannot be set by a dynamic variable.

Note A discrete attribute map variable is valid for this option starting with SAS 9.4M3.

When this option is specified with the GROUP= option, the series line markers are selected from the GraphData1–GraphDataN style elements based on the MARKERCOLORGROUP= column instead of on the GROUP= column.

Default The line marker colors are selected based on the GROUP= column.

Requirement The column value must be the same for all of the points that define a series line.

Interactions The DISPLAY= option must enable the display of the series line markers for this option to have any effect.

The GROUP= option must be specified for this option to have any effect.

This option overrides the COLOR= suboption of the MARKERATTRS= option.

The COLORRESPONSE= option overrides this option.

Note If you specify a column in a SAS data set, the group-value marker colors are assigned in data order. If you specify a column in a CAS in-memory table, group-value marker colors are assigned in ascending order of the group column character values or unformatted numeric values.

Tip Use the MARKERATTRS= option to set the marker symbol size.

See GROUP= on page 900

MARKERATTRS= on page 909

MARKERFILLATTRS=*style-element* | (*fill-options*)
specifies the appearance of the filled markers.

Defaults For non-grouped data, the Color attribute of the GraphDataDefault style element

For grouped data, the Color attribute of a GraphData1–GraphDataN style element

Restriction The TRANSPARENCY= fill option is ignored. Use the MARKERATTRS= option to set the marker transparency.

Interaction This option is in effect only when FILLEDOUTLINEDMARKERS=TRUE and the DISPLAY= option enables fill display.

Note When *style-element* is specified, only the style element's Color attribute is used.

See "General Syntax for Attribute Options" on page 1599

"Fill Color Options" on page 1600

MARKEROUTLINEATTRS=*style-element* | (*line-options*)
specifies the appearance of the marker outlines.

Defaults For non-grouped data, the GraphOutlines style element.

For grouped data, the LineThickness attritube of the GraphOutlines style element and the ContrastColor attribute of a GraphData1–GraphDataN style element.

Restriction The line style of the marker outline is always solid.

Interaction This option is ignored when a data skin is applied by the current style or by the DATASKIN= option. In the latter case, the outline is set by the data skin.

Note When *style-element* is specified, only the style element's CONTRASTCOLOR and LINETHICKNESS attributes are used.

See "General Syntax for Attribute Options" on page 1599

"Line Options" on page 1602

MARKERSYMBOLGROUP=*column* | *discrete-attr-var* | *expression*
specifies a column that determines the marker symbols for a grouped plot independently of the GROUP= column.

Note: This feature applies to SAS 9.4M2 and to later releases.

discrete-attr-var
specifies a discrete attribute map variable.

The discrete attribute map variable is created by a DISCRETEATTRVAR statement.

Restriction A discrete attribute map variable specification must be a direct reference to the attribute map variable. It cannot be set by a dynamic variable.

Note A discrete attribute map variable is valid for this option starting with SAS 9.4M3.

When this option is specified with the GROUP= option, the series line marker symbols are selected from the GraphData1–GraphDataN style elements based on the MARKERSYMBOLGROUP= column instead of on the GROUP= column.

Default The line marker symbols are selected based on the GROUP= column.

Requirement The column value must be the same for all of the points that define a series line.

Interactions The GROUP= option must be specified for this option to have any effect.

This option overrides the SYMBOL= suboption of the MARKERATTRS= option.

The DISPLAY= option must enable the display of the series line markers for this option to have any effect.

Note If you specify a column in a SAS data set, the visual attributes for each group value are assigned in data order. If you specify a column in a CAS in-memory table, the visual attributes for each

group value are assigned in ascending order of the group column character values or unformatted numeric values.

Tip Use the MARKERATTRS= option to set the marker symbol size.

See GROUP= on page 900

MARKERATTRS= on page 909

NAME="*string*"

assigns a name to this plot statement for reference in other template statements. The specified name is used primarily in legend statements to coordinate the use of colors and line patterns between the plot and the legend.

Restrictions The *string* is case sensitive, cannot contain spaces, and must define a unique name within the template.

This option does not support variables that are created by the DYNAMIC, MVAR, and NMVAR template statements.

Interaction The *string* is used as the default legend label if the LEGENDLABEL= option is not used.

PRIMARY=TRUE | FALSE

specifies that the data columns for this plot and the plot type be used for determining default axis features. This option is needed only when two or more plots within an overlay-type layout contribute to a common axis.

Default FALSE

Restriction This option is ignored if the plot is placed under a GRIDDED or LATTICE layout block.

Note In an OVERLAY layout, only one plot in an overlay can be the primary plot on a per-axis basis. When no plot is designated as the primary plot, the first plot that can be a primary plot is considered the primary plot. If multiple plots specify PRIMARY=TRUE for the same axis, then the last such plot encountered is considered the primary plot.

See "When Plots Share Data and a Common Axis" on page 1046

"boolean " on page xii for other Boolean values that you can use.

ROLENAME=(*role-name-list*)

specifies user-defined roles that can be used to display information in the data tips. This option provides a way to add to the data columns that appear in data tips that are specified by the TIP= option.

(*role-name-list*)

a space-separated list of *role-name = column* pairs.

Example The following example assigns the column Obs to the user-defined role TIP:

```
ROLENAME=(TIP1=OBS)
```

Default No user-defined roles

Requirement The role names that you choose must be unique and different from the predefined roles X, Y, CURVELABEL, DATALABEL, GROUP, and INDEX.

SMOOTHCONNECT=TRUE | FALSE
specifies that a smoothed line passes through all vertices.

Default FALSE

Interaction Starting with SAS 9.4M3, this option is ignored when SPLINETYPE=QUADRATICBEZIER is in effect.

See "boolean " on page xii for other Boolean values that you can use.

SPLINEPOINTS=*positive-integer*
specifies a multiplier to apply to the time interval that is in effect for the INTERVAL= axis option.

Note: This feature applies to SAS 9.4M3 and to later releases.

Default 20

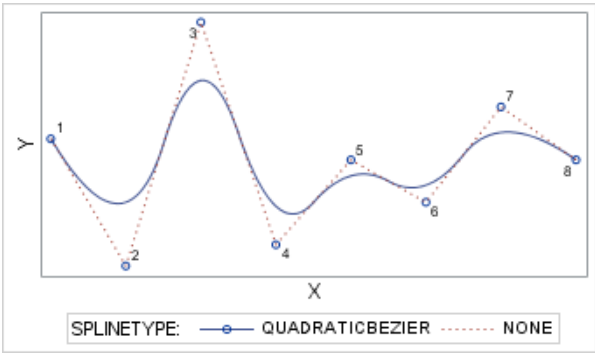
Interaction When this option is set to a non-default value, markers and data labels, when displayed, are positioned at their original data points.

SPLINETYPE=NONE | QUADRATICBEZIER
specifies the type of spline interpolation that is used to draw the series line.

Note: This feature applies to SAS 9.4M3 and to later releases.

The following figure shows an example of SPLINETYPE= values QUADRATICBEZIER and NONE.

Figure 6.2 *Spline Types QUADRATICBEZIER and NONE*



Default NONE

Interaction The SMOOTHCONNECT= option is ignored when this option is set to a value other than NONE.

Note Markers and data labels, when displayed, are positioned at their original data points as shown in Figure 6.5 on page 914.

TIP=(*role-list*) | NONE
specifies the information to display when the cursor is positioned over the series line. If this option is used, then the information specified replaces all the information that is displayed by default. You can specify roles for columns that do not contribute to the series plot along with roles that do.

(*role-list*)
an ordered, space-separated list of unique SERIESPLOT roles and user-defined roles.

SERIESPLOT roles include X, Y, CURVELABEL, DATALABEL, GROUP, and COLORRESPONSE.

Define user-defined roles with the ROLENAME= option.

Notes CURVELABEL is considered a role only when it is assigned a column of values. It is not considered a role and does not display data tips when it is assigned a string.

Starting with SAS 9.4M3, the COLORRESPONSE role is valid.

Example The following example displays data tips for the columns assigned to the roles X and Y as well as the column Obs, which is not assigned to any pre-defined SERIESPLOT role. The Obs column must first be assigned a role.

```
ROLENAME=(TIP1=OBS)
TIP=(TIP1 X Y)
```

NONE
suppresses data tips and URLs (if requested) from the plot.

Default The columns assigned to these roles are automatically included in the data tip information: X, Y, DATALABEL, COLORRESPONSE, and GROUP.

Requirement To generate data tips in the output, you must include an ODS GRAPHICS ON statement that specifies the IMAGEMAP option, and you must write the output to the ODS HTML destination.

Interaction This option is ignored when the plot statement is in an OVERLAY or PROTOTYPE layout and the INCLUDERANGES= option is specified in the LINEAROPTS= or TIMEOPTS= option for either axis.

Tip You can control the labels and formats for the TIP roles with the TIPLABEL= and TIPFORMAT= options.

TIPFORMAT=(*role-format-list*)
specifies display formats for tip columns. This option provides a way to control the formats of columns that appear in data tips.

(role-format-list)
a space-separated list of *role-name* = *format* pairs.

Example
```
ROLENAME=(TIP1=SALARY)
TIP=(TIP1)
TIPFORMAT=(TIP1=DOLLAR12.)
```

Default The column format of the column assigned to the role or BEST6 if no format is assigned to a numeric column.

Restriction Only the roles that appear in the TIP= option are used.

Requirement A column must be assigned to each of the specified roles. (See the ROLENAME= option.)

TIPLABEL=(*role-label-list*)
specifies display labels for tip columns. This option provides a way to control the labels of columns that appear in data tips.

role-label-list
a space-separated list of *rolename* ="*string*" pairs.

Example
```
ROLENAME=(TIP1=PCT)
TIP=(TIP1)
TIPLABEL=(TIP1="Percent")
```

Default The column label or column name of the column assigned to the role.

Restriction Only the roles that appear in the TIP= option are used.

Requirement A column must be assigned to each of the specified roles. (See the ROLENAME= option.)

URL=*string-column*
specifies an HTML page to display when a point or a segment of the curve is selected.

string-column
specifies a column that contains a valid HTML page reference (HREF) for each series line segment that is to have an active link.

Example **`http://www.sas.com`**

Requirement To generate selectable points or segments of the curve, you must include an ODS GRAPHICS ON statement that specifies the IMAGEMAP option, and you must write the output to the ODS HTML destination.

Interactions This option has no effect when TIP=NONE.

This option is ignored when the plot statement is in an OVERLAY or PROTOTYPE layout and the INCLUDERANGES= option is specified in the LINEAROPTS= or TIMEOPTS= option for either axis.

Note When you select a portion of a segment that is not an endpoint, the nearest segment endpoint is used.

Tips The URL value can be blank for some X and Y pairs, meaning that no action is taken when the corresponding segment is selected.

The URL value can be the same for any X and Y pair, meaning that the same action is taken when the segment for those X and Y pairs is selected.

By default, drill-down links open in a new browser window (link target _blank). To specify a different target for your drill-down links, such as _self or _parent, add the DRILLTARGET="*target*" option to your ODS GRAPHICS statement. See DRILLTARGET= on page 1568.

XAXIS=X | X2
specifies whether data are mapped to the primary X (bottom) axis or to the secondary X2 (top) axis.

Default X

Interaction The overall plot specification and the layout type determine the axis display. For more information, see "How Axis Features Are Determined" on page 1040.

XERRORLOWER=*numeric-column* | *expression*
specifies values for the lower endpoints on the X error bars. The error bars are drawn from the markers to the endpoints.

Note: This option is valid in SAS 9.4M5 and later releases.

Default The lower segment of the error bars is not drawn.

Note The values are actual values, not relative values.

Tips The appearance of the error bars is controlled by the ERRORBARATTRS= option.

If markers are displayed in the plot, then the markers overlay the error bars. Large filled markers can obscure short error bars. To enable the error bars to show through the markers in that case, you can use the MARKERATTRS= option to specify a degree of transparency for the filled markers.

XERRORUPPER=*numeric-column* | *expression*
specifies values for the upper endpoints on the X error bars. The error bars are drawn from the markers to the endpoints.

Note: This option is valid in SAS 9.4M5 and later releases.

Default The upper segment of the error bars is not drawn.

Note The values are actual values, not relative values.

Tips The appearance of the error bars is controlled by the ERRORBARATTRS= option.

If markers are displayed in the plot, then the markers overlay the error bars. Large filled markers can obscure short error bars. To enable the error bars to show through the markers in that case, you can use the MARKERATTRS= option to specify a degree of transparency for the filled markers.

YAXIS=Y | Y2
specifies whether data are mapped to the primary Y (left) axis or to the secondary Y2 (right) axis.

Default Y

Interaction The overall plot specification and the layout type determine the axis display. For more information, see "How Axis Features Are Determined" on page 1040.

YERRORLOWER=*numeric-column* | *expression*
specifies values for the lower endpoints on the Y error bars. The error bars are drawn from the markers to the endpoints.

Note: This option is valid in SAS 9.4M5 and later releases.

Default The lower segment of the error bars is not drawn.

Note The values are actual values, not relative values.

Tips The appearance of the error bars is controlled by the ERRORBARATTRS= option.

If markers are displayed in the plot, then the markers overlay the error bars. Large filled markers can obscure short error bars. To enable the error bars to show through the markers in that case, you can use the MARKERATTRS= option to specify a degree of transparency for the filled markers.

YERRORUPPER=*numeric-column* | *expression*
specifies values for the upper endpoints on the Y error bars. The error bars are drawn from the markers to the endpoints.

Note: This option is valid in SAS 9.4M5 and later releases.

Default The upper segment of the error bars is not drawn.

Note The values are actual values, not relative values.

Tips

The appearance of the error bars is controlled by the ERRORBARATTRS= option.

If markers are displayed in the plot, then the markers overlay the error bars. Large filled markers can obscure short error bars. To enable the error bars to show through the markers in that case, you can use the MARKERATTRS= option to specify a degree of transparency for the filled markers.

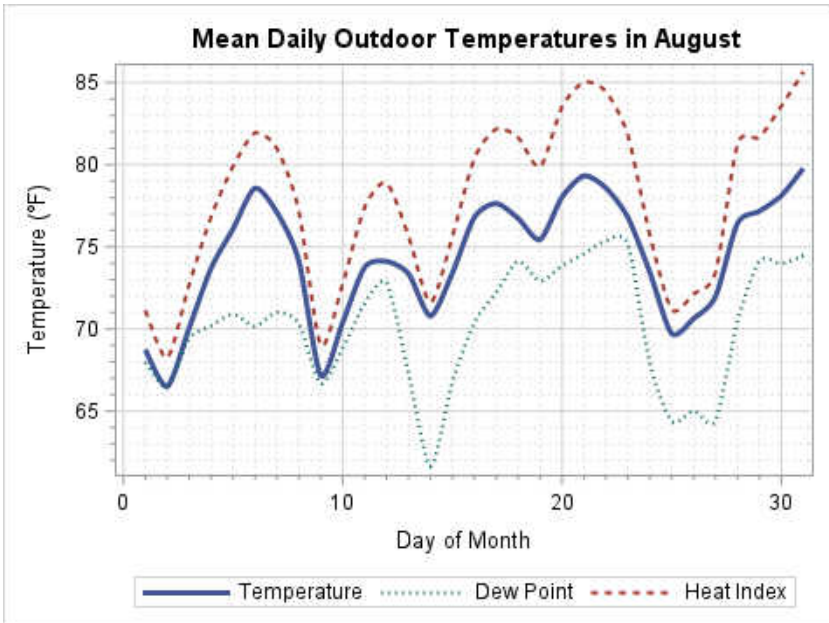
Details

The SERIESPLOT statement is typically used to show time-dependent data.

Examples

Example 1: Overlay Series Plot

The following graph was generated by the "Example Program" on page 919:



Example Program

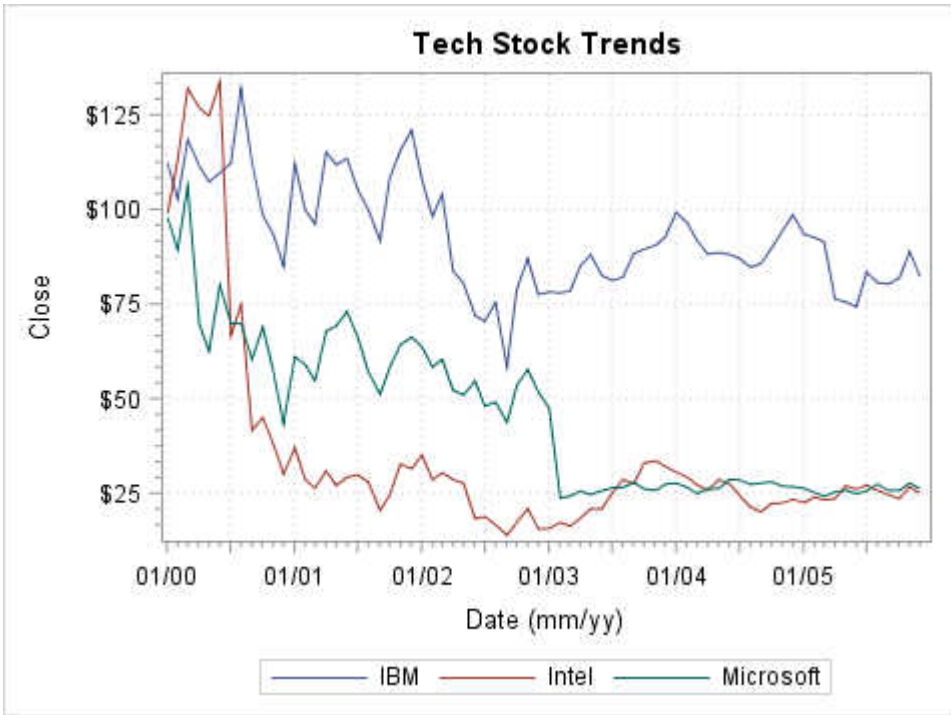
```
/* Mean temperature data for August in 2014. */
data augusttemps;
   input day temp dewpoint heat_index;
   label day="Day of Month" Temp="Temperature"
      Dewpoint="Dew Point" Heat_Index="Heat Index";
```

```
datalines;
1   68.74  67.96  71.14
2   66.49  66.49  68.23
3   70.05  69.41  72.70
4   73.70  70.19  76.82
5   76.09  70.89  79.89
6   78.57  70.16  81.93
7   77.10  71.02  80.98
8   74.14  70.33  77.20
9   67.16  66.66  69.01
10  70.39  68.82  72.75
11  73.75  71.53  77.40
12  74.11  72.81  78.89
13  73.36  67.32  75.66
14  70.79  61.63  71.61
15  73.40  66.76  75.61
16  76.79  70.37  80.37
17  77.64  72.23  82.17
18  76.73  74.12  81.65
19  75.44  72.92  79.85
20  78.03  73.85  83.52
21  79.32  74.57  85.02
22  78.58  75.37  84.45
23  76.80  75.15  81.79
24  73.46  67.93  75.74
25  69.71  64.37  71.18
26  70.63  65.01  72.13
27  71.98  64.41  73.45
28  76.43  70.46  81.25
29  77.17  74.14  81.68
30  78.12  73.98  83.58
31  79.77  74.46  85.64
;
run;

proc template;
   define statgraph seriesoverlay;
      begingraph;
         entrytitle "Mean Daily Outdoor Temperatures in August";
         layout overlay / cycleattrs=true
            xaxisopts=(type=linear
               griddisplay=on gridattrs=(color=lightgray pattern=solid)
               linearopts=(minorticks=true minortickcount=9
                  minorgrid=true minorgridattrs=(color=lightgray
pattern=dot)))
            yaxisopts=(type=linear
               label="Temperature ((*ESC*){unicode '00B0'x}F)"
               griddisplay=on gridattrs=(color=lightgray pattern=solid)
               linearopts=(minorticks=true minortickcount=4
                  minorgrid=true minorgridattrs=(color=lightgray
pattern=dot)));
            seriesplot x = day y = temp / name="temp"
               smoothconnect=true lineattrs=(thickness=3px);
            seriesplot x = day y = heat_index / name = "heat_index"
                smoothconnect=true
                lineattrs=(thickness=2px pattern=shortdash);
```

```
            seriesplot x = day y = dewpoint / name = "dewpoint"
                smoothconnect=true
                lineattrs=(thickness=2px pattern=dot);
            discretelegend "temp" "dewpoint" "heat_index";
          endlayout;
        endgraph;
    end;
run;

proc sgrender data=augusttemps template=seriesoverlay;
run;
```

Example 2: Grouped Series Plot

The following graph was generated by the "Example Program" on page 921:



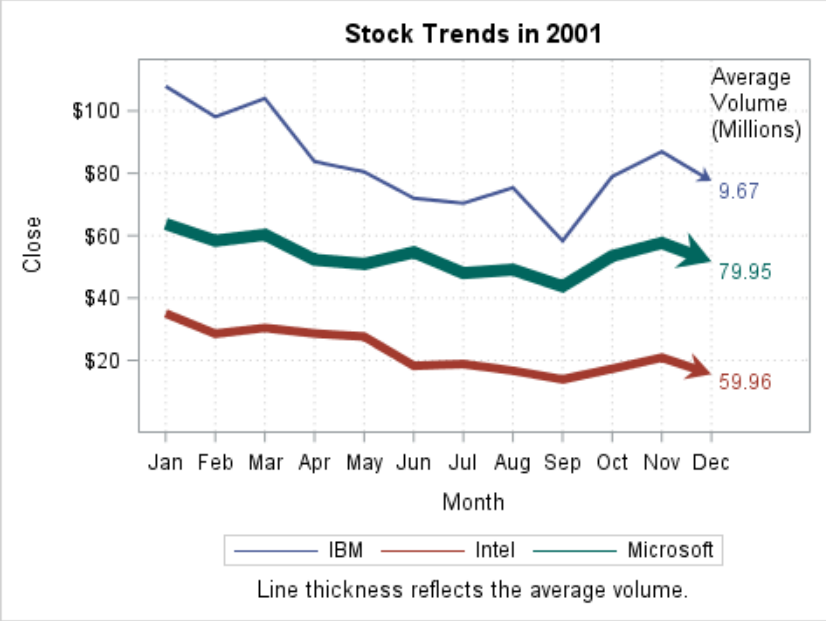
Example Program

```
proc template;
  define statgraph seriesplot;
    begingraph;
      entrytitle "Tech Stock Trends";
      layout overlay /
        xaxisopts=(label="Date (mm/yy)"
           griddisplay=on gridattrs=(color=lightgray pattern=dot)
           timeopts=(tickvalueformat=mmyys5. minorticks=true
              minortickinterval=month))
        yaxisopts=(griddisplay=on gridattrs=(color=lightgray
pattern=dot)
```

```
            linearopts=(minorticks=true minortickcount=5));
          seriesplot x=date y=close / group=stock name="stocks";
          discretelegend "stocks";
        endlayout;
      endgraph;
    end;
run;

proc sgrender data=sashelp.stocks template=seriesplot;
  where date > "31dec1999"d;
run;
```

Example 3: Series Plot with Line-Thickness Response and Arrowheads

Starting with SAS 9.4M3, you can specify a response variable to control the thickness of the lines in your grouped series plot. You can also add arrowheads to one or both ends of your grouped or ungrouped series lines. This example creates a grouped series plot that shows the monthly closing price for IBM, Intel, and Microsoft stock in 2001. The mean volume is computed for each stock and is used to control the thickness of the series line for each stock. The minimum line thickness is set to 2px, and the maximum line width is set to 7px. A barbed arrowhead, scaled to 1.25, is positioned at the end of each series line. In order to position the arrowheads properly, the data must be sorted in ascending order by date. The following figure shows the output.



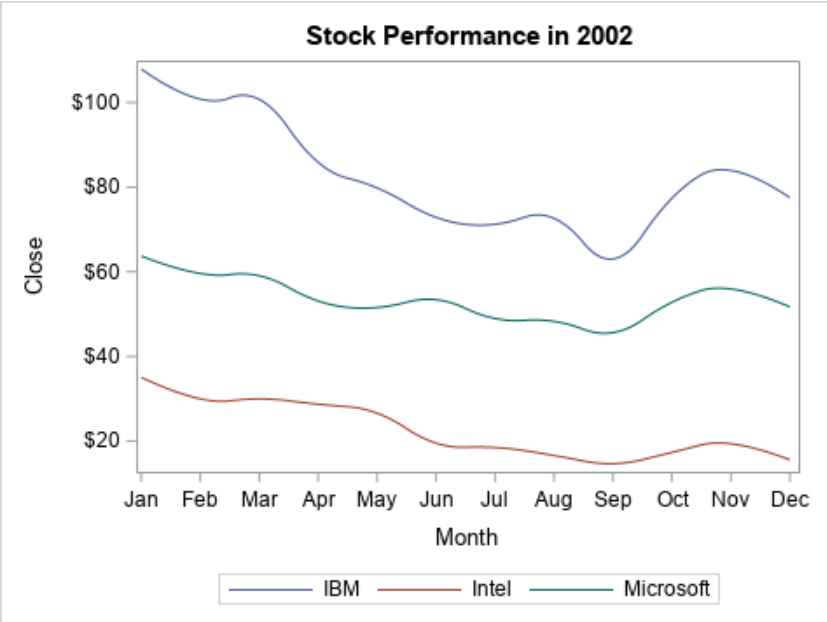
Example Program

```
/* Extract the 2001 data from Sashelp.Stocks
   and convert Volume to millions. */
data stocks;
```

```
  set sashelp.stocks(where=
    (date between "1jan02"d and "31dec02"d));
  volume = volume / 1000000;
  format date MONNAME3. volume 6.2;
;

/* Compute the average volume for each stock */
proc means data=stocks noprint;
  by stock notsorted;
  var volume;
  output out=meanvolume(keep=stock meanvolume) mean=meanvolume;
run;

/* Merge the average volume data with the stock data */
data stocks;
  merge stocks meanvolume;
  by stock;
run;

/* Sort the data by Date */
proc sort data=stocks;
  by date;
run;

/* Define the graph template */
proc template;
 define statgraph seriesplot;
   begingraph / drawspace=wallpercent;
   entrytitle "Stock Trends in 2001";
   entryfootnote "Line thickness reflects the average volume.";
   layout overlay /
     xaxisopts=(griddisplay=on
       gridattrs=(color=lightgray pattern=dot)
       type=discrete label="Month")
     yaxisopts=(griddisplay=on
       gridattrs=(color=lightgray pattern=dot));
     seriesplot x=date y=close / group=stock name="stocks"
       arrowheadposition=end arrowheadshape=barbed
       arrowheadscale=1.25
       linethicknessresponse=meanvolume
       linethicknessmin=2px linethicknessmax=7px
       curvelabel=meanvolume;
     drawtext "Average Volume (Millions)" / x=94 y=90
       width=80 widthunit=pixel;
     discretelegend "stocks";
   endlayout;
  endgraph;
 end;

/* Render the graph */
proc sgrender data=stocks template=seriesplot;
run;
```

Example 4: Series Plot with Quadratic Bézier Spline Curves

This example shows you how to create a series plot with quadratic Bézier spline curves. The SERIESPLOT statement is used to generate a grouped plot of stock closing prices in the year 2002. The SPLINETYPE=QUADRATICBEZIER option is used in the SERIESPLOT statement to specify quadratic Bézier spline curves. Here is the output for this example.



Example Program

```
proc template;
 define statgraph seriesplot;
    begingraph;
   entrytitle "Stock Performance in 2002";
   layout overlay /
     xaxisopts=(type=discrete label="Month"
        discreteopts=(tickvaluefitpolicy=thin));
     seriesplot x=date y=close / name="series" group=stock
        splinetype=quadraticbezier;
     discretelegend "series" / across=3 displayclipped=true;
   endlayout;
  endgraph;
 end;

proc sgrender data=sashelp.stocks template=seriesplot;
  where date between "1jan02"d and "31dec02"d;
  format date MONNAME3.;
run;
```

STEPPLOT Statement

Displays a series of horizontal and vertical line segments that connect observations of input data.

Note: The STEPPLOT statement plots data in data order. For this reason, the input data set should be sorted by the X variable. Otherwise, unexpected results might occur. If the data is not sorted, you can specify CONNECTORDER=XAXIS in the STEPPLOT statement. See CONNECTORDER= on page 931.

Syntax

STEPPLOT X=*column* | *expression*
Y=*numeric-column* | *expression* </*options*>;

Summary of Optional Arguments

Appearance options

ARROWHEADPOSITION= NONE | START | END | BOTH | *column*
: specifies a position for arrowheads.

ARROWHEADSCALE=*positive-number* | *numeric-column* | *expression*
: specifies an arrowhead scale factor based on the thickness of the arrow line.

ARROWHEADSHAPE= OPEN | FILLED | BARBED | *column*
: specifies a shape for arrowheads.

BREAK=TRUE | FALSE
: determines whether the plot line should show breaks at occurrences of missing values of the Y column.

CLUSTERWIDTH=*number*
: on a discrete axis, specifies the width of the group clusters as a fraction of the midpoint spacing. On an interval axis, specifies the width of the group clusters as a fraction of the minimum interval between adjacent data values.

DATASKIN=NONE | CRISP | GLOSS | MATTE | PRESSED | SHEEN
: enhances the visual appearance of the step plot lines.

DATATRANSPARENCY=*number*
: specifies the degree of the transparency of the step lines, markers, error bars, step-line labels, and data labels, when displayed.

DISPLAY=(*display-options*) | STANDARD | ALL
: specifies which step-line features to display.

ERRORBARATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
: specifies the attributes of the error bars that are associated with the data points.

ERRORBARCAPSCALE=*positive-number*
: specifies a positive number to use as a multiplier for determining the default width of the error-bar caps.

ERRORBARCAPSHAPE=SERIF | NONE
: specifies whether the error bars have a serif cap.

ERRORLOWER=*numeric-column* | *expression*
: specifies the values of the lower endpoints on the Y error bars.

ERRORUPPER=*numeric-column* | *expression*
: specifies the values of the upper endpoints on the Y error bars.

FILLEDOUTLINEDMARKERS=TRUE | FALSE
: specifies whether markers are drawn with both fill and an outline.

INDEX=*positive-integer-column* | *expression*
: specifies indices for mapping line attributes (color, marker symbol, and line pattern) to one of the GraphData1–GraphDataN style elements.

JUSTIFY=(LEFT | CENTER | RIGHT)
: specifies the location of the data point relative to the step.

LINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
: specifies the attributes of the step line connecting the data points.

LINETHICKNESSMAX=*dimension*
: specifies the maximum line thickness when a response variable is used to determine the line thickness.

LINETHICKNESSMAXRESPONSE=*numeric* | *scalar-numeric-expression*
: specifies the response value that corresponds to the maximum line thickness.

LINETHICKNESSMIN=*dimension*
: specifies the minimum line thickness when a response variable is used to determine the line thickness.

LINETHICKNESSRESPONSE=*numeric-column* | *expression*
: specifies a response column or range attribute variable that is used to map a line thickness to each group value.

MARKERATTRS=*style-element* | *style-element* (*marker-options*) | (*marker-options*)
: specifies the attributes of the data markers.

MARKERFILLATTRS=*style-element* | (*fill-options*)
: specifies the appearance of the filled markers.

MARKEROUTLINEATTRS=*style-element* | (*line-options*)
: specifies the appearance of the marker outlines.

Axes options

CLUSTERAXIS=AUTO | X | Y
: specifies the axis to use for clustering groups when GROUPDISPLAY=CLUSTER.

PRIMARY=TRUE | FALSE
: specifies that the data columns for this plot and the plot type be used for determining default axis features.

XAXIS=X | X2
: specifies whether data are mapped to the primary X (bottom) axis or to the secondary X2 (top) axis.

YAXIS=Y | Y2
specifies whether data are mapped to the primary Y (left) axis or to the secondary Y2 (right) axis.

Connect options

CONNECTORDER=XVALUES | XAXIS
specifies how to connect the data points to form the step line.

JOIN=TRUE | FALSE
specifies whether the steps are connected.

Data tip options

ROLENAME=(*role-name-list*)
specifies user-defined roles that can be used to display information in the data tips.

TIP=(*role-list*) | NONE
specifies the information to display when the cursor is positioned over the step line.

TIPFORMAT=(*role-format-list*)
specifies display formats for tip columns.

TIPLABEL=(*role-label-list*)
specifies display labels for tip columns.

Label options

CURVELABEL=*"string"* | *column* | *expression*
specifies a label for the step line.

CURVELABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font attributes of the step-line labels.

CURVELABELLOCATION=INSIDE | OUTSIDE
specifies the location of the step-line label relative to the plot area.

CURVELABELPOSITION=AUTO | MAX | MIN | START | END
specifies the position of the step-line labels relative to the step line.

CURVELABELSPLIT=TRUE | FALSE
specifies whether to split the step-line label at the specified split characters.

CURVELABELSPLITCHAR="*character-list*"
specifies one or more characters on which the step-line label can be split if needed.

CURVELABELSPLITCHARDROP=TRUE | FALSE
specifies whether the split characters are included in the step-line label text.

CURVELABELSPLITJUSTIFY=AUTO | CENTER | LEFT | RIGHT
specifies the justification of the strings that are inside the step-line label block.

DATALABEL=*column* | *expression*
specifies a column that supplies values for the data point labels.

DATALABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font attributes of the data labels.

DATALABELPOSITION=AUTO | TOPRIGHT | TOP | TOPLEFT | LEFT | CENTER | RIGHT | BOTTOMLEFT | BOTTOM | BOTTOMRIGHT
: specifies the location of the data labels relative to the data points and markers, when displayed.

DATALABELSPLIT=TRUE | FALSE
: specifies whether to split the data labels at the specified split characters.

DATALABELSPLITCHAR="*character-list*"
: specifies one or more characters on which the data labels can be split if needed.

DATALABELSPLITCHARDROP=TRUE | FALSE
: specifies whether the split characters are included in the data labels.

DATALABELSPLITJUSTIFY=AUTO | CENTER | LEFT | RIGHT
: specifies the justification of the strings that are inside the data label blocks.

LEGENDLABEL="*string*"
: specifies a label to be used in a discrete legend for this plot.

Midpoint options

DISCRETEOFFSET=*number*
: specifies an amount to offset all step lines and markers from discrete X values when graphing multiple response variables side by side on a common axis.

GROUP=*column* | *discrete-attr-var* | *expression*
: creates a distinct set of lines, markers, and data labels for each unique group value of the specified column.

GROUPDISPLAY=OVERLAY | CLUSTER
: specifies whether grouped step lines and markers are overlaid or clustered around the category midpoints.

GROUPORDER=DATA | REVERSEDATA | ASCENDING | DESCENDING
: specifies the ordering of the groups within a category.

INCLUDEMISSINGGROUP=TRUE | FALSE
: specifies whether missing values of the group variable are included in the plot.

ODS options

URL=*string-column*
: specifies an HTML page to display when a step line segment is selected.

Plot reference options

NAME="*string*"
: assigns a name to this plot statement for reference in other template statements.

Required Arguments

X=*column* | *expression*
specifies the column of the X values.

Y=*numeric-column* | *expression*
specifies the numeric column of the Y values.

Optional Arguments

ARROWHEADPOSITION= NONE | START | END | BOTH | *column*
specifies a position for arrowheads.

Note: This feature applies to SAS 9.4M3 and to later releases.

NONE
no arrowheads are displayed.

START
an arrowhead is displayed at the starting point of each line.

END
an arrowhead is displayed at the ending point of each line.

BOTH
an arrowhead is displayed at each end of each line.

column
specifies a column that provides an arrowhead position for each group value.

Default NONE

Restriction When you specify a column and the GROUP= option is in effect, the arrowhead position values are assumed to be constant for each group value. If the column has multiple values for a single group value, then only one of the arrowhead position values is used for that group.

See "Example 3: Series Plot with Line-Thickness Response and Arrowheads" on page 922 for an example of how to use this option.

ARROWHEADSCALE=*positive-number* | *numeric-column* | *expression*
specifies an arrowhead scale factor based on the thickness of the arrow line.

Note: This feature applies to SAS 9.4M3 and to later releases.

Default 1.0

Restriction The arrowhead scale values are assumed to be constant for each line. If a column or expression provides multiple values for a line, only one of the values is used.

Interaction This option is ignored when ARROWHEADPOSITION=NONE is in effect.

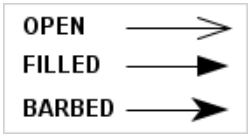
Tip Use a factor greater than 1.0 to make a larger arrowhead.

See "Example 3: Series Plot with Line-Thickness Response and Arrowheads" on page 922 for an example of how to use this option.

ARROWHEADSHAPE= OPEN | FILLED | BARBED | *column*
specifies a shape for arrowheads.

Note: This feature applies to SAS 9.4M3 and to later releases.

The following figure shows each of the arrowhead shapes.



Default OPEN

Restriction When you specify a column and the GROUP= option is in effect, the arrowhead shape values are assumed to be constant for each group value. If the column has multiple values for a single group value, only one of the arrowhead shape values is used for that group.

Interaction This option is ignored when ARROWHEADPOSITION=NONE is in effect.

See "Example 3: Series Plot with Line-Thickness Response and Arrowheads" on page 922 for an example of how to use this option.

BREAK=TRUE | FALSE
determines whether the plot line should show breaks at occurrences of missing values of the Y column.

Default FALSE

Note When this option is set to FALSE, missing values are skipped and the line continues through the missing value and to the next point.

See "boolean " on page xii for other Boolean values that you can use.

CLUSTERAXIS=AUTO | X | Y
specifies the axis to use for clustering groups when GROUPDISPLAY=CLUSTER.

AUTO
uses the discrete axis for clustering groups when only one axis is discrete. Uses the X axis for clustering if both axes are discrete or interval.

X
Y
uses the X or Y axis for clustering groups.

Default AUTO

Interaction The GROUPDISPLAY= option must be set to CLUSTER for this option to have any effect.

CLUSTERWIDTH=*number*
on a discrete axis, specifies the width of the group clusters as a fraction of the midpoint spacing. On an interval axis, specifies the width of the group clusters as a fraction of the minimum interval between adjacent data values.

Default 0.85

Range 0–1, where 0 is the minimum width, which is one pixel wide, and 1 is the maximum possible width

Interactions For this option to take effect, the GROUP= option must also be specified, and the GROUPDISPLAY= option must be set to CLUSTER.

When markers are displayed for interval data and GROUPDISPLAY=CLUSTER and CLUSTERWIDTH= are in effect, the size of the markers in each cluster might be reduced to no less than 5 pixels in order to display the cluster within the smallest effective midpoint space. If you need larger markers in that case, use the MARKERATTRS= option to specify a larger marker size.

CONNECTORDER=XVALUES | XAXIS
specifies how to connect the data points to form the step line.

XVALUES
connects data points in the data order of the X column.

Note In SAS 9.4M6 and earlier releases, unexpected results might occur when XVALUES is specified and data stored in a CAS in-memory table is used. In that case, use XAXIS instead. Starting with SAS Viya 3.5 and SAS Studio 5.2, XVALUES is ignored when data stored in a CAS in-memory table is used.

XAXIS
connects data points sorted by their X values.

Tip When the input data for the step lines is not sorted by the X column, you can use XAXIS to assure the expected connect order.

Defaults XVALUES if the data is a SAS data set

XAXIS if the data is a CAS in-memory table

CURVELABEL=*"string"* | *column* | *expression*
specifies a label for the step line.

Restrictions When the GROUP= option is specified, *"string"* and *expression* are not valid. Use *column* in that case.

When the GROUP= option is not specified, *column* is not valid. Use *"string"* or *expression* in that case.

The line label for missing values is ignored.

Tip The font and color attributes for the label are specified by the CURVELABELATTRS= option.

See GROUP= on page 944

CURVELABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font attributes of the step-line labels. When the GROUP= option is used, each distinct group value might be represented by a different color. The series label that is associated with the group is assigned the group color. This option can be used to specify a single color for all series labels in a plot, without affecting items that have the group color, such as lines and marker symbols.

Defaults For non-grouped data, the GraphValueText style element.

For grouped data, text color is derived from the GraphData1:ContrastColor–GraphDataN:ContrastColor style references. The font is derived from the GraphValueText style element.

Interactions For this option to take effect, the CURVELABEL= option must also be used.

This option's COLOR= setting overrides the colors indicated by the GROUP= option.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Text Options" on page 1606 for available *text-options*.

CURVELABELLOCATION=INSIDE | OUTSIDE
specifies the location of the step-line label relative to the plot area.

INSIDE
locates the labels inside the plot area

OUTSIDE
locates the labels outside the plot area

Default INSIDE

Restriction OUTSIDE cannot be used when the STEPPLOT is used in multicell layouts such as LATTICE, DATAPANEL, or DATALATTICE, where axes are external to the grid.

Interactions For this option to take effect, the CURVELABEL= option must also be specified.

This option is used in conjunction with the CURVELABELPOSITION= option to determine where the step-line labels appear. For more information, see "Location and Position of Curve Labels" on page 213.

CURVELABELPOSITION=AUTO | MAX | MIN | START | END
specifies the position of the step-line labels relative to the step line.

AUTO
automatically positions the step-line label near the step boundary along unused axes whenever possible (typically Y2 and X2) in order to avoid collision with tick values.

Restriction This option is used only when CURVELABELPOSITION=OUTSIDE.

MAX
forces the step-line label to appear near maximum step values (typically, upper right)

MIN
forces the step-line label to appear near minimum step values (typically, lower left)

START
forces the step-line label to appear near the beginning of the steps.

Restriction This option is used only when CURVELABELLOCATION=INSIDE.

Tip This option is particularly useful when the step line spirals around.

END
forces the step-line label to appear near the end of the steps.

Restriction This option is used only when CURVELABELLOCATION=INSIDE.

Tip This option is particularly useful when the step line spirals around.

Defaults AUTO when CUVELABELLOCATION=OUTSIDE.

END when CURVELABELLOCATION=INSIDE.

Restriction The AUTO setting is ignored if CURVELABELLOCATION= INSIDE is specified. The START and END settings are ignored if CURVELABELLOCATION=OUTSIDE is specified.

Interactions For this option to take effect, the CURVELABEL= option must also be specified.

This option is used in conjunction with the CURVELABELLOCATION= option to determine where the step-line label appears. For more information, see “Location and Position of Curve Labels” on page 213.

Note When you specify TICKVALUELIST=, VIEWMAX=, or VIEWMIN= in an axis statement, the data points that are used to determine the position of the step-line label might fall outside of the graph area. In that case, the step-line label might not be displayed or might be positioned incorrectly.

Tip When END is in effect, no attempt is made to avoid curve label collisions. If your curve labels collide, try using MAX instead.

CURVELABELSPLIT=TRUE | FALSE
specifies whether to split the step-line label at the specified split characters. When a step-line label is split, the label is split on each occurrence of the specified split characters.

Default FALSE. The step-line label is not split.

Requirement The CURVELABEL= option must also be specified.

Interactions The CURVELABELSPLITCHAR= option specifies one or more characters on which the splits occur.

This option has no effect when CURVELABELPOSITION=AUTO.

See “boolean ” on page xii for other Boolean values that you can use.

CURVELABELSPLITCHAR="*character-list*"
specifies one or more characters on which the step-line label can be split if needed. When multiple split characters are specified, each character in the list is treated as a separate split character unless the specified characters appear consecutively in the step-line label. In that case, all of the specified split characters together are treated as a single split character.

When CURVELABEL= is specified and CURVELABELSPLIT=TRUE, the step-line label is split unconditionally at each occurrence of any of the specified split characters. If the step-line label does not contain any of the specified characters, then the label is not split.

"character-list"
one or more characters with no delimiter between each character and enclosed in quotation marks.

Default A blank space

Requirements The list of characters must be enclosed in quotation marks.

Multiple characters must be specified with no delimiters. For example, to specify the split characters a, b, and c, use the following option:

```
curvelabelsplitchar="abc"
```

The CURVELABEL= option and the CURVELABELSPLIT=TRUE option must also be specified.

Interactions This option has no effect if CURVELABELPOSITION=AUTO.

The CURVELABELSPLITCHARDROP= option specifies whether the split characters are included in the step-line label or are dropped.

Notes When multiple characters are specified, the order of the characters in the list is not significant.

The split characters are case sensitive.

Tip Use the CURVELABELSPLITJUSTIFY= option to specify the justification of the strings in the step-line label block.

CURVELABELSPLITCHARDROP=TRUE | FALSE
specifies whether the split characters are included in the step-line label text.

TRUE
drops the split characters from the step-line label text.

FALSE
includes the split characters in the step-line label text.

When CURVELABELSPLIT=TRUE and CURVELABELSPLITCHARDROP=FALSE, each split character remains as the last character in the current line. The characters that follow the split character, up to and including the next split character, are then wrapped to the next line.

The following figure shows an example of a step-line label with the following specifications:

- CURVELABELPOSITION=MAX
- CURVELABEL="Product*Group*A"
- CURVELABELSPLIT=TRUE
- CURVELABELSPLITCHARDROP=TRUE | FALSE
- CURVELABELSPLITCHAR="*"

Note: The horizontal line to the left of the label represents the maximum end of the step line for reference.

When CURVELABELSPLITCHARDROP=TRUE, the asterisks are removed from the label. When CURVELABELSPLITCHARDROP=FALSE, each asterisk remains as the last character in the line prior to the new line.

Default TRUE. The split characters are dropped from the step-line label.

Requirement The CURVELABEL= option and the CURVELABELSPLIT=TRUE option must also be specified.

Interaction The CURVELABELSPLITCHAR= option specifies the split characters.

See "boolean " on page xii for other Boolean values that you can use.

CURVELABELSPLITJUSTIFY=AUTO | CENTER | LEFT | RIGHT
specifies the justification of the strings that are inside the step-line label block.

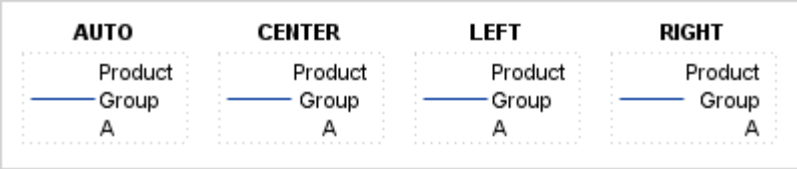
AUTO
justifies the labels based on the CURVELABELPOSITION= option.

CURVELABELPOSITION= Value	Justification
MAX or END	LEFT
MIN or START	RIGHT

CENTER
LEFT
RIGHT
justifies the labels center, left, or right, as specified.

The following figure shows an example in which CURVELABELPOSITION=MAX.

Note: The horizontal line to the left of each label represents the maximum end of the step line for reference.



In this case, because CURVELABELPOSITION=MAX, AUTO left-justifies the lines of text.

Default AUTO

Requirement The CURVELABEL= option and the CURVELABELSPLIT=TRUE option must also be specified.

Interaction This option has no effect if CURVELABELPOSITION=AUTO.

DATALABEL=*column* | *expression*
specifies a column that supplies values for the data point labels.

Note The label positions are adjusted to prevent the labels from overlapping.

DATALABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font attributes of the data labels. When the GROUP= option is used, each distinct group value might be represented by a different color. The data label that is associated with the group is assigned the group color. This option can be used to specify a single color for all data labels in a plot, without affecting items that have the group color, such as error bars and marker symbols.

Defaults For non-grouped data, the GraphDataText style element.

For grouped data, the GraphData1:ContrastColor–GraphDataN:ContrastColor style references.

Interactions For this option to take effect, the DATALABEL= option must also be specified.

This option's COLOR= setting overrides the colors indicated by the GROUP= option.

The LINEATTRS= on page 948 COLOR= suboption overrides the default data label color for grouped plots.

Notes When the DATALABELPOSITION=AUTO option is in effect, in some cases, the data label font size might be reduced in order to avoid overlapping labels and markers.

If an attribute map is used with a grouped plot and the attribute map specifies line color, the line color specified in the attribute map overrides the default data label color.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Text Options" on page 1606 for available *text-options*.

DATALABELPOSITION=AUTO | TOPRIGHT | TOP | TOPLEFT | LEFT | CENTER | RIGHT | BOTTOMLEFT | BOTTOM | BOTTOMRIGHT
specifies the location of the data labels relative to the data points and markers, when displayed.

AUTO
uses a data-label collision avoidance algorithm to position the labels.

Note When AUTO is in effect, in some cases, the data label font size might be reduced in order to avoid overlapping labels and markers.

See "LABELPLACEMENT=AUTO | GREEDY | SA" on page 36

TOPRIGHT
TOP
TOPLEFT
LEFT
CENTER
RIGHT
BOTTOMLEFT
BOTTOM
BOTTOMRIGHT
specifies a location for all of the data labels.

Default AUTO

DATALABELSPLIT=TRUE | FALSE
specifies whether to split the data labels at the specified split characters.

Default FALSE. The data labels are not split.

Requirement The DATALABEL= option must also be specified.

Interactions The DATALABELSPLITCHAR= option specifies one or more characters on which splits can occur.

This option has no effect when DATALABELPOSITION=AUTO.

See “boolean ” on page xii for other Boolean values that you can use.

DATALABELSPLITCHAR="*character-list*"
specifies one or more characters on which the data labels can be split if needed. When multiple split characters are specified, each character in the list is treated as a separate split character unless the specified characters appear consecutively in the data label. In that case, all of the specified split characters together are treated as a single split character.

When DATALABEL= is specified and DATALABELSPLIT=TRUE, the data label is split unconditionally at each occurrence of any of the specified split characters. If the data label does not contain any of the specified characters, then the label is not split.

"character-list"
one or more characters with no space between each character and enclosed in quotation marks.

Default A blank space

Requirements The list of characters must be enclosed in quotation marks.

Multiple characters must be specified with no space between them. For example, to specify the split characters a, b, and c, use the following option:

```
datalabelsplitchar="abc"
```

The DATALABEL= option and the DATALABELSPLIT=TRUE option must also be specified.

Interactions This option has no effect if DATALABELPOSITION=AUTO.

The DATALABELSPLITCHARDROP= option specifies whether the split characters are included in the data label or are dropped.

Notes When multiple characters are specified, the order of the characters in the list is not significant.

The split characters are case sensitive.

Tip Use the DATALABELSPLITJUSTIFY= option to specify the justification of the strings in the data label block.

DATALABELSPLITCHARDROP=TRUE | FALSE
specifies whether the split characters are included in the data labels.

TRUE
drops the split characters from the data label.

FALSE
includes the split characters in the data label.

When DATALABELSPLIT=TRUE and DATALABELSPLITCHARDROP=FALSE, each split character remains as the last character in the current line. The characters that follow the split character, up to and including the next split character, are then wrapped to the next line.

The following figure shows an example of a data label with the following specifications:

- the data label text for this label is Product*Group*A
- DATALABELSPLIT=TRUE
- DATALABELSPLITCHARDROP=TRUE | FALSE
- DATALABELSPLITCHAR="*"

When DATALABELSPLITCHARDROP=TRUE, the asterisks are removed from the label. When DATALABELSPLITCHARDROP=FALSE, each asterisk remains as the last character in the line prior to the new line.

Default TRUE. The split characters are dropped from the data label.

Requirement The DATALABEL= option and the DATALABELSPLIT=TRUE option must also be specified.

Interaction The DATALABELSPLITCHAR= option specifies the split characters.

See "boolean " on page xii for other Boolean values that you can use.

DATALABELSPLITJUSTIFY=AUTO | CENTER | LEFT | RIGHT
specifies the justification of the strings that are inside the data label blocks.

AUTO
justifies the labels based on the DATALABELPOSITION= option.

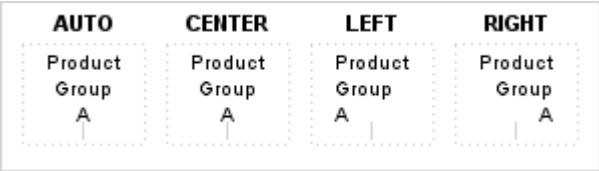
DATALABELPOSITION= Value	Justification
TOPLEFT, LEFT, or BOTTOMLEFT	RIGHT
TOPRIGHT, RIGHT, or BOTTOMRIGHT	LEFT

DATALABELPOSITION= Value	Justification
TOP, CENTER, or BOTTOM	CENTER

CENTER
LEFT
RIGHT
justifies the labels center, left, or right, as specified.

The following figure shows an example in which DATALABELPOSITION=TOP.

Note: The gray vertical line at the bottom of each label represents the horizontal center of the text box for reference.



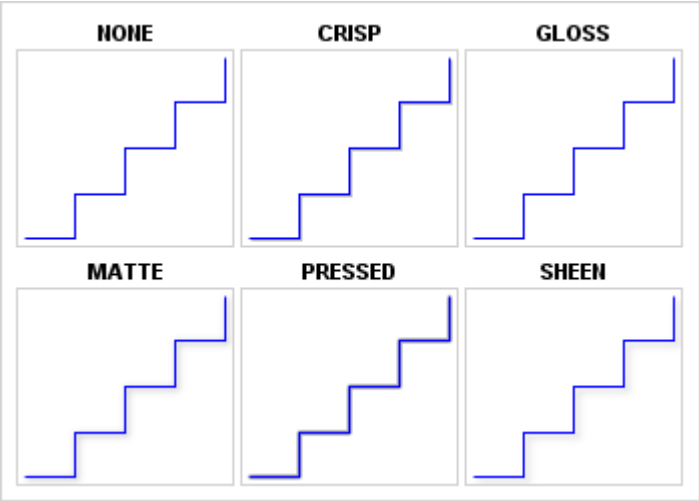
In this case, because DATALABELPOSITION=TOP, AUTO centers the lines of text. The text box is anchored the same way that the unsplit text is anchored. For example, if DATALABELPOSITION=TOP, the bottom center of the text box is positioned at the top of the marker.

Default AUTO

Requirement The DATALABEL= option and the DATALABELSPLIT=TRUE option must also be specified.

Interaction This option has no effect if DATALABELPOSITION=AUTO.

DATASKIN=NONE | CRISP | GLOSS | MATTE | PRESSED | SHEEN
enhances the visual appearance of the step plot lines. The following figure shows a step plot with each of the skins applied.



Default The DATASKIN= option value that is specified in the BEGINGRAPH statement. If that value is not specified, then the GraphSkins:DataSkin style element value is used.

Restriction Starting with SAS 9.4M1, the maximum number of skinned graphical elements is limited to 200 per plot in an OVERLAY or PROTOTYPE layout. When this limit is exceeded for a plot, the specified data skin is not applied to that plot. In that case, use the DATASKINMAX= option in your ODS GRAPHICS statement to increase the maximum limit.

Interaction This option overrides the BEGINGRAPH statement DATASKIN= option.

DATATRANSPARENCY=*number*
specifies the degree of the transparency of the step lines, markers, error bars, step-line labels, and data labels, when displayed.

Default 0

Range 0–1, where 0 is opaque and 1 is entirely transparent

DISCRETEOFFSET=*number*
specifies an amount to offset all step lines and markers from discrete X values when graphing multiple response variables side by side on a common axis.

Default 0 (no offset, all step lines and markers are centered on the discrete X values)

Range -0.5 to +0.5, where 0.5 represents half the distance between discrete ticks. A positive offset is to the right. If the layout's axis options set REVERSE=TRUE, then the offset direction is also reversed.

Restriction This option applies to discrete axes only. For nondiscrete axes, this option is ignored.

Tip Setting the discrete offset for the plots does not affect the axis minimum and maximum offsets. In some cases, setting a discrete offset can cause clipping at each end of the axis. In those cases, use the OFFSETMIN= and OFFSETMAX= axis options to increase the axis minimum and maximum offsets to accommodate the discrete offset.

DISPLAY=(*display-options*) | STANDARD | ALL
specifies which step-line features to display.

(*display-options*)
a space-separated list of one or more options enclosed in parentheses.

Currently, only the MARKERS option is supported, which displays a step line with markers.

STANDARD
displays a step line without markers.

ALL
displays a step line with markers.

Default STANDARD

Tip Use the MARKERATTRS= and LINEATTRS= options to control the appearance of the line and markers.

ERRORBARATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the attributes of the error bars that are associated with the data points.

Defaults For ungrouped data, the GraphError style element ContrastColor, LineStyle, and LineThickness attributes.

For grouped data, a GraphData1–GraphDataN style element ContrastColor attribute, and the GraphDataDefault style elemement LineStyle and LineThickness attributes.

Interaction For this option to take effect, error bars must be displayed by the ERRORLOWER= , ERRORUPPER= options.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

ERRORBARCAPSCALE=*positive-number*
specifies a positive number to use as a multiplier for determining the default width of the error-bar caps.

Note: This feature applies to SAS 9.4M5 and to later releases.

Default 1

Interaction This option is ignored when ERRORBARCAPSHAPE=NONE is in effect.

Tips Use the ERRORBARCAPSHAPE= option to specify the cap shape.

The thickness (height) of the SERIF, LINE, and BRACKET is determined by the thickness specified in the ERRORBARATTRS= option. The cap line pattern is always solid.

Examples Double the size of the error-bar caps:
```
errorbarcapscale=2
```

Reduce the size of the error-bar caps by 50%:
```
errorbarcapscale=0.5
```

ERRORBARCAPSHAPE=SERIF | NONE
specifies whether the error bars have a serif cap.

Interaction Starting with SAS 9.4M5, when ERRORBARCAPSCALE= is in effect, the display width for SERIF caps is the cap's default width multiplied by the value specified in ERRORBARCAPSCALE=.

Tip The appearance of the error bars is controlled by the ERRORBARATTRS= option.

ERRORLOWER=*numeric-column* | *expression*
specifies the values of the lower endpoints on the Y error bars.

Default The lower segment of the error bars is not drawn.

Requirement The error bar values must be absolute data values, not data values relative to the value of the bar.

Interaction When this option is specified, the DATALABEL= on page 308 and DATALABELTYPE= on page 314 options are ignored, and data labels are not displayed.

Tip You can use the ERRORBARATTRS= option to control the appearance of the error bars.

ERRORUPPER=*numeric-column* | *expression*
specifies the values of the upper endpoints on the Y error bars.

Default The upper segment of the error bars is not drawn.

Requirement The error bar values must be absolute data values, not data values relative to the value of the bar.

Interaction When this option is specified, the DATALABEL= on page 308 and DATALABELTYPE= on page 314 options are ignored, and data labels are not displayed.

Tip You can use the ERRORBARATTRS= option to control the appearance of the error bars.

FILLEDOUTLINEDMARKERS=TRUE | FALSE
specifies whether markers are drawn with both fill and an outline.

TRUE
draws filled markers (marker symbols with the suffix FILLED) using both fill and an outline.

When this option is TRUE, the fill color and outline color for filled markers are determined in the following ways:

- If the GROUP= option is specified, then by default, the fill color is derived from the GraphData1–GraphDataN style elements Color attribute, and

the marker outlined color is derived from the GraphData1–GraphDataN style elements ContrastColor attribute.

- If the GROUP= option is not specified, then the marker fill is drawn by using the MARKERFILLATTRS= specification, and the outline is drawn by using the MARKEROUTLINEATTRS= specification.

FALSE
draws the markers using fill or an outline, but not both.

Default FALSE

Tip To specify the marker fill and outline colors for a non-grouped plot, set this option to TRUE, and then use the MARKERFILLATTRS= and MARKEROUTLINEATTRS= options to specify the colors.

See GROUP= on page 944

MARKERFILLATTRS= on page 951

MARKEROUTLINEATTRS= on page 952

"boolean " on page xii for other Boolean values that you can use.

GROUP=*column* | *discrete-attr-var* | *expression*
creates a distinct set of lines, markers, and data labels for each unique group value of the specified column.

discrete-attr-var
specifies a discrete attribute map variable.

The discrete attribute map variable is created by a DISCRETEATTRVAR statement.

Restriction A discrete attribute map variable specification must be a direct reference to the attribute map variable. It cannot be set by a dynamic variable.

Default Each distinct group value might be represented in the plot by a different combination of color, line pattern, and marker symbol. Lines and markers vary according to the ContrastColor, LineStyle, and MarkerSymbol attributes of the GraphData1–GraphDataN and GraphMissing style elements. Line thickness (for grouped and ungrouped data) is controlled by the LINEATTRS= option.

Restriction Starting with SAS 9.4M5, the number of vertices for a patterned line cannot exceed the maximum specified by the ODS GRAPHICS statement option LINEPATTERNOBSMAX=. The default is 10,000. If the limit is exceeded, the plot is not drawn and a note is written to the SAS log stating that the limit has been exceeded. In that case, increase LINEPATTERNOBSMAX= to the value suggested in the note or change the line pattern to SOLID.

Interactions The group values are mapped in the order of the data, unless the INDEX= option is used to alter the default sequence of marker symbols, colors, and line patterns.

The marker size is set by the MARKERATTRS= option.

The INCLUDEMISSINGGROUP= option controls whether missing group values are considered a distinct group value.

Note If you specify a column in a SAS data set, the visual attributes for each group value are assigned in data order. If you specify a column in a CAS in-memory table, the visual attributes for each group value are assigned in ascending order of the group column character values or of unformatted numeric values.

Tips The representations that are used to identify the groups can be overridden. For example, each distinct group value is often represented by a different line pattern, but the LINEATTRS=(PATTERN=*pattern*) option could be used to assign the same line pattern to all of the plot's line patterns, letting line color indicate group values. Likewise, LINEATTRS=(COLOR=*color*) could be used to assign the same color to all lines, letting line pattern indicate group values.

By default, ODS Graphics limits the number of groups to 1000. When this limit is exceeded, the GROUP= option is ignored. Use the GROUPMAX= option in the ODS GRAPHICS statement to change the maximum number of groups that can be processed.

See "DISCRETEATTRVAR Statement" on page 1516

GROUPDISPLAY=OVERLAY | CLUSTER
specifies whether grouped step lines and markers are overlaid or clustered around the category midpoints.

OVERLAY
centers the step lines and markers for matching category values on the midpoints.

The step lines in each set of group values are superimposed on each other.

CLUSTER
clusters the step lines and markers for matching category values around the midpoints on a discrete axis or around the intervals on an interval axis.

Each cluster of group values is centered at the midpoint for the category.

Default OVERLAY

Restriction For this option to take effect, the GROUP= option must also be specified.

Note When you plot a SAS data set, the items for each group value are drawn in data order. When you plot a CAS in-memory table, they are drawn in ascending order of the group column character values or unformatted numeric values.

GROUPORDER=DATA | REVERSEDATA | ASCENDING | DESCENDING
specifies the ordering of the groups within a category.

DATA
orders the groups within a category in the group-column data order.

REVERSEDATA
orders the groups within a category in the reverse group-column data order.

Note: This feature applies to SAS 9.4M2 and to later releases.

Tip This option is useful when you want to reverse the category axis.

ASCENDING
orders the groups within a category in ascending order.

DESCENDING
orders the groups within a category in descending order.

Defaults DATA if the data is a SAS data set.

ASCENDING if the data is a CAS in-memory table. Sorting is based on nonformatted values for numeric group values or on formatted values for character group values.

Interactions This option is ignored if the GROUP= option is not also specified.

By default, the groups in the legend are shown in the order that is specified in GROUPORDER.

Notes When plotting a SAS data set, attributes such as color, symbol, and pattern are assigned to each group in DATA order by default. When plotting a CAS in-memory table, attributes are assigned in ascending order of the group column character values or unformatted numeric values by default.

The ASCENDING and DESCENDING settings linguistically sort the group values within each category (or X value) for display position purposes only. For numeric data, the order is based on the unformatted values. For character data, the order is based on the formatted values. The data order of the observations and the visual attributes that are assigned to the group values remain unchanged.

In SAS 9.4M6 and earlier releases, when data stored in a CAS in-memory table is used and DATA or REVERSEDATA is specified, unpredictable results might occur. To generate consistent graphs in that case, specify ASCENDING or DESCENDING. Starting with SAS Viya 3.5 and SAS Studio 5.2, when data stored in a CAS in-memory table is used and DATA or REVERSEDATA is specified, it is ignored, and ASCENDING is used instead.

Tip Use the INDEX= option to alter the default sequence of visual attributes that is assigned to the groups.

INCLUDEMISSINGGROUP=TRUE | FALSE
specifies whether missing values of the group variable are included in the plot.

Default TRUE

Interaction For this option to take effect, the GROUP= option must also be specified.

Tip The attributes of the missing group value are determined by the GraphMissing style element unless a discrete attribute map is in effect, the INDEX= option is used, the MISSING= system option changes the default missing character, or a user-defined format is applied to the group value. In those cases, the attributes of the missing group value are determined by a GraphData1–GraphDataN style element instead of by the GraphMissing style element.

See "boolean " on page xii for other Boolean values that you can use.

INDEX=*positive-integer-column* | *expression*
specifies indices for mapping line attributes (color, marker symbol, and line pattern) to one of the GraphData1–GraphDataN style elements.

Requirements The column or expression value must be an integer value of 1 or greater. Otherwise, this option is ignored.

The positive-integer column must not contain missing values. Otherwise, the entire column is invalidated and this option is ignored.

All of the indexes for a specific group value must be the same. Otherwise, the results are unpredictable.

Interaction For this option to take effect, the GROUP= option must also be specified.

Notes The index values are 1-based indices. For the style attributes in GraphData1–GraphDataN, if the index value is greater than N, then a modulo operation remaps that index value to a number less than N to determine which style to use.

If you do not use this option, then the group values are mapped in the order of the data.

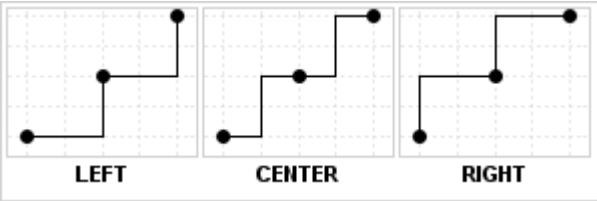
Tip You can use indexing to collapse the number of groups that are represented in a graph. For more information, see "Remapping Groups for Grouped Data" on page 211.

JOIN=TRUE | FALSE
specifies whether the steps are connected.

Default TRUE

See "boolean " on page xii for other Boolean values that you can use.

JUSTIFY=(LEFT | CENTER | RIGHT)
specifies the location of the data point relative to the step.



Default LEFT

LEGENDLABEL="*string*"
specifies a label to be used in a discrete legend for this plot.

Default The Y-column label. If a label is not defined, then the Y-column name is used.

Restriction This option applies only to an associated DISCRETELEGEND statement.

Interaction If the GROUP= option is specified, then this option is ignored.

LINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the attributes of the step line connecting the data points.

Defaults For non-grouped data, the GraphDataDefault style element.

For grouped data, the ContrastColor and LineStyle attributes of the GraphData1–GraphDataN style elements, and the GraphDataDefault:LineThickness style reference.

Restriction Starting with SAS 9.4M5, the number of vertices for a patterned line cannot exceed the maximum specified by the ODS GRAPHICS statement option LINEPATTERNOBSMAX=. The default is 10,000. If the limit is exceeded, the plot is not drawn and a note is written to the SAS log stating that the limit has been exceeded. In that case, increase LINEPATTERNOBSMAX= to the value suggested in the note or change the line pattern to SOLID.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

LINETHICKNESSMAX=*dimension*
specifies the maximum line thickness when a response variable is used to determine the line thickness. By default, this option determines the thickness of the line that represents the maximum response column value.

Note: This feature applies to SAS 9.4M3 and to later releases.

Default Ten times the thickness that is specified by the GraphDataDefault style element LineThickness attribute.

Interactions The LINETHICKNESSRESPONSE= option must be specified for this option to have any effect.

The LINETHICKNESSMAXRESPONSE= option specifies the response value at which this maximum line thickness is reached. The line thickness for response values that exceed the LINETHICKNESSMAXRESPONSE= value are set to the value that is specified by this option.

If the line thickness that is calculated from the LINETHICKNESSMIN=, LINETHICKNESSMAX=, and LINETHICKNESSMAXRESPONSE= option values is less than 0.5 for a line, that line is not drawn.

Tip Use the LINETHICKNESSMIN= option to specify the minimum line thickness.

See "dimension" on page xiii

"Example 3: Series Plot with Line-Thickness Response and Arrowheads" on page 922 for an example of how to use this option.

LINETHICKNESSMAXRESPONSE=*numeric* | *scalar-numeric-expression*
specifies the response value that corresponds to the maximum line thickness.

Note: This feature applies to SAS 9.4M3 and to later releases.

Default The maximum value in the response column that is specified in the LINETHICKNESSRESPONSE= option.

Interactions The LINETHICKNESSRESPONSE= option must be specified for this option to have any effect.

The thickness for all lines that exceed the maximum response value is set to the value specified in the LINETHICKNESSMAX= option.

If the line thickness that is calculated from the LINETHICKNESSMIN=, LINETHICKNESSMAX=, and LINETHICKNESSMAXRESPONSE= option values is less than 0.5 for a line, that line is not drawn.

LINETHICKNESSMIN=*dimension*
specifies the minimum line thickness when a response variable is used to determine the line thickness.

Note: This feature applies to SAS 9.4M3 and to later releases.

Default The thickness specified by the GraphDataDefault style element LineThickness attribute.

Interactions The LINETHICKNESSRESPONSE= option must be specified for this option to have any effect.

If the line thickness that is calculated from the LINETHICKNESSMIN=, LINETHICKNESSMAX=, and LINETHICKNESSMAXRESPONSE= option values is less than 0.5 for a line, that line is not drawn.

Tip Use the LINETHICKNESSMAX= option to specify the maximum line thickness.

See "dimension" on page xiii

"Example 3: Series Plot with Line-Thickness Response and Arrowheads" on page 922 for an example of how to use this option.

LINETHICKNESSRESPONSE=*numeric-column* | *expression*
specifies a response column or range attribute variable that is used to map a line thickness to each group value.

Note: This feature applies to SAS 9.4M3 and to later releases.

Default The GraphDataDefault style element LineThickness attribute.

Interactions When the column values are all zero, all negative, or all missing, this option is ignored. In these cases, the default line thickness is used for all of the lines.

This option overrides suboption THICKNESS= in the LINEATTRS= option.

Notes The line thicknesses are not reflected in a discrete legend.

The LINETHICKNESSRESPONSE= values are assumed to be constant for each group value in a grouped plot and for the entire plot in an ungrouped plot. If the LINETHICKNESSRESPONSE column has multiple values for a single GROUP value or ungrouped plot, unpredictable results might occur.

See "Example 3: Series Plot with Line-Thickness Response and Arrowheads" on page 922 for an example of how to use this option.

MARKERATTRS=*style-element* | *style-element* (*marker-options*) | (*marker-options*)
specifies the attributes of the data markers.

Defaults For non-grouped data, GraphDataDefault style element.

For grouped data, the MarkerSymbol and ContrastColor attributes of the GraphData1–GraphDataN style elements, and the GraphDataDefault:MarkerSize style reference.

Interactions If FILLEDOUTLINEDMARKERS=TRUE, then this option's COLOR= suboption is ignored. In that case, to specify the marker fill color, use the MARKERFILLATTRS= option instead.

This option's COLOR= suboption overrides the default behavior for grouped data. When the COLOR= suboption is specified in that case, all markers have the same color, and the marker symbol alone distinguishes the markers.

This option's SYMBOL= suboption overrides the default behavior for grouped data. When the SYMBOL= suboption is specified in that case, all markers have the same symbol, and the symbol color alone distinguishes the markers.

The TRANSPARENCY= fill option overrides this option's DATATRANSPARENCY= suboption.

This option is ignored if the DISPLAY= option disables the display of the markers.

If the DATASKIN= option is in effect, then the data skin determines the marker outlines. Any outline-related settings from the current ODS style or from the marker attribute options are ignored.

Note When *style-element* is specified, only the style element's MARKERSYMBOL, CONTRASTCOLOR, and MARKERSIZE attributes are used.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Marker Options" on page 1604 for available *marker-options*.

MARKERFILLATTRS=*style-element* | (*fill-options*)
specifies the appearance of the filled markers.

Defaults For non-grouped data, the Color attribute of the GraphDataDefault style element

For grouped data, the Color attribute of a GraphData1–GraphDataN style element

Restriction The TRANSPARENCY= fill option is ignored. Use the MARKERATTRS= option to set the marker transparency.

Interaction This option is in effect only when FILLEDOUTLINEDMARKERS=TRUE and the DISPLAY= option enables fill display.

Note When *style-element* is specified, only the style element's Color attribute is used.

See "General Syntax for Attribute Options" on page 1599

"Fill Color Options" on page 1600

MARKEROUTLINEATTRS=*style-element* | (*line-options*)
specifies the appearance of the marker outlines.

Defaults For non-grouped data, the GraphOutlines style element.

For grouped data, the LineThickness attritube of the GraphOutlines style element and the ContrastColor attribute of a GraphData1–GraphDataN style element.

Restriction The line style of the marker outline is always solid.

Interaction This option is ignored when a data skin is applied by the current style or by the DATASKIN= option. In the latter case, the outline is set by the data skin.

Note When *style-element* is specified, only the style element's CONTRASTCOLOR and LINETHICKNESS attributes are used.

See "General Syntax for Attribute Options" on page 1599

"Line Options" on page 1602

NAME="*string*"
assigns a name to this plot statement for reference in other template statements. The specified name is used primarily in legend statements to coordinate the use of colors and line patterns between the plot and the legend.

Restrictions The *string* is case sensitive, cannot contain spaces, and must define a unique name within the template.

This option does not support variables that are created by the DYNAMIC, MVAR, and NMVAR template statements.

Interaction The *string* is used as the default legend label if the LEGENDLABEL= option is not used.

PRIMARY=TRUE | FALSE
specifies that the data columns for this plot and the plot type be used for determining default axis features. This option is needed only when two or more plots within an overlay-type layout contribute to a common axis.

Default FALSE

Restriction This option is ignored if the plot is placed under a GRIDDED or LATTICE layout block.

Note In an OVERLAY layout, only one plot in an overlay can be the primary plot on a per-axis basis. When no plot is designated as the primary plot, the first plot that can be a primary plot is considered the primary plot. If multiple plots specify PRIMARY=TRUE for the same axis, then the last such plot encountered is considered the primary plot.

See "When Plots Share Data and a Common Axis" on page 1046

"boolean " on page xii for other Boolean values that you can use.

ROLENAME=(*role-name-list*)
specifies user-defined roles that can be used to display information in the data tips. This option provides a way to add to the data columns that appear in data tips that are specified by the TIP= option.

(*role-name-list*)
a space-separated list of *role-name = column* pairs.

Example The following example assigns the column Obs to the user-defined role TIP:

```
ROLENAME=(TIP1=OBS)
```

Default No user-defined roles

Requirement The role names that you choose must be unique and different from the predefined roles X, Y, CURVELABEL, DATALABEL, ERRORLOWER, ERRORUPPER, GROUP, and INDEX.

TIP=(*role-list*) | NONE
specifies the information to display when the cursor is positioned over the step line. If this option is used, then it replaces all of the information that is displayed by default. Roles for columns that do not contribute to the step plot can be specified along with roles that do.

(*role-list*)
an ordered, space-separated list of unique STEPPLOT and user-defined roles.

STEPPLOT roles include X , Y , CURVELABEL , DATALABEL , ERRORLOWER , ERRORUPPER , and GROUP .

User-defined roles are defined with the ROLENAME= option.

Note CURVELABEL is considered a role only when it is assigned a column of values. It is not considered a role and does not display data tips when assigned a string.

Example The following example displays data tips for the columns assigned to the roles X and Y as well as the column Obs, which is not assigned to any pre-defined STEPPLOT role. The Obs column must first be assigned a role.

```
ROLENAME=(TIP1=OBS)
TIP=(TIP1 X Y)
```

NONE
suppresses data tips and URLs (if requested) from the plot.

Default The columns assigned to these roles are automatically included in the data tip information: X , Y , DATALABEL , ERRORLOWER , ERRORUPPER , and GROUP .

Requirement To generate data tips in the output, you must include an ODS GRAPHICS ON statement that specifies the IMAGEMAP option, and you must write the output to the ODS HTML destination.

Interaction This option is ignored when the plot statement is in an OVERLAY or PROTOTYPE layout and the INCLUDERANGES= option is specified in the LINEAROPTS= or TIMEOPTS= option for either axis.

Tip The labels and formats for the TIP roles can be controlled with the TIPLABEL= and TIPFORMAT= options.

TIPFORMAT=(*role-format-list*)
specifies display formats for tip columns. This option provides a way to control the formats of columns that appear in data tips.

(role-format-list)
a space-separated list of *role-name* = *format* pairs.

Example
```
ROLENAME=(TIP1=SALARY)
TIP=(TIP1)
TIPFORMAT=(TIP1=DOLLAR12.)
```

Default The column format of the column assigned to the role or BEST6 if no format is assigned to a numeric column.

Restriction Only the roles that appear in the TIP= option are used.

Requirement A column must be assigned to each of the specified roles. (See the ROLENAME= option.)

TIPLABEL=(*role-label-list*)
specifies display labels for tip columns. This option provides a way to control the labels of columns that appear in data tips.

role-label-list
a space-separated list of *rolename* ="*string*" pairs.

Example
```
ROLENAME=(TIP1=PCT)
TIP=(TIP1)
TIPLABEL=(TIP1="Percent")
```

Default The column label or column name of the column assigned to the role.

Restriction Only the roles that appear in the TIP= option are used.

Requirement A column must be assigned to each of the specified roles. (See the ROLENAME= option.)

URL=*string-column*
specifies an HTML page to display when a step line segment is selected.

string-column
specifies a column that contains a valid HTML page reference (HREF) for each step line segment that is to have an active link.

Example `http://www.sas.com`

Requirement To generate selectable segments, you must include an ODS GRAPHICS ON statement that specifies the IMAGEMAP option, and you must write the output to the ODS HTML destination.

Interactions This option has no effect when TIP=NONE.

This option is ignored when the plot statement is in an OVERLAY or PROTOTYPE layout and the INCLUDERANGES= option is specified in the LINEAROPTS= or TIMEOPTS= option for either axis.

Note When selecting a portion of a segment that is not an endpoint, the nearest segment endpoint is used.

Tips The URL value can be blank for some X and Y pairs, meaning that no action is taken when the corresponding segment is selected.

The URL value can be the same for any X and Y pairs, meaning that the same action is taken when the segment for those X and Y pairs are selected.

By default, drill-down links open in a new browser window (link target _blank). To specify a different target for your drill-down links, such as _self or _parent, add the DRILLTARGET="*target*" option to your ODS GRAPHICS statement. See DRILLTARGET= on page 1568.

XAXIS=X | X2
specifies whether data are mapped to the primary X (bottom) axis or to the secondary X2 (top) axis.

Default X

Interaction The overall plot specification and the layout type determine the axis display. For more information, see "How Axis Features Are Determined" on page 1040.

YAXIS=Y | Y2
specifies whether data are mapped to the primary Y (left) axis or to the secondary Y2 (right) axis.

Default Y

Interaction The overall plot specification and the layout type determine the axis display. For more information, see "How Axis Features Are Determined" on page 1040.

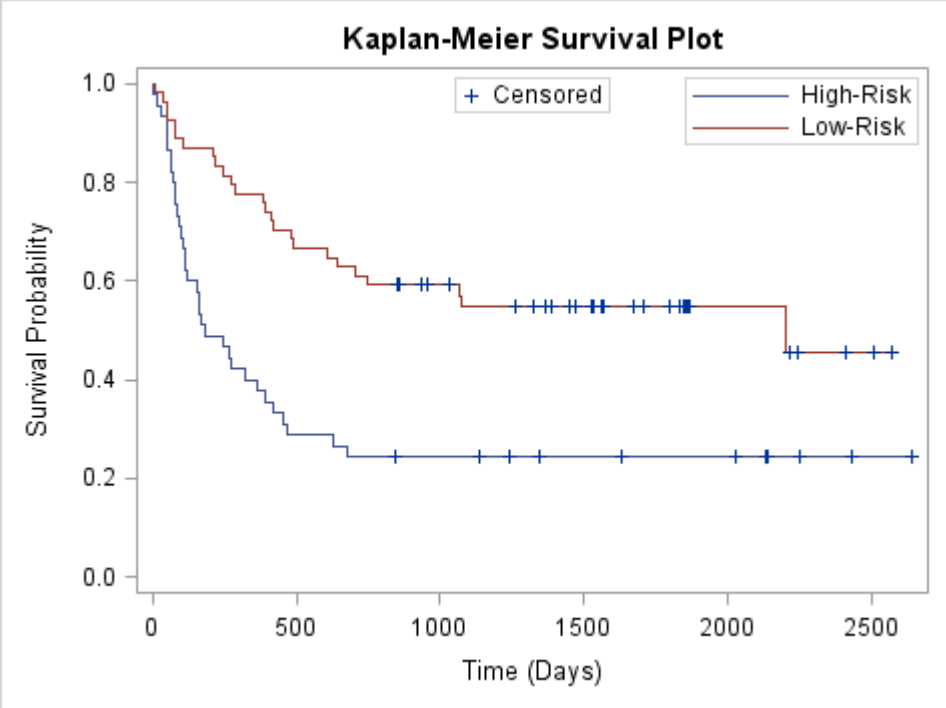
Details

For character columns, the X axis is always discrete. For numeric columns, both the X and Y axes are linear by default. You can change the axis type for numeric axes with the XAXISOPTS= and YAXISOPTS= options of the containing OVERLAY layout.

By default, the STEPPLOT statement uses the X values in data order. You can use the CONNECTORDER= option to change the order.

Example: STEPPLOT Statement

The following graph was generated by the "Example Program" on page 957:



Input Data

Here is the DATA step code that generates the input data for this example.

```
data Study;
input Group : $10. Time Status @@;
label Time="Time (Days)";
datalines;
Low-Risk  2569 0 Low-Risk  2506 0 Low-Risk  2409 0
Low-Risk  2218 0 Low-Risk  1857 0 Low-Risk  1829 0
Low-Risk  1562 0 Low-Risk  1470 0 Low-Risk  1363 0
Low-Risk  1030 0 Low-Risk   860 0 Low-Risk  1258 0
```

```
Low-Risk  2246 0 Low-Risk  1870 0 Low-Risk  1799 0
Low-Risk  1709 0 Low-Risk  1674 0 Low-Risk  1568 0
Low-Risk  1527 0 Low-Risk  1324 0 Low-Risk   957 0
Low-Risk   932 0 Low-Risk   847 0 Low-Risk   848 0
Low-Risk  1850 0 Low-Risk  1843 0 Low-Risk  1535 0
Low-Risk  1447 0 Low-Risk  1384 0 Low-Risk   414 1
Low-Risk  2204 1 Low-Risk  1063 1 Low-Risk   481 1
Low-Risk   105 1 Low-Risk   641 1 Low-Risk   390 1
Low-Risk   288 1 Low-Risk   421 1 Low-Risk    79 1
Low-Risk   748 1 Low-Risk   486 1 Low-Risk    48 1
Low-Risk   272 1 Low-Risk  1074 1 Low-Risk   381 1
Low-Risk    10 1 Low-Risk    53 1 Low-Risk    80 1
Low-Risk    35 1 Low-Risk   248 1 Low-Risk   704 1
Low-Risk   211 1 Low-Risk   219 1 Low-Risk   606 1
High-Risk 2640 0 High-Risk 2430 0 High-Risk 2252 0
High-Risk 2140 0 High-Risk 2133 0 High-Risk 1238 0
High-Risk 1631 0 High-Risk 2024 0 High-Risk 1345 0
High-Risk 1136 0 High-Risk  845 0 High-Risk  422 1
High-Risk  162 1 High-Risk   84 1 High-Risk  100 1
High-Risk    2 1 High-Risk   47 1 High-Risk  242 1
High-Risk  456 1 High-Risk  268 1 High-Risk  318 1
High-Risk   32 1 High-Risk  467 1 High-Risk   47 1
High-Risk  390 1 High-Risk  183 1 High-Risk  105 1
High-Risk  115 1 High-Risk  164 1 High-Risk   93 1
High-Risk  120 1 High-Risk   80 1 High-Risk  677 1
High-Risk   64 1 High-Risk  168 1 High-Risk   74 1
High-Risk   16 1 High-Risk  157 1 High-Risk  625 1
High-Risk   48 1 High-Risk  273 1 High-Risk   63 1
High-Risk   76 1 High-Risk  113 1 High-Risk  363 1
;
run;
```

Example Program

Here is the program code for this example.

```
proc template;
  define statgraph stepplot;
    begingraph;
      entrytitle "Kaplan-Meier Survival Plot";
      layout overlay /
        yaxisopts=(linearopts=(viewmin=0 viewmax=1));
        stepplot x=Time y=Survival /
          group=Stratum name="step";
        scatterplot x=Time y=Censored /  name="scat"
          legendlabel="Censored" markerattrs=(symbol=plus);
        discretelegend "step" / location=inside
          halign=right valign=top across=1;
        discretelegend "scat" /
          location=inside halign=center valign=top;
       endlayout;
    endgraph;
  end;
run;
```

```
ods graphics;
ods exclude all;
ods output survivalplot=plotdata;
proc lifetest data=Study plots=(survival);
   time Time * Status(0);
   survival;
   strata Group;
run;
ods select all;

proc sgrender data=plotdata template=stepplot;
run;
```

SURFACEPLOTPARM Statement

Creates a three-dimensional surface representing a response variable evaluated over a grid of X and Y values.

Restriction: The SURFACEPLOTPARM statement does not support data tips.

Requirements: For surface plots, the input data should form an evenly spaced grid of horizontal values (X and Y) and one or more vertical values (Z) for each combination.

If the plot data is a SAS data set, the input data must be sorted by Y and X in order to obtain the correct lighting. If the plot data is a CAS in-memory table, the data is sorted automatically before it is plotted.

Syntax

SURFACEPLOTPARM X=*numeric-column* | *expression*
Y=*numeric-column* | *expression*
Z=*numeric-column* | *expression* <*/options*>;

Summary of Optional Arguments

Appearance options

COLORMODEL=*style-element* | (*color-list*)
: specifies a color ramp that is to be used with the COLORRESPONSE= or SURFACECOLORGRADIENT= option.

COLORRESPONSE=*numeric-column* | *range-attr-var* | *expression*
: starting with SAS 9.4M2, specifies the column or range attribute map variable to use to determine the surface colors.

DATATRANSPARENCY=*number*
: specifies the degree of the transparency of the surface.

FILLATTRS=*style-element* | *style-element* (*fill-options*) | (*fill-options*)
: specifies the color of the filled surface or the wire-frame mesh.

REVERSECOLORMODEL=TRUE | FALSE
specifies whether to reverse the gradient (color ramp) that is defined by either the ODS style that is in effect or by the COLORMODEL= option.

SURFACECOLORGRADIENT=*numeric-column* | *range-attr-var*
specifies the column or range attribute map variable that is used to determine the surface colors (in SAS 9.4M1 and earlier releases).

SURFACETYPE=FILLGRID | FILL | WIREFRAME
specifies how the surface is displayed.

Axes options

PRIMARY=TRUE | FALSE
specifies that the data columns for this plot and the plot type be used for determining default axis features.

Label options

LEGENDLABEL="*string*"
specifies a label to be used in a discrete legend for this plot.

Plot reference options

NAME="*string*"
assigns a name to this plot statement for reference in other template statements.

Required Arguments

X=*numeric-column* | *expression*
specifies the X coordinates of the grid.

Y=*numeric-column* | *expression*
specifies the Y coordinates of the grid.

Z=*numeric-column* | *expression*
specifies the height of response values.

Note The input data should be sorted by both 1) the Y column and 2) the X column. The sort direction for Y should be ascending. The sort direction of X be either ascending or descending.

Optional Arguments

COLORMODEL=*style-element* | (*color-list*)
specifies a color ramp that is to be used with the COLORRESPONSE= or SURFACECOLORGRADIENT= option.

style-element
specifies the name of a style element.

The style element should contain these style attributes:

STARTCOLOR	specifies a color for the smallest data value of the COLORRESPONSE= or SURFACECOLORGRADIENT= column.

NEUTRALCOLOR specifies a color for the midpoint of the range of the COLORRESPONSE= or SURFACECOLORGRADIENT= column.

ENDCOLOR specifies a color for the highest data value of the COLORRESPONSE= or SURFACECOLORGRADIENT= column.

(*color-list*)
specifies a space-separated list of colors to use in the color ramp.

You can use style attribute references such as GraphData3:Color, color names, or RGB, CMYK, HLS, and HSV (HSB) color codes to specify a color. The list can contain a mix of style attribute references, color names, and color codes.

Requirement The list of colors must be enclosed in parentheses.

See "color " on page xii

Default The ThreeColorRamp style element.

Interaction For this option to have any effect, the COLORRESPONSE= or SURFACECOLORGRADIENT= option must also be used.

Tip The REVERSECOLORMODEL= option can be used to reverse the start and end colors of the ramp assigned to the color model.

COLORRESPONSE=*numeric-column* | *range-attr-var* | *expression*
starting with SAS 9.4M2, specifies the column or range attribute map variable to use to determine the surface colors.

Note: Starting with SAS 9.4M2, the COLORRESPONSE= option replaces the SURFACECOLORGRADIENT= option. The syntax and functionality are the same. The SURFACECOLORGRADIENT= option is still honored, but the COLORRESPONSE= option is preferred.

range-attr-var
specifies a range attribute map variable that is defined in a RANGEATTRVAR statement.

"RANGEATTRVAR Statement"

Restriction A range attribute map variable specification must be a direct reference to the attribute map variable. It cannot be set as a dynamic variable.

See "RANGEATTRVAR Statement" on page 1531

When a numeric column or expression is specified, the range of column or expression values are linearly mapped to the color ramp that is specified by the COLORMODEL= option. When a range attribute map variable is specified, the colors that are defined in the associated range attribute map are used instead.

You can use this option to add a second response variable to an analysis. For an example, see "Example 1: Surface Plot" on page 963.

Interaction Suboption COLOR= in the FILLATTRS= option overrides this option for the fill colors.

Tip To display a legend with this option in effect, use a CONTINUOUSLEGEND statement.

DATATRANSPARENCY=*number*
specifies the degree of the transparency of the surface.

Default 0

Range 0–1, where 0 is opaque and 1 is entirely transparent

FILLATTRS=*style-element* | *style-element* (*fill-options*) | (*fill-options*)
specifies the color of the filled surface or the wire-frame mesh.

Default The GraphDataDefault:Color style reference.

Interaction The COLORRESPONSE= or SURFACECOLORGRADIENT= option is ignored if this option is specified.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Fill Color Options" on page 1600 for available *fill-options*.

LEGENDLABEL="*string*"
specifies a label to be used in a discrete legend for this plot.

Default The Z-column label. If a label is not defined, then the Z-column name is used.

Restriction This option applies only to an associated DISCRETELEGEND statement.

NAME="*string*"
assigns a name to this plot statement for reference in other template statements. The specified name is used primarily in legend statements to coordinate the use of colors and line patterns between the plot and the legend.

Restrictions The *string* is case sensitive, cannot contain spaces, and must define a unique name within the template.

This option does not support variables that are created by the DYNAMIC, MVAR, and NMVAR template statements.

Interaction The *string* is used as the default legend label if the LEGENDLABEL= option is not used.

PRIMARY=TRUE | FALSE
specifies that the data columns for this plot and the plot type be used for determining default axis features. This option is needed only when two or more plots within an OVERLAY3D layout contribute to a common axis.

Default FALSE

See "When Plots Share Data and a Common Axis" on page 1046

"boolean " on page xii for other Boolean values that you can use.

REVERSECOLORMODEL=TRUE | FALSE
specifies whether to reverse the gradient (color ramp) that is defined by either the ODS style that is in effect or by the COLORMODEL= option.

Default FALSE

See COLORMODEL=

"boolean " on page xii for other Boolean values that you can use.

SURFACECOLORGRADIENT=*numeric-column* | *range-attr-var*
specifies the column or range attribute map variable that is used to determine the surface colors (in SAS 9.4M1 and earlier releases).

Note: Starting with SAS 9.4M2, the SURFACECOLORGRADIENT= option is deprecated and replaced with the COLORRESPONSE= option. The syntax and functionality are the same. The SURFACECOLORGRADIENT= option is still honored, but the COLORRESPONSE= option is preferred.

See COLORRESPONSE= on page 960

SURFACETYPE=FILLGRID | FILL | WIREFRAME
specifies how the surface is displayed.

FILLGRID
specifies a filled surface with superimposed grid lines

FILL
specifies a filled surface without grid lines

WIREFRAME
specifies an unfilled surface with grid lines

Default FILLGRID

Details

The SURFACEPLOTPARM statement assumes that the Z response values have been provided for a uniform X-Y grid. Missing Z values leave a "hole" in the surface. The observations in the input data set should form an evenly spaced grid of horizontal (X and Y) values and one vertical (Z) value for each of these

combinations. The observations should be in sorted order of Y and X to obtain an accurate plot.

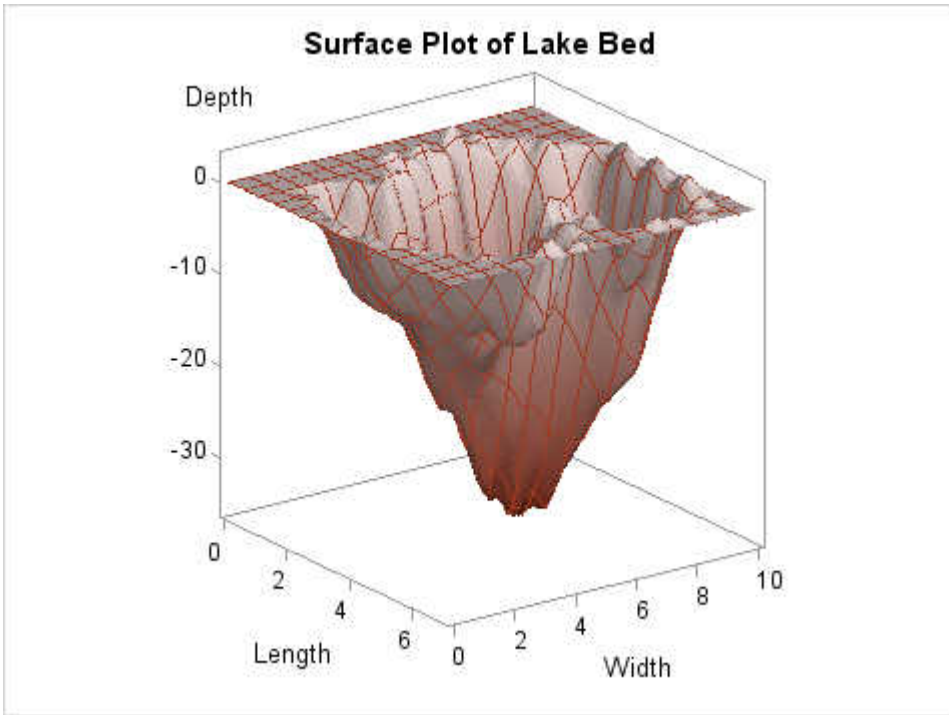
The G3GRID procedure (requires a SAS/GRAPH license) can be used to interpolate the necessary values to produce a data set with nonmissing Z values for every combination of X and Y. The G3GRID procedure can also smooth data with spline interpolations. For further details, see the documentation for PROC G3GRID in the *SAS/GRAPH: Reference*.

The KDE procedure can produce an output data set of gridded X-Y values where the Z value is computed to be a Kernel Density Estimate of the distribution of X and Y. For more information, see The KDE Procedure in *SAS/STAT User's Guide*.

Examples

Example 1: Surface Plot

The following graph was generated by the "Example Program" on page 963:



Example Program

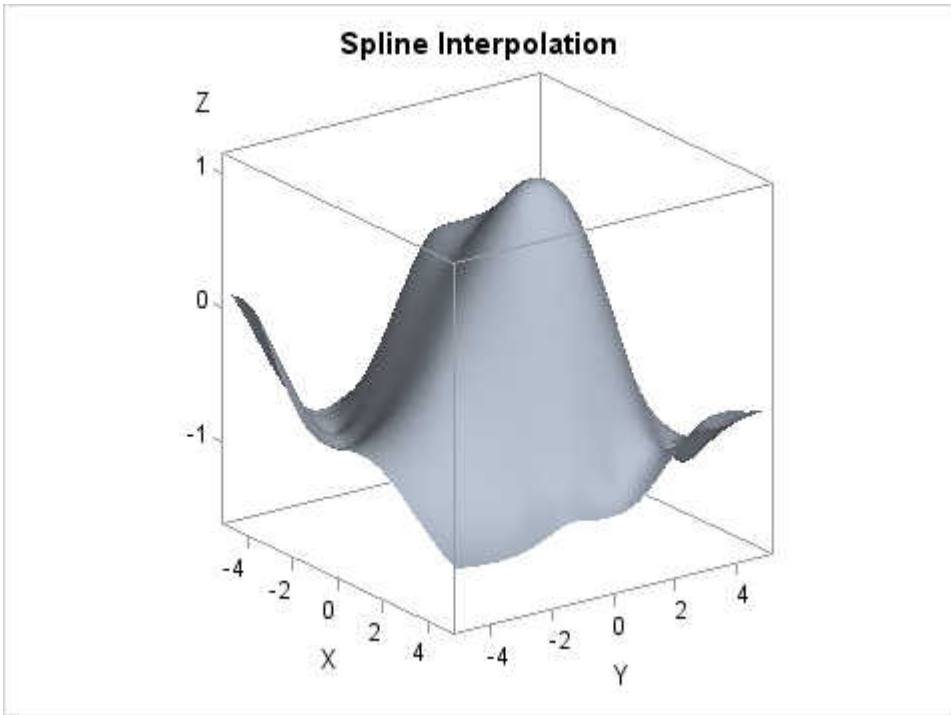
Here is the code for this example. The COLORRESPONSE= option is valid starting with SAS 9.4M2. For prior releases, use the SURFACECOLORGRADIENT= option instead.

```
proc template;
  define statgraph surfaceplotparm;
```

```
    begingraph;
      entrytitle "Surface Plot of Lake Bed";
      layout overlay3d / cube=false;
        surfaceplotparm x=length y=width z=depth /
          reversecolormodel=true
          colorresponse=depth
          colormodel=twocoloraltramp;
      endlayout;
    endgraph;
  end;

/* create gridded data for surface
 * proc g3grid is a sas/graph procedure */
proc g3grid data=sashelp.lake out=gridded;
  grid width*length = depth / naxis1=75 naxis2=75;
run;

proc sgrender data= gridded template=surfaceplotparm;
run;
```

Example 2: Spline Interpolation

The following graph was generated by the "Example Program" on page 965:



Input Data

Here is the SAS code that generates the data for this example.

```
data nums;
  do i=1 to 30;
```

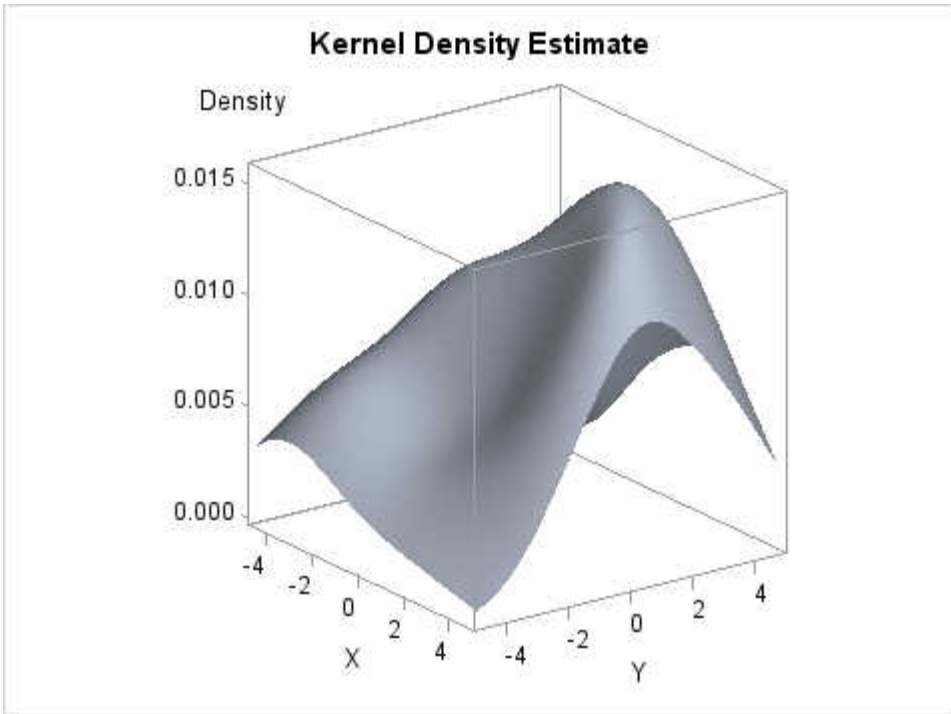
```
      X=10*ranuni(33)-5;
      Y=10*ranuni(33)-5;
      Z=sin(sqrt(x*x+y*y));
      output;
    end;
  run;
  proc g3grid data=nums out=gridded;
    grid y*x=z / spline
                 axis1=-5 to 5 by 0.1
                 axis2=-5 to 5 by 0.1;
  run;
  proc sort data=gridded; by y x; run;
```

Example Program

```
proc template;
  define statgraph g3grid_surface;
   begingraph;
    entrytitle "Spline Interpolation";
    layout overlay3d;
      surfaceplotparm x=x y=y z=z /
        surfacetype=fill;
    endlayout;
   endgraph;
  end;
run;

proc sgrender data=gridded template=g3grid_surface;
run;
```

Example 3: Kernel Density Estimate

The following graph was generated by the “Example Program” on page 966:



Input Data

Here is the SAS code that generates the data for this example.

```
data nums;
  do i=1 to 30;
     X=10*ranuni(33)-5;
     Y=10*ranuni(33)-5;
     Z=sin(sqrt(x*x+y*y));
     output;
  end;
run;
proc kde data=nums;
  bivar x y / ngrid=100
    gridl=-5 gridu=5
    out=binned(rename=(value1=X value2=Y));
run;
proc sort data=binned; by y x;
  label x="X" y="Y";
run;
```

Example Program

```
proc template;
  define statgraph kde_surface;
   begingraph;
     entrytitle "Kernel Density Estimate";
```

```
    layout overlay3d;
      surfaceplotparm x=x y=y z=density /
        surfacetype=fill;
    endlayout;
  endgraph;
 end;
run;

proc sgrender data=binned template=kde_surface;
run;
```

TEXTPLOT Statement

Displays text values at specific X and Y locations in the graph.

Note: This feature applies to SAS 9.4M2 and to later releases.

Tip: Use the TEXTPLOT statement, rather than the SCATTERPLOT statement with the MARKERCHARACTER= option, when you want more control over the appearance of the text. The TEXTPLOT statement enables you to rotate the text to any angle, manage the text position, split the text into multiple lines, display a bounding box around the text, add a back-light effect to the text, and so on.

Syntax

TEXTPLOT X=*column* | *expression*
Y=*column* | *expression*
TEXT=*column* | *expression* </*options*>;

Summary of Optional Arguments

Appearance options

BACKLIGHT=*number* | AUTO
: specifies a back-light effect for the marker text.

CLUSTERWIDTH=*number*
: on a discrete axis, specifies the width of the group clusters as a fraction of the midpoint spacing. On an interval axis, specifies the width of the group clusters as a fraction of the minimum interval between adjacent data values.

COLORMODEL=*color-ramp-style-element* | (*color-list*)
: specifies a color ramp to use with the COLORRESPONSE= option.

COLORRESPONSE=*numeric-column* | *range-attr-var* | *expression*
: specifies the column or range attribute map variable to use to determine the text-marker text colors.

CONTRIBUTEOFFSETS=ALL | NONE | (*axis-offset-list*)

specifies whether space requirements for this plot contribute to the calculation of the axis offsets.

DATATRANSPARENCY=*number*
specifies the degree of the transparency of the text.

DISPLAY=(*display-options*) | STANDARD | ALL
specifies the text features to display.

FILLATTRS=*style-element* | (*fill-options*)
specifies the appearance of the filled areas of the text.

INDEX=*positive-integer-column* | *expression*
specifies indices for mapping marker text color to one of the GraphData1–GraphDataN style elements.

OUTLINEATTRS=*style-element* | *style-element*(*line-options*) | (*line-options*)
specifies the appearance of the text-marker outlines.

PAD=*dimension* | *(pad-options)*
specifies the amount of extra space to add inside the text-marker border.

REVERSECOLORMODEL=TRUE | FALSE
specifies whether to reverse the gradient (color ramp) that is defined by either the ODS style that is in effect or by the COLORMODEL= option.

TEXTATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font properties of the text-marker text.

Axes options

CLUSTERAXIS=AUTO | X | Y
specifies the axis to use for clustering groups when GROUPDISPLAY=CLUSTER.

PRIMARY=TRUE | FALSE
specifies that the data columns for this plot and the plot type be used for determining default axis features.

XAXIS=X | X2
specifies whether data are mapped to the primary X (bottom) axis or to the secondary X2 (top) axis.

YAXIS=Y | Y2
specifies whether data are mapped to the primary Y (left) axis or to the secondary Y2 (right) axis.

Data tip options

ROLENAME=(*role-name-list*)
specifies user-defined roles that can be used to display information in the data tips.

TIP=(*role-list*) | NONE
specifies the information to display when the cursor is positioned over the text values.

TIPFORMAT=(*role-format-list*)
specifies display formats for tip columns.

TIPLABEL=(*role-label-list*)
specifies display labels for tip columns.

Experimental options

OUTFILE=*fileref* | *"filename"*

specifies a file for storing information about the text bounding-box for each text value in the column specified in the OUTID= option.

OUTID=*column* | *expression*
specifies a column that contains text values to write to the file specified in the OUTFILE= option.

Label options

LEGENDLABEL="*string*"
specifies a label to be used in a discrete legend for this plot.

Midpoint options

DISCRETEOFFSET=*number*
specifies the distance to offset all text values from discrete X values, discrete Y values, or both.

GROUP=*column* | *discrete-attr-var* | *expression*
creates a separate text value for each unique group value in the specified column.

GROUPDISPLAY=OVERLAY | CLUSTER
specifies how marker groups are positioned for the coordinate pairs.

INCLUDEMISSINGGROUP=TRUE | FALSE
specifies whether missing values of the group variable are included in the plot.

ODS options

URL=*string-column*
specifies an HTML page to display when a text value is selected.

Plot reference options

NAME="*string*"
assigns a name to this plot statement for reference in other template statements.

Text options

FORMAT=*format*
specifies a SAS format or a user-defined format for the TEXT= column.

POSITION=BOTTOM | BOTTOMLEFT | BOTTOMRIGHT | CENTER | LEFT | RIGHT | TOP | TOPLEFT | TOPRIGHT | *keyword-column*
specifies the position of the text value with respect to the location of the data point.

POSITIONOFFSETX=*number* | *numeric-column*
specifies the positive or negative X offset for an individual text item.

POSITIONOFFSETY=*number* | *numeric-column*
specifies the positive or negative Y offset for an individual text item.

ROTATE=*number* | *numeric-column*
specifies the angle of rotation, in degrees, for the text values.

SIZEMAX=*dimension*
specifies the maximum font size for a text marker when a response variable is used to size the text-marker font.

SIZEMAXRESPONSE=*numeric* | *scalar-numeric-expression*

specifies the response value that corresponds to the maximum font size for text markers.

SIZEMIN=*dimension*
specifies the minimum font size for text markers when a response variable is used to size the font for text values.

SIZERESPONSE=*numeric-column | numeric-expression*
specifies a response column that is used to determine the font size for each text value.

SPLITCHAR="*character-list*"
specifies one or more characters on which the text-marker text can be split.

SPLITCHARDROP=TRUE | FALSE
specifies whether the split characters are included in the text-marker text.

SPLITJUSTIFY=AUTO | CENTER | LEFT | RIGHT
specifies the justification of the lines of text in the text-marker text blocks.

SPLITPOLICY=NONE | SPLIT | SPLITALWAYS
specifies a policy for avoiding collisions among the text values.

SPLITWIDTH=AUTO | *width-in-characters*
specifies the maximum width of each split line.

STRIP=TRUE | FALSE
specifies whether leading and trailing blanks should be stripped from the text-marker text before it is displayed.

VCENTER=BBOX | BASELINE
specifies whether the text is vertically centered with respect to the text bounding box or to the text baseline.

Required Arguments

X=*column*
specifies the column for the X values.

Y=*column*
specifies the column for the Y values.

TEXT=*column*
specifies the column for the text values that are to be used for the markers.

Optional Arguments

BACKLIGHT=*number* | AUTO
specifies a back-light effect for the marker text. The effect is applied only to the marker text.

number
specifies the degree of the back-light effect.

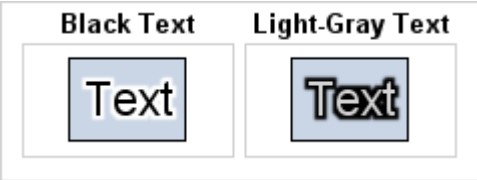
Range 0–1, where 0 specifies no effect and 1 specifies maximum effect

AUTO
the system selects an appropriate level for the back-light effect.

If the GROUP= or COLORRESPONSE= option is in effect, BACKLIGHT=0.75. Otherwise, BACKLIGHT=0.5.

The following figure shows the effect on the text of an outlined, filled text marker.

The back light is based on text color. For dark colors, a contrasting white back-light effect is used. For lighter colors, a contrasting black back-light effect is used. The following figure shows the two back-light types when BACKLIGHT=1.



Default 0 (no back-light effect)

Restriction Vector graphics output cannot be generated when the back-light effect is applied. If you request vector graphics output and enable the back-light effect, an image is generated instead.

Note If the background color is white, the white backlight effect for dark text colors is not visible. Conversely, if the background color is black, the black backlight effect for light text colors is not visible.

Tip The BACKLIGHT= option is most effective when the text color has a low level of contrast with the background or when the background is cluttered.

CLUSTERAXIS=AUTO | X | Y

specifies the axis to use for clustering groups when GROUPDISPLAY=CLUSTER.

AUTO

uses the discrete axis for clustering groups when only one axis is discrete. Uses the X axis for clustering if both axes are discrete or interval.

X
Y

uses the X or Y axis for clustering groups.

Default AUTO

Interaction The GROUPDISPLAY= option must be set to CLUSTER for this option to have any effect.

CLUSTERWIDTH=*number*
on a discrete axis, specifies the width of the group clusters as a fraction of the midpoint spacing. On an interval axis, specifies the width of the group clusters as a fraction of the minimum interval between adjacent data values.

Default 0.85

Range 0–1, where 0 is the minimum width, which is one pixel wide, and 1 is the maximum possible width

Interaction For this option to take effect, the GROUP= option must also be specified, and the GROUPDISPLAY= option must be set to CLUSTER.

COLORMODEL=*color-ramp-style-element* | (*color-list*)
specifies a color ramp to use with the COLORRESPONSE= option.

color-ramp-style-element
specifies the name of a color-ramp style element.

The style element should contain these style attributes:

STARTCOLOR
specifies the color for the smallest data value of the COLORRESPONSE= column.

NEUTRALCOLOR
specifies the color for the midpoint of the range of the COLORRESPONSE= column.

ENDCOLOR
specifies the color for the highest data value of the COLORRESPONSE= column.

(*color-list*)
specifies a space-separated list of colors to use in the color ramp. You can use style attribute references such as GraphData3:Color, color names, or RGB, CMYK, HLS, and HSV (HSB) color codes to specify a color. The list can contain a mix of style attribute references, color names, and color codes.

Requirement The list of colors must be enclosed in parentheses.

See “color ” on page xii

Default The ThreeColorAltRamp style element.

Interaction For this option to take effect, the COLORRESPONSE= option must also be specified.

Tip To reverse the start and end colors of the ramp that is assigned to the color model, use the REVERSECOLORMODEL= option.

COLORRESPONSE=*numeric-column* | *range-attr-var* | *expression*
specifies the column or range attribute map variable to use to determine the text-marker text colors.

range-attr-var
specifies a range attribute map variable that is defined in a RANGEATTRVAR statement.

"RANGEATTRVAR Statement"

Restriction A range attribute map variable specification must be a direct reference to the attribute map variable. It cannot be set as a dynamic variable.

Tip For each range in the attribute map, the RANGECOLOR= or RANGECOLORMODEL= option in the RANGE statement determines the bounding-box fill colors. The RANGEALTCOLOR= or RANGEALTCOLORMODEL= option determines the text colors and the bounding-box outline colors.

See "RANGEATTRVAR Statement" on page 1531

When a numeric column or expression is specified, the range of column or expression values are linearly mapped to the color ramp that is specified by the COLORMODEL= option. When a range attribute map variable is specified, the colors that are defined in the associated range attribute map are used instead.

You can use this option to add a second response variable to an analysis.

Interactions When the GROUP= option is specified with the COLORRESPONSE= option, the GROUP= option is ignored.

Prior to SAS 9.4M3, suboption COLOR= in the TEXTATTRS=, FILLATTRS=, and OUTLINEATTRS= options overrides the color attributes that are normally determined by this option.

Starting with SAS 9.4M3, interactions between this option and suboption COLOR= in the TEXTATTRS=, FILLATTRS=, and OUTLINEATTRS= options depend on the DISPLAY= option settings. See "Response Colors in a Text Plot" on page 993.

Note The gradient in a continuous legend for this plot reflects the text colors.

Tips To display a legend with this option in effect, use a CONTINUOUSLEGEND statement.

Use the OUTLINEATTRS= option to set the text bounding-box color to a fixed color.

Use the FILLATTRS= option to set the text bounding-box fill color to a fixed color or to modify the fill transparency.

Prior to SAS 9.4M3, when fill is displayed and the COLORRESPONSE= option is in effect, the text color and the fill color are derived from the color gradient, which makes the text unreadable. In that case, use the BACKLIGHT= option to add a backlight effect to the text, or use the TEXTATTRS= or FILLATTRS= option to specify a different text or fill color.

CONTRIBUTEOFFSETS=ALL | NONE | (*axis-offset-list*)
specifies whether space requirements for this plot contribute to the calculation of the axis offsets. This plot's layout container queries each of its plots for a preferred offset and includes all of the offsets in the axis offset calculations. If the DATALABEL= or MARKERCHARACTER= option is specified for this plot, this plot might request a preferred offset that prevents the clipping of any data labels or marker character strings that appear at the ends of the axes. The requested offset is based on the longest string. If the label or marker character lengths vary significantly, the result is wasted space when the shorter strings appear near the ends of the axes. In that case, you can use the CONTRIBUTEOFFSETS= option to modify or eliminate this plot's contribution to the offset calculations in order to reclaim that space.

ALL
the space requirements for this plot are contributed to the axis offset calculations.

NONE
the space requirements for this plot are not contributed to the axis offset calculations.

(*axis-offset-list*)
a space-delimited list of specific contributions that this plot makes to the axis offset calculations.

The list is one or more of the following values, enclosed in parentheses:

XMAX
the space requirements for this plot are contributed to the X-axis offset calculation for the maximum end.

XMIN
the space requirements for this plot are contributed to the X-axis offset calculation for the minimum end.

YMAX
the space requirements for this plot are contributed to the Y-axis offset calculation for the maximum end.

YMIN
the space requirements for this plot are contributed to the Y-axis offset calculation for the minimum end.

Default ALL

Interaction Offsets that are set in the layout axis options are always honored, regardless of the setting on this option.

Note This option does not affect offset requests from other plots.

DATATRANSPARENCY=*number*
specifies the degree of the transparency of the text.

Default 0

Range 0–1, where 0 is opaque and 1 is entirely transparent

Restriction The specified transparency is not applied to missing values. Missing values are always opaque.

DISCRETEOFFSET=*number*
specifies the distance to offset all text values from discrete X values, discrete Y values, or both.

Default 0 (no offset, all text values are centered on the discrete X values, or discrete Y values, or both)

Range −0.5 to +0.5, where 0.5 represents half the distance between discrete tick marks. A positive offset is to the right on discrete X values and is up on discrete Y values. If the layout's axis options set REVERSE=TRUE, then the offset direction is also reversed.

Restriction This option applies to discrete axes only. For nondiscrete axes, this option is ignored.

Tip Setting the discrete offset for the plots does not affect the axis minimum and maximum offsets. In some cases, setting a discrete offset can cause clipping at each end of the axis. In those cases, use the OFFSETMIN= and OFFSETMAX= axis options to increase the axis minimum and maximum offsets to accommodate the discrete offset.

DISPLAY=(*display-options*) | STANDARD | ALL
specifies the text features to display.

(*display-options*)
a space-separated list of one or more display options, enclosed in parentheses.

The list can include one or more of the following options:

FILL
displays filled bounding boxes around the text

Tip Use the FILLATTRS= option to modify the appearance of the bounding-box fill.

OUTLINE
displays outlined bounding boxes around the text

Tip Use the OUTLINEATTRS= option to modify the appearance of the bounding-box outline.

STANDARD
displays the text only

ALL
specifies FILL and OUTLINE

Default STANDARD

Restriction Vector graphics output cannot be generated when FILL or OUTLINE is displayed. If you request vector graphics output and specify

DISPLAY=FILL or DISPLAY=OUTLINE, an image is generated instead.

Tip When fill is displayed and the COLORRESPONSE= option is in effect, a low contrast between the fill color and the text color can make some of the text difficult to read or unreadable. In that case, use the TRANSPARENCY= suboption to adjust the fill transparency or use the BACKLIGHT= option to add a backlight effect to the text.

FILLATTRS=*style-element* | (*fill-options*)
specifies the appearance of the filled areas of the text. When fill options are specified, only the COLOR= and TRANSPARENCY= suboptions are honored.

Defaults For non-grouped data, the Color attribute of the GraphDataDefault style element.

For grouped data, the Color attribute of the GraphData1–GraphDataN style elements.

Interactions For this option to have any effect, the fill must be enabled by the ODS style or by the DISPLAY= option.

When this option's COLOR= suboption is specified with the GROUP= or COLORRESPONSE= option, the bounding-box fill color is set to the COLOR= specification for all of the text values.

Tip The DATATRANSPARENCY= option sets the transparency for the text-marker text, fill, and outlines. You can combine this option with DATATRANSPARENCY= to set one transparency for the text and outlines but a different transparency for the fills. Example:

```
datatransparency=0.2 fillattrs=(transparency=0.6)
```

See "General Syntax for Attribute Options" on page 1599 for the syntax for using a *style-element*.

"Fill Color Options" on page 1600 for available *fill-options*.

FORMAT=*format*
specifies a SAS format or a user-defined format for the TEXT= column.

Default The format that is in effect for the column that is specified in the TEXT= argument. If no format is in effect, BEST6 is used for numeric columns.

Note Not all of the SAS formats are supported. See Appendix 4, "Format Support in ODS Graphics," on page 1621.

GROUP=*column* | *discrete-attr-var* | *expression*
creates a separate text value for each unique group value in the specified column.

discrete-attr-var
specifies a discrete attribute map variable.

The discrete attribute map variable is created by a DISCRETEATTRVAR statement.

Restriction A discrete attribute map variable specification must be a direct reference to the attribute map variable. It cannot be set by a dynamic variable.

Tip For each value in the discrete attribute map, the VALUE statement TEXTATTRS= option determines the text color, the LINEATTRS= option determines the bounding-box outline color, and the FILLATTRS= option determines the bounding-box fill color and transparency.

Interactions The group values are mapped in the order in which they appear in the data.

The INCLUDEMISSINGGROUP option controls whether missing group values are considered a distinct group value.

The COLORRESPONSE= option overrides the group settings for the text color of the text value. In that case, text color is set according to the gradient.

The COLOR= suboption of the TEXTATTRS= option overrides the group settings for the text color of the text value. In that case, the text color for all of the text values is set to the COLOR= specification.

Notes The legend entries for this plot reflect the text colors.

By default, for each text value, the bounding-box outline color is set to the text color.

If you specify a column in a SAS data set, the visual attributes for each group value are assigned in data order. If you specify a column in a CAS in-memory table, the visual attributes for each group value are assigned in ascending order of the group column character values or of unformatted numeric values.

Tips Use the OUTLINEATTRS= option to set the text bounding-box color to a fixed color.

By default, ODS Graphics limits the number of groups to 1000. When this limit is exceeded, the GROUP= option is ignored. Use the GROUPMAX= option in the ODS GRAPHICS statement to change the maximum number of groups that can be processed.

GROUPDISPLAY=OVERLAY | CLUSTER

specifies how marker groups are positioned for the coordinate pairs.

OVERLAY

draws text values for a given group value at the exact coordinate.

Depending on the data, markers at a given coordinate might overlap.

CLUSTER
draws text values for a given group value adjacent to each other.

Restriction CLUSTER is supported only when at least one axis is discrete.

Default OVERLAY

Note When you plot a SAS data set, the items for each group value are drawn in data order. When you plot a CAS in-memory table, they are drawn in ascending order of the group column character values or unformatted numeric values.

Tip Use the CLUSTERWIDTH= option to control the width of the clusters when CLUSTER is in effect.

INCLUDEMISSINGGROUP=TRUE | FALSE
specifies whether missing values of the group variable are included in the plot.

Default TRUE

Interaction For this option to take effect, the GROUP= option must also be specified.

Tip The attributes of the missing group value are determined by the GraphMissing style element unless a discrete attribute map is in effect, the INDEX= option is used, the MISSING= system option changes the default missing character, or a user-defined format is applied to the group value. In those cases, the attributes of the missing group value are determined by a GraphData1–GraphDataN style element instead of by the GraphMissing style element.

See “boolean ” on page xii for other Boolean values that you can use.

INDEX=*positive-integer-column* | *expression*
specifies indices for mapping marker text color to one of the GraphData1–GraphDataN style elements.

Requirements The column or expression value must be an integer value of 1 or greater. Otherwise, this option is ignored.

The positive-integer column must not contain missing values. Otherwise, the entire column is invalidated and this option is ignored.

All of the indexes for a specific group value must be the same. Otherwise, the results are unpredictable.

Interaction For this option to take effect, the GROUP= option must also be specified.

Notes The index values are 1-based indices. For the style attributes in GraphData1–GraphDataN, if the index value is greater than N, then a modulo operation remaps that index value to a number less than N to determine which style to use.

If you do not use this option, then the group values are mapped in the order of the data.

Tip You can use indexing to collapse the number of groups that are represented in a graph. For more information, see "Remapping Groups for Grouped Data" on page 211.

LEGENDLABEL="*string*"
specifies a label to be used in a discrete legend for this plot.

Default The TEXT-column label. If a label is not defined, then the TEXT-column name is used.

Restriction This option applies only to an associated DISCRETELEGEND statement.

Interaction If the GROUP= option is specified, then this option is ignored.

NAME="*string*"
assigns a name to this plot statement for reference in other template statements. The specified name is used primarily in legend statements to coordinate the use of colors and line patterns between the plot and the legend.

Restrictions The *string* is case sensitive, cannot contain spaces, and must define a unique name within the template.

This option does not support variables that are created by the DYNAMIC, MVAR, and NMVAR template statements.

OUTFILE=*fileref* | "*filename*"
specifies a file for storing information about the text bounding-box for each text value in the column specified in the OUTID= option. The information is written in the comma-separated value (CSV) format.

CAUTION
OUTFILE= is an experimental option that is available in SAS 9.4M3. Do not use this option in production jobs.

Interaction The OUTID= option must be specified for this option to have any effect.

Note This option is a specialized feature for users who want to customize the placement of the text in a text plot.

Tip Use the IMPORT procedure to import the CSV values into a SAS data set.

See "Customizing Text Marker Placement (Experimental)" on page 994

OUTID=*column* | *expression*
specifies a column that contains text values to write to the file specified in the OUTFILE= option.

CAUTION

OUTID= is an experimental option that is available in SAS 9.4M3. Do not use this option in production jobs.

Interaction The OUTFILE= option must be specified for this option to have any effect.

Note This option is a specialized feature for users who want to customize the placement of the text in a text plot.

See "Customizing Text Marker Placement (Experimental)" on page 994

OUTLINEATTRS=*style-element* | *style-element*(*line-options*) | (*line-options*)
specifies the appearance of the text-marker outlines.

Defaults For non-grouped data, the ContrastColor attribute of the GraphOutlines style element.

For grouped data, text values use the ContrastColor attribute of the GraphData1–GraphDataN style elements. If the COLORRESPONSE= option is specified, the outline colors vary according to the color gradient.

Restriction This option uses only the color specification in the style element or line options. The line pattern and line thickness specifications are ignored.

Interactions For this option to have any effect, outlines must be enabled by the ODS style or by the DISPLAY= option.

When the COLOR= suboption is specified with the GROUP= option or with the COLORRESPONSE= option, for all of the text values, the bounding-box border color is set to the COLOR= specification.

Note This plot's legend entries reflect the marker text color.

See "General Syntax for Attribute Options" on page 1599 for the syntax for using a *style-element*.

COLOR= on page 1602

PAD=*dimension* | *(pad-options)*
specifies the amount of extra space to add inside the text-marker border.

dimension
specifies a dimension to use for the extra space at the left, right, top, and bottom of the text-marker border.

(*pad-options*)
a space-separated list of one or more pad options, enclosed in parentheses.

The list can include one or more of the following name-value-pair options:

LEFT=*dimension* TOP=*dimension*
RIGHT=*dimension* BOTTOM=*dimension*

Default Padding is a fraction of the font height.

Note Sides that are not assigned padding are padded with the default amount.

Tips This option is meaningful only when the DISPLAY= option displays fills, outlines, or both.

Use *pad-options* to create non-uniform padding.

Note The default units for *dimension* are pixels.

See "dimension" on page xiii

POSITION=BOTTOM | BOTTOMLEFT | BOTTOMRIGHT | CENTER | LEFT | RIGHT | TOP | TOPLEFT | TOPRIGHT | *keyword-column*
specifies the position of the text value with respect to the location of the data point.

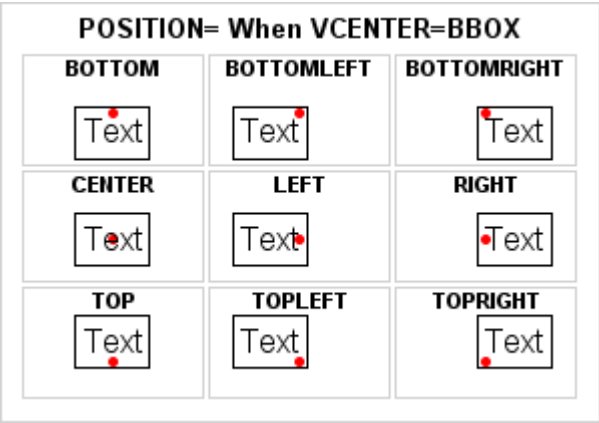
BOTTOM | BOTTOMLEFT | BOTTOMRIGHT | CENTER | LEFT | RIGHT | TOP | TOPLEFT | TOPRIGHT
specifies a position option.

keyword-column
specifies a column that contains position options.

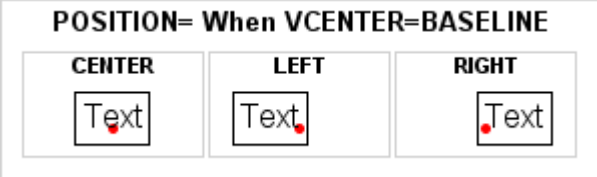
Interaction When *keyword-column* is specified and SPLITJUSTIFY= on page 986 is other than AUTO (default), the position values specified in *keyword-column* are ignored and the text is positioned BOTTOMRIGHT.

Note This feature applies to SAS 9.4M5 and to later releases.

The VCENTER= option specifies whether the position is relative to the text bound box or the text baseline. See the VCENTER= option. By default, the positions are relative to the text bounding box. The following figure shows the effect of each of these values on the position of an outlined text value when VCENTER=BBOX is in effect. The red dot indicates the marker data-point location.



When CENTER, LEFT, or RIGHT is specified, and VCENTER=BASELINE is in effect, the positions are relative to the text baseline, as shown in the following figure.



Default CENTER

POSITIONOFFSETX=*number* | *numeric-column*
specifies the positive or negative X offset for an individual text item.

Note: This feature applies to SAS 9.4M5 and to later releases.

The offset is relative to the item's data coordinate. The value can be greater than 1. The offset unit is the font height of the current text item, which varies according to the text's font size based on size response, and so on.

Notes A value of 1 implies an X offset that is the same distance as the current text item's font height.

A reverse axis reverses the offset direction.

Tip This option is most useful when the text is placed around other objects in the graph.

POSITIONOFFSETY=*number* | *numeric-column*
specifies the positive or negative Y offset for an individual text item.

Note: This feature applies to SAS 9.4M5 and to later releases.

The offset is relative to the item's data coordinate. The value can be greater than 1. The offset unit is the font height of the current text item, which varies according to the text's font size based on size response, and so on.

Notes A value of 1 implies an Y offset that is the same distance as the current text item's font height.

A reverse axis reverses the offset direction.

Tip This option is most useful when the text is placed around other objects in the graph.

PRIMARY=TRUE | FALSE
specifies that the data columns for this plot and the plot type be used for determining default axis features. This option is needed only when two or more plots within an overlay-type layout contribute to a common axis.

Default FALSE

Restriction This option is ignored if the plot is placed under a GRIDDED or LATTICE layout block.

Note In an OVERLAY layout, only one plot in an overlay can be the primary plot on a per-axis basis. When no plot is designated as the primary plot, the first plot that can be a primary plot is considered the primary plot. If multiple plots specify PRIMARY=TRUE for the same axis, then the last such plot encountered is considered the primary plot.

See "When Plots Share Data and a Common Axis" on page 1046

"boolean " on page xii for other Boolean values that you can use.

REVERSECOLORMODEL=TRUE | FALSE
specifies whether to reverse the gradient (color ramp) that is defined by either the ODS style that is in effect or by the COLORMODEL= option.

Default FALSE

See COLORMODEL=

"boolean " on page xii for other Boolean values that you can use.

ROTATE=*number* | *numeric-column*
specifies the angle of rotation, in degrees, for the text values. Positive angles are measured in a counter-clockwise direction, and negative angles are measured in a clockwise direction. You can use an angle that exceeds 360 degrees in absolute value.

Default 0

ROLENAME=(*role-name-list*)
specifies user-defined roles that can be used to display information in the data tips. This option provides a way to add to the data columns that appear in data tips that are specified by the TIP= option.

(*role-name-list*)
a space-separated list of *role-name = column* pairs.

Example The following example assigns the column Obs to the user-defined role TIP:

```
ROLENAME=(TIP1=OBS)
```

Default No user-defined roles

Requirement The role names that you choose must be unique and different from the predefined roles X, Y, GROUP, and COLORRESPONSE.

SIZEMAX=*dimension*
specifies the maximum font size for a text marker when a response variable is used to size the text-marker font. By default, the font size of the text values that are associated with the maximum response column value is set to the value specified by this option.

Default Three times the size specified in the GraphDataText style element for the maximum response column value marker.

Interactions The SIZERESPONSE= option must be specified for this option to have any effect.

The SIZEMAXRESPONSE= option specifies the response value at which the maximum font size for a text marker is reached. The font size for all text values that exceed the SIZEMAXRESPONSE= value is set to the value specified in this option.

Tips Use the SIZEMAXRESPONSE= option to specify the response value at which the maximum font size for a text marker is reached.

Use the SIZEMIN= option to specify the minimum font size for text markers.

See "dimension" on page xiii

SIZEMAXRESPONSE=*numeric* | *scalar-numeric-expression*
specifies the response value that corresponds to the maximum font size for text markers.

Default The maximum value in the response column specified in the SIZERESPONSE= option.

Interaction The SIZERESPONSE= option must be specified for this option to have any effect.

Note The font size for all text values that exceed the maximum response value is set to the value specified in the SIZEMAX= option.

SIZEMIN=*dimension*
specifies the minimum font size for text markers when a response variable is used to size the font for text values.

Default The size specified in the GraphDataText style element for the minimum response column value marker.

Interaction The SIZERESPONSE= option must be specified for this option to have any effect.

Tip Use the SIZEMAX= option to specify the maximum text size.

See "dimension" on page xiii

SIZERESPONSE=*numeric-column* | *numeric-expression*
specifies a response column that is used to determine the font size for each text value.

Default The size specified in the GraphDataText style element for all text values.

Notes When the column value for an observation is 0, the font size for the text value for that observation is set to the SIZEMIN= option value.

When the column value for an observation is negative or missing, the text value for that observation is not displayed in the text plot. However, that observation still contributes to the axis ranges, legend, and so on.

When all the column values are 0 or missing, this option is ignored. In that case, the default font size is used for all of the text values.

Tip Use the SIZEMIN= and SIZEMAX= options to limit the minimum and maximum font size for the text values.

SPLITCHAR="*character-list*"
specifies one or more characters on which the text-marker text can be split.

When multiple split characters are specified, each character in the list is treated as a separate split character unless the specified characters appear consecutively in the data label. In that case, all of the specified split characters together are treated as a single split character.

When SPLITPOLICY=SPLIT and a text value collision is detected, the text-marker text is split on a specified split character only if a split is needed at that point in order to make the text fit. In that case, a split might not occur on every split character. When SPLITPOLICY=SPLITALWAYS, the text-marker text is split unconditionally on every occurrence of a split character. If the text-marker text does not contain any of the specified split characters, then the text is not split.

"character-list"
one or more characters with no space between each character and enclosed in quotation marks.

Default A blank space

Requirements The list of characters must be enclosed in quotation marks.

Multiple characters must be specified with no space between them. For example, to specify the split characters a, b, and c, use the following option:

```
splitchar="abc"
```

The SPLITPOLICY= option must specify SPLIT or SPLITALWAYS.

Interaction The SPLITCHARDROP= option specifies whether the split characters are included in the displayed data label or are dropped.

Notes When multiple characters are specified, the order of the characters in the list is not significant.

The split characters are case sensitive.

SPLITCHARDROP=TRUE | FALSE
specifies whether the split characters are included in the text-marker text.

TRUE
drops a split character from the text-marker text when a split occurs at that character.

Split characters at which a split does not occur are left in place. The SPLITPOLICY= option determines where the text is split. When SPLITPOLICY=SPLIT, the text for each text value is split at a split character only where a split is needed to fit the text in the available space. At each split point, the split character is dropped, and the characters that follow the split character, up to but not including the split character at the next split point, are wrapped to the following line.

When SPLITPOLICY=SPLITALWAYS, the text-marker text is split at every instance of a split character. All of the split characters are dropped. The characters that follow each split character, up to but not including the next split character, are wrapped to the next line.

FALSE
includes the split characters in the data label display.

The SPLITPOLICY= option determines how the split characters are displayed. When SPLITPOLICY=SPLIT, each data label is split at a split character only where a split is needed in order to make the label fit the available space. A split might not occur at every split character in the label. At each split point, the split character remains as the last character in the current line. The characters that follow the split character, up to and including the split character at the next split point, are then wrapped to the following line. This process repeats until all of the text is displayed.

When SPLITPOLICY=SPLITALWAYS, the text for each marker is split at every instance of a split character in the text regardless of whether a split is actually needed. Each split character remains as the last character in the current line. The characters that follow each split character, up to and including the next split character, are then wrapped to the next line.

Default TRUE. A split character is dropped from the text-marker text when a split occurs at that character.

Requirement The SPLITPOLICY= option must specify SPLIT or SPLITALWAYS.

See “boolean ” on page xii for other Boolean values that you can use.

SPLITJUSTIFY=AUTO | CENTER | LEFT | RIGHT
specifies the justification of the lines of text in the text-marker text blocks.

AUTO
justifies the text based on the POSITION= option.

POSITION= Value	Justification
TOPLEFT, LEFT, or BOTTOMLEFT	RIGHT
TOPRIGHT, RIGHT, or BOTTOMRIGHT	LEFT
TOP, CENTER, or BOTTOM	CENTER

CENTER
LEFT
RIGHT
justifies the text center, left, or right, as specified.

Default AUTO

SPLITPOLICY=NONE | SPLIT | SPLITALWAYS
specifies a policy for avoiding collisions among the text values.

NONE
does not split the text for text values that collide.

SPLIT
splits the text-marker text at a split character only if a split is needed at that character in order to make the text fit the available space.

No split occurs at split characters that occur where a split is not needed. If the text does not contain any of the specified split characters, then a split does not occur. In that case, if the text does not fit the available space, then it might collide with the adjoining text values.

See the SPLITCHAR= option for information about specifying the split characters

SPLITALWAYS
splits the text-marker text at every occurrence of a split character.

If the text does not contain any of the specified split characters, then a split does not occur.

See the SPLITCHAR= option for information about specifying the split characters

Default NONE

SPLITWIDTH=AUTO | *width-in-characters*
specifies the maximum width of each split line.

AUTO
uses the width of the longest inter-split-character substring.

width-in-characters
specifies a fixed width, expressed as a character count.

Note When you specify a fixed width, the text-marker text is split unconditionally every *n* characters, where *n* is the value of *width-in-characters*.

Restriction This option has an effect only when SPLITPOLICY=SPLIT.

STRIP=TRUE | FALSE
specifies whether leading and trailing blanks should be stripped from the text-marker text before it is displayed.

Default FALSE

Tip Stripping the blanks from the numeric value strings helps center each string relative to its data point.

See "boolean " on page xii for other Boolean values that you can use.

TEXTATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font properties of the text-marker text.

Defaults For non-grouped data, the GraphDataText style element.

For grouped data, the Font attribute of the GraphDataText style element, and the ContrastColor attribute of a GraphDataN style element.

Interactions When this option's COLOR= suboption is used with the GROUP= option, the COLOR= suboption specifies the color for all of the text values.

This option's COLOR= suboption overrides the COLORRESPONSE= option. In that case, if a continuous legend is requested for the plot, the legend is not drawn.

Note If one or more text options are specified and they do not include all the font properties (color, family, size, weight, and style), the properties that are not specified are derived from the GraphDataText style element.

See "General Syntax for Attribute Options" on page 1599 for the syntax for using a *style-element*.

"Text Options" on page 1606 for available *text-options*.

TIP=(*role-list*) | NONE
specifies the information to display when the cursor is positioned over the text values. If you use this option, it replaces all of the information that is displayed by default. Roles for columns that do not contribute to the scatter plot can be specified along with roles that do.

(*role-list*)
specifies an ordered, space-separated list of unique TEXTPLOT roles and user-defined roles. TEXTPLOT roles include X, Y, GROUP, and COLORRESPONSE.

User-defined roles are defined with the ROLENAME= option.

Example The following example displays data tips for the columns assigned to the roles X and Y, as well as the column Obs, which is not assigned to any pre-defined TEXTPLOT role. The Obs column must first be assigned a role.

```
ROLENAME=(TIP1=OBS)
TIP=(TIP1 X Y)
```

NONE
suppresses data tips and URLs (if requested) from the plot.

Default The columns assigned to the following roles are automatically included in the data tip information: X, Y, GROUP, and COLORRESPONSE.

Restriction Data tips in text plots are not supported in the SVG output format. To generate a text plot with data tips, use a bitmapped output format such as PNG.

Requirement To generate data tips in the output, you must include an ODS GRAPHICS ON statement with the IMAGEMAP option specified, and you must write the output to the ODS HTML destination.

Interaction This option is ignored when the plot statement is in an OVERLAY or PROTOTYPE layout and the INCLUDERANGES= option is specified in the LINEAROPTS= or TIMEOPTS= option for either axis.

Tip You can control the labels and formats for the TIP roles with the TIPLABEL= and TIPFORMAT= options.

TIPFORMAT=(*role-format-list*)
specifies display formats for tip columns. This option provides a way to control the formats of columns that appear in data tips.

(role-format-list)
a space-separated list of *role-name* = *format* pairs.

Example
```
ROLENAME=(TIP1=SALARY)
TIP=(TIP1)
TIPFORMAT=(TIP1=DOLLAR12.)
```

Default The column format of the column assigned to the role or BEST6 if no format is assigned to a numeric column.

Restriction Only the roles that appear in the TIP= option are used.

Requirement A column must be assigned to each of the specified roles. (See the ROLENAME= option.)

TIPLABEL=(*role-label-list*)
specifies display labels for tip columns. This option provides a way to control the labels of columns that appear in data tips.

role-label-list
a space-separated list of *rolename* ="*string*" pairs.

Example
```
ROLENAME=(TIP1=PCT)
TIP=(TIP1)
TIPLABEL=(TIP1="Percent")
```

Default The column label or column name of the column assigned to the role.

Restriction Only the roles that appear in the TIP= option are used.

Requirement A column must be assigned to each of the specified roles. (See the ROLENAME= option.)

URL=*string-column*
specifies an HTML page to display when a text value is selected.

string-column
specifies a column that contains a valid HTML page reference (HREF) for each text value that is an active link.

Example `http://www.sas.com`

Requirement To generate selectable text values, you must include an ODS GRAPHICS ON statement that specifies the IMAGEMAP option, and you must write the output to the ODS HTML destination.

Interactions This option has no effect when TIP=NONE.

This option is ignored when the plot statement is in an OVERLAY or PROTOTYPE layout and the INCLUDERANGES= option is specified in the LINEAROPTS= or TIMEOPTS= option for either axis.

Tips The URL value can be blank for some X and Y pairs, meaning that no action is taken when the corresponding point is selected.

The URL value can be the same for any X and Y pair. In that case, the same action is taken when the points for that X and Y pair are selected.

By default, drill-down links open in a new browser window (link target _blank). To specify a different target for your drill-down links, such as _self or _parent, add the DRILLTARGET="*target*" option to your ODS GRAPHICS statement. See DRILLTARGET= on page 1568.

VCENTER=BBOX | BASELINE
specifies whether the text is vertically centered with respect to the text bounding box or to the text baseline.

BBOX
vertically centers the text with respect to its bounding box.

BASELINE
vertically centers the text with respect to the text baseline.

If the text is split into multiple lines, the text is centered on the baseline of the last line of text.

Restriction This option is valid only when POSITION= is set to CENTER, LEFT, or RIGHT. If POSITION= is set to any other value, VCENTER=BBOX is used instead.

Default BBOX

Tip Use the POSITION= option to specify the text position with respect to the text bounding box or to the text baseline.

XAXIS=X | X2
specifies whether data are mapped to the primary X (bottom) axis or to the secondary X2 (top) axis.

Default X

Interaction The overall plot specification and the layout type determine the axis display. For more information, see "How Axis Features Are Determined" on page 1040.

YAXIS=Y | Y2
specifies whether data are mapped to the primary Y (left) axis or to the secondary Y2 (right) axis.

Default Y

Interaction The overall plot specification and the layout type determine the axis display. For more information, see "How Axis Features Are Determined" on page 1040.

Details

About Text Plots

A text plot is basically a scatter plot that uses text as markers. To generate a text plot, you can use the SCATTERPLOT statement with the MARKERCHARACTER= option or you can use the TEXTPLOT statement. However, the TEXTPLOT statement provides more control over the marker text. With the TEXTPLOT statement, the plot data provides the marker location as X and Y coordinates, and the marker text. Each marker consists of the marker text enclosed in a bounding box that is centered on its X and Y coordinates. By default, the bounding box is not visible. You can specify options in the TEXTPLOT statement to add an outline, background fill, or both, to the bounding box. The following figure shows a simple example of a text marker with a filled and outlined bounding box.

Using additional options in the TEXTPLOT statement, you can rotate the text around its anchor point to any angle, manage the text position, split the text into multiple lines, add a back-light effect to the text, and so on. If you currently use the SCATTERPLOT statement and the MARKERCHARACTER= option to generate text plots, SAS recommends that you use the TEXTPLOT statement instead.

Using Colors in a Text Plot

Text Marker Color Attributes

The TEXTPLOT statement enables you to control the following color attributes for the text markers:

- text color
- bounding-box fill color
- bounding-box outline color

By default, only the marker text is displayed. Use the DISPLAY= option to specify whether the bounding-box fill, bounding-box outline, or both are displayed.

The following table lists the options that you can use to control the color attributes.

Option	Color Attribute	Default
TEXTATTRS=(COLOR=*color*)	text color	For non-grouped data, the GraphDataText:color style reference. For grouped data, the GraphDataN:ContrastColor style reference.
FILLATTRS=(COLOR=*color*)	bounding-box fill color	For non-grouped data, the GraphDataDefault:color style reference. For non-grouped data, the GraphDataN:color style reference.
OUTLINEATTRS=(COLOR=*color*)	bounding-box outline color	For non-grouped data, the GraphOutlines:ContrastColor style reference. For non-grouped data, the GraphDataN:ContrastColor style reference.

When a response variable is used, in some cases, an attribute option is overridden by the response color. See “Response Colors in a Text Plot” on page 993.

Group Colors in a Text Plot

The TEXTPLOT statement supports the GROUP= option, which enables you to create a separate text marker for each unique value in a specified column. When the GROUP= option is in effect, by default, the text marker color attributes are controlled by the GraphData1–GraphDataN style elements. You can use the TEXTATTRS=, FILLATTRS=, and OUTLINEATTRS= options to set one or more color

attributes to a fixed color. However, when you specify fixed colors, the contrast between the fixed colors and the remaining variable colors might not be sufficient for some group values. When both the GROUP= and COLORRESPONSE= options are in effect, the COLORRESPONSE= option controls the color attributes.

Response Colors in a Text Plot

The TEXTPLOT statement supports the COLORRESPONSE= option, which enables you to specify a numeric column or range attribute map variable that is used to determine the text-marker colors. When a numeric column is specified, each unique value is assigned a color from a color ramp that is specified in the COLORMODEL= option. When a range attribute map variable is specified, each unique value is assigned the attributes for that value that are defined in the attribute map. If the attribute map does not define the color attributes for a value, that value is assigned a color from the color ramp.

The TEXTPLOT statement COLORRESPONSE= option controls the color of the marker text, fill, and outline, depending on which bounding-box attributes are displayed. Prior to SAS 9.4M3, when the bounding-box fill and outline are displayed, COLORRESPONSE= determines the color of the text and the bounding-box fill. The bounding-box outline color in that case is determined by suboption COLOR= in the OUTLINEATTRS= option. When only the outline is displayed, the COLORRESPONSE= option determines the color of the text and the bounding-box outline. You can use suboption COLOR= in the FILLATTRS=, OUTLINEATTRS=, and TEXTATTRS= options to override the individual attributes.

Starting with SAS 9.4M3, when the bounding-box fill and outline are displayed, the COLORRESPONSE= option determines the color of the text and of the bounding-box outline. The bounding-box fill color in that case is determined by suboption COLOR= in the FILLATRS= option. You can use suboption COLOR= in the FILLATTRS=, OUTLINEATTRS=, and TEXTATTRS= options to override the individual attributes, depending on which bounding-box attributes are displayed. The following table lists the results when suboption COLOR= is specified in some common color attribute option settings and the COLORRESPONSE= option is in effect.

Attribute Option	Result
TEXTATTRS=	The result depends on the bounding-box display as follows: ■ If the bounding-box fill, outline, or both are displayed, the text color is set to its COLOR= specification. The bounding-box outline color is determined by the GraphDataDefault style element, and the bounding-box fill is assigned a color from the color ramp. ■ If no bounding-box attributes are displayed, suboption COLOR= in TEXTATTRS= is ignored, and the text is assigned a color from the color ramp.
TEXTATTRS= and FILLATTRS=	The result depends on the bounding-box display as follows:

Attribute Option	Result
	■ If the fill and outline are displayed, the text and fill colors are set to their COLOR= specification. The bounding-box outline is assigned a color from the color ramp. ■ If only the fill is displayed, the text color is set to its COLOR= specification. Suboption COLOR= in FILLATTRS= is ignored, and the bounding-box fill is assigned a color from the color ramp.
TEXTATTRS= and OUTLINEATTRS=	The result depends on the bounding-box display as follows: ■ If the fill and outline are displayed, the text and outline colors are set to their COLOR= specification. The bounding-box fill is assigned a color from the color ramp. ■ If only the outline is displayed, the outline color is set to its COLOR= specification. Suboption COLOR= in TEXTATTRS= is ignored, and the text is assigned a color from the color ramp.
TEXTATTRS=, FILLATTRS=, and OUTLINEATTRS=	When the bounding-box fill and outline are displayed, suboption COLOR= in TEXTATTRS= is ignored, and the text is assigned a color from the color ramp. The fill and outline colors are set to their COLOR= specification.

Customizing Text Marker Placement (Experimental)

Starting with SAS 9.4M3, you can use the TEXTPLOT statement OUTFILE= and OUTID= options to write information about the bounding box size and position for each text marker to a comma-separated values (CSV) file.

CAUTION
OUTFILE= and OUTID= are experimental options that are available in SAS 9.4M3. Do not use these options in production jobs.

These options are for users who want to customize the placement of the text in a text plot. After you write the attributes to a CSV file, you can import the data into a SAS data set, and then use the data to customize the placement of the text markers.

The following table lists the information that is written to the CSV file.

Column Name	Data Type	Description
DataDescent	Numeric	The descent, in y-axis units, of this observation's text string. For a discrete axis, one unit is the distance between adjacent discrete category ticks.

Column Name	Data Type	Description
DataHeight	Numeric	The height, in y-axis units, of this observation's text string. For a discrete axis, one unit is the distance between adjacent discrete category ticks.
DataWidth	Numeric	The width, in x-axis units, of this observation's text string. For a discrete axis, one unit is the distance between adjacent discrete category ticks.
Descent	Numeric	The descent, in pixels, of this observation's text string.
Height	Numeric	The height, in pixels, of the bounding box for this observation's text string.
Name	Character	The name that is specified in the NAME= option in this TEXTPLOT statement. The name associates this CSV file with a specific TEXTPLOT statement. This column is useful when multiple CSV files from different TEXTPLOT statements are merged into a single SAS data set.
OutID	Character	The value for this observation from the column specified in the OUTID= option in this TEXTPLOT statement. The ID is used as a unique identifier for this observation's text string.
RelativeDescent	Numeric	The relative descent of this observation's bounding box as a proportion of the plot area width.
RelativeHeight	Numeric	The relative height of this observation's text string as a proportion of the plot area height.
RelativeWidth	Numeric	The relative width of this observation's bounding box as a proportion of the plot area width.
Width	Numeric	The width, in pixels, of the bounding box for this observation's text string.

Here is an example of using the OUTFILE= and OUTID= options in a TEXTPLOT statement to write text bounding-box information to CSV file textboxdata.csv. It also shows how to import the CSV file into SAS data set Work.TextBoxData.

```
filename csvout "textboxdata.csv";

/* Write the text bound-box data to file textboxdata.csv */
proc template;
define statgraph textplot;
  begingraph;
```

```
    layout overlay;
      textplot x=weight y=height text=name / name="textboxdata"
        outfile=csvout outid=name;
    endlayout;
  endgraph;
end;

proc sgrender data=sashelp.class template=textplot;
run;

/* Import the CSV file into data set Work.TextBoxData */
proc import
  out=work.textboxdata
  datafile=csvout
  dbms=csv replace;
  getnames=yes;
run;
```

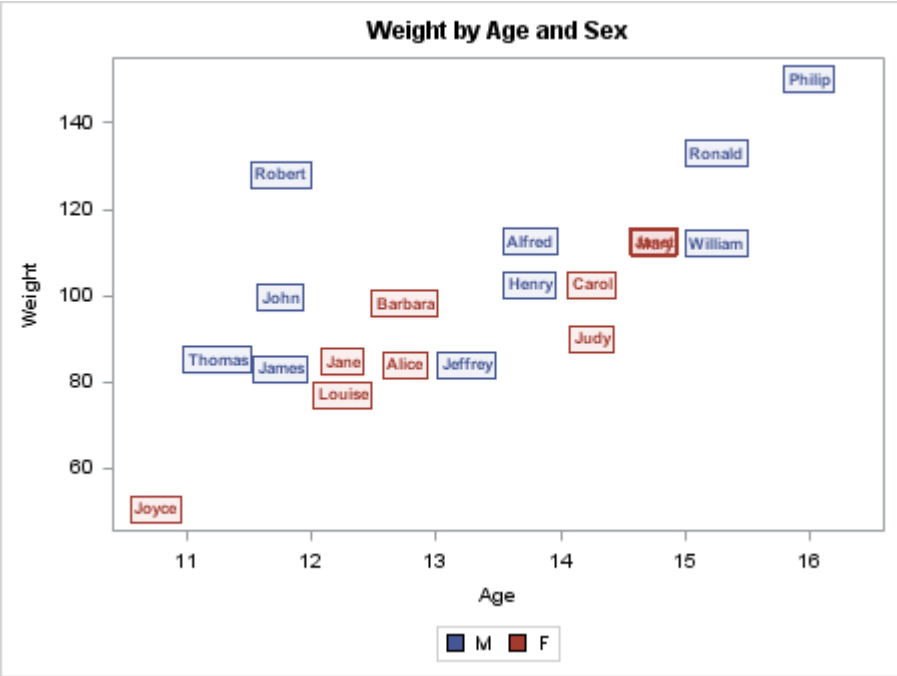
Here is a partial listing of data set Work.TextBoxData.

```
The SAS System

Obs      NAME        OUTID      WIDTH      HEIGHT     DESCENT    RELATIVEWIDTH

  1   textboxdata   Alfred    34.045307   19.028384   5.004367     0.060364
  2   textboxdata   Alice     31.040453   19.028384   5.004367     0.055036
  3   textboxdata   Barbara   43.059872   19.028384   5.004367     0.076347
  …
Obs   RELATIVEHEIGHT   RELATIVEDESCENT   DATAWIDTH   DATAHEIGHT   DATADESCENT

  1      0.046411         0.012206       6.489479     1.062499     0.279432
  2      0.046411         0.012206       5.916715     1.062499     0.279432
  3      0.046411         0.012206       8.207772     1.062499     0.279432
  …
```

After you import the CSV file into a SAS data set, you can then use the data to position the text values as needed.

Example: TEXTPLOT Statement

This example creates a text plot of weight by age and sex. Column Name provides the text for filled, outlined markers. The following figure shows the output.



Here is the SAS code for this example.

```
proc template;
  define statgraph textplot;
    begingraph;
      entrytitle "Weight by Age and Sex";
      layout overlay / yaxisopts=(offsetmin=0.05 offsetmax=0.05);
        textplot x=age y=weight text=name / name='textplot1'
          display=all
          textattrs=(weight=bold) fillattrs=(transparency=0.9)
          group=sex groupdisplay=cluster clusterwidth=1;
        discretelegend 'textplot1';
      endlayout;
   endgraph;
 end;
run;

proc sgrender data=sashelp.class template=textplot;
run;
```

VECTORPLOT Statement

Creates a plot of vectors (directed line segments).

Syntax

VECTORPLOT X=*numeric-column* | *expression*
Y=*numeric-column* | *expression*
XORIGIN=*numeric-constant* | *numeric-column* | *expression*

YORIGIN=*numeric-constant* | *numeric-column* | *expression* < */options* >;

Summary of Optional Arguments

Appearance options

CLIP=TRUE | FALSE
: specifies whether the origin is considered when determining the data ranges for the axes.

COLORMODEL=*color-ramp-style-element* | (*color-list*)
: specifies a color ramp to use with the COLORRESPONSE= option.

COLORRESPONSE=*numeric-column* | *range-attr-var* | *expression*
: specifies the column or range attribute variable to use to map the line colors to a continuous color gradient.

DATASKIN=NONE | CRISP | GLOSS | MATTE | PRESSED | SHEEN
: enhances the visual appearance of the vector plot lines.

DATATRANSPARENCY=*number*
: specifies the degree of the transparency of the vector line and arrowhead, and the vector labels.

INDEX=*positive-integer-column* | *expression*
: specifies indices for mapping line attributes (color and line pattern) to one of the GraphData1–GraphDataN style elements.

LINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
: specifies the attributes of the vector line and arrowhead.

LINETHICKNESSMAX=*dimension*
: specifies the maximum line thickness when a response variable is used to determine the line thickness.

LINETHICKNESSMAXRESPONSE=*numeric* | *scalar-numeric-expression*
: specifies the response value that corresponds to the maximum line thickness.

LINETHICKNESSMIN=*dimension*
: specifies the minimum line thickness when a response variable is used to determine the line thickness.

LINETHICKNESSRESPONSE=*numeric-column* | *expression*
: specifies a response column or range attribute variable that is used to map a line thickness to each group value.

Axes options

PRIMARY=TRUE | FALSE
: specifies that the data columns for this plot and the plot type be used for determining default axis features.

XAXIS=X | X2
: specifies whether data are mapped to the primary X (bottom) axis or to the secondary X2 (top) axis.

YAXIS=Y | Y2
: specifies whether data are mapped to the primary Y (left) axis or to the secondary Y2 (right) axis.

Data tip options

ROLENAME=(*role-name-list*)
: specifies user-defined roles that can be used to display information in the data tips.

TIP=(*role-list*) | NONE
: specifies the information to display when the cursor is positioned over a vector line.

TIPFORMAT=(*role-format-list*)
: specifies display formats for tip columns.

TIPLABEL=(*role-label-list*)
: specifies display labels for tip columns.

Label options

DATALABEL=*column* | *expression*
: specifies the labels at the ends of the vectors.

DATALABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
: specifies the color and font attributes of the data labels.

DATALABELPOSITION=AUTO | TOPRIGHT | TOP | TOPLEFT | LEFT | CENTER | RIGHT | BOTTOMLEFT | BOTTOM | BOTTOMRIGHT
: specifies the location of the data labels relative to the end points and arrow heads.

DATALABELSPLIT=TRUE | FALSE
: specifies whether to split the data labels at specified split characters.

DATALABELSPLITCHAR="*character-list*"
: specifies one or more characters on which the data labels can be split if needed.

DATALABELSPLITCHARDROP=TRUE | FALSE
: specifies whether the split characters are included in the data labels.

DATALABELSPLITJUSTIFY=AUTO | CENTER | LEFT | RIGHT
: specifies the justification of the strings that are inside the data label blocks.

LEGENDLABEL="*string*"
: specifies a label to be used in a discrete legend for this plot.

Midpoint options

GROUP=*column* | *discrete-attr-var* | *expression*
: creates a distinct set of vector lines and data label colors for each unique group value in the specified column.

INCLUDEMISSINGGROUP=TRUE | FALSE
: specifies whether missing values of the group variable are included in the plot.

Plot reference options

NAME="*string*"
: assigns a name to this plot statement for reference in other template statements.

Vector options

ARROWDIRECTION=OUT | IN | BOTH
specifies the placement of the arrowhead(s) at the end of the vector.

ARROWHEADS=TRUE | FALSE
specifies whether arrowheads are displayed on the vectors.

ARROWHEADSHAPE=OPEN | CLOSED | FILLED | BARBED
specifies the shape of the arrowheads.

SCALE=*number*
specifies the scale factor of the vector length.

Required Arguments

X=*numeric-column* | *expression*
specifies the column for the X values of the vector endpoints.

Y=*numeric-column* | *expression*
specifies the column for the Y values of the vector endpoints.

XORIGIN=*numeric-constant* | *numeric-column* | *expression*
specifies the X data coordinate of the vector origin.

YORIGIN=*numeric-constant* | *numeric-column* | *expression*
specifies the Y data coordinate of the vector origin.

Optional Arguments

ARROWDIRECTION=OUT | IN | BOTH
specifies the placement of the arrowhead(s) at the end of the vector.

OUT
specifies a single arrowhead, pointing away from the origin, at the end of the vector away from the origin.

IN
specifies a single arrowhead, pointing toward the origin, at the end of the vector near the origin.

BOTH
specifies two arrowheads.

One arrowhead points away from the origin, at the end of the vector opposite from the origin. The other arrowhead points toward the origin, at the end of the vector near the origin.

Default OUT

Interaction If ARROWHEADS= FALSE, then this option is ignored.

Tip Use the ARROWHEADSHAPE= option to control arrowhead appearance.

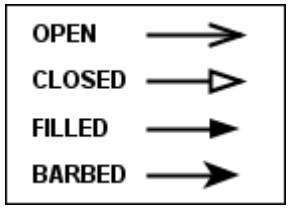
ARROWHEADS=TRUE | FALSE
specifies whether arrowheads are displayed on the vectors.

Default TRUE

Interaction When this option is set to FALSE, the ARROWDIRECTION= and ARROWHEADSHAPE= options are ignored and all vectors are displayed as undirected line segments.

See "boolean " on page xii for other Boolean values that you can use.

ARROWHEADSHAPE=OPEN | CLOSED | FILLED | BARBED
specifies the shape of the arrowheads.



Default OPEN

Interaction This option is ignored if ARROWHEADS= FALSE.

Note No arrowhead is drawn for a zero-length vector. A zero-length vector is represented as a dot at its starting point.

Tip Use the ARROWDIRECTION= option to control arrow direction.

CLIP=TRUE | FALSE
specifies whether the origin is considered when determining the data ranges for the axes.

FALSE
includes the origin when establishing the axis scales.

Each axis might be extended to force the display of the origin.

TRUE
ignores the origin when establishing axis scales.

Each axis scale is determined by the other plots in the overlay. This might result in the origin not being displayed if its data range is not within the data ranges of tips of the vectors.

Default FALSE

See "boolean " on page xii for other Boolean values that you can use.

COLORMODEL=*color-ramp-style-element* | (*color-list*)
specifies a color ramp to use with the COLORRESPONSE= option.

color-ramp-style-element
specifies the name of a color-ramp style element.

The style element should contain these style attributes:

STARTCOLOR
specifies the color for the smallest data value of the COLORRESPONSE= column.

NEUTRALCOLOR
specifies the color for the midpoint of the range of the COLORRESPONSE= column.

ENDCOLOR
specifies the color for the highest data value of the COLORRESPONSE= column.

(*color-list*)
specifies a space-separated list of colors to use in the color ramp. You can use style attribute references such as GraphData3:Color, color names, or RGB, CMYK, HLS, and HSV (HSB) color codes to specify a color. The list can contain a mix of style attribute references, color names, and color codes.

Requirement The list of colors must be enclosed in parentheses.

See "color " on page xii

Default The ThreeColorAltRamp style element.

Interaction For this option to take effect, the COLORRESPONSE= option must also be specified.

COLORRESPONSE=*numeric-column* | *range-attr-var* | *expression*
specifies the column or range attribute variable to use to map the line colors to a continuous color gradient.

Note: This feature applies to SAS 9.4M3 and to later releases.

range-attr-var
specifies a range attribute map variable that is defined in a RANGEATTRVAR statement.

"RANGEATTRVAR Statement"

Restriction A range attribute map variable specification must be a direct reference to the attribute map variable. It cannot be set as a dynamic variable.

See "RANGEATTRVAR Statement" on page 1531

When a numeric column or expression is specified, the range of column or expression values are linearly mapped to the color ramp that is specified by the COLORMODEL= option. When a range attribute map variable is specified, the colors that are defined in the associated range attribute map are used instead.

Requirement For a grouped plot, the COLORRESPONSE values should remain constant for each group value. If the COLORRESPONSE column has multiple values for a single GROUP value, unexpected results might occur.

Interactions When the GROUP= option is specified with the COLORRESPONSE= option, the color attributes are controlled by the COLORRESPONSE= option.

Suboption COLOR= in the DATALABELATTRS= option overrides this option for the data label color attribute.

This option overrides suboption COLOR= in the LINEATTRS= option and varies the line color according to the color gradient or the attribute map.

Tips To display a legend with this option in effect, use a CONTINUOUSLEGEND statement.

For a numeric column or expression, the ThreeColorAltRamp style element defines the line color gradient.

DATALABEL=*column* | *expression*
specifies the labels at the ends of the vectors.

Default No data labels are displayed

Note The label positions are automatically adjusted to prevent the labels from colliding with other labels and other arrows.

DATALABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font attributes of the data labels.

Defaults For non-grouped data, the GraphDataText style element.

For grouped data, the GraphData1:ContrastColor–GraphDataN:ContrastColor style references.

Interaction For this option to take effect, the DATALABEL= option must also be specified.

Note When the DATALABELPOSITION=AUTO option is in effect, in some cases, the data label font size might be reduced in order to avoid overlapping labels and markers.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Text Options" on page 1606 for available *text-options*.

DATALABELPOSITION=AUTO | TOPRIGHT | TOP | TOPLEFT | LEFT | CENTER | RIGHT | BOTTOMLEFT | BOTTOM | BOTTOMRIGHT
specifies the location of the data labels relative to the end points and arrow heads.

AUTO
uses a data-label collision avoidance algorithm to position the labels.

Note When AUTO is in effect, in some cases, the data label font size might be reduced in order to avoid overlapping labels and markers.

See "LABELPLACEMENT=AUTO | GREEDY | SA" on page 36

TOPRIGHT
TOP
TOPLEFT
LEFT
CENTER
RIGHT
BOTTOMLEFT
BOTTOM
BOTTOMRIGHT
specifies a location for all of the data labels.

Default AUTO

DATALABELSPLIT=TRUE | FALSE
specifies whether to split the data labels at specified split characters.

Default FALSE. The data labels are not split.

Requirement The DATALABEL= option must also be specified.

Interactions The DATALABELSPLITCHAR= option specifies one or more characters on which splits can occur.

This option has no effect when DATALABELPOSITION=AUTO.

See "boolean " on page xii for other Boolean values that you can use.

DATALABELSPLITCHAR="*character-list*"
specifies one or more characters on which the data labels can be split if needed. When multiple split characters are specified, each character in the list is treated as a separate split character unless the specified characters appear consecutively in the data label. In that case, all of the specified split characters together are treated as a single split character.

When DATALABEL= is specified and DATALABELSPLIT=TRUE, the data label is split unconditionally at each occurrence of any of the specified split characters. If the data label does not contain any of the specified characters, then the label is not split.

"character-list"
one or more characters with no space between each character and enclosed in quotation marks.

Default A blank space

Requirements The list of characters must be enclosed in quotation marks.

Multiple characters must be specified with no space between them. For example, to specify the split characters a, b, and c, use the following option:

```
datalabelsplitchar="abc"
```

The DATALABEL= option and the DATALABELSPLIT=TRUE option must also be specified.

Interactions This option has no effect if DATALABELPOSITION=AUTO.

The DATALABELSPLITCHARDROP= option specifies whether the split characters are included in the data label or are dropped.

Notes When multiple characters are specified, the order of the characters in the list is not significant.

The split characters are case sensitive.

Tip Use the DATALABELSPLITJUSTIFY= option to specify the justification of the strings in the data label block.

DATALABELSPLITCHARDROP=TRUE | FALSE

specifies whether the split characters are included in the data labels.

TRUE

drops the split characters from the data label.

FALSE

includes the split characters in the data label.

When DATALABELSPLIT=TRUE and DATALABELSPLITCHARDROP=FALSE, each split character remains as the last character in the current line. The characters that follow the split character, up to and including the next split character, are then wrapped to the next line.

The following figure shows an example of a data label with the following specifications:

- the data label text for this label is Product*Group*A
- DATALABELSPLIT=TRUE
- DATALABELSPLITCHARDROP=TRUE | FALSE
- DATALABELSPLITCHAR="*"

When DATALABELSPLITCHARDROP=TRUE, the asterisks are removed from the label. When DATALABELSPLITCHARDROP=FALSE, each asterisk remains as the last character in the line prior to the new line.

Default TRUE. The split characters are dropped from the data label.

Requirement The DATALABEL= option and the DATALABELSPLIT=TRUE option must also be specified.

Interaction The DATALABELSPLITCHAR= option specifies the split characters.

See "boolean " on page xii for other Boolean values that you can use.

DATALABELSPLITJUSTIFY=AUTO | CENTER | LEFT | RIGHT
specifies the justification of the strings that are inside the data label blocks.

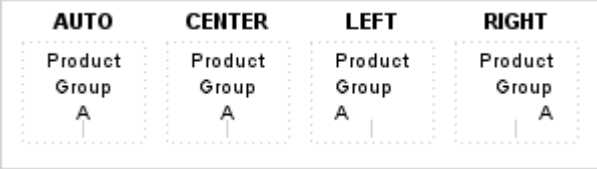
AUTO
justifies the labels based on the DATALABELPOSITION= option.

DATALABELPOSITION= Value	Justification
TOPLEFT, LEFT, or BOTTOMLEFT	RIGHT
TOPRIGHT, RIGHT, or BOTTOMRIGHT	LEFT
TOP, CENTER, or BOTTOM	CENTER

CENTER
LEFT
RIGHT
justifies the labels center, left, or right, as specified.

The following figure shows an example in which DATALABELPOSITION=TOP.

Note: The gray vertical line at the bottom of each label represents the horizontal center of the text box for reference.



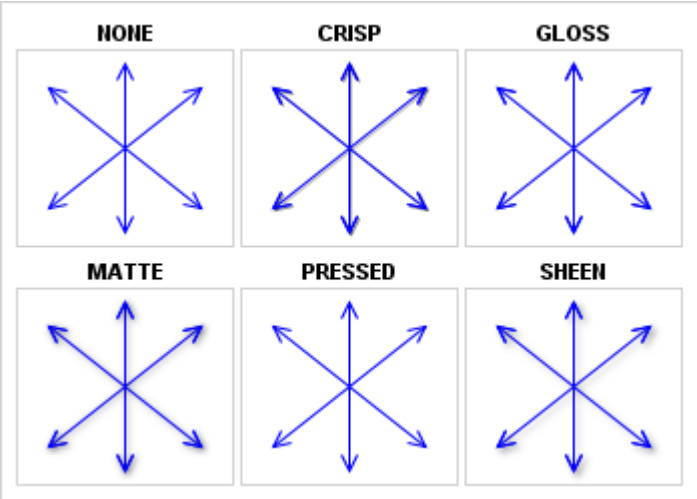
In this case, because DATALABELPOSITION=TOP, AUTO centers the lines of text. The text box is anchored the same way that the unsplit text is anchored. For example, if DATALABELPOSITION=TOP, then the bottom center of the text box is positioned at the top of the marker.

Default AUTO

Requirement The DATALABEL= option and the DATALABELSPLIT=TRUE option must also be specified.

Interaction This option has no effect if DATALABELPOSITION=AUTO.

DATASKIN=NONE | CRISP | GLOSS | MATTE | PRESSED | SHEEN
enhances the visual appearance of the vector plot lines. The following figure shows a vector plot with each of the skins applied.



Default The DATASKIN= option value that is specified in the BEGINGRAPH statement. If that value is not specified, then the GraphSkins:DataSkin style element value is used.

Restriction Starting with SAS 9.4M1, the maximum number of skinned graphical elements is limited to 200 per plot in an OVERLAY or PROTOTYPE layout. When this limit is exceeded for a plot, the specified data skin is not applied to that plot. In that case, use the DATASKINMAX= option in your ODS GRAPHICS statement to increase the maximum limit.

Interaction This option overrides the BEGINGRAPH statement DATASKIN= option.

DATATRANSPARENCY=*number*
specifies the degree of the transparency of the vector line and arrowhead, and the vector labels.

Default 0

Range 0–1, where 0 is opaque and 1 is entirely transparent

Restriction The specified transparency is not applied to missing values. Missing values are always opaque.

GROUP=*column* | *discrete-attr-var* | *expression*
creates a distinct set of vector lines and data label colors for each unique group value in the specified column.

discrete-attr-var
specifies a discrete attribute map variable.

The discrete attribute map variable is created by a DISCRETEATTRVAR statement.

Restriction A discrete attribute map variable specification must be a direct reference to the attribute map variable. It cannot be set by a dynamic variable.

Default Each distinct group value might be represented in the plot by a different combination of color and line pattern. Lines vary according to the ContrastColor and LineStyle attributes of the GraphData1–GraphDataN and GraphMissing style elements.

Interactions The group values are mapped in the order of the data, unless the INDEX= option is used to alter the default sequence of line patterns and colors.

The INCLUDEMISSINGGROUP= option controls whether missing group values are considered a distinct group value.

When both the GROUP= and the COLORRESPONSE= options are specified, the color attributes are controlled by the COLORRESPONSE= option.

Note If you specify a column in a SAS data set, the visual attributes for each group value are assigned in data order. If you specify a column in a CAS in-memory table, the visual attributes for each group value are assigned in ascending order of the group column character values or of unformatted numeric values.

Tips You can use the LINEATTRS= option to override the representations that are used to identify the groups. For example, You can use LINEATTRS=(PATTERN=SOLID) to assign the same pattern to all of the lines, letting the line color distinguish group values. Likewise, you can use LINEATTRS=(COLOR=BLACK) to assign the same color to all of the lines, letting the line pattern distinguish group values.

By default, ODS Graphics limits the number of groups to 1000. When this limit is exceeded, the GROUP= option is ignored. Use the GROUPMAX= option in the ODS GRAPHICS statement to change the maximum number of groups that can be processed.

See “DISCRETEATTRVAR Statement” on page 1516

INCLUDEMISSINGGROUP=TRUE | FALSE

specifies whether missing values of the group variable are included in the plot.

Default TRUE

Interaction For this option to take effect, the GROUP= option must also be specified.

Tip The attributes of the missing group value are determined by the GraphMissing style element unless a discrete attribute map is in effect, the INDEX= option is used, the MISSING= system option changes the default missing character, or a user-defined format is applied to the group value. In those cases, the attributes of the missing group value are determined by a GraphData1–GraphDataN style element instead of by the GraphMissing style element.

See “boolean ” on page xii for other Boolean values that you can use.

INDEX=*positive-integer-column* | *expression*
specifies indices for mapping line attributes (color and line pattern) to one of the GraphData1–GraphDataN style elements.

Requirements The column or expression value must be an integer value of 1 or greater. Otherwise, this option is ignored.

The positive-integer column must not contain missing values. Otherwise, the entire column is invalidated and this option is ignored.

All of the indexes for a specific group value must be the same. Otherwise, the results are unpredictable.

Interaction For this option to take effect, the GROUP= option must also be specified.

Notes The index values are 1-based indices. For the style attributes in GraphData1–GraphDataN, if the index value is greater than N, then a modulo operation remaps that index value to a number less than N to determine which style to use.

If you do not use this option, then the group values are mapped in the order of the data.

Tip You can use indexing to collapse the number of groups that are represented in a graph. For more information, see "Remapping Groups for Grouped Data" on page 211.

LEGENDLABEL="*string*"
specifies a label to be used in a discrete legend for this plot.

Default The *string* specified on the NAME= option.

Restriction This option applies only to an associated DISCRETELEGEND statement.

Interaction If the GROUP= option is specified, then this option is ignored.

LINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the attributes of the vector line and arrowhead.

Defaults For non-grouped data, the GraphDataDefault style element.

For grouped data, the ContrastColor, LineStyle, and LineThickness attributes of the GraphData1–GraphDataN style elements.

Interactions The COLORRESPONSE= option overrides this option's COLOR= suboption.

The LINETHICKNESSRESPONSE= option overrides this option's THICKNESS= suboption.

Note The arrow head size is nonlinearly proportional to the line thickness in order to maintain appropriately sized arrow heads for thicker lines.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*

"Line Options" on page 1602 for available *line-options*.

LINETHICKNESSMAX=*dimension*
specifies the maximum line thickness when a response variable is used to determine the line thickness. By default, this option determines the thickness of the line that represents the maximum response column value.

Note: This feature applies to SAS 9.4M3 and to later releases.

Default Ten times the thickness that is specified by the GraphDataDefault style element LineThickness attribute.

Interactions The LINETHICKNESSRESPONSE= option must be specified for this option to have any effect.

The LINETHICKNESSMAXRESPONSE= option specifies the response value at which this maximum line thickness is reached. The line thickness for response values that exceed the LINETHICKNESSMAXRESPONSE= value are set to the value that is specified by this option.

If the line thickness that is calculated from the LINETHICKNESSMIN=, LINETHICKNESSMAX=, and LINETHICKNESSMAXRESPONSE= option values is less than 0.5 for a line, that line is not drawn.

Tip Use the LINETHICKNESSMIN= option to specify the minimum line thickness.

See "dimension" on page xiii

LINETHICKNESSMAXRESPONSE=*numeric* | *scalar-numeric-expression*
specifies the response value that corresponds to the maximum line thickness.

Note: This feature applies to SAS 9.4M3 and to later releases.

Default The maximum value in the response column that is specified in the LINETHICKNESSRESPONSE= option.

Interactions The LINETHICKNESSRESPONSE= option must be specified for this option to have any effect.

The thickness for all lines that exceed the maximum response value is set to the value specified in the LINETHICKNESSMAX= option.

If the line thickness that is calculated from the LINETHICKNESSMIN=, LINETHICKNESSMAX=, and LINETHICKNESSMAXRESPONSE= option values is less than 0.5 for a line, that line is not drawn.

LINETHICKNESSMIN=*dimension*
specifies the minimum line thickness when a response variable is used to determine the line thickness.

Note: This feature applies to SAS 9.4M3 and to later releases.

Default The thickness specified by the GraphDataDefault style element LineThickness attribute.

Interactions The LINETHICKNESSRESPONSE= option must be specified for this option to have any effect.

If the line thickness that is calculated from the LINETHICKNESSMIN=, LINETHICKNESSMAX=, and LINETHICKNESSMAXRESPONSE= option values is less than 0.5 for a line, that line is not drawn.

Tip Use the LINETHICKNESSMAX= option to specify the maximum line thickness.

See “dimension” on page xiii

LINETHICKNESSRESPONSE=*numeric-column* | *expression*
specifies a response column or range attribute variable that is used to map a line thickness to each group value.

Note: This feature applies to SAS 9.4M3 and to later releases.

Default The GraphDataDefault style element LineThickness attribute.

Interactions When the column values are all zero, all negative, or all missing, this option is ignored. In these cases, the default line thickness is used for all of the lines.

This option overrides suboption THICKNESS= in the LINEATTRS= option.

Note The line thicknesses are not reflected in a discrete legend.

NAME="*string*"
assigns a name to this plot statement for reference in other template statements. The specified name is used primarily in legend statements to coordinate the use of colors and line patterns between the plot and the legend.

Restrictions The *string* is case sensitive, cannot contain spaces, and must define a unique name within the template.

This option does not support variables that are created by the DYNAMIC, MVAR, and NMVAR template statements.

Interaction The *string* is used as the default legend label if the LEGENDLABEL= option is not used.

PRIMARY=TRUE | FALSE
specifies that the data columns for this plot and the plot type be used for determining default axis features. This option is needed only when two or more plots within an overlay-type layout contribute to a common axis.

Default FALSE

Restriction This option is ignored if the plot is placed under a GRIDDED or LATTICE layout block.

Note In an OVERLAY layout, only one plot in an overlay can be the primary plot on a per-axis basis. When no plot is designated as the primary plot, the first plot that can be a primary plot is considered the primary plot. If multiple plots specify PRIMARY=TRUE for the same axis, then the last such plot encountered is considered the primary plot.

See "When Plots Share Data and a Common Axis" on page 1046

"boolean " on page xii for other Boolean values that you can use.

ROLENAME=(*role-name-list*)
specifies user-defined roles that can be used to display information in the data tips. This option provides a way to add to the data columns that appear in data tips that are specified by the TIP= option.

(*role-name-list*)
a space-separated list of *role-name = column* pairs.

Example The following example assigns the column Obs to the user-defined role TIP:

```
ROLENAME=(TIP1=OBS)
```

Default No user-defined roles

Requirement The role names that you choose must be unique and different from the predefined roles X, Y, DATALABEL, XORIGIN, YORIGIN, GROUP, and INDEX.

SCALE=*number*
specifies the scale factor of the vector length.

Default 1.0

Restriction The number specified must be greater than 0.

TIP=(*role-list*) | NONE
specifies the information to display when the cursor is positioned over a vector line. If this option is used, then the information specified replaces all of the

information that is displayed by default. You can specify roles for columns that do not contribute to the vector plot along with roles that do.

(role-list)
an ordered, space-separated list of unique VECTORPLOT roles and user-defined roles.

VECTORPLOT roles include X, Y, DATALABEL, XORIGIN, YORIGIN, GROUP, INDEX, and COLORRESPONSE.

Define user-defined roles with the ROLENAME= option.

Note Starting with SAS 9.4M3, the COLORRESPONSE role is valid.

Example The following example displays data tips for the columns assigned to the roles X, Y, GROUP, and the column Obs, which is not assigned to any pre-defined VECTORPLOT role. The Obs column must first be assigned a role.

```
ROLENAME=(TIP1=OBS)
TIP=(TIP1 X Y GROUP)
```

NONE
suppresses data tips from the plot.

Default The columns assigned to these roles are automatically included in the data tip information: X, Y, DATALABEL, XORIGIN, YORIGIN, GROUP, and COLORRESPONSE.

Requirement To generate data tips in the output, you must include an ODS GRAPHICS ON statement that specifies the IMAGEMAP option, and you must write the output to the ODS HTML destination.

Interaction This option is ignored when the plot statement is in an OVERLAY or PROTOTYPE layout and the INCLUDERANGES= option is specified in the LINEAROPTS= or TIMEOPTS= option for either axis.

Tip You can control the labels and formats for the TIP roles with the TIPLABEL= and TIPFORMAT= options.

TIPFORMAT=(*role-format-list*)
specifies display formats for tip columns. This option provides a way to control the formats of columns that appear in data tips.

(role-format-list)
a space-separated list of *role-name* = *format* pairs.

Example
```
ROLENAME=(TIP1=SALARY)
TIP=(TIP1)
TIPFORMAT=(TIP1=DOLLAR12.)
```

Default The column format of the column assigned to the role or BEST6 if no format is assigned to a numeric column.

Restriction Only the roles that appear in the TIP= option are used.

Requirement A column must be assigned to each of the specified roles. (See the ROLENAME= option.)

TIPLABEL=(*role-label-list*)
specifies display labels for tip columns. This option provides a way to control the labels of columns that appear in data tips.

role-label-list
a space-separated list of *rolename* ="*string*" pairs.

Example
```
ROLENAME=(TIP1=PCT)
TIP=(TIP1)
TIPLABEL=(TIP1="Percent")
```

Default The column label or column name of the column assigned to the role.

Restriction Only the roles that appear in the TIP= option are used.

Requirement A column must be assigned to each of the specified roles. (See the ROLENAME= option.)

XAXIS=X | X2
specifies whether data are mapped to the primary X (bottom) axis or to the secondary X2 (top) axis.

Default X

Interaction The overall plot specification and the layout type determine the axis display. For more information, see "How Axis Features Are Determined" on page 1040.

YAXIS=Y | Y2
specifies whether data are mapped to the primary Y (left) axis or to the secondary Y2 (right) axis.

Default Y

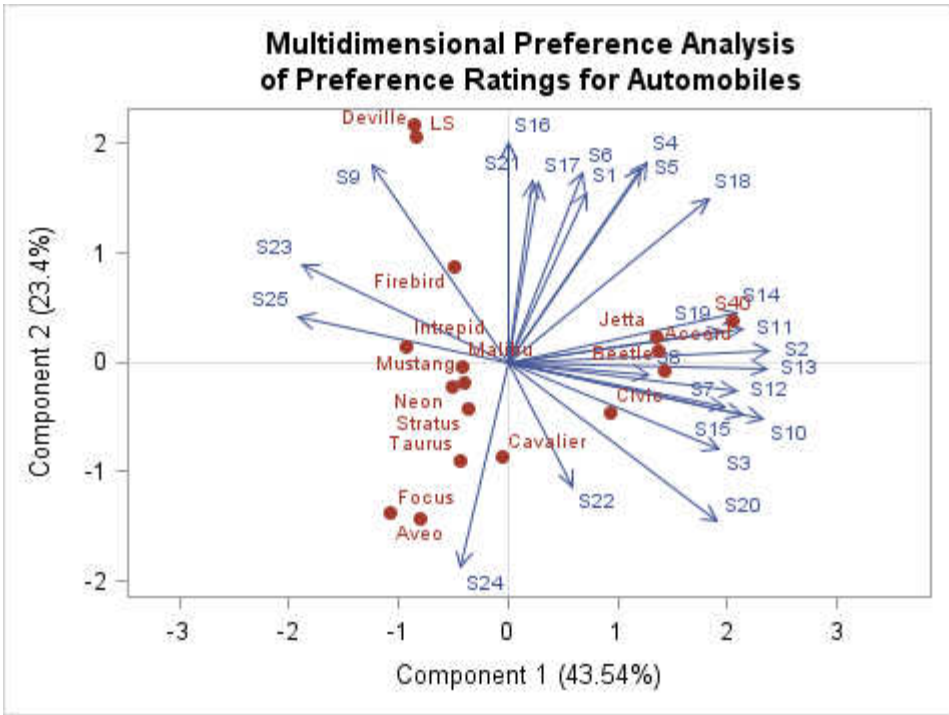
Interaction The overall plot specification and the layout type determine the axis display. For more information, see "How Axis Features Are Determined" on page 1040.

Details

By default in a VECTORPLOT, each vector starts at 0, 0 in the data space and is terminated with an open arrowhead. Zero-length vectors are represented by a dot at the starting point. To specify alternative coordinates for the starting point, use the XORIGIN= and YORIGIN= arguments.

Example: VECTORPLOT Statement

The following graph was generated by the "Example Program" on page 1015:



Example Program

```
data CarPref;
  input Make $11. Model $13. (S1-S25) (1.);
datalines;
Cadillac    Deville      800799049124050897109380 9
Chevrolet   Aveo          005120042345104300351569 8
Chevrolet   Cavalier      405330581416164354474779 5
Chevrolet   Malibu        602740072312134554566865 8
Dodge       Intrepid      700600043410110733345870 8
Dodge       Stratus       300500563546130244467565 5
Dodge       Neon          400500361402160275447655 5
Ford        Taurus        202400671502144353064865 5
Ford        Mustang       500719770502110185065755 5
Ford        Focus         002100030303020150051407 8
Honda       Accord        595689760969995299897507 8
Honda       Civic         483670950748885256776507 5
Lincoln     LS            700899059223040996209190 9
Pontiac     Firebird      010789561320120695826590 7
Volkswagen  Jetta         485869650887779537789500 0
Volkswagen  Beetle        485850970969579548788500 0
Volvo       S40           998999890999998798991900 0
;
run;
* Compute Two Component Model;
```

```
ods graphics;
ods exclude all;
ods output mdprefplot=plotdata;
proc prinqual data=CarPref n=2 replace mdpref method=mgv;
  id model;
  transform monotone(S1-S25);
run;
ods select all;

proc template;
 define statgraph vectorplot;
  begingraph;
   entrytitle "Multidimensional Preference Analysis";
   entrytitle "of Preference Ratings for Automobiles";
   layout overlayequated / equatetype=fit cycleattrs=true;
    referenceline y=0 / datatransparency=0.7;
    referenceline x=0 / datatransparency=0.7;
    vectorplot y=vec2 x=vec1 xorigin=0 yorigin=0 /
      datalabel=label2var;
    scatterplot y=prin2 x=prin1 /
      datalabel=idlab1 primary=true
      markerattrs=(symbol=circlefilled);
   endlayout;
  endgraph;
 end;
run;

proc sgrender data=plotdata template=vectorplot;
run;
```

WATERFALLCHART Statement

Creates a waterfall chart that is computed from input data.

Restriction: The WATERFALLCHART statement does not support CAS in-memory tables. In SAS 9.4M6 and earlier releases, unexpected results might occur when data stored in a CAS in-memory table is used. Starting with SAS Viya 3.5 and SAS Studio 5.2, the waterfall chart is dropped when data stored in a CAS in-memory table is used.

Interaction: A Waterfall chart accumulates response values in data order. Any change in the order of the X-axis values from the data order can adversely affect the waterfall chart. The X-axis value order can change when the Waterfall chart is overlaid with other plots or when it is used in a Lattice with uniform axes. It can also change when certain options are applied to the X axis.

Tip: Starting with SAS 9.4M3, you can use subpixel rendering with this statement. It is enabled by default. To disable subpixel rendering, specify SUBPIXEL=OFF in the BEGINGRAPH statement or in an ODS GRAPHICS statement. For information about the BEGINGRAPH statement SUBPIXEL= option, see SUBPIXEL= on page 39. For information about the ODS GRAPHICS statement SUBPIXEL= option, see “ODS GRAPHICS Statement” on page 1561.

Syntax

WATERFALLCHART CATEGORY=*column* | *expression*
RESPONSE=*numeric-column* | *expression* </*options*>;

Summary of Optional Arguments

Appearance options

BARWIDTH=*number*
: specifies the width of a bar as a ratio of the maximum possible width.

BASELINEATTRS=*style-element* | (*line-options*)
: specifies the appearance of the baseline.

COLORGROUP=*column* | *discrete-attr-var* | *expression*
: specifies a column that is used to discretely color the transaction bars.

COLORMODEL=*color-ramp-style-element* | (*color-list*)
: specifies a color ramp to use with the COLORRESPONSE= option.

COLORRESPONSE=*numeric-column* | *range-attr-var* | *expression*
: specifies the numeric column or range attribute map variable that is used to determine the transaction-bar colors.

CONNECTBREAK=TRUE | FALSE
: specifies whether the connect line is broken for values that have no observations.

DATASKIN=NONE | CRISP | GLOSS | MATTE | PRESSED | SHEEN
: enhances the visual appearance of the filled bars.

DATATRANSPARENCY=*number*
: specifies the degree of the transparency of the bar fill, bar outline, bar labels, and trend lines, if displayed.

DISPLAY=(*display-options*) | STANDARD | ALL
: specifies which bar features to display.

FILLATTRS=*style-element* | *style-element* (*fill-options*) | (*fill-options*)
: specifies the appearance of the filled transaction bars.

FILLTYPE=SOLID | GRADIENT
: specifies the bar fill type.

FINALBARATTRS=*style-element* | *style-element* (*fill-options*) | (*fill-options*)
: specifies the appearance of the “final” bar, if displayed.

INITIALBARATTRS=*style-element* | *style-element* (*fill-options*) | (*fill-options*)
: specifies the appearance of the “initial” bar, if displayed.

INITIALBARVALUE=*number*
: specifies a value for the initial bar.

OUTLINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
: specifies the appearance of the bar outlines.

Axes options

BASELINEINTERCEPT=*number*
: specifies the response axis intercept for the baseline.

FINALBARTICKVALUE="*string*"

specifies a tick value to use on the category axis when the “final” bar is displayed

INITIALBARTICKVALUE="*string*"
specifies a tick value to use on the category axis when the “initial” bar is displayed.

XAXIS=X | X2
specifies whether data are mapped to the primary X (bottom) axis or to the secondary X2 (top) axis.

YAXIS=Y | Y2
specifies whether data are mapped to the primary Y (left) axis or to the secondary Y2 (right) axis.

Data tip options

ROLENAME=(*role-name-list*)
specifies user-defined roles that can be used to display information in the data tips.

TIP=(*role-list*) | NONE
specifies the information to display when the cursor is positioned over a bar.

TIPFORMAT=(*role-format-list*)
specifies display formats for tip columns.

TIPLABEL=(*role-label-list*)
specifies display labels for tip columns.

Label options

BARLABEL=TRUE | FALSE
specifies whether the bar statistic value is displayed at the end of the bar.

BARLABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the text properties of the bar label text.

BARLABELFITPOLICY=AUTO | NONE
specifies a policy for avoiding collisions among the bar labels when labels are displayed.

BARLABELFORMAT=*format*
specifies the text format used to display the bar label.

LEGENDLABEL="*string*"
specifies a label to be used in a discrete legend for this plot.

ODS options

URL=*string-column*
specifies an HTML page to display when a bar is selected.

Plot reference options

NAME="*string*"
assigns a name to this plot statement for reference in other template statements.

Statistics options

COLORSTAT=SUM | MEAN

specifies the statistic to use for computing the response colors.

STAT=SUM | MEAN
specifies the statistic to be computed for the RESPONSE axis.

Trend line options

CONNECT=START | END
determines whether trend lines connect to the adjacent bar's starting or ending value.

CONNECTATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the appearance of the trend lines that connect the bars.

CONNECTDECREASINGATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the appearance of trend lines that denote a decreasing value between bars.

CONNECTINCREASINGATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the appearance of trend lines that denote an increasing value between bars.

Required Arguments

CATEGORY=*column* | *expression*
specifies the column or expression for the category values. Duplicated category values are summarized into a unique value. All values are treated as discrete.

RESPONSE=*numeric-column* | *expression*
specifies the numeric column or expression for the response values.

Optional Arguments

BARLABEL=TRUE | FALSE
specifies whether the bar statistic value is displayed at the end of the bar.

Default FALSE

Note By default, the bar-label format is derived from the format that is assigned to the response column or from BEST6 if no format is assigned. The derived format retains the precision of the response-column format and, if necessary, increases the format width to accommodate the summarized value on the response axis.

Tip The font and color attributes for the label are specified by the BARLABELATTRS= option. The text format is specified by the BARLABELFORMAT= option.

See "boolean " on page xii for other Boolean values that you can use.

BARLABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the text properties of the bar label text.

Default The GraphDataText style element.

Requirement For this option to take effect, BARLABEL=TRUE must be specified.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Text Options" on page 1606 for available *text-options*.

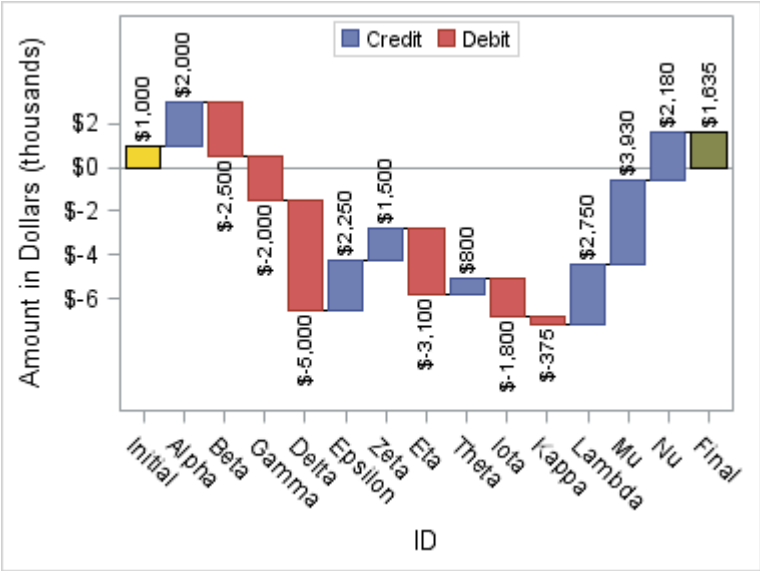
BARLABELFITPOLICY=AUTO | NONE

specifies a policy for avoiding collisions among the bar labels when labels are displayed.

AUTO

rotates the bar labels if the labels exceed the midpoint spacing.

If the labels collide horizontally due to thin bars, then AUTO drops all of the labels. The following figure shows an example.



See the BARWIDTH= option for more information about the bar spacing.

NONE

does not rotate the bar labels.

Labels that are too long overlap.

Default AUTO

Requirement For this option to take effect, BARLABEL=TRUE must be specified.

BARLABELFORMAT=*format*

specifies the text format used to display the bar label.

Default The bar-label format is derived from the format that is applied to the response column or from BEST6 if no format is assigned. The derived format retains the precision of the response-column format and, if necessary, increases the format width to accommodate the summarized value on the response axis.

Requirement For this option to take effect, BARLABEL=TRUE must be specified.

Note When a bar-label format is specified with this option, the bar labels are formatted as specified by *format*. The specified format is not automatically expanded to accommodate values that are too wide.

Tip If you want the bar-label format to expand automatically for summarized values on the response axis, specify the format for the response column rather than in this option.

BARWIDTH=*number*
specifies the width of a bar as a ratio of the maximum possible width.

Default 0.85

Range 0–1, where 0 is the minimum width, which is one pixel wide, and 1 is the maximum possible width

Notes This option is needed only to change the default behavior.

By default, the bar width automatically adjusts based on the number of bars to be displayed and the wall width.

Tip To remove any inter-bar gap, set BARWIDTH=1.

BASELINEATTRS=*style-element* | (*line-options*)
specifies the appearance of the baseline.

Default The ContrastColor, LineThickness, and LineStyle attributes of the GraphAxisLines style element.

Notes The baseline is always drawn by default.

When *style-element* is specified, only the style element's Color, LineStyle, and LineThickness attributes are used.

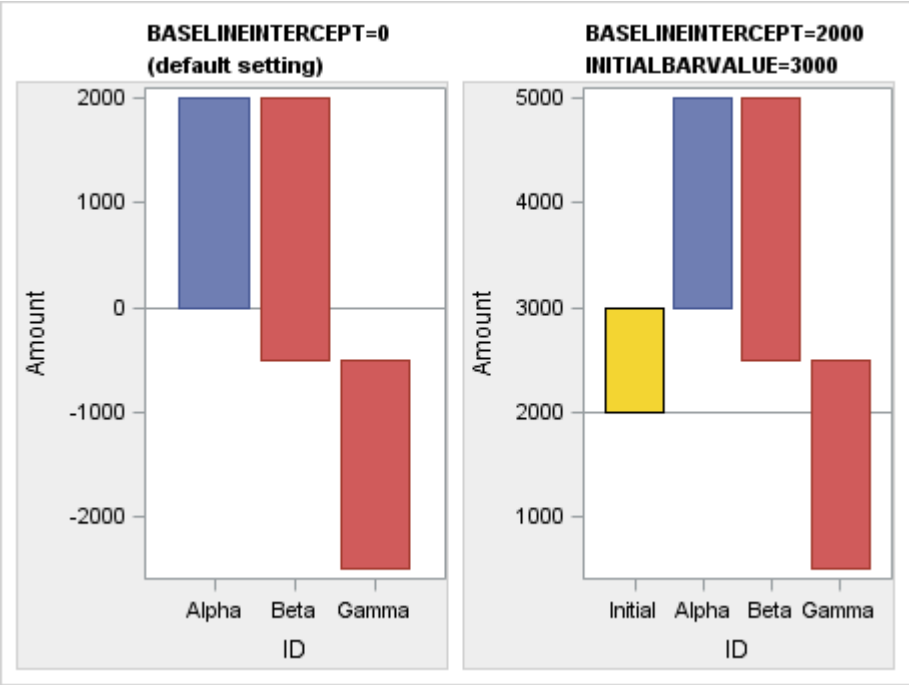
Tip To suppress the baseline, set the line thickness to 0:

```
baselineattrs=(thickness=0)
```

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

BASELINEINTERCEPT=*number*
specifies the response axis intercept for the baseline. The baseline is always displayed in the chart, whether for a specified value or for the default value. When the BASELINEINTERCEPT= option is used, the axis range is adjusted to include the baseline, and the baseline is placed at the specified value on the response axis.



Default 0

Interactions The value set by this option affects only the chart's initial and final bars. If no initial bar value is specified, then the first transaction bar is drawn from 0, no matter what is set for the baseline value.

If necessary, the response axis data range is extended to include the baseline intercept. When a logarithmic response axis is requested and BASELINEINTERCEPT= specifies 0 or a negative value, the response axis reverts to a linear axis. To restore the log axis in that case, set BASELINEINTERCEPT= to a positive value.

Note Label positions are automatically adjusted to prevent the labels from overlapping.

Tips Control the appearance of the baseline with the BASELINEATTRS= option.

To suppress the baseline prior to SAS 9.4M5, use the BASELINEATTRS= option to set the line thickness to 0. Starting with SAS 9.4M5, specify DISPLAYBASELINE=OFF.

COLORGROUP=*column* | *discrete-attr-var* | *expression*
specifies a column that is used to discretely color the transaction bars.

discrete-attr-var
specifies a discrete attribute map variable.

The discrete attribute map variable is created by a DISCRETEATTRVAR statement.

Restriction A discrete attribute map variable specification must be a direct reference to the attribute map variable. It cannot be set by a dynamic variable.

Interactions This option is ignored if the COLORRESPONSE= option is also specified.

If a column or expression is specified, then the unique column values are found and the transaction bar colors are derived from the GraphData1–GraphDataN style elements. The Color attribute is used for the bar fill colors and the ContrastColor attribute is used for the bar outline colors.

If a variable that is associated with an attribute map is specified, then the color mapping defined by the associated DISCRETEATTRMAP statement is used for the transaction bars.

Notes All of the COLORGROUP values for a specific category value must be the same. Otherwise, the results are unpredictable.

All the transaction bars have only one fill and one outline color, determined by the ODS style or set by the FILLATTRS= and OUTLINEATTRS= options.

If you specify a column in a SAS data set, colors are mapped to group values in data order. If you specify a column in a CAS in-memory table, colors are mapped to group values in ascending order of the group column character values or unformatted numeric values.

Tip To manage the color of the “initial” bar, use the INITIALBARATTRS= option. To manage the color of the “final” bar, use the FINALBARATTRS= option.

See “DISCRETEATTRMAP Statement” on page 1505

“DISCRETEATTRVAR Statement” on page 1516

COLORMODEL=*color-ramp-style-element* | (*color-list*)
specifies a color ramp to use with the COLORRESPONSE= option.

color-ramp-style-element
specifies the name of a color-ramp style element.

The style element should contain these style attributes:

STARTCOLOR
specifies the color for the smallest data value of the COLORRESPONSE= column.

NEUTRALCOLOR
specifies the color for the midpoint of the range of the COLORRESPONSE= column.

ENDCOLOR
specifies the color for the highest data value of the COLORRESPONSE= column.

(*color-list*)
specifies a space-separated list of colors to use in the color ramp. You can use style attribute references such as GraphData3:Color, color names, or RGB, CMYK, HLS, and HSV (HSB) color codes to specify a color. The list can contain a mix of style attribute references, color names, and color codes.

Requirement The list of colors must be enclosed in parentheses.

See "color " on page xii

Default The ThreeColorRamp style element

Interactions For this option to take effect, the COLORRESPONSE= option must also be specified.

When FILLTYPE=GRADIENT and a color list is specified, the middle color in the list is treated as the NEUTRAL color.

Tip To manage the color of the initial bar, use the INITIALBARATTRS= option. To manage the color of the final bar, use the FINALBARATTRS= option.

COLORRESPONSE=*numeric-column* | *range-attr-var* | *expression*
specifies the numeric column or range attribute map variable that is used to determine the transaction-bar colors.

range-attr-var
specifies a range attribute map variable that is defined in a RANGEATTRVAR statement.

"RANGEATTRVAR Statement"

Restriction A range attribute map variable specification must be a direct reference to the attribute map variable. It cannot be set as a dynamic variable.

See "RANGEATTRVAR Statement" on page 1531

When a numeric column or expression is specified, the range of column or expression values are linearly mapped to the color ramp that is specified by the COLORMODEL= option. When a range attribute map variable is specified, the colors that are defined in the associated range attribute map are used instead.

Restriction This option affects only the fill colors. When only the bar outlines are displayed, this option has no effect.

Interactions When the COLORGROUP= option is specified with this option, the COLORGROUP= option is ignored.

This option overrides suboption COLOR= in the FILLATTRS= option.

Tips To display a legend with this option in effect, use a CONTINUOUSLEGEND statement.

Use the COLORSTAT= option to specify the statistic to compute for the COLORRESPONSE= column.

To produce discrete color mapping, the RANGEATTRMAP statement can define an attribute map that maps a single color to all values greater than 0, and another color to all values less than 0.

Use the FILLTYPE= option to indicate whether the color mapping is used to produce solid or gradient fills. When FILLTYPE=GRADIENT is in effect, the color at the end of the bar is based on the color mapping, and the neutral color of the color ramp is used as the starting color of each bar.

COLORSTAT=SUM | MEAN
specifies the statistic to use for computing the response colors.

Note: This feature applies to SAS 9.4M3 and to later releases.

Default SUM

Interaction This option is ignored when the COLORRESPONSE= option is not specified.

Tip This option might affect existing SAS programs. For programs written before SAS 9.4M3, if STAT= and COLORRESPONSE= are specified in a WATERFALLCHART statement, the chart colors and color statistic might change from the previous SAS releases. To restore the original colors and color statistic in that case, set COLORSTAT= in the WATERFALLCHART statement to the same statistic that is specified in STAT=.

CONNECT=START | END
determines whether trend lines connect to the adjacent bar's starting or ending value.

START
draws the trend lines horizontally and connects each to the adjacent bar's starting value.

Each connecting line extends from the right corner of one bar's ending value to the left corner of the adjacent bar's starting value.

END
draws the trend lines diagonally and connects each to the adjacent bar's ending value.

Each connecting line extends from the right corner of one bar's ending value to the left corner of the adjacent bar's ending value.

Default START

Restriction The last connect line is always drawn horizontally, extending from the right corner of the last data bar's ending value to the left corner of the "final" bar's starting value.

CONNECTATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the appearance of the trend lines that connect the bars.

Default The GraphConnectLine style element.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

CONNECTBREAK=TRUE | FALSE
specifies whether the connect line is broken for values that have no observations.

Note: This feature applies to SAS 9.4M5 and to later releases.

Default FALSE

Requirement DISPLAY= must include CONNECT for this option to have any effect.

Interaction This option is ignored when the GROUP= option is in effect.

CONNECTDECREASINGATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the appearance of trend lines that denote a decreasing value between bars.

Default The appearance specified by the CONNECTATTRS= option.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

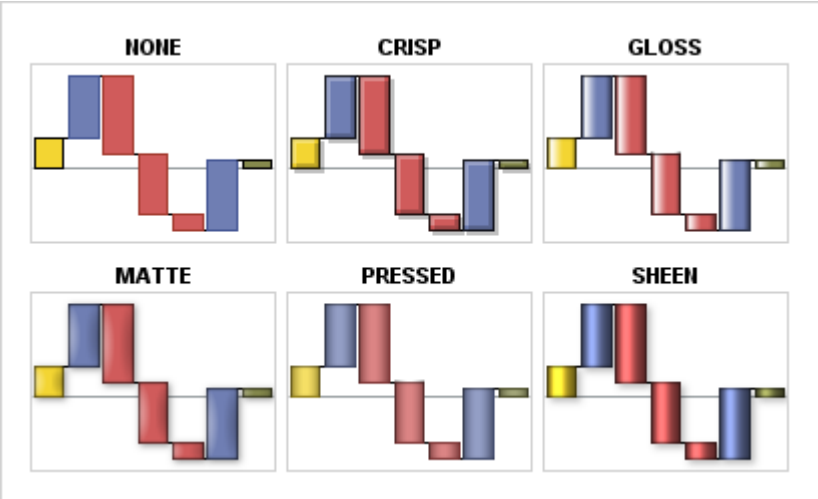
CONNECTINCREASINGATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the appearance of trend lines that denote an increasing value between bars.

Default The appearance specified by the CONNECTATTRS= option.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

DATASKIN=NONE | CRISP | GLOSS | MATTE | PRESSED | SHEEN
enhances the visual appearance of the filled bars. The following figure shows bars with each of the skins applied.



Default The DATASKIN= option value that is specified in the BEGINGRAPH statement. If not specified, then the GraphSkins:DataSkin style element value is used.

Restriction Starting with SAS 9.4M1, the maximum number of skinned graphical elements is limited to 200 per plot in an OVERLAY or PROTOTYPE layout. When this limit is exceeded for a plot, the specified data skin is not applied to that plot. In that case, use the DATASKINMAX= option in your ODS GRAPHICS statement to increase the maximum limit.

Requirement For this option to have any effect, the fill must be enabled by the ODS style or the DISPLAY= option.

Interactions This option overrides the BEGINGRAPH statement DATASKIN= option.

The skin appearance is based on the FILLATTRS= color.

When a data skin is applied, all bar outlines are set by the skin, and the OUTLINEATTRS= option is ignored.

DATATRANSPARENCY=*number*

specifies the degree of the transparency of the bar fill, bar outline, bar labels, and trend lines, if displayed.

Default 0

Range 0–1, where 0 is opaque and 1 is entirely transparent

Tip The FILLATTRS= option can be used to set transparency for just the filled bar area. The INITIALBARATTRS= and FINALBARATTRS= options can be used to specify transparency for the initial and final bars. You can combine this option with FILLATTRS=, INITIALBARATTRS=, and FINALBARATTRS= to set one transparency for the bar outlines and trend lines but a different transparency for the bar fills. Example:

```
datatransparency=0.2 fillattrs=(transparency=0.6)
```

DISPLAY=(*display-options*) | STANDARD | ALL
specifies which bar features to display.

(*display-options*)
a space-separated list of one or more display options enclosed in parentheses.

The list can include one or more of the following options:

CONNECT
displays line segments (trend lines) connecting adjacent bar. The connection point is determined by the CONNECT= option.

FILL
displays filled bars.

FINALBAR
displays the final bar.

OUTLINE
displays outlined bars.

STANDARD
specifies CONNECT, FILL, FINALBAR, and OUTLINE

ALL
currently the same as STANDARD

Default STANDARD

Tips To control the appearance of the bars, use the COLORMODEL= , FILLATTRS= , and OUTLINEATTRS= options.

To control the appearance of the trend lines, use the CONNECTATTRS= , CONNECTDECREASINGATTRS= , and CONNECTINCREASINGATTRS= options.

FILLATTRS=*style-element* | *style-element* (*fill-options*) | (*fill-options*)
specifies the appearance of the filled transaction bars.

Defaults If the COLORGROUP= option is not specified, then the GraphDataDefault:Color style reference.

If the COLORGROUP= option is specified, then the GraphData1:Color–GraphDataN:Color style references.

Interaction This option's color specification is ignored if either the COLORMODEL= or COLORRESPONSE= option is specified. The transparency specification is honored in that case.

Tip The DATATRANSPARENCY= option sets the transparency for the bar fill, bar outline, and trend lines. You can combine this option with DATATRANSPARENCY= to set one transparency for the bar outlines and trend lines but a different transparency for the bar fills. Example:

```
datatransparency=0.2 fillattrs=(transparency=0.6)
```

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Fill Color Options" on page 1600 for available *fill-options*.

FILLTYPE=SOLID | GRADIENT
specifies the bar fill type.

Note: This feature applies to SAS 9.4M2 and to later releases.

SOLID
fills each bar with the color that is assigned to that bar.

GRADIENT
fills each bar with a color gradient that starts with the neutral color from the color model or with the middle color from the color model color list, if specified, and ends with the color for that bar that is determined by the COLORGROUP= or COLORRESPONSE= option.

Interaction The SHEEN data skin cannot be used when FILLTYPE=GRADIENT is in effect. You can use one of the other data skins.

Default SOLID

Interaction The DISPLAY= option must include FILL for this option to have any effect.

Tip The colors that are used depend on whether the COLORGROUP= option or the COLORRESPONSE= option is also specified.

See DATASKIN= on page 1026

FINALBARATTRS=*style-element* | *style-element* (*fill-options*) | (*fill-options*)
specifies the appearance of the "final" bar, if displayed.

Default the GraphFinal style element

Interaction This option is ignored if the DISPLAY= option does not display the "final" bar.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Fill Color Options" on page 1600 for available *fill-options*.

FINALBARTICKVALUE="*string*"
specifies a tick value to use on the category axis when the "final" bar is displayed

Default "Final"

Interaction This option is ignored if the DISPLAY= option does not display the "final" bar.

INITIALBARATTRS=*style-element* | *style-element* (*fill-options*) | (*fill-options*)
specifies the appearance of the "initial" bar, if displayed.

Default the GraphInitial style element

Interaction For this option to take effect, the INITIALBARVALUE= option must also be specified.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

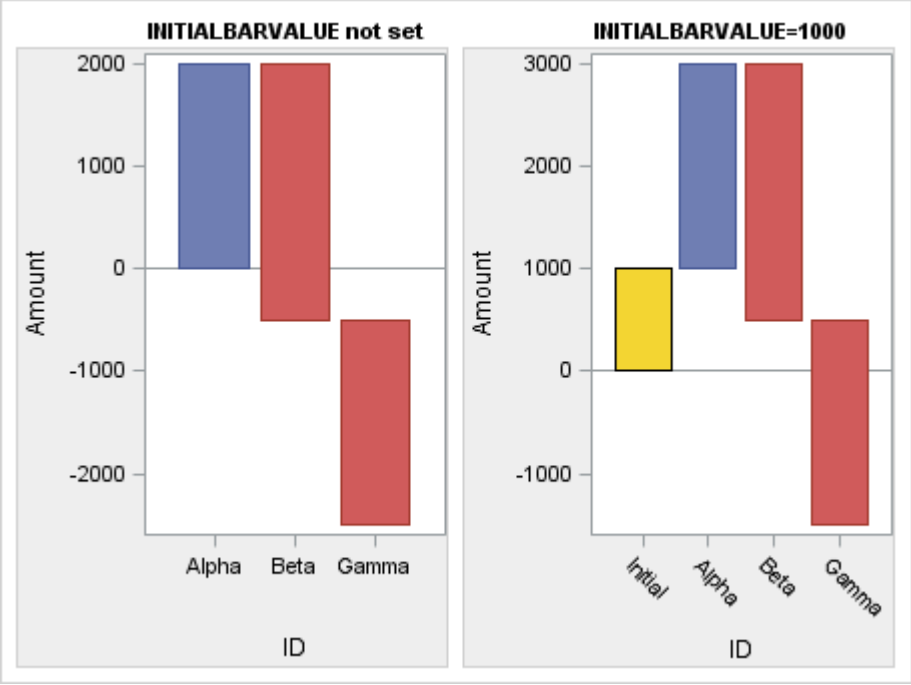
"Fill Color Options" on page 1600 for available *fill-options*.

INITIALBARTICKVALUE="*string*"
specifies a tick value to use on the category axis when the "initial" bar is displayed.

Default "Initial"

Interaction For this option to take effect, the INITIALBARVALUE= option must also be specified.

INITIALBARVALUE=*number*
specifies a value for the initial bar. The initial bar's value is used as the starting response value for the first transaction bar.



Interactions If this option is not specified, then the initial bar is not included in the chart and the first transaction bar is drawn from response value 0. This is true even if an intercept value is set by the BASELINEINTERCEPT= option.

If necessary, the response axis data range is extended to include the initial bar value. When a logarithmic response axis is requested

and INITIALBARVALUE= specifies 0 or a negative value, the response axis reverts to a linear axis. To restore the log axis in that case, set INITIALBARVALUE= to a positive value.

Note The first transaction bar starts at response value 0.

LEGENDLABEL="*string*"
specifies a label to be used in a discrete legend for this plot.

Default The response-variable label. If a label is not defined, then the response-variable name is used.

Restriction This option applies only to an associated DISCRETELEGEND statement.

Interaction If the COLORGROUP= option is in effect, then this option is ignored.

NAME="*string*"
assigns a name to this plot statement for reference in other template statements. The specified name is used primarily in legend statements to coordinate the use of colors and line patterns between the plot and the legend.

Restrictions The *string* is case sensitive, cannot contain spaces, and must define a unique name within the template.

This option does not support variables that are created by the DYNAMIC, MVAR, and NMVAR template statements.

Interaction The *string* is used as the default legend label if the LEGENDLABEL= option is not used.

OUTLINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the appearance of the bar outlines.

Default The ContrastColor and LineThickness attributes of the GraphOutlines style element.

Interactions For this option to have any effect, outlines must be enabled by the ODS style or the DISPLAY= option.

If the DATASKIN= option applies a data skin, then this option is ignored.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

ROLENAME=(*role-name-list*)
specifies user-defined roles that can be used to display information in the data tips. This option provides a way to add to the data columns that appear in data tips that are specified by the TIP= option.

(*role-name-list*)
a space-separated list of *role-name* = *column* pairs.

Example The following example assigns the column Obs to the user-defined role TIP:

```
ROLENAME=(TIP1=OBS)
```

Default No user-defined roles

Requirement The role names that you choose must be unique and different from the predefined roles CATEGORY, RESPONSE, COLORGROUP, and COLORRESPONSE.

STAT=SUM | MEAN

specifies the statistic to be computed for the RESPONSE axis.

Default SUM

Tip If you use this option with COLORRESPONSE= in SAS programs that were written before SAS 9.4M3, the chart colors and color statistic might change from the previous SAS releases. To restore the original colors and color statistic in that case, set COLORSTAT= in the WATERFALLCHART statement to the same statistic that is specified in STAT=.

TIP=(*role-list*) | NONE

specifies the information to display when the cursor is positioned over a bar. If this option is used, then it replaces all of the information that is displayed by default. Roles for columns that do not contribute to the waterfall chart can be specified along with roles that do.

(role-list)

an ordered, space-separated list of unique WATERFALLCHART and user-defined roles.

WATERFALLCHART roles include CATEGORY , RESPONSE , COLORGROUP , and COLORRESPONSE .

Example The following example displays data tips only for the column that is assigned to the RESPONSE role:

```
TIP=(RESPONSE)
```

NONE

suppresses data tips and URLs (if requested) from the plot.

Default The columns assigned to these roles are automatically included in the data tip information: CATEGORY and RESPONSE .

Requirement To enable data tips in the output, you must include an ODS GRAPHICS ON statement that specifies the IMAGEMAP option, and you must write the output to the ODS HTML destination.

Interaction This option is ignored when the plot statement is in an OVERLAY or PROTOTYPE layout and the INCLUDERANGES= option is specified in the LINEAROPTS= or TIMEOPTS= option for either axis.

Tip The labels and formats for the TIP roles can be controlled with the TIPLABEL= and TIPFORMAT= options.

TIPFORMAT=(*role-format-list*)
specifies display formats for tip columns. This option provides a way to control the formats of columns that appear in data tips.

(role-format-list)
a space-separated list of *role-name* = *format* pairs.

Example
```
TIP=(RESPONSE)
TIPFORMAT=(RESPONSE=DOLLAR12.)
```

Default The column format of the column assigned to the role or BEST6 if no format is assigned to a numeric column.

Restriction Only the roles that appear in the TIP= option are used.

Requirement A column must be assigned to each of the specified roles.

TIPLABEL=(*role-label-list*)
specifies display labels for tip columns. This option provides a way to control the labels of columns that appear in data tips.

role-label-list
a space-separated list of *rolename* ="*string*" pairs.

Example
```
TIP=(RESPONSE)
TIPLABEL=(RESPONSE="Average Sales")
```

Default The column label or column name of the column assigned to the role.

Restriction Only the roles that appear in the TIP= option are used.

Requirement A column must be assigned to each of the specified roles.

URL=*string-column*
specifies an HTML page to display when a bar is selected.

string-column
specifies a column that contains a valid HTML page reference (HREF) for each bar that is to have an active link.

Example **`http://www.sas.com`**

Requirements To generate selectable bars, you must include an ODS GRAPHICS ON statement that specifies the IMAGEMAP option, and you must write the output to the ODS HTML destination.

For non-grouped data, the values of the column are expected to be same for each unique RESPONSE value. If they are not, then the results might be unpredictable.

For grouped data, the values of the column are expected to be the same for each unique RESPONSE and group combination.

Interactions This option has no effect when TIP=NONE.

This option is ignored when the plot statement is in an OVERLAY or PROTOTYPE layout and the INCLUDERANGES= option is specified in the LINEAROPTS= or TIMEOPTS= option for either axis.

Tips The URL value can be blank for some RESPONSE values, meaning that no action is taken when the bars for those RESPONSE values are selected.

The URL value can be the same for different RESPONSE values, meaning that the same action is taken when the bars for those RESPONSE values are selected.

By default, drill-down links open in a new browser window (link target _blank). To specify a different target for your drill-down links, such as _self or _parent, add the DRILLTARGET="*target*" option to your ODS GRAPHICS statement. See DRILLTARGET= on page 1568.

XAXIS=X | X2
specifies whether data are mapped to the primary X (bottom) axis or to the secondary X2 (top) axis.

Default X

Interaction The overall plot specification and the layout type determine the axis display. For more information, see "How Axis Features Are Determined" on page 1040.

YAXIS=Y | Y2
specifies whether data are mapped to the primary Y (left) axis or to the secondary Y2 (right) axis.

Default Y

Interactions This option is ignored if the RESPONSE= argument is not specified.

The overall plot specification and the layout type determine the axis display. For more information, see "How Axis Features Are Determined" on page 1040.

Details

The input data for the WATERFALLCHART statement is raw, unsummarized input data, and the statement calculates appropriate summarization statistics (sum or mean). By default, the bars in the chart appear in the order in which the CATEGORY

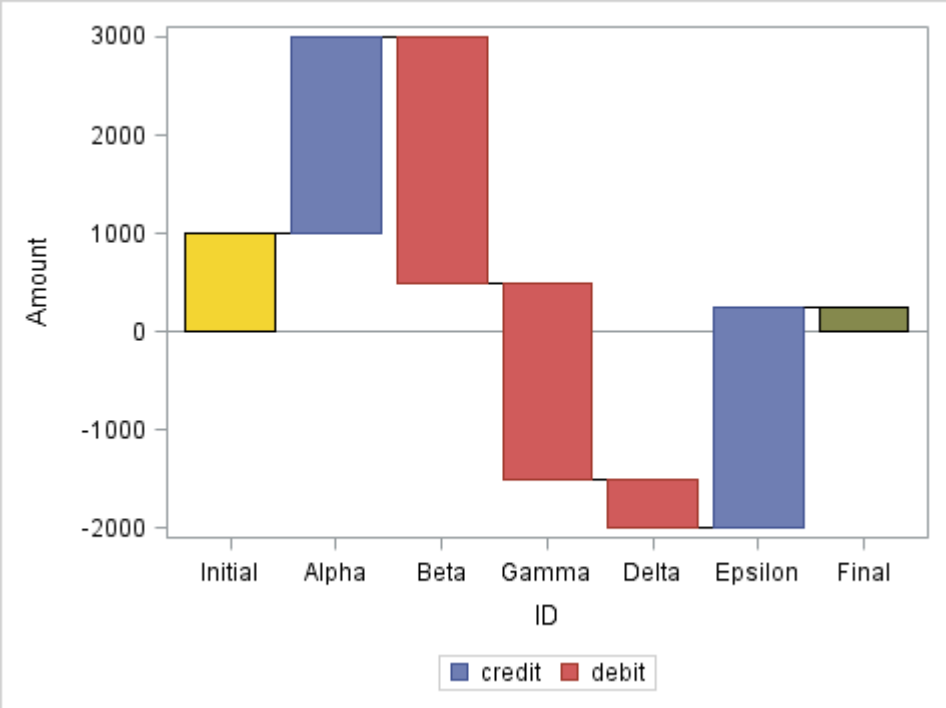
values are present in the input data. A waterfall chart is typically used to show credit and debit transactions or successive changes to a given state.

In a waterfall chart, the bars that are calculated from the data are called "transaction" bars. The transaction bars represent the values of the RESPONSE variable across a series of intermediate values for the specified CATEGORY variable. You can manage the color of the transaction bars using the COLORGROUP , COLORMODEL , or COLORRESPONSE= option.

A waterfall chart can also display an "initial" bar and a "final" bar. The value of the initial bar determines the starting response value for the first transaction bar. To set the initial value, use the INITIALBARVALUE= option. If the initial bar is not displayed, then the first transaction bar has a starting response value of 0. The value of the final bar is set automatically to the ending value of the last transaction bar.

Example: WATERFALLCHART Statement

The following graph was generated by the "Example Program" on page 1035:



Example Program

```
data transactions;
input ID $ Amount type $;
datalines;
Alpha 2000 credit
Beta -2500 debit
```

```
Gamma -2000 debit
Delta -500 debit
Epsilon 2250 credit
;
proc template;
  define statgraph waterfallchart;
    begingraph;
      layout overlay;
        waterfallchart category=id response=amount /
          colorgroup=type
          initialbarvalue=1000
          name="waterfall";
        discretelegend "waterfall";
      endlayout;
    endgraph;
  end;
run;

proc sgrender data=transactions template=waterfallchart;
run;
```

PART 5

Plot Axes

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7

Axis Features in Layouts

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Overview

GTL plots are specified within layout blocks that enable you to control the graph display features, including the display of the axes for the plots within the layout. For example, the LAYOUT OVERLAY statement has XAXISOPTS= and YAXISOPTS= options that enable you to specify axis features for the plots within the layout.

The following sections explain how the axis features are determined in a layout. The sections also discuss the issues that you must consider when setting the axis type or adjusting the appearance of the axis display.

How Axis Features Are Determined

Overview

GTL uses various criteria to determine the displayed axis features for a graph. Generally, axis features are based on the following criteria:

- the layout type
- the order of plot statements in the layout and the options specified on those statements
- the use of primary and secondary axes on the plots (when secondary axes are supported)
- the plot type
- the column or columns of data that contribute to defining the axis range
- the data formats for the contributing data columns

Because the default axis features depend on a combination of the factors above, it is useful to understand how the axis features are determined in the templates that you build:

- how the data are mapped to the plot axes
- how the various layout types manage the axes.

Plot Data Are Mapped to a Designated Axis

Overview for Axis Mapping

Depending on the layout type and the plots that you specify within the layout, you can manage up to four axes for two-dimensional plots:

- a primary X (bottom) axis
- a primary Y (left) axis
- a secondary X axis (X2 or “top” axis)
- a secondary Y axis (Y2 or “right” axis)

Within single-cell layouts (for example, OVERLAY layout), there can be just one each of these four axes. However, within multi-cell layouts (for example, LATTICE

layouts), each cell can display the four axes. Thus, there can be multiple X, X2, Y, and Y2 axes across the columns and rows in the layout grid. In a lattice-type layout, you might have to use layout options to specify how the data ranges and axis display should be managed. This section discusses the simpler case for axis mapping, and "Axis Mapping in Lattice-type Layouts" on page 1042 discusses the case for lattice-type layouts.

Note: GRIDDED layouts can be used to create a grid of cells, but the cells are independent. Thus, axes in the grid cannot be managed across columns and rows, so the simpler case applies to GRIDDED layouts.

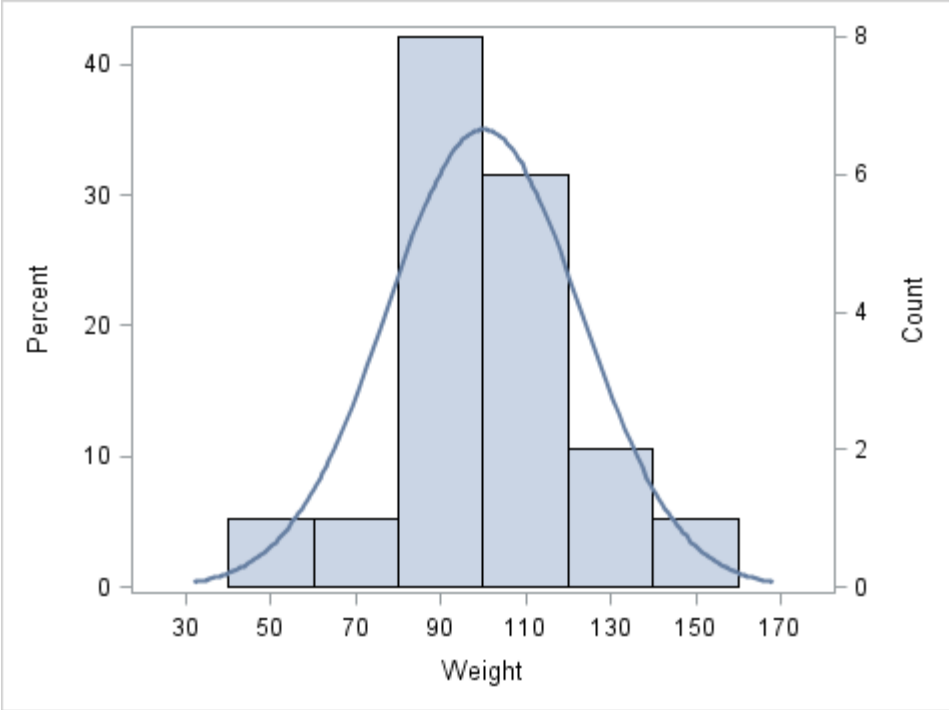
Primary and Secondary Axes

By default, plot data are mapped to the primary axes. To enable you to override the default, plot statements that support a secondary X2 axis provide an XAXIS= option that can map data to the X or X2 axis. Plot statements that support a Y axis provide a YAXIS= option that can map data to the Y or Y2 axis.

To determine the axis features within a layout, GTL must first determine what data must be mapped to a particular axis. Thus, your use of primary and secondary axes on plot specifications affects GTL's determination of default axis features for the layout.

For example, the plot statements in the following template specify Y-data mappings to the Y2 and Y axes:

```
proc template;
  define statgraph y2axis;
    begingraph;
      layout overlay;
        histogram weight / scale=count yaxis=y2 ;
        histogram weight / scale=percent yaxis=y ;
        densityplot weight / normal();
      endlayout;
    endgraph;
  end;
run;
proc sgrender data=sashelp.class template=y2axis;
run;
```



In this example, the first HISTOGRAM maps its Y-axis data to the Y2 axis, and the second HISTOGRAM maps its Y-axis data to the Y axis. The DENSITY plot does not explicitly map its Y-axis data, so the default Y axis is used. None of the plots explicitly maps X-data, so the default X axis is used for all three plots. Thus, GTL must manage any interactions that result from representing multiple plots on the X and Y axes. For example, on the X axis, it must determine an appropriate data range for representing the data values of all three plots.

When establishing axis features for each axis, GTL determines which plot specifications map data to the axis. GTL also collects the data for all of the plots that must be represented and maps that data to the designated axis. "When Plots Share Data and a Common Axis" on page 1046 discusses the criteria GTL uses to determine the axis features for the axes after this mapping has been done for each axis.

Axis Mapping in Lattice-type Layouts

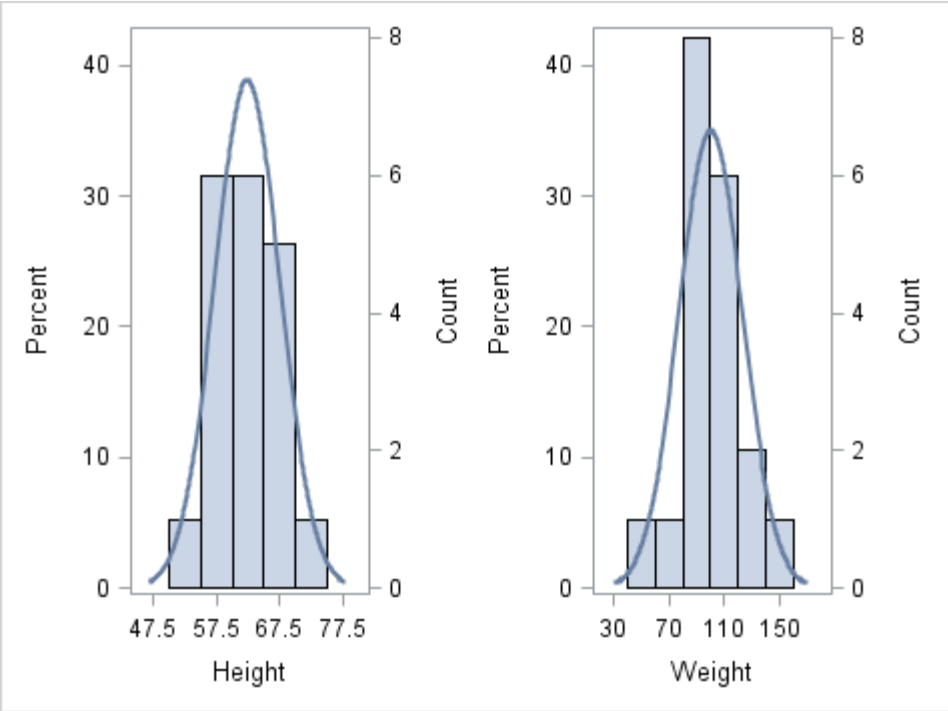
Lattice-type layouts (LAYOUT LATTICE, LAYOUT DATALATTICE, and LAYOUT DATAPANEL) present a grid of graphs that automatically aligns plot areas and tick display areas across grid cells. This alignment facilitates data comparisons among graphs, and for those comparisons to be meaningful, the graph axes must be coordinated across the columns and rows in the grid. All of the principles discussed in "Overview for Axis Mapping" on page 1040 apply to the lattice-type layouts. In addition, because there can be multiple X, X2, Y, and Y2 axes across grid cells, you might have to use layout options to specify how the data ranges and axis display should be managed.

For example, the following template uses a LAYOUT LATTICE to generate a grid that displays a height analysis next to a weight analysis. By default in a LAYOUT

LATTICE statement, the options ROWDATARANGE= and ROW2DATARANGE= are set to DATA. The DATA setting scales the Y-axis and Y2-axis data ranges separately for each cell in the layout. To ensure that the Y-axis data range is the same in both cells, the example specifies ROWDATARANGE=UNION. Similarly, to ensure that the Y2-axis data range is the same in both cells, the example specifies ROW2DATARANGE=UNION:

```
proc template;
  define statgraph y2axis;
    begingraph;
      layout lattice / columns=2 columngutter=10
          rowdatarange=union row2datarange=union ;
        layout overlay;
          histogram height / scale=count yaxis=y2;
          histogram height / scale=percent yaxis=y;
          densityplot height / normal();
        endlayout;
        layout overlay;
          histogram weight / scale=count yaxis=y2;
          histogram weight / scale=percent yaxis=y;
          densityplot weight / normal();
        endlayout;
      endlayout;
    endgraph;
  end;

proc sgrender data=sashelp.class template=y2axis;
run;
```



By default in a LAYOUT LATTICE statement, the options COLUMNDATARANGE= and COLUMN2DATARANGE= are also set to DATA. But in this analysis, the height is a separate measure from the weight, so the separate scales are appropriate for the X-axes across cells. If the X-axes were displaying the same measure (for

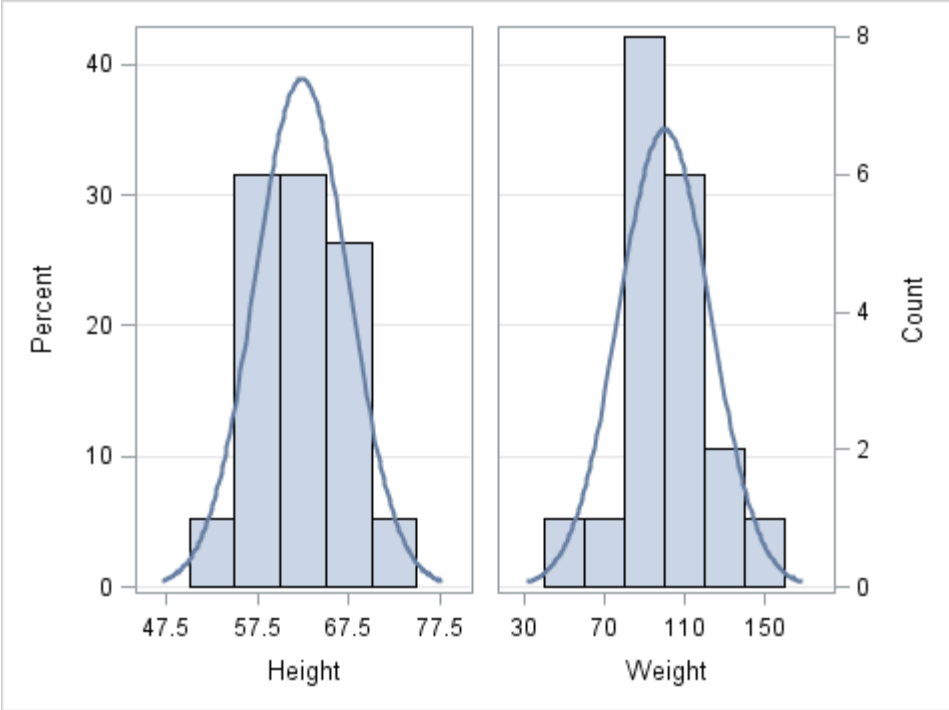
example, comparing the height of female subjects to the height of male subjects), then you could specify COLUMNDATARANGE=UNIONALL. This would set the same scaling to the X-axis data ranges across the two layout columns. In this example, you would not bother changing the default COLUMN2DATARANGE= setting because the X2 axis is not needed.

Note: For DATALATTICE and DATAPANEL statements, UNIONALL is the default value for the data ranges. Thus, you would not have to change the data ranges unless you wanted to set UNION to scale data ranges per row or per column in the layout.

In the example, scaling the data ranges across the row ensures proper axis scaling. However, the graph display is cluttered by the duplicate display of ticks, axis values, and axis labels on both the Y and Y2 axes. To simplify the display, you can consolidate the axes. To do so, use a ROWAXES block to display a single Y axis for both cells, and a ROW2AXES block to display a single Y2 axis for both cells. The consolidated view removes the internal axes from the grid and displays only the external axes:

```
proc template;
  define statgraph y2axis;
    begingraph;
      layout lattice / columns=2 columngutter=10
          rowdatarange=union row2datarange=union;
        rowaxes;
          rowaxis / griddisplay=on;
        endrowaxes;
        row2axes;
          rowaxis;
        endrow2axes;
        layout overlay;
          histogram height / scale=count yaxis=y2;
          histogram height / scale=percent yaxis=y;
          densityplot height / normal();
        endlayout;
        layout overlay;
          histogram weight / scale=count yaxis=y2;
          histogram weight / scale=percent yaxis=y;
          densityplot weight / normal();
        endlayout;
      endlayout;
    endgraph;
  end;

proc sgrender data=sashelp.class template=y2axis;
run;
```



When using ROWAXES or ROW2AXES blocks in a LATTICE layout, you nest within the block one ROWAXIS statement for each row in the layout grid. The ROWAXIS statements are applied sequentially to the rows, and each ROWAXIS statement specifies the axis options for the Y or Y2 axes in its corresponding row. ROWAXIS statements within the ROWAXES block apply to the Y axes, and ROWAXIS statements within the ROW2AXES block apply to the Y2 axes. This example has just a single row in the grid, so each block specifies only one ROWAXIS statement. Notice that the ROWAXIS statement in the ROW2AXES block does not use any options. Thus, it consolidates Y2 axes in the row into a single, external Y2 axis, but it does not alter the default features of that axis. For columns in the grid, the LATTICE layout provides COLUMNAXES and COLUMN2AXES blocks. These blocks use COLUMNAXIS statements to externalize X and X2 axes and specify their features.

When you use DATALATTICE and DATAPANEL layouts, the layout dynamically generates a grid that contains as many cells as can be produced from the combination of classification values. In those layouts the axes are always external, and you can use the COLUMNAXISOPTS=, COLUMN2AXISOPTS=, ROWAXISOPTS=, and ROW2AXISOPTS= options to specify the features for the axes. The settings on each option apply across the entire grid. For example, if you specify the ROWAXISOPTS= option in a DATALATTICE layout, then the specified settings apply to the external Y axes in every row.

When Plots Share Data and a Common Axis

Overview

If a layout block contains multiple plots that share data and a common axis, then the plot settings often interact in ways that affect the axis features. Axis features include the axis type, axis label, tick-mark layout, and so on. GTL resolves these interactions in ways that vary according to the layout block and plot statements.

Note: Axis interactions might not occur if other settings in the template prevent them. As discussed in "Plot Data Are Mapped to a Designated Axis" on page 1040, if two plot statements are within an OVERLAY layout, then one of them might map its data to the X axis and the other might map its data to the X2 (top) axis. Mapping to separate axes can avoid the interactions that might occur if they both mapped their data to the X axis.

Axis Features in Overlay-type Layouts

Overlay-type layouts (OVERLAY, OVERLAYEQUATED, and PROTOTYPE, for example) build a composite from one or more *GTL-statements*.

Within overlay-type layouts, if you do not explicitly set axis features in your template statements, then GTL automatically determines them. It sets the axis features based on the layouts and plots in the layout block and the data that are associated with the template at run time.

If only one plot statement within an overlay-type layout generates an axis, then determining axis features is straight forward: the features are derived directly from the plot type and the columns that are used for the plot data. For example, if a LAYOUT OVERLAY block contains a single SCATTERPLOT and the X= argument specifies a numeric column of children's weights, then the default X-axis type is LINEAR. The default X-axis label is the column label of the Weight column. If the Weight column has no defined label, then the column name is used as a label.

When an overlay-type layout contains multiple plots that generate axes, GTL can determine default axis features for the shared axes. Alternatively, you can use the PRIMARY= option on one of the plot statements to specify which plot you want GTL to use. The following code fragment explicitly specifies that the SCATTERPLOT of children's weights be used to determine axis features within the layout:

```
layout overlay;
  scatterplot x=weight ... / primary=true;
  ...
```

- If no plot in an overlay-type layout is designated as primary, then the first plot that generates an axis is considered primary on a per-axis basis.
- If PRIMARY=TRUE for a plot within an overlay-type layout, then that plot's data columns, data type, and plot type determine the default axis features. An explicitly specified primary plot determines the default axis features regardless of where that plot statement occurs within the layout block.
- Only one plot can be primary on a per-axis basis. If multiple plots specify PRIMARY=TRUE for the same axis, then the last one encountered is considered primary.

The following SCATTERPLOT specifies a character column on the X= argument:

```
layout overlay;
  scatterplot x=name ... / primary=true;
  ...
```

In this case, the default X-axis type is DISCRETE and the X-axis label is the label that is assigned to column Name, or Name if no label is assigned to column Name.

Note: The SAS format on the primary plot's column determines the axis format, although the axis might not use that SAS format "as-is" from the column.

If a SCATTERPLOT's X= argument specifies a column that has a SAS DATETIME format, then the default X-axis type is TIME. The default X-axis label is the column label or name of the DateTime column:

```
layout overlay;
  scatterplot x=date ... / primary=true;
  ...
```

For some plot types, the default axis type does not directly correlate to the specified column's data type. For example, the following code fragment specifies a BARCHART for the numeric column Age:

```
layout overlay;
  barchart category=age ... / primary=true;
  ...
```

Because a BARCHART requires a discrete X axis, the default X-axis type in this case is DISCRETE, in spite of the fact that column Age is numeric. The X-axis label is the column label of Age, or the column name if no label exists.

Finally, consider a HISTOGRAM that is set as the primary plot in the layout and that bins data values:

```
layout overlay;
  histogram weight / binaxis=true primary=true;
  ...
```

In this case, the default X-axis type is LINEAR, but the histogram's data bins are used by default as the basis for the axis tick marks.

Axis Features in Data Panel and Data Lattice Layouts

The criteria discussed in "Axis Features in Overlay-type Layouts" on page 1046 apply to determining the default axis features for the plots within DATAPANEL and DATALATTICE layouts. Both of these layout types nest a LAYOUT PROTOTYPE statement within their layout blocks. In both cases, the plot statements within the LAYOUT PROTOTYPE block—an overlay-type layout—determine the axis features for the plot display.

Axis Features in Lattice-type Layouts

The LAYOUT LATTICE statement can create a grid of graphs that automatically aligns plot areas, data display areas, labels, and headers across the columns and rows in the layout. The layout gives you the option of unifying the scale of the data ranges that are displayed in the graphs.

If a LAYOUT LATTICE specification generates only one cell, then no competition exists between cells for determining axis features in the display. In this case, the axis features are derived directly from the plot type and the columns used for the plot data.

Similarly, for multi-cell displays, if any or all of the options COLUMNDATARANGE=, COLUMN2DATARANGE=, ROWDATARANGE=, or ROW2DATARANGE= use the DATA setting to scale axis data ranges separately for each cell in the layout, then the layout cells are data-independent. The data-independent cells do not interact with each other for determining the axis features in the display.

Axes are shared in the layout when one of the options COLUMNDATARANGE=, COLUMN2DATARANGE=, ROWDATARANGE=, or ROW2DATARANGE= is used to unite axis data ranges for layout cells. By default in those cases, the first cell that is drawn (by default, the top left cell) determines the axis features in the display. When UNIONALL is in effect, those same features are used in all of the grid's layout cells. When UNION is in effect, those same features are used on a per-row or per-column basis. If you specify external axes for the columns or rows in the layout, you can specify desired axis features on the appropriate COLUMNAXIS or ROWAXIS statements used in the layout.

For an example LATTICE layout with external axes, see "Axis Mapping in Lattice-type Layouts" on page 1042.

Axis Features in Gridded Layouts

In a GRIDDED layout the layout cells are independent of one another. Plot statements within the layout cells do not share data and are not represented on a

common axis. Thus, no competition exists among layout cells for determining the axis features.

Plot Axis Types Must Agree on Common Axes

GTL is extremely flexible and enables you to generate a wide variety of plot displays. However, if you request incompatible plot displays within the same layout, then the results are unpredictable.

"When Plots Share Data and a Common Axis" on page 1046 discusses the criteria GTL uses to determine the default axis features. After the axis type has been determined, GTL expects that all plots that share that axis will have the assigned axis type. The expectation applies whether you specify axis features in your template or let GTL determine default features.

For example, a BOXPLOT cannot be overlaid by a LINEPARM: the two types of plot cannot share axes because the plot types are incompatible within the same set of axes. Thus, if you were to use both a BOXPLOT statement and a LINEPARM statement within a LAYOUT OVERLAY block, then only one of them can be displayed. GTL therefore displays the primary plot (the first specified plot by default, or the plot designated as primary by setting PRIMARY=TRUE). The other plot is not displayed.

Similarly, a BARCHART requires a discrete X axis, whereas a HISTOGRAM cannot be displayed on a discrete axis. If you specify both a BARCHART and a HISTOGRAM within the same overlay-type layout, then only the primary plot is displayed and the other plot is rejected from the display.

Axis types must also be the same for plots that must share an axis across the columns or rows in a multi-cell layout. For example, in a LAYOUT LATTICE, GTL expects that plots have the same axis type and data ranges if they are to share an external axis. Otherwise, the external axis cannot be displayed for that row or column.

Controlling Axis Features

Overview

To enable you to control axis features within each of the layout types, there are different sets of axis options for the different types of axes:

Option Category	Statement
Two-dimensional axis options	LAYOUT OVERLAY statement
Three-dimensional axis options	LAYOUT OVERLAY3D statement
Equated axis options	LAYOUT OVERLAYEQUATED statement
Lattice axis options	LAYOUT LATTICE statement
DataLattice and DataPanel axes	LAYOUT DATALATTICE and LAYOUT DATAPANEL statements

The options that are available for each layout are documented separately, but it is worth discussing the following tasks in general for all of the layout types:

- Setting the Axis Type
- Adjusting the Axis View
- Adjusting Axis Thresholds
- Adjusting Axis Offsets

Setting the Axis Type

Within any given layout in the graph display, each plot axis is always of a particular type. In the default cases, the axis type is always LINEAR, DISCRETE, or TIME.

The axis options for each layout statement include a TYPE= option that enables you to specify an axis type that overrides the default selection mechanisms. When you override the default axis type, you must be sure to specify the correct axis type for the plots that you are defining. For every plot in the template language, the documentation indicates what axis types it supports. Plots statements that are specified in the template are ignored if they are incompatible with the axis type.

Each axis type has features specific to that type, and the following axis options enable you to specify features for the different types:

```
LINEAROPTS=(linear-suboptions)
DISCRETEOPTS=(discrete-suboptions)
TIMEOPTS=(time-suboptions)
LOGOPTS=(log-suboptions)
```

One or more of these options can be specified for an axis, but the specified settings are applied only to the axis type that supports them.

For example, a bar chart has two axes – a TYPE=DISCRETE axis for the X axis and a TYPE=LINEAR axis for the Y axis. If a numeric column (for example, Age) is assigned to the X role, then this column's values are always treated as discrete values, never as a continuous range of values. You cannot request another axis type for the X axis, but you can request a different axis type for the Y axis.

Sometimes you want a specialized axis type depending on the nature of the data. For example, if the data have a very large range of values (orders of magnitude apart), then you could request that the values be displayed on a logarithmic scale. To set a logarithmic scale, use the TYPE=LOG axis option.

Time series data benefit from displaying the X axis with a TYPE=TIME axis. A TIME axis type requires that the column values are SAS Date, Time, or Datetime values.

Three-dimensional plots such as BIHISTOGRAM3DPARM and SURFACEPLOTPARM always use TYPE=LINEAR for X, Y, and Z axes.

Note: Certain plot types or layouts might impose restrictions on what type of axis can be assigned. The documentation for each plot and layout type identifies any restrictions that might apply to the axes.

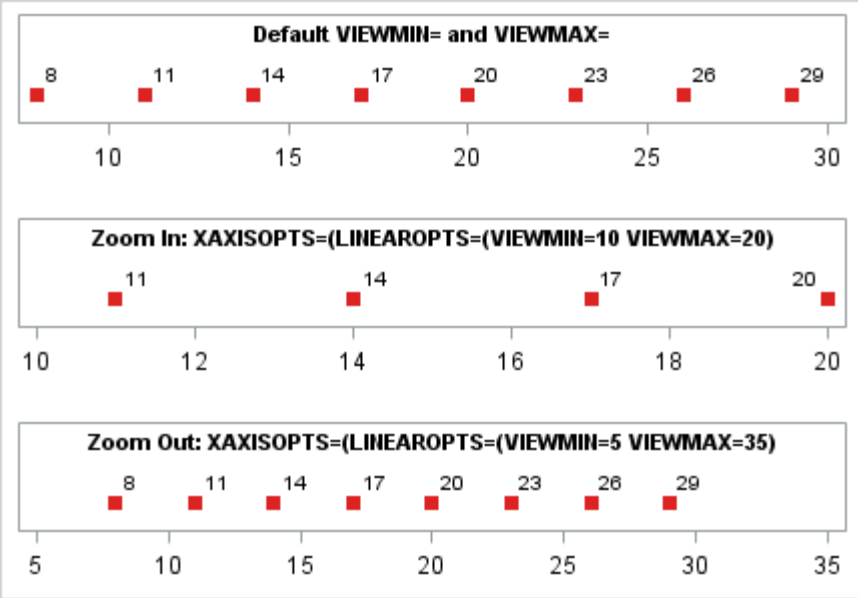
Adjusting the Axis View

The VIEWMIN= and VIEWMAX= axis options can be used to adjust the view of an axis. You can specify minimum data values to include in the display, maximum data values, or both (the specified values might be adjusted by the threshold calculation). By default, the VIEWMIN= value is the minimum data value for the specified axis and the VIEWMAX= value is the maximum data value for the specified axis.

A VIEWMIN= value that is greater than the data minimum or a VIEWMAX= value that is less than the data maximum acts like a “zoom in” operation. The adjusted view reduces the range of values represented on the axis and can sometimes exclude markers, lines, or fills that would normally appear.

A VIEWMIN= value that is less than the data minimum or a VIEWMAX= value that is greater than the data maximum acts like a “zoom out” operation. The adjusted view extends the range of values represented on the axis and sometimes compresses the markers, lines, or fills into a smaller area.

The following figure shows how the view settings can affect the tick and data displays.



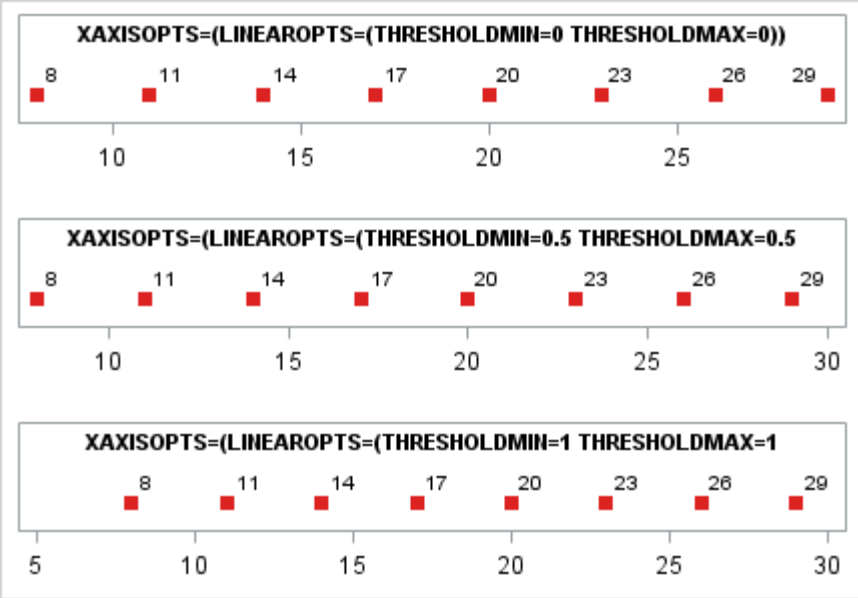
Adjusting Axis Thresholds

On a continuous, linear axis, the THRESHOLDMIN= and THRESHOLDMAX= axis options can be used to set a bias for including one more tick mark outside of either end of the data range (or VIEWMIN to VIEWMAX range). The threshold range is from 0 (do not include the tick mark) to 1 (include the tick mark). The default is 0.30. The bias at the minimum end of the axis is calculated using the THRESHOLDMIN= value and the minimum data value (by default) or the VIEWMIN= value (if set).

The bias at the maximum end of the axis is calculated using the THRESHOLDMAX= value and the maximum data value (by default) or the VIEWMAX= value (if set).

Specifying THRESHOLDMIN=0 and THRESHOLDMAX=0 prevents the tick marks from extending beyond the data range. Specifying THRESHOLDMIN=1 and THRESHOLDMAX=1 ensures that the data range is bounded by tick marks.

The following figure shows how the threshold settings can affect the tick display on an axis. In the figure, 8 is the minimum value for the display and 29 is the maximum value.

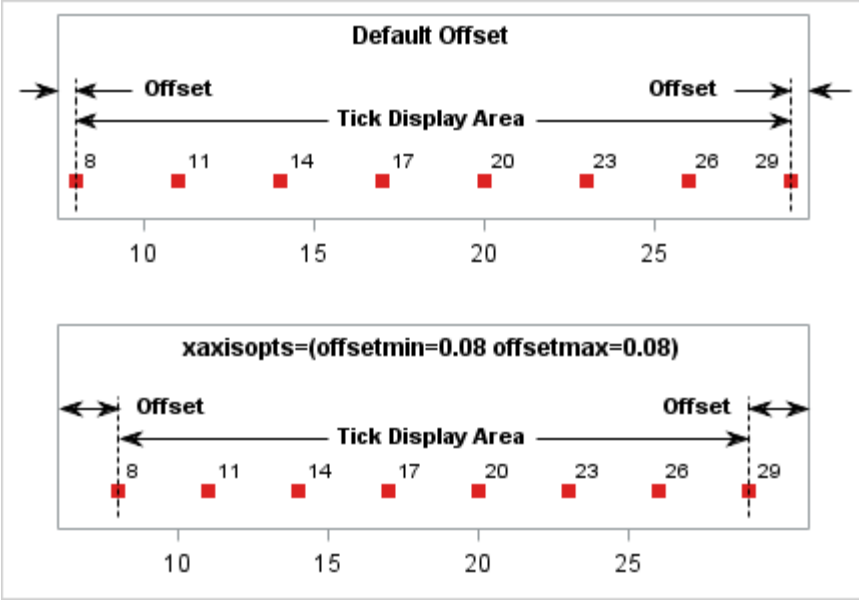


Adjusting Axis Offsets

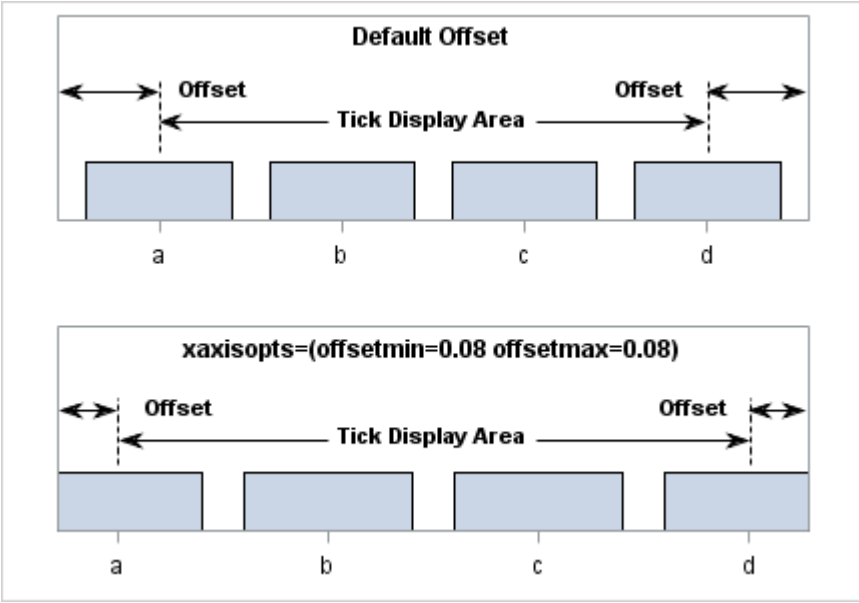
The OFFSETMIN= and OFFSETMAX= axis options can be used to reserve an area at the minimum end of an axis, the maximum end, or both ends. No tick marks are displayed in the reserved areas.

The offset range is from 0 to 1, and the specified value is used to calculate the offset as a percentage of the full axis length. The larger the offset area that is reserved, the less space is available for the tick display area. The default offset reserves just enough area to fully display markers and other graphical features near the ends of an axis.

The following figure shows how offset values of 0.08 might compare with the default offsets for a continuous axis.



This next figure shows how offset values might affect the discrete axis of a bar chart.



8

Axis Options in Layouts

Dictionary **1055**
Axis Options for LAYOUT OVERLAY 1055
Axis Options for LAYOUT OVERLAY3D 1119
Row and Column Axis Options for LAYOUT LATTICE 1140
Axis Options for LAYOUT OVERLAYEQUATED 1197
Axis Options for LAYOUT DATALATTICE and LAYOUT DATAPANEL 1218

Dictionary

Axis Options for LAYOUT OVERLAY

Axis options for the plots within an OVERLAY layout.

Interaction: The OVERLAY's axis options are ignored when the LAYOUT OVERLAY statement is nested within another layout type that has external axes in effect. For example, the axis options are ignored when the OVERLAY is nested in a LAYOUT LATTICE with a COLUMNAXIS= or ROWAXIS= option in effect.

Note: Unless otherwise indicated in an option description, each axis option is available for the X, Y, X2, and Y2 axis.

See: "LAYOUT OVERLAY Statement" on page 159

Syntax

Axis options for the plots within an OVERLAY layout are specified with the following
options on a LAYOUT OVERLAY statement:

XAXISOPTS=(*axis-options*)

YAXISOPTS=(*axis-options*)

X2AXISOPTS=(*axis-options*)

Y2AXISOPTS=(*axis-options*)

General Options for All Axes in an Overlay

The options that are documented in this section can be used with any of the axis types that are supported within an OVERLAY layout. Subsequent sections in the chapter document the axis options that are available only for specific axis types: discrete, linear, log, or time axes. The following table provides a summary of the options.

Statement Option	Description
DISCRETEOPTS	Specifies options for a discrete axis.
DISPLAY	Controls which axis features are displayed on the primary axis.
DISPLAYSECONDARY	Controls which axis features are displayed on the secondary axis.
GRIDATTRS	Specifies the attributes of the grid lines.
GRIDDISPLAY	Specifies whether axis grid lines are displayed.
LABEL	Specifies the axis label.
LABELATTRS	Specifies the color and font attributes of the axis label.
LABELFITPOLICY	Specifies a policy for fitting axis labels in the available space.
LABELPOSITION	Specifies the position of the axis label.
LABELSPLITCHAR	Specifies one or more characters on which the axis labels can be split, if needed.
LABELSPLITCHARDROP	Specifies whether the split characters should be included in the displayed axis labels.
LABELSPLITJUSTIFY	Specifies the justification of the strings that are inside the axis label blocks.
LINEAROPTS	Specifies features for a standard numeric interval axis.

Statement Option	Description
LINEEXTENT	Specifies the extent of the axis line.
LOGOPTS	Specifies features for a log axis.
NAME	Assigns a name to an axis for reference in other statements.
OFFSETMAX	Reserves an area at the maximum end of the axis. No tick marks are displayed in the reserved area.
OFFSETMIN	Reserves an area at the minimum end of the axis. No tick marks are displayed in the reserved area.
REVERSE	Specifies whether the tick values should appear in the reverse order.
SHORTLABEL	Specifies an alternate axis label to use if the default or specified axis label is too long for the axis length.
TICKSTYLE	Specifies the placement of tick marks in relation to the axis line.
TICKVALUEATTRS	Specifies the color and font attributes of the axis tick values.
TICKVALUEHALIGN	Specifies the horizontal alignment for all of the tick values that are displayed on the Y and Y2 axes.
TICKVALUEVALIGN	Specifies the vertical alignment for all of the tick values that are displayed on the X and X2 axes.
TIMEOPTS	Specifies features for a TIME axis.
TYPE	Specifies the type of axis to use.

DISCRETEOPTS=(*discrete-axis-options*)
specifies one or more options for a discrete axis. Options must be enclosed in parentheses. Each option is specified as a *name = value* pair and each pair is space separated.

Interaction This option is ignored if the axis type is not DISCRETE.

See "Options for Discrete Axes Only" on page 1072 for the options that you can use for *discrete-axis-options*.

DISPLAY=STANDARD | ALL | NONE | (*display-options*)
controls which axis features are displayed on the primary axis.

STANDARD
specifies that the LABEL, LINE, TICKS, and TICKVALUES are displayed

ALL
currently the same as STANDARD

NONE
specifies that no axis features are displayed

(*display-options*)
specifies a space-separated list of one or more display options, enclosed in parentheses.

The list can contain one or more of the following options:

LABEL
displays the axis label

LINE
displays the axis line

TICKS
displays the tick marks

TICKVALUES
displays the values that are represented by the major tick marks

Default STANDARD

Tips The default line attributes for the axis line and axis tick marks are defined in the GraphAxisLine style element.

Use the GRIDDISPLAY= and GRIDATTRS= options to set the axis grid lines.

When LINE is excluded from the DISPLAY= option, the layout wall outline or the default baseline of a bar chart, needle plot, or waterfall chart can appear to be an axis line. To suppress the wall outline, use the WALLDISPLAY= option in the layout statement. To suppress the plot baseline, use the BASELINEATTRS= option in the plot statement.

DISPLAYSECONDARY=NONE | ALL | STANDARD | (*display-options*)
controls which axis features are displayed on the secondary axis. A secondary axis is not an independent axis. Rather, it mirrors the primary axis. Thus, for this option to take effect, all plot statements in the layout must map data to the same primary axis. For example, a secondary X2 axis can be displayed on top in the layout, provided all plot statements set XAXIS=X to map data to the primary X axis (bottom). Similarly, a secondary Y2 axis can be displayed to the right in the layout, provided all plot statements set YAXIS=Y to map data to the primary Y axis (left).

NONE
specifies that no axis features are displayed

STANDARD
specifies that the LABEL, LINE, TICKS, and TICKVALUES are displayed on the secondary axis

ALL
currently the same as STANDARD

(*display-options*)
specifies a space-separated list of one or more display options, enclosed in parentheses.

The list can contain one or more of the following options:

LABEL
displays the axis label

LINE
displays the axis line

TICKS
displays the tick marks

TICKVALUES
displays the values that are represented by the major tick marks

Default NONE

Restriction If some plot statements set XAXIS=X and others set XAXIS=X2, both the X and X2 axis are primary and a secondary X axis cannot be displayed. In that case, this option is ignored. The same applies for the Y axes.

Tip Use the GRIDDISPLAY= and GRIDATTRS= options to set the axis grid lines.

GRIDATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the attributes of the grid lines.

Default The GraphGridLines style element.

Interaction This option is ignored if the GRIDDISPLAY= option does not display the grid lines.

Tip On a log axis, this option affects the appearance of the major grid lines only. It does not affect the appearance of the minor grid lines. To control the appearance of the minor grid lines on a log axis, use the MINORGRIDATTRS= option.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

GRIDDISPLAY=AUTO_OFF | AUTO_ON | ON | OFF
specifies whether axis grid lines are displayed. This option enables the template to absolutely control the display of grid lines or to allow interaction with the current style to decide whether grid lines are displayed.

AUTO_OFF
specifies that grid lines are not displayed unless the GraphGridLines element in the current style contains DisplayOpts="ON."

AUTO_ON
specifies that grid lines are displayed unless the GraphGridLines element in the current style contains DisplayOpts="OFF."

ON
specifies that grid lines are always displayed.

The current style has no override.

OFF
specifies that grid lines are never displayed.

The current style has no override.

The following table shows the end results for various combinations of the GRIDDISPLAY= option and the DisplayOpts= attribute of the GraphGridLines style element. Most supplied templates use the default setting AUTO_OFF to indicate a preference for not displaying grid lines, but allowing the style to override.

GRIDDISPLAY= option	DisplayOpts= style attribute	Grid Lines Shown?
AUTO_OFF	AUTO	no
AUTO_OFF	ON	yes
AUTO_OFF	OFF	no
AUTO_ON	AUTO	yes
AUTO_ON	ON	yes
AUTO_ON	OFF	no
ON	any value	yes
OFF	any value	no

Default AUTO_OFF

Note Supplied styles use DisplayOpts="AUTO," which means that the style has no preference about grid lines and the graphics template setting for grid lines is always used.

LABEL=*"string"* | (*"string"* ...*"string"*)
specifies the axis label. The string can be either a string literal or a dynamic. The list form implies that all included string literals or dynamic variables will be concatenated.

Default The default label is derived from the primary plot in the layout. For more information, see "When Plots Share Data and a Common Axis" on page 1046.

Interaction This option is ignored if the DISPLAY= option or the DISPLAYSECONDARY= option does not display the axis label.

Note If the axis label is too long to fit along the axis, then it is truncated by default.

Tips Use the SHORTLABEL= option to specify an alternate axis label to be used whenever truncation would normally occur.

Use the ODS escape sequence to specify Unicode characters in an axis label. Here is an example that species degrees Fahrenheit in an axis label for temperature:

```
label="Temperature ((*ESC*){unicode '00B0'x}F)"
```

See "Overriding the Default Axis Label" in *SAS Graph Template Language: User's Guide*

LABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font attributes of the axis label.

Default The GraphLabelText style element.

Interaction This option is ignored if the DISPLAY= or DISPLAYSECONDARY= option does not display the axis label.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Text Options" on page 1606 for available *text-options*.

LABELFITPOLICY=AUTO | SPLIT | SPLITALWAYS | STACKED
specifies a policy for fitting axis labels in the available space.

AUTO
uses the short label, when specified, instead of the original label.

If the short label does not fit, then it is clipped. When no short label is specified, the original label is clipped.

SPLIT
splits the axis label at a split character only when necessary in order to make the label fit the available space.

The split character is specified by the LABELSPLITCHAR= option. The short label is not used. A split does not occur at a split character if a split is not needed at that location. If the label does not contain any of the specified split characters, then it is not split. A label that cannot be split or that does

not fit the available space even after splitting might overlap the adjoining space.

SPLITALWAYS
always split the axis label at every occurrence of a split character, which is specified by the LABELSPLITCHAR= option.

If the label cannot be split, then it is clipped.

STACKED
displays the Y or Y2 axis label vertically as stacked letters.

Note: This feature applies to SAS 9.4M5 and to later releases.

Valid in YAXISOPTS= and Y2AXISOPTS only

Default AUTO

Interactions This option has effect only when LABELPOSITION= is CENTER or DATACENTER.

When the overlay layout is nested in a LATTICE layout, SPLIT is ignored and AUTO is used instead.

Note When LABELPOSITION=CENTER, the available area is the full axis, including the axis offsets. When LABELPOSITION=DATACENTER, the available area is the tick display area, excluding the axis offsets.

LABELPOSITION=CENTER | DATACENTER | TOP | BOTTOM | LEFT | RIGHT
specifies the position of the axis label.

CENTER
centers the axis label in the axis area.

For the Y and Y2 axes, the label is oriented vertically and is centered in the axis area (including the offsets). The label is positioned to the left of the tick values for the Y axis or to the right of the axis values for the Y2 axis. For the X and X2 axes, the label is centered in the axis area (including the offsets). It is positioned below the tick values for the X axis or above the axis values for the X2 axis.

DATACENTER
centers the axis label in the axis tick display area.

For the Y and Y2 axes, the label is oriented vertically and is centered in the axis tick display area (excluding the offsets). It is positioned to the left of the tick values for the Y axis or to the right of the axis values for the Y2 axis. For the X and X2 axes, the label is centered in the axis tick display area (excluding the offsets). The label is positioned below the tick values for the X axis or above the axis values for the X2 axis.

TOP
BOTTOM
orients the label horizontally at the top or bottom of the axis area.

The label is right-justified in the axis area for the Y axis and left-justified for the Y2 axis. If there is not sufficient room in the axis area to display the label, then the label grows to the right for the Y axis and to the left for the Y2 axis.

Restriction These options are valid for the Y and Y2 axes only.

Note When TOP or BOTTOM is used, the label might collide with other graphical features. In that case, use CENTER or DATACENTER instead.

LEFT
RIGHT

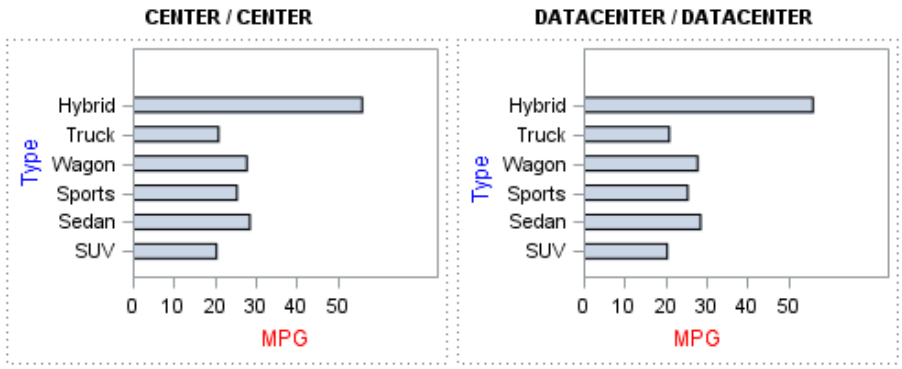
positions the label to the left or right of the axis area.

The label is centered vertically in the axis area.

Restriction These options are valid for the X and X2 axes only.

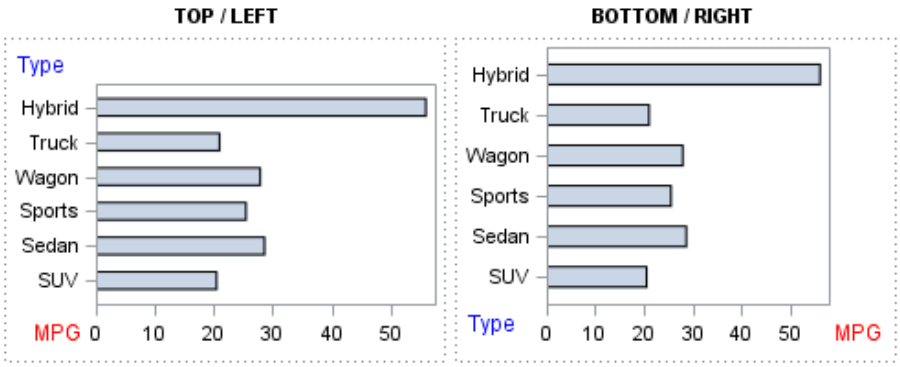
Note When LEFT or RIGHT is used, the label might collide with other graphical features.

The following figure shows the CENTER and DATACENTER positions for a blue Y-axis label Type and a red X-axis label MPG.



In this example, an axis offset is applied to the maximum end of both axes in order to demonstrate the difference between CENTER and DATACENTER. CENTER centers the labels on the entire axis area, including the offset. DATACENTER centers the labels on the tick display areas, which does not include the offset.

The next figure shows the TOP and LEFT positions, and the BOTTOM and RIGHT positions for the same axis labels.



The following figure shows the CENTER and DATACENTER positions for a blue Y-axis label Qtr and a red X-axis label Close.

The next figure shows the TOP and LEFT positions, and the BOTTOM and RIGHT positions for the same axis labels.

Default CENTER

Restriction This option does not support collision avoidance. In some cases, axis label collisions can occur in the axis area.

Interaction When LEFT, RIGHT, TOP, or BOTTOM is in effect, the SHORTLABEL= option is ignored.

See SHORTLABEL= on page 1068 for information about how short labels are used.

LABELSPLITCHAR="*character-list*"

specifies one or more characters on which the axis labels can be split, if needed. When multiple split characters are specified, each character in the list is treated as a separate split character unless the specified characters appear consecutively in the axis label. In that case, all of the specified split characters together are treated as a single split character.

When LABELFITPOLICY=SPLIT, if the axis label does not fit the available space, then it is split on a specified split character only if a split is needed at that point to make the label fit. In this case, a split might not occur on every split character. When LABELFITPOLICY=SPLITALWAYS, the axis label is split unconditionally on every occurrence of a split character. If the axis label does not contain any of the specified split characters, the label is not split.

"character-list"

one or more characters with no space between each character and enclosed in quotation marks.

Default A blank space

Requirements The list of characters must be enclosed in quotation marks.

Multiple characters must be specified with no space between them. For example, to specify the split characters a, b, and c, use the following option:

```
labelsplitchar="abc"
```

Interactions This option has effect only when LABELPOSITION= is CENTER or DATACENTER.

The LABELSPLITCHARDROP= option specifies whether the split characters are included in the displayed data label or are dropped.

Notes When multiple characters are specified, the order of the characters in the list is not significant.

The split characters are case sensitive.

Tip Use the LABELSPLITJUSTIFY= option to specify the justification of the strings in the axis label block.

LABELSPLITCHARDROP=TRUE | FALSE
specifies whether the split characters are included in the displayed axis labels.

TRUE
drops the split characters from the axis label display.

FALSE
includes the split characters in the axis label display.

When the label is split while LABELSPLITCHARDROP=FALSE is in effect, each split character remains as the last character in the current line. The characters that follow the split character, up to and including the next split character, are then wrapped to the next line.

Default TRUE. The split characters are dropped from the axis label.

Interactions This option has effect only when LABELPOSITION= is CENTER or DATACENTER.

The LABELSPLITCHAR= option specifies the split characters.

See “boolean ” on page xii for other Boolean values that you can use.

LABELSPLITJUSTIFY=*justification*
specifies the justification of the strings that are inside the axis label blocks.

justification

CENTER
LEFT
RIGHT
specifies the justification for the X or X2 axis label.

CENTER
TOP
BOTTOM
specifies the justification for the Y or Y2 axis label.

Default CENTER

Interaction This option has effect only when LABELPOSITION= is CENTER or DATACENTER.

LINEAROPTS=(*linear-axis-options*)
specifies one or more options for a numeric interval axis. Options must be enclosed in parentheses. Each option is specified as a *name = value* pair and each pair is space separated.

Interaction This option is ignored if the axis type is not LINEAR.

See "Options for Linear Axes Only" on page 1082 for the options that you can use for *linear-axis-options*.

LINEEXTENT=FULL | DATA | *number*
specifies the extent of the axis line.

Note: This feature applies to SAS 9.4M3 and to later releases.

FULL
specifies an axis line that extends along the entire length of the axis.

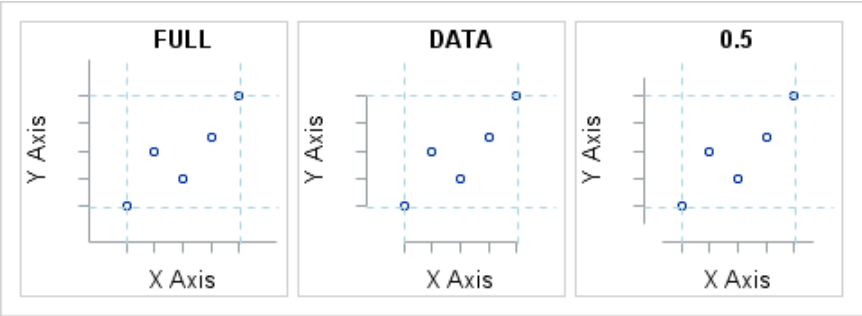
DATA
specifies an axis line that extends through the data range from the minimum offset to the maximum offset.

number
specifies how much the axis line extends from DATA toward FULL as a decimal proportion. A value of 0 is equivalent to DATA, and a value of 1 is equivalent to FULL.

Range 0–1

Tip A numeric value is useful for bar charts when DATA terminates the axis line at the midpoint positions of the minimum and maximum bars. In that case, you can specify a numeric value to lengthen the axis line so that it extends to the full width of both bars.

The following figure shows a simple example of each value for the X axis and Y-axis lines. The light-blue dashed lines depict the minimum and maximum offsets that are set on the axes.



Default FULL

Restriction This option is valid only in OVERLAY and OVERLAYEQUATED layouts.

Interaction This option overrides the AXISLINEEXTENT= option in the BEGINGRAPH statement.

Tip The graph wall outline might appear to be an axis line. In that case, use the WALLDISPLAY=NONE or WALLDISPLAY=(FILL) option in the layout statement to suppress the wall outline.

LOGOPTS=(*log-axis-options*)
specifies one or more options for a log axis. Options must be enclosed in parentheses. Each option is specified as a *name = value* pair and each pair is space separated.

Interaction This option is ignored if the axis type is not LOG.

See "Options for Log Axes Only" on page 1097 for the options that you can use for *log-axis-options*.

NAME="*string*"
assigns a name to an axis for reference in other statements. Currently, it is used only in an AXISLEGEND statement.

Restriction This option does not support variables that are created by the DYNAMIC, MVAR, and NMVAR template statements.

Interactions This option is ignored unless the axis is discrete. The axis can be discrete by default, or explicitly set to discrete with a TYPE= DISCRETE setting.

For this option to take effect, an axis legend must be enabled. To enable an axis legend, the DISCRETEOPTS= option must set the TICKVALUEFITPOLICY to either EXTRACT or EXTRACTALWAYS. In addition, an AXISLEGEND statement must be specified to generate the axis legend.

OFFSETMAX=AUTO | AUTOCOMPRESS | *number*
reserves an area at the maximum end of the axis. No tick marks are displayed in the reserved area.

AUTO
reserves just enough area to fully display markers and other graphical features near the maximum end of an axis.

AUTOCOMPRESS
applies an automatic offset that prevents axis labels and tick values from extending beyond the axis length.

number
specifies the offset as a decimal proportion of the full axis length.

Default AUTO

Range 0–1. The sum of OFFSETMAX= and OFFSETMIN= should not be more than 1.

See "Adjusting Axis Offsets" on page 1053

OFFSETMIN=AUTO | AUTOCOMPRESS | *number*
reserves an area at the minimum end of the axis. No tick marks are displayed in the reserved area.

AUTO
reserves just enough area to fully display markers and other graphical features near the maximum end of an axis.

AUTOCOMPRESS
applies an automatic offset that prevents axis labels and tick values from extending beyond the axis length.

number
specifies the offset as a decimal proportion of the full axis length.

Default AUTO

Range 0–1. The sum of OFFSETMAX= and OFFSETMIN= should not be more than 1.

See "Adjusting Axis Offsets" on page 1053.

REVERSE=TRUE | FALSE
specifies whether tick values should appear in the reverse order.

Default FALSE

See "boolean " on page xii for other Boolean values that you can use.

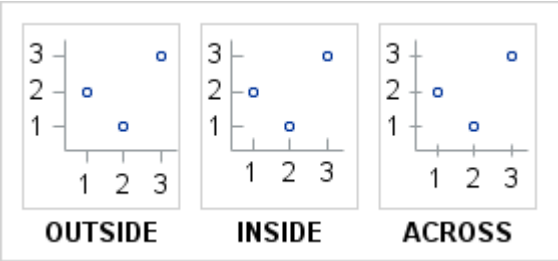
SHORTLABEL="*string*"
specifies an alternate axis label to display when the default label or the label specified by the LABEL= option is too long to fit the available space. When LABELPOSITION=CENTER (default), the available space for an axis label is the full axis, including the axis offsets. When LABELPOSITION=DATACENTER, the available space for an axis label is the axis tick display area, which excludes the axis offsets. If the label length exceeds the available space, then the label is anchored at the left or bottom offset. It extends beyond the opposing offset until it reaches the end of the axis where it is truncated. An ellipsis designates the truncation.

Interactions This option is ignored if the DISPLAY= option or the DISPLAYSECONDARY= option does not display the axis label.

This option has effect only when the LABELPOSITION= option is set to CENTER or DATACENTER.

Note If the specified label is itself too long for the axis, it is truncated in the display.

TICKSTYLE=OUTSIDE | INSIDE | ACROSS
specifies the placement of tick marks in relation to the axis line. The figure shows the tick display for each value.



OUTSIDE
displays tick marks outside of the axis frame.

INSIDE
displays tick marks inside the axis frame.

ACROSS
displays tick marks across the axis line.

Default The GraphAxisLines:TickDisplay style reference.

Restriction This option applies to the major tick marks only. It does not affect the minor tick marks.

Interaction This option is ignored if the DISPLAY= or DISPLAYSECONDARY= option does not display tick marks.

Note This option has no effect on the placement of the tick values, which are always outside the axis frame.

Tip You can use the Annotate facility to draw inside or across minor tick marks in your graphs. See "Creating a Macro That Generates Annotation Data" in *SAS Graph Template Language: User's Guide*.

TICKVALUEATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font attributes of the axis tick values.

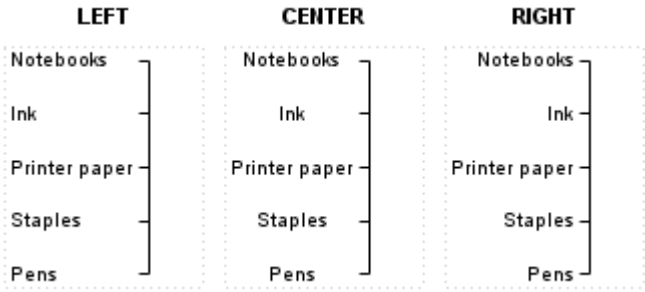
Default The GraphValueText style element.

Interaction This option is ignored if the DISPLAY= or DISPLAYSECONDARY= option does not display tick values.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Text Options" on page 1606 for available *text-options*.

TICKVALUEHALIGN=LEFT | CENTER | RIGHT
specifies the horizontal alignment for all of the tick values that are displayed on the Y and Y2 axes.

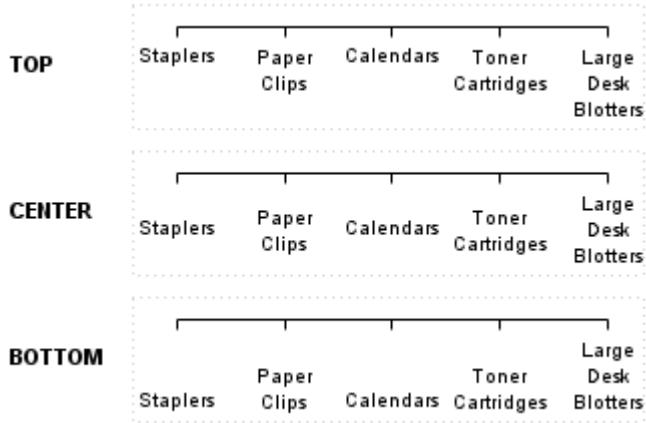


Defaults RIGHT for a Y axis

LEFT for a Y2 axis

Restriction This option is valid for the Y and Y2 axes only.

TICKVALUEVALIGN=TOP | CENTER | BOTTOM
specifies the vertical alignment for all of the tick values that are displayed on the X and X2 axes.



Defaults TOP for an X axis

BOTTOM for an X2 axis

Restriction This option is valid for the X and X2 axes only.

TIMEOPTS=(*time-axis-options*)
specifies one or more options for a time axis.

Requirements Columns associated with a time axis must be in SAS time, SAS date, or SAS datetime units and have an associated SAS time, date, or datetime format.

Options must be enclosed in parentheses. Each option is specified as a *name = value* pair and each pair is space separated.

Interaction This option is ignored if the axis type is not TIME.

See "Options for Time Axes Only" on page 1107 for the options that you can use for *time-axis-options*.

TYPE=AUTO | DISCRETE | LINEAR | TIME | LOG
specifies the type of axis to use.

AUTO
requests that the axis type be automatically determined, based on the overlay contents.

For more information, see "When Plots Share Data and a Common Axis" on page 1046.

DISCRETE
uses a DISCRETE axis if possible.

The data for discrete axes can be character or numeric. You can add a DISCRETEOPTS= option list to customize this axis type.

LINEAR
uses a LINEAR axis if possible.

You can add a LINEAROPTS= option list to customize this axis type.

TIME
uses a TIME axis if possible.

Data for this axis must be SAS time, SAS date, or SAS datetime values. You can add a TIMEOPTS= option list to customize this axis type.

LOG
uses a LOG axis if possible.

You can add a LOGOPTS= option list to customize this axis type.

Interaction If a log axis is requested and the axis data contains 0 or negative values, the axis reverts to a linear axis. This outcome can occur for the response axis of a bar chart, line chart, needle plot, or waterfall chart when a baseline intercept of 0 or less is specified. It can also occur for the response axis of a waterfall chart when an initial bar value of 0 or less is specified. To get a log response axis in those cases, set the baseline intercept or initial bar value to a positive value.

Default AUTO

Interactions If this option is set to anything other than AUTO, then plots within the layout are dropped from the display if their data types or data ranges do not match the axis type requirements. For more information, see "Plot Axis Types Must Agree on Common Axes" on page 1049.

After the axis type is determined (whether you set a specific type or AUTO is in effect), you can use only options that are supported by that axis type. For example, if TYPE=TIME, then only the general OVERLAY axis options and those available on TIMEOPTS= are supported.

Options for Discrete Axes Only

The options that are documented in this section can be used with the DISCRETEOPTS= axis option. The following table provides a summary of the options.

Discrete Axis Options	Description
COLORBANDS	Specifies the display of alternating wall-color bands corresponding to the discrete axis bins.
COLORBANDSATTRS	Specifies the appearance of the alternating wall-color bands.
SORTORDER	Specifies how the values on the axis are to be sorted.
TICKDISPLAYLIST	Specifies the text that is displayed for the tick values that are defined in the TICKVALUELIST= option.
TICKTYPE	Specifies the position of the axis tick mark.
TICKVALUEFITPOLICY	Specifies a policy for avoiding tick value collision on an axis.
TICKVALUEFORMAT	Specifies how to format the values for major tick marks.
TICKVALUELIST	Specifies the list of tick values that are displayed on the axis.
TICKVALUEROTATION	Specifies how the tick values are rotated on the X and X2 axes.
TICKVALUESPLITCHAR	Specifies whether the split characters are included in the displayed tick values.
TICKVALUESPLITCHARDROP	Specifies whether the split characters are included in or dropped from the displayed tick value.
TICKVALUESPLITJUSTIFY	Specifies justification of the strings that are inside the tick value block.

COLORBANDS=NONE | EVEN | ODD

specifies the display of alternating wall-color bands corresponding to the discrete axis bins.

Default NONE

Restriction This option applies to discrete axes only.

Interaction Specifying this option for more than one axis in the layout might have unexpected results. The order in which color bands are drawn might not match the order in which the axis options are specified.

Note The full width of a color band is the distance between midpoints. When no axis offsets are specified, the first band begins at one-half of the midpoint distance, and the last band ends at one-half of the midpoint distance. When axis offsets are specified, the first and last color bands on the axis might extend into their adjacent offsets by as much as half the color-band width.

Tips Borders for the color bands can be added by setting TICKTYPE= INBETWEEN in the DISCRETEOPTS= option, and by setting GRIDDISPLAY= ON.

Because alternating color bands are drawn on top of the plot wall, this option can be coordinated with the LAYOUT OVERLAY statement's WALLCOLOR= option.

COLORBANDSATTRS=*style-element* | *style-element* (*fill-options*) | (*fill-options*)
specifies the appearance of the alternating wall-color bands. For the alternating colors, one set uses the WALLCOLOR= colors that are set in the LAYOUT OVERLAY statement, and the other set uses the colors set on this option.

Default The GraphBlock style element.

Restriction This option applies to discrete axes only.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Fill Color Options" on page 1600 for available *fill-options*.

SORTORDER=AUTO | DATA
specifies how the axis values are to be sorted.

Note: This option applies to SAS 9.4M5 and to later releases.

AUTO
for a column in a SAS data set, enables the system to determine the best sorting for the axis tick values.

For a column in a CAS in-memory table, sorts the tick values in ascending order by the formatted values.

DATA
arranges the axis tick values in the order in which they appear in the data.

Note In SAS 9.4M6 and SAS 9.4M5, when data stored in a CAS in-memory table is used and DATA is specified, unpredictable results might occur. To generate consistent graphs in that case, specify AUTO. Starting with SAS Viya 3.5 and SAS Studio 5.2, when data stored in a CAS in-

memory table is used and DATA is specified, DATA is ignored, and AUTO is used instead.

Default AUTO

TICKDISPLAYLIST=(*string-list*)
specifies the text that is displayed for the tick values that are defined in the TICKVALUELIST= option. The string list is a space-separated list of string values that are displayed on the axis in place of the values in the TICKVALUELIST= option. The strings map one-to-one positionally with the values that are listed in the TICKVALUELIST= option.

Default Determined by the system or by the TICKVALUELIST= option.

Requirements The list of values must be enclosed in parentheses.

Each value (character and numeric) must be enclosed in quotation marks and separated from adjacent values by a blank space.

Tip This option should be used with the TICKVALUELIST= option. The number of items in the list for this option should equal the number of items in the list for the TICKVALUELIST= option.

Example The following example specifies the axis tick values 10, 20, 30, and 40, and the tick display values A, B, C, and D:

```
tickvaluelist=("10" "20" "30" "40");
tickdisplaylist=("A" "B" "C" "D");
```

TICKTYPE=MIDPOINT | INBETWEEN
specifies the position of the axis tick marks.

MIDPOINT
places the tick marks at the midpoint value location.

INBETWEEN
places the tick marks half way between adjacent midpoint locations.

Default MIDPOINT

Restriction This option applies to discrete axes only.

Note Starting with SAS 9.4M2, when TICKTYPE=INBETWEEN, the outermost tick marks and grid lines at each end of the axis are not drawn.

TICKVALUEFITPOLICY=*policy*
specifies a policy for avoiding tick value collision on an axis. The effectiveness of a collision-avoidance policy depends on the number of tick values, their length, and the length of the axis. Which policies are valid depends on the axis on which this option is used.

For the Y and Y2 axes, the following policies are valid:

EXTRACT
displays consecutive integers along the axis instead of the actual tick values in order to represent those tick values.

In most cases, this policy is implemented if the system estimates that a collision might occur. If no collision occurs, then the actual tick values are displayed on the axis in the normal manner.

Requirement The EXTRACT policy must be used with an AXISLEGEND statement. For more information, see "Extracting Discrete Axis Tick Values into a Legend" in *SAS Graph Template Language: User's Guide*.

EXTRACTALWAYS
same as EXTRACT, except that the extraction is implemented regardless of whether collision occurs.

Requirement The EXTRACTALWAYS policy must be used with an AXISLEGEND statement. For more information, see "Extracting Discrete Axis Tick Values into a Legend" in *SAS Graph Template Language: User's Guide*.

NONE
makes no attempt to avoid collisions between tick values.

Tick values are displayed even when they collide.

SPLIT
splits the tick value at a split character, which is specified by the TICKVALUESPLITCHAR= option, only when necessary in order to make the value fit the available space.

A split does not occur at a split character if a split is not needed at that location. If the value does not contain any of the specified split characters, then the value is not split. Values that are not split or that do not fit the available space even after splitting might overlap the adjoining space.

See TICKVALUESPLITCHAR= on page 1079

SPLITALWAYS
always splits the axis tick value at every occurrence of a split character that is specified by the TICKVALUESPLITCHAR= option.

See TICKVALUESPLITCHAR= on page 1079

SPLITALWAYSTHIN
same as SPLITALWAYS, except that thinning is performed when long words do not fit the available space.

SPLITTHIN
same as SPLIT, except that thinning is performed when long words do not fit the available space.

THIN
eliminates alternate tick values.

For the X and X2 axes, the following policies are valid:

EXTRACT
displays consecutive integers along the axis instead of the actual tick values in order to represent those tick values.

In most cases, this policy is implemented if the system estimates that a collision might occur. If no collision occurs, then the actual tick values are displayed on the axis in the normal manner.

Requirement The EXTRACT policy must be used with an AXISLEGEND statement. For more information, see "Extracting Discrete Axis Tick Values into a Legend" in *SAS Graph Template Language: User's Guide*.

EXTRACTALWAYS
same as EXTRACT, except that the extraction is implemented regardless of whether collision occurs.

Requirement The EXTRACTALWAYS policy must be used with an AXISLEGEND statement. For more information, see "Extracting Discrete Axis Tick Values into a Legend" in *SAS Graph Template Language: User's Guide*.

NONE
makes no attempt to avoid collisions between tick values.

Tick values are displayed even when they collide.

ROTATE
rotates the tick values if a collision occurs.

The TICKVALUEROTATION= option specifies whether the values are rotated to a 45-degree diagonal or a 90-degree vertical position. By default, the values are rotated to a 45-degree diagonal position.

ROTATEALWAYS
rotates the tick values regardless of whether a collision occurs.

The TICKVALUEROTATION= option specifies whether the values are rotated to a 45-degree diagonal or a 90-degree vertical position. By default, the values are rotated to a 45-degree diagonal position.

ROTATEALWAYSDROP
attempts the ROTATEALWAYS policy, and then drops the tick values if collisions still occur.

ROTATETHIN
attempts the ROTATE policy, and then the THIN policy.

SPLIT
splits the tick value at a split character, which is specified by the TICKVALUESPLITCHAR= option, only when necessary in order to make the value fit the available space.

A split does not occur at a split character if a split is not needed at that location. If the value does not contain any of the specified split characters, then the value is not split. Values that are not split or that do not fit the available space even after splitting might overlap the adjoining space.

See TICKVALUESPLITCHAR= on page 1079

SPLITALWAYS
always splits the axis tick value at every occurrence of a split character that is specified by the TICKVALUESPLITCHAR= option.

See TICKVALUESPLITCHAR= on page 1079

SPLITROTATE
attempts the SPLIT policy, and then the ROTATE policy.

STACKEDALWAYS
always displays the tick values vertically as stacked letters.

Valid in XAXISOPTS= and X2AXISOPTS only

STACKEDALWAYSTHIN
always displays the tick values vertically as stacked letters.

Thinning is performed when the tick values do not fit the available space.

Valid in XAXISOPTS= and X2AXISOPTS only

STAGGER
alternates the tick values between two rows.

STAGGERROTATE
attempts the STAGGER policy, and then the ROTATE policy.

STAGGERTHIN
attempts the STAGGER policy, and then the THIN policy.

STAGGERTRUNCATE
attempts the STAGGER policy, and then the TRUNCATE policy.

THIN
eliminates alternate tick values.

TRUNCATE
shortens the tick labels that exceed 12 characters to 12 characters.

A trailing ellipsis indicates that a label is truncated.

Note Data labels might overlap on a crowded axis.

TRUNCATEROTATE
attempts the TRUNCATE policy, and then the ROTATE policy.

TRUNCATESTAGGER
attempts the TRUNCATE policy, and then the STAGGER policy.

TRUNCATETHIN
attempts the TRUNCATE policy, and then the THIN policy.

Defaults THIN for the Y and Y2 axes

ROTATE for the X and X2 axes

Note A note is written to the SAS log when tick value thinning occurs.

TICKVALUEFORMAT=*format*
specifies how to format the values for major tick marks.

Note: This feature applies to SAS 9.4M3 and to later releases.

Restrictions This option applies only to discrete axes.

Only character formats are supported.

Interaction This option is ignored when the axis tick values are extracted to an axis legend. See TICKVALUEFITPOLICY=EXTRACT | EXTRACTALWAYS.

Tip Use this option when you want to duplicate tick values on an axis.

TICKVALUELIST=(*string-list*)
specifies the list of tick values that are to be displayed on the axis.

string-list
a space-separated list of values, enclosed in parentheses.

You must enclose each value in the list in quotation marks.

Only the tick values that are included in the string list are displayed on the axis. The values are displayed in the order in which they are listed. The data values that are not in the list are dropped. The list can be a subset of the data values. It can also contain values that are not included in the actual data. A tick value that is not included in the data appears on the axis, but no data is represented at its tick mark.

Requirements The list of values must be enclosed in parentheses.

Each value must be enclosed in quotation marks and separated from adjacent values by a blank space.

Notes If the string list contains duplicate values, then the first occurrence of the duplicated value in the list is honored and the remaining instances are ignored.

When the values specified in the list are compared with the actual data values, leading blanks are honored and trailing blanks are ignored.

Tips You can use this option to subset the axis values or to display the values in a specific order.

You can use this option to display values on the axis that are not contained in the data.

Examples The following example specifies the axis tick values Sedan, Sports, Wagon, and SUV:

```
tickvaluelist=("Sedan" "Sports" "Wagon" "SUV")
```

The following example specifies the axis tick values 10, 20, 30, and 40:

```
tickvaluelist=("10" "20" "30" "40")
```

TICKVALUEROTATION=DIAGONAL | DIAGONAL2 | VERTICAL
specifies how the tick values are rotated on the X and X2 axes.

DIAGONAL
rotates the tick values to a 45-degree diagonal position.

The X labels read left to right in a downward direction. The X2 labels read left to right in an upward direction.

DIAGONAL2
rotates the tick values to a −45-degree diagonal position.

The X labels read left to right in an upward direction. The X2 labels read left to right in a downward direction.

Note: This feature applies to SAS 9.4M5 and to later releases.

VERTICAL
rotates the labels to a 90-degree vertical position.

The labels are always drawn from bottom to top.

Default DIAGONAL

Restriction This option is valid for XAXISOPTS= and X2AXISOPTS= only.

Interaction The TICKVALUEFITPOLICY= option must be set to ROTATE or ROTATEALWAYS for this option to have any effect.

TICKVALUESPLITCHAR="*character-list*"
specifies a list of characters on which the tick values can be split, if needed. When multiple characters are specified, each character in the list is treated as a separate split character unless the specified characters appear consecutively in the tick value. In that case, all of the specified split characters together are treated as a single split character.

When TICKVALUESPLITPOLICY=SPLIT, if a tick value collision is detected, then the tick value is split on a split character only if necessary at that point in order to avoid collision. In that case, a split might not occur on every split character. When TICKVALUEFITPOLICY=SPLITALWAYS, the tick value is split unconditionally on every occurrence of a split character. If the tick value does not contain any of the specified split characters, then it is not split.

"character-list"
one or more characters with no delimiter between each character.

Default A blank space

Requirements The list of characters must be enclosed in quotation marks.

Multiple characters must be specified with no delimiters. For example, to specify the characters a, b, and c, use the following option:

```
tickvaluesplitchar="abc"
```

Interactions This option is ignored unless option TICKVALUEFITPOLICY= is set to SPLIT, SPLITALWAYS, SPLITTHIN, or SPLITALWAYSTHIN.

The TICKVALUEFITPOLICY= option sets the policy that is used to manage the split behavior of the tick values.

The TICKVALUESPLITCHARDROP= option specifies whether the split characters are displayed or dropped from the display.

Notes When multiple characters are specified, the order of characters in the list is not significant.

The split characters are case sensitive.

Tips Use the TICKVALUESPLITJUSTIFY= option to specify the justification of the strings in the tick value block.

For the X and X2 axis tick values, use the TICKVALUEVALIGN= option to specify the vertical alignment of the tick values.

For the Y and Y2 axis tick values, use the TICKVALUEHALIGN= option to specify the horizontal alignment of the tick values.

Example The following example specifies a blank space, a comma, and an underscore as split characters:

```
tickvaluesplitchar=" ,_"
```

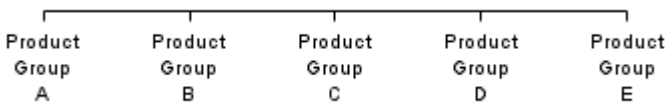
TICKVALUESPLITCHARDROP=TRUE | FALSE

specifies whether the split characters should be included in the displayed tick values. The split characters are specified by the TICKVALUESPLITCHAR= option.

TRUE

drops the split characters from the tick value display.

The following figure shows an example in which TICKVALUESPLITCHARDROP=TRUE and three-word, asterisk-delimited tick values are split on the asterisk character by using the SPLITALWAYS policy.



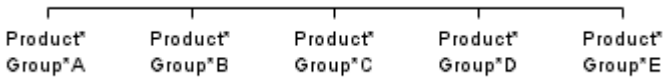
Notice that the asterisk delimiter is not displayed.

FALSE

includes the split characters in the tick value display.

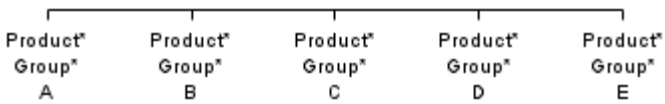
The fit policy determines how the characters are displayed. If the display policy is SPLIT or SPLITTHIN and TICKVALUESPLITCHARDROP=FALSE, then each tick value is split at a split character only where a split is necessary in order to make the value fit the available space. A split might not

occur at every split character in the tick value. At each split point, the split character remains as the last character in the current line. The characters that follow the split character, up to and including the split character at the next split point, are then wrapped to the following line. This process repeats until the entire data tick value is displayed. The following figure shows an example in which TICKVALUESPLITCHARDROP=FALSE and three-word, asterisk-delimited tick values are split on the asterisk character by using the SPLIT policy.



Notice that a split occurs on the first asterisk and not at the second. In this case, a split is not needed at the second asterisk.

If the fit policy is SPLITALWAYS or SPLITALWAYSTHIN, and TICKVALUESPLITCHARDROP=FALSE, then each tick value is split at every instance of a split character in the value regardless of whether a split is actually needed. Each split character remains as the last character in the current line. The characters that follow each split character, up to and including the next split character, are then wrapped to the next line. The following figure shows an example in which TICKVALUESPLITCHARDROP=FALSE and three-word, asterisk-delimited tick values are split on the asterisk character by using the SPLITALWAYS policy.



Notice that a split occurs after each asterisk and each asterisk appears at the end of the line. In this case, three lines are displayed.

Default TRUE

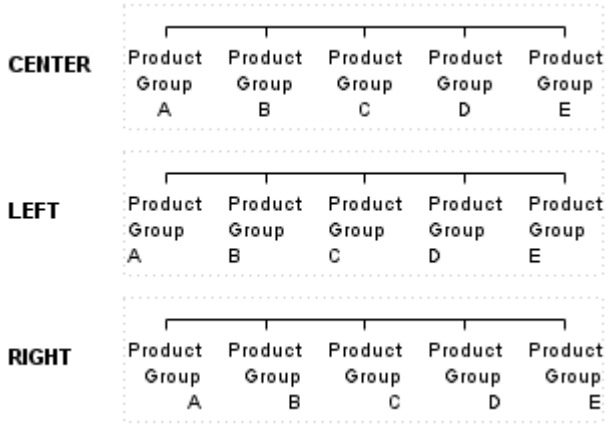
Interactions The TICKVALUESPLITCHAR= option specifies the split character or characters.

This option is ignored unless option TICKVALUEFITPOLICY= is set to SPLIT, SPLITALWAYS, SPLITTHIN, or SPLITALWAYSTHIN.

See “boolean ” on page xii for other Boolean values that you can use.

TICKVALUESPLITJUSTIFY=CENTER | LEFT | RIGHT

specifies justification of the strings that are inside the tick value block. The justification is relative to an individual tick value’s display area and does not affect the display of tick values that are not split.



Defaults CENTER for an X or X2 axis

RIGHT for a Y axis

LEFT for a Y2 axis

Interaction This option is ignored unless option TICKVALUEFITPOLICY= is set to SPLIT, SPLITALWAYS, SPLITTHIN, or SPLITALWAYSTHIN.

Options for Linear Axes Only

The options that are documented in this section can be used only with the LINEAROPTS= axis option. The following table provides a summary of the options.

Linear Axis Option	Description
INCLUDERANGES on page 1083	Specifies one or more ranges for a broken axis.
INTEGER	Specifies that evenly spaced integer values are used for tick marks.
MINORGRID	Specifies whether grid lines are displayed at the minor tick values.
MINORGRIDATTRS	Specifies the attributes of the minor grid lines.
MINORTICKCOUNT	Specifies the number of minor ticks that are displayed on the axis.
MINORTICKS	Specifies whether the minor tick marks are displayed on the axis.
ORIGIN	Specifies that the axis perpendicular to the current axis be drawn at the indicated data value.

Linear Axis Option	Description
THRESHOLDMAX	Specifies a bias for including one more tick mark at the maximum end of the axis.
THRESHOLDMIN	Specifies a bias for including one more tick mark at the minimum end of the axis.
TICKDISPLAYLIST	Specifies the text that is displayed for the tick values that are defined by the TICKVALUELIST= option.
TICKVALUEFITPOLICY	Specifies a policy for avoiding tick value collision. Only the default policy (THIN) is available for a Y or Y2 axis.
TICKVALUEFORMAT	Specifies how to format the values for major tick marks.
TICKVALUELIST	Specifies the order of the tick values for a linear axis as list.
TICKVALUEPRIORITY	Specifies whether an axis tick specification can extend the axis data range.
TICKVALUEROTATION	Specifies how the tick values are rotated on the X and X2 axes.
TICKVALUESEQUENCE	Specifies the tick values for a linear axis by start, end, and increment.
VIEWMAX	Specifies the maximum data value to include in the display.
VIEWMIN	Specifies the minimum data value to include in the display.

INCLUDERANGES=(*start–end <start2–end2 startN–endN ...>*)
specifies the ranges for a broken axis.

Note: This option is valid starting in SAS 9.4M1.

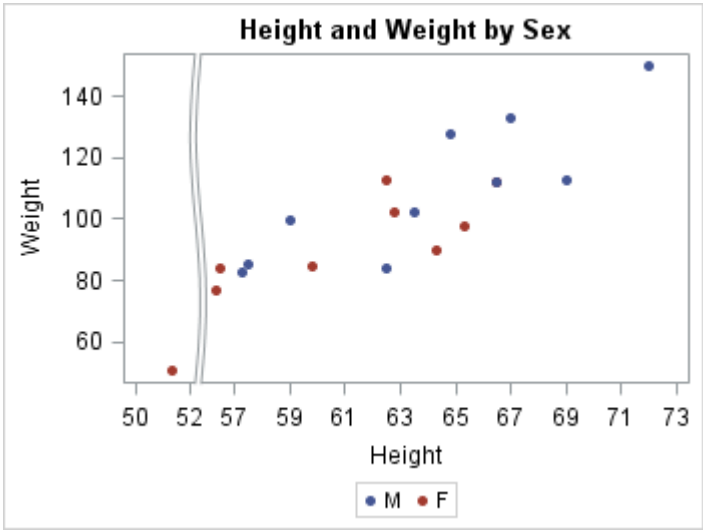
start
specifies a numeric value or the keyword MIN.

MIN specifies the minimum data value.

end
specifies a numeric value or the keyword MAX.

MAX specifies the maximum data value.

The following figure shows a linear axis, broken into ranges 50–52 and 56–73.



The following figure shows a time axis, broken into ranges '01Jan2001'd–'01May2003'd and '01Jan2005'd–'01Oct2005'd.

As shown in the figure, break lines are drawn to indicate the break in the axis.

Restrictions

This option is valid for linear and time axes in an OVERLAY layout only.

Only one axis can be broken. If this option is specified for both axes, then it is honored for the vertical axis and ignored for the horizontal axis.

When plots are associated with the X and X2 axes or with Y and Y2 axes, neither axis can be broken.

A binned heat map or histogram axis cannot be broken.

A broken axis is not supported in vector graphics output. When a broken axis is specified and vector graphics output is requested, the graph is converted into an image instead. A note indicating the conversion is written to the SAS log. To restore the vector graphics output in that case, remove the INCLUDERANGES= option from the LINEAROPTS= or TIMEOPTS= option.

Requirements

All of the ranges must be enclosed in parenthesis.

You must specify each range as a starting value, a hyphen, and an ending value. You must separate adjacent ranges with a space.

Each range must be nonzero. A zero range such as 12–12 is considered invalid.

Interactions

When this option is specified, axis options THRESHOLDMIN=, THRESHOLDMAX=, VIEWMIN=, VIEWMAX=, and TICKVALUEPRIORITY= are ignored. Suboption EXTRACTSCALE= of the TICKVALUEFORMAT= option is also ignored.

When this option is specified, data tips are not displayed, and the plot URL= option is ignored.

Notes When this option is specified, data-clipping might occur for the following: plot markers and marker characters, box-plot outlier markers, fixed-position data labels, needle plots and fringe plots in the X direction, reference lines and drop lines on the broken axis, axis tables, and relative bubble plots.

Curve label positions are based on the contiguous axis data range. When curve labels are specified with a broken axis, the curve label positions might not be ideal.

Tip Starting with SAS 9.4M3, you can use the AXISBREAKTYPE= and AXISBREAKSYMBOL= options in the BEGINGRAPH statement to display the break in the axis as only a symbol on the axis line.

See "Creating a Broken Linear Axis" in *SAS Graph Template Language: User's Guide*

Example
```
includeranges=(10-500 1000-5000 10000-50000)
```

INTEGER=TRUE | FALSE
specifies that evenly spaced integer values are used for tick marks.

Default FALSE

Interactions This option is overridden by the TICKVALUELIST= or TICKVALUESEQUENCE= option.

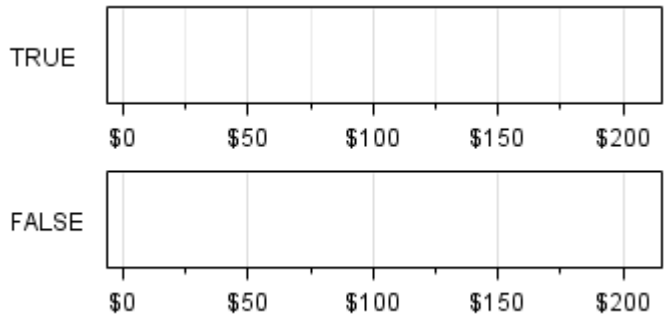
This option overrides the MAXDECIMALS= and PREFERREDDECIMALS= suboptions of the TICKVALUEFORMAT= option.

INTEGER=TRUE is ignored for the X or X2 axis when a histogram plot is the primary plot and BINAXIS=TRUE is specified in the HISTOGRAM or HISTOGRAMPARM statement.

Note This option is ignored when the data exceeds the limits of integer values.

See "boolean " on page xii for other Boolean values that you can use.

MINORGRID=TRUE | FALSE
specifies whether grid lines are displayed at the minor tick marks.



Defaults FALSE in SAS 9.4M1 and earlier releases.

The GraphMinorGridLines:DisplayOpts style reference starting with SAS 9.4M2. If attribute DisplayOpts is not defined in the active style, then FALSE is the default value.

Interaction This option is ignored if the GRIDDISPLAY= option does not display the grid lines.

Tips The GRIDATTRS= option does not affect the appearance of the minor grid lines. To control the minor grid line appearance, use the MINORGRIDATTRS= option.

Use the MINORTICKS= option to display the minor tick marks on the axis.

See "boolean " on page xii for other Boolean values that you can use.

MINORGRIDATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the attributes of the minor grid lines. This option does not affect the major grid lines.

The following figure shows the minor grid lines set to light blue, dotted lines on a linear axis. (See the example.)

The following figure shows the minor grid lines set to light blue, dotted lines on a base-10 log axis. (See the example.)

The following figure shows the minor grid lines set to light blue, dotted lines on a time axis. (See the example.)

Defaults The GraphGridLines style element is used starting with SAS 9.4.

The GraphMinorGridLines style element is used starting with SAS 9.4M2.

Interaction This option is ignored when MINORTICKS=FALSE.

Note When *style-element* is specified, only the style element's ContrastColor, LineStyle, and LineThickness attributes are used.

Tip Use the GRIDATTRS= option to control the appearance of the major grid lines.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a style element.

"Line Options" on page 1602 for available line options.

Example Here is an example that specifies light blue, dotted lines for the minor grid.

```
minorgridattrs=(color=lightblue pattern=dot);
```

MINORTICKCOUNT=*positive-integer*

specifies the number of minor ticks that are displayed on the axis.

Defaults Four ticks with five intervals in SAS 9.4M1 and earlier releases.

One tick with two intervals starting with SAS 9.4M2.

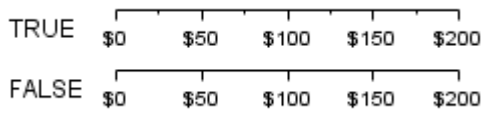
Interactions The DISPLAY= or DISPLAYSECONDARY= option specification must include TICKS for this option to have any effect.

The MINORTICKS= option must specify TRUE for this option to have any effect.

Tip To display *n* intervals between major ticks, use MINORTICKCOUNT=*n*-1.

MINORTICKS=TRUE | FALSE

specifies whether minor ticks are displayed. When MINORTICKS=TRUE, the minor tick marks are displayed on the axis as shown in the following figure.



Default FALSE

Interaction If MINORTICKS=TRUE is specified and TICKVALUELIST= specifies nonuniform tick values such as 3, 5, 11, and 23, then MINORTICK=TRUE is ignored. To display minor tick marks in that case, specify uniform tick values such as 0, 10, 20, and 30 in the TICKVALUELIST= option.

Tip Use the MINORGRID= option to display grid lines at the minor tick values.

See "boolean " on page xii for other Boolean values that you can use.

ORIGIN=*number*

specifies that the axis perpendicular to the current axis is drawn at the indicated data value. For managing origin settings, GTL treats the X and Y axes as a pair, and the X2 and Y2 axes as a separate pair. Thus, if you set the Y-axis origin to 200, then the X axis is drawn from that origin point. If the graph also displays an X2 axis, then it is unaffected and does not move. Similarly, if you set an origin for the Y2 axis, then the X2 axis moves to that origin point and the X axis is unaffected.

If you set an origin for the Y2 axis and there is no X2 axis, then the origin setting for Y2 does not affect the graph display. That is, the X axis does not move to that origin point.

If you set an origin for an axis and the axis has a tick value at that origin value, the tick value is not displayed. Suppressing the tick value at the origin prevents the value from colliding with the axis value on the perpendicular axis. However, it is possible that the tick values on the orthogonal axes will collide.

Default — The axis perpendicular to the current axis is drawn at the minimum tick value minus the OFFSETMIN= value.

Restriction — This option applies to linear axes only.

Interactions — If the specified value is outside the data range for the current axis, then the data range is extended to include the value.

The axis line, ticks, and tick values of the “perpendicular” axis move to the location indicated by the origin. The axis label is not moved.

Tip — This option is often used to create Cartesian axes (axes centered at ORIGIN=0).

THRESHOLDMAX=*number*

specifies a bias for including one more tick mark at the maximum end of the axis.

Default — 0.30

Range — 0–1

Restriction — This option applies to linear axes only.

Interactions — This option is ignored if the TICKVALUELIST= or TICKVALUESEQUENCE= option is used.

This option is ignored when the INCLUDERANGES= option is specified.

Tips — If the threshold is set to 0, the potential tick mark is never displayed. If the threshold is set to 1, then the tick mark is always displayed.

Specifying THRESHOLDMIN=0 and THRESHOLDMAX=0 prevents the tick marks from extending beyond the data range.

Specifying THRESHOLDMIN=1 and THRESHOLDMAX=1 ensures that the data range is bounded by tick marks.

For the minimum axis length, set the THRESHOLDMIN= and THRESHOLDMAX= options to 0.

See "Adjusting Axis Thresholds" on page 1052

THRESHOLDMIN=*number*
specifies a bias for including one more tick mark at the minimum end of the axis.

Default 0.30

Range 0–1

Restriction This option applies to linear axes only.

Interactions This option is ignored if the TICKVALUELIST= or TICKVALUESEQUENCE= option is used.

This option is ignored when the INCLUDERANGES= option is specified.

Tips If the threshold is set to 0, the potential tick mark is never displayed. If the threshold is set to 1, then the tick mark is always displayed.

Specifying THRESHOLDMIN=0 and THRESHOLDMAX=0 prevents the tick marks from extending beyond the data range.

Specifying THRESHOLDMIN=1 and THRESHOLDMAX=1 ensures that the data range is bounded by tick marks.

For the minimum axis length, set the THRESHOLDMIN= and THRESHOLDMAX= options to 0.

See "Adjusting Axis Thresholds" on page 1052

TICKDISPLAYLIST=(*string-list*)
specifies the text that is displayed for the tick values that are defined in the TICKVALUELIST= option. The string list is a space-separated list of string values that are displayed on the axis in place of the values in the TICKVALUELIST= option. The strings map one-to-one positionally with the values that are listed in the TICKVALUELIST= option.

Default The display of tick values is controlled by the TICKVALUEFORMAT= option.

Requirements The list of values must be enclosed in parentheses.

Each value (character and numeric) must be enclosed in quotation marks and separated from adjacent values by a blank space.

Interaction When this option is specified, the TICKVALUEFORMAT= option is ignored.

Tip This option should be used with the TICKVALUELIST= option. The number of items in the list for this option should equal the number of items in the list for the TICKVALUELIST= option.

TICKVALUEFITPOLICY=*policy*
specifies a policy for avoiding tick value collision on an axis. The effectiveness of a collision-avoidance policy depends on the number of tick values, their length, and the length of the axis. Which policies are valid depends on the axis on which this option is used.

For the Y and Y2 axes, the following policies are valid:

NONE
makes no attempt to avoid collisions between tick values.

Tick values are displayed even when they collide.

THIN
eliminates alternate tick values.

For the X and X2 axes, the following policies are valid:

NONE
makes no attempt to avoid collisions between tick values.

Tick values are displayed even when they collide.

ROTATE
rotates the tick values if a collision occurs.

The TICKVALUEROTATION= option specifies whether the values are rotated to a 45-degree diagonal or a 90-degree vertical position. By default, the values are rotated to a 45-degree diagonal position.

ROTATEALWAYS
rotates the tick values regardless of whether a collision occurs.

The TICKVALUEROTATION= option specifies whether the values are rotated to a 45-degree diagonal or a 90-degree vertical position. By default, the values are rotated to a 45-degree diagonal position.

ROTATETHIN
attempts the ROTATE policy, and then the THIN policy.

STAGGER
alternates the tick values between two rows.

STAGGERROTATE
attempts the STAGGER policy, and then the ROTATE policy.

STAGGERTHIN
attempts the STAGGER policy, and then the THIN policy.

THIN
eliminates alternate tick values.

Default THIN

Note A note is written to the SAS log when tick value thinning occurs.

TICKVALUEFORMAT=(*format-options*) | DATA | *format*
specifies how to format the values for major tick marks.

(*format-options*)
specifies one or more formatting options for major tick values.

Together, these options provide parameters for determining an optimal format (*w.d*, E*w*., BEST*w*.) for displaying major tick values.

MAXWIDTH=*integer*
specifies the maximum width for displayed tick values.

Values might be rounded or converted to E notation to fit into this width.

Default 8

MAXDECIMALS=*integer*
specifies the maximum number of decimals for displayed tick values.

Values might be rounded or converted to E notation to fit into this width.

Default 6

Note The MAXWIDTH= option value should be greater than the MAXDECIMALS= option value.

PREFERREDDECIMALS=*integer*
specifies the number of decimal places that you want to display for most values.

The actual number might vary based on other constraints.

Default 2

EXTRACTSCALE=TRUE | FALSE
specifies whether to extract a scale factor from the tick values and use it to reduce the tick value width.

The scale can be a named scale or a scientific-notation scale. The EXTRACTSCALETYPE= option specifies the scale type. The scale that is used is appended to the axis label, as shown in the following example.

```
Total Sales (millions)
```

For long axis labels, if the scale does not fit the available space, then the label is truncated, and the scale is appended to the truncated label. Ellipses indicate that the label was truncated, as shown in the following example.

```
Total Sales for the Fourth Quarter Of ... (millions)
```

In extreme cases in which the scale does not fit even with truncation, the entire axis is dropped.

Default FALSE

Restriction The scale that is extracted by the EXTRACTSCALE= option is derived from the English locale for all locales.

Interactions The scale type is determined by the EXTRACTSCALETYPE= option.

If the axis label is not displayed, then the EXTRACTSCALE=TRUE option is ignored.

The EXTRACTSCALE= suboption is ignored when the INCLUDERANGES= option is specified.

Note When EXTRACTSCALE=TRUE and a scale is extracted, the tick values are formatted to provide the best fit on the axis. In that case, the tick value format might differ from the data format even when a named format is applied to the data values.

See "boolean " on page xii for other Boolean values that you can use.

EXTRACTSCALETYPE=DEFAULT | SCIENTIFIC
specifies whether to extract a named scale or a scientific-notation scale.

DEFAULT
extracts a named scale.

A named scale can be millions, billions, or trillions for values of 999 trillion or less, or a multiple of 10 (denoted as 10^*n*) for values over 999 trillion. For large tick values, the scale factor is set to ensure that the absolute value of the largest value is greater than 1. For small fractional tick values, the scale factor is set to ensure that the absolute value of the smallest value is greater than 1. The scale can be millionth, billionth, or trillionth for values of 1 trillionth or more, or a multiple of 1/10 (10^−*n*) for values less than 1 trillionth.

SCIENTIFIC
extracts a scientific-notation scale.

A scientific-notation scale is a multiple of 10 expressed as 10^*n* for values greater than 1, or a multiple of 1/10 expressed as 10^−*n* for values less than 1.

Default DEFAULT

Restriction The scale is derived from the English locale for all locales.

DATA
uses the format that has been assigned to the column that is contributing to the axis (or BEST6 if no format is assigned) in order to control the formatting of the major tick values.

format
specifies a format to apply to the major tick values.

Restriction GTL currently honors most, but not every, SAS format. For details, see Appendix 4, "Format Support in ODS Graphics," on page 1621 .

Note If you specify a format that significantly reduces precision, because of tick-value rounding, the plot data elements might not align properly with the axis tick values. In that case, specify a tick-value format with a higher precision.

Default (MAXWIDTH=8, MAXDECIMALS=6, PREFERREDDECIMALS=2, EXTRACTSCALE=FALSE, EXTRACTSCALETYPE=DEFAULT)

Interaction This option is ignored when the TICKDISPLAYLIST= option is specified.

TICKVALUELIST=(*numeric-list*)

specifies the tick values for a linear axis as a list.

Default An internal algorithm determines the tick marks, based on the actual axis data range or the data range established by the VIEWMIN= and VIEWMAX= options. By default, when this option is used, the only tick values that appear are the tick values in *numeric-list* that fall within the explicit data range (set by VIEWMIN= and VIEWMAX=) or the implicit data range (set by the actual data minimum and data maximum).

Restriction This option applies to linear axes only.

Requirement The tick values must be specified as a space-separated list of numeric values, enclosed in parentheses.

Interactions This option overrides the INTEGER= option.

This option is ignored if the TICKVALUESEQUENCE= option is specified, or if the DISPLAY= option or the DISPLAYSECONDARY= option does not display tick values.

The VIEWMIN= and VIEWMAX= options alter the axis data range. If the VIEWMIN= option is set to the minimum tick list value and the VIEWMAX= option is set to the maximum tick list value, then all ticks in the tick list are displayed. This might result in some data not being displayed. For example, data might not be displayed when the VIEWMIN= value is greater than the actual data minimum, or when the VIEWMAX= value is less than actual data maximum.

If TICKVALUEPRIORITY= TRUE, then the VIEWMIN= and VIEWMAX= options are ignored if they are fully enclosed by the *numeric-list*. The tick *numeric-list* can extend the implicit data range of the axis, but cannot reduce it.

If MINORTICKS=TRUE is specified and TICKVALUELIST= specifies nonuniform tick values such as 3, 5, 11, and 23, then MINORTICK=TRUE is ignored. To display minor tick marks in that case, specify uniform tick values such as 0, 10, 20, and 30 in the TICKVALUELIST= option.

Tip The values in the list are formatted according to the setting for the TICKVALUEFORMAT= option.

TICKVALUEPRIORITY=TRUE | FALSE
specifies whether an axis tick specification (TICKVALUELIST= or TICKVALUESEQUENCE=) can extend the axis data range.

TRUE
extends the axis data range (but does not reduce it) to include the minimum and maximum values that are specified by either the TICKVALUELIST= or TICKVALUESEQUENCE= option.

If the minimum and maximum of the user-specified values are within the data range, this option has no effect.

FALSE
displays only the tick values that are specified by the TICKVALUELIST= option that fall within the explicit data range set by the VIEWMIN= and VIEWMAX= options or by the implicit data range set by the actual data minimum and data maximum.

Default FALSE

Restriction This option applies to linear axes only.

Interactions When this option is set to TRUE, the VIEWMIN= and VIEWMAX= options are ignored.

This option is ignored if the TICKVALUELIST= or TICKVALUESEQUENCE= option is not specified.

This option is ignored if the DISPLAY= option or the DISPLAYSECONDARY= option does not display the tick values.

This option is ignored when the INCLUDERANGES= option is specified.

Note If the minimum and maximum of the specified values are within the data range, then this option has no effect.

See “boolean ” on page xii for other Boolean values that you can use.

TICKVALUEROTATION=DIAGONAL | DIAGONAL2 | VERTICAL
specifies how the tick values are rotated on the X and X2 axes.

DIAGONAL
rotates the tick values to a 45-degree diagonal position.

The X labels read left to right in a downward direction. The X2 labels read left to right in an upward direction.

DIAGONAL2
rotates the tick values to a –45-degree diagonal position.

The X labels read left to right in an upward direction. The X2 labels read left to right in a downward direction.

Note: This feature applies to SAS 9.4M5 and to later releases.

VERTICAL
rotates the labels to a 90-degree vertical position.

The labels are always drawn from bottom to top.

Default DIAGONAL

Restriction This option is valid for XAXISOPTS= and X2AXISOPTS= only.

Interaction The TICKVALUEFITPOLICY= option must be set to ROTATE or ROTATEALWAYS for this option to have any effect.

TICKVALUESEQUENCE=(START=*number* END=*number* INCREMENT=*number*)
specifies the tick values by start, end, and increment.

START=*number*
specifies the value for the first tick mark.

END=*number*
specifies the value for the last tick mark.

INCREMENT=*number*
specifies the increment for intermediate tick marks between the first and last tick marks.

The END value always controls the last tick mark. The interval between the last tick mark and the previous tick mark might not necessarily be the INCREMENT value.

Default An internal algorithm determines the tick marks, based on the actual axis data range or the data range established by the VIEWMIN= and VIEWMAX= options. By default, when this option is used, the only tick values that appear are those that fall within the explicit data range (set by VIEWMIN= and VIEWMAX=) or the implicit data range (set by the actual data minimum and data maximum).

Interactions This option overrides the INTEGER= option.

The VIEWMIN= and VIEWMAX= options alter the axis data range. If the VIEWMIN= option is set to the START= option value and the VIEWMAX= option is set to the END= option value, then all ticks in the tick sequence are displayed.

If TICKVALUEPRIORITY= TRUE, then the tick sequence might extend the explicit data range of the axis, but never reduce it.

This option is ignored if the DISPLAY= option or the DISPLAYSECONDARY= option does not display tick marks.

Tip The values in the sequence are formatted according to the setting for the TICKVALUEFORMAT= option.

See TICKVALUELIST= option as an alternative for customizing tick marks.

VIEWMAX=*number*
specifies the maximum data value to include in the display. The value might be adjusted by the threshold calculation.

Default The maximum value in the data for the specified axis.

Requirements If VIEWMIN= is also specified, VIEWMAX= must be greater than VIEWMIN=. Otherwise, the default values are used for VIEWMIN= and VIEWMAX=.

If VIEWMIN= is not specified, VIEWMAX= must be less than the data maximum. Otherwise, a blank graph is drawn.

Interactions This option does not determine the maximum axis tick value that is displayed. The THRESHOLDMAX= value is used to determine the maximum tick value.

This option is ignored when TICKVALUEPRIORITY= TRUE.

This option is ignored when the INCLUDERANGES= option is specified.

Notes Setting a VIEWMAX= or VIEWMIN= value does not alter the original data or any calculations on it.

The maximum axis tick value might differ from the VIEWMAX= value. The VIEWMIN= and VIEWMAX= values, and additional factors such as thresholds and the tick values computed by the plot statement, are used to determine the axis tick values.

Tip To display the VIEWMAX= value as the maximum tick value, use the TICKVALUELIST= option.

See “Adjusting the Axis View” on page 1051

VIEWMIN=*number*
specifies the minimum data value to include in the display. The value might be adjusted by the threshold calculation.

Default The minimum value in the data for the specified axis.

Requirements If VIEWMAX= is also specified, VIEWMIN= must be less than VIEWMAX=. Otherwise, the default values are used for VIEWMAX= and VIEWMIN=.

If VIEWMAX= is not specified, VIEWMIN= must be greater than the data minimum. Otherwise, a blank graph is drawn.

Interactions This option does not determine the minimum axis tick value that is displayed. The THRESHOLDMIN= value is used to determine the minimum tick value.

This option is ignored when TICKVALUEPRIORITY= TRUE.

This option is ignored when the INCLUDERANGES= option is specified.

Notes

Setting a VIEWMAX= or VIEWMIN= value does not alter the original data or any calculations on it.

The minimum axis tick value might differ from the VIEWMIN= value. The VIEWMIN= and VIEWMAX= values, and additional factors such as thresholds and the tick values computed by the plot statement, are used to determine the axis tick values.

Tip

To display the VIEWMIN= value as the minimum tick value, use the TICKVALUELIST= option.

See

"Adjusting the Axis View" on page 1051

Options for Log Axes Only

The options that are documented in this section can be used with the LOGOPTS= axis option. The following table provides a summary of the options.

Log Axis Option	Description
BASE	Specifies the base of the logarithmic scale for the axis values.
MINORGRID	Specifies whether grid lines are displayed at the minor tick values.
MINORGRIDATTRS	Specifies the attributes of the minor grid lines.
MINORTICKCOUNT	Specifies the number of minor ticks that are displayed on the axis.
MINORTICKS	Specifies whether minor ticks are displayed.
THRESHOLDMAX	Specifies a bias for including one more tick mark at the maximum end of the axis.
THRESHOLDMIN	Specifies a bias for including one more tick mark at the minimum end of the axis.
TICKINTERVALSTYLE	Specifies how to scale and format the values for major tick marks.
TICKVALUEFORMAT=	Specifies how to format the values for major tick marks.

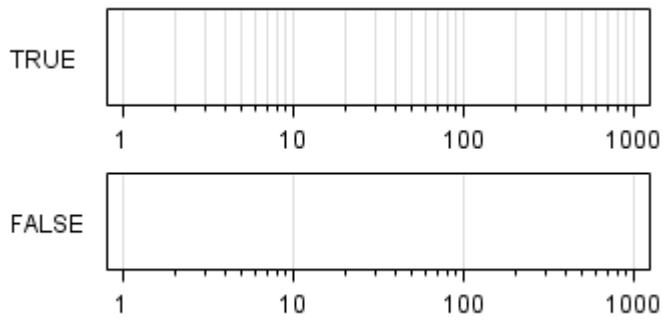
Log Axis Option	Description
TICKVALUELIST	Specifies the tick values for a log axis as a space-separated list.
TICKVALUEPRIORITY	Specifies whether the TICKVALUELIST= specification can extend the axis data range.
VALUESTYPE	Specifies the scale that the system uses when interpreting the TICKVALUELIST=, VIEWMAX=, and VIEWMIN= option values.
VIEWMAX	Specifies the maximum data value to include in the display.
VIEWMIN	Specifies the minimum data value to include in the display.

BASE=10 | 2 | E
specifies the base of the logarithmic scale for the axis values.

Default 10

Restriction This option applies to log axes only.

MINORGRID=TRUE | FALSE
specifies whether grid lines are displayed at the minor tick marks.



Defaults FALSE in SAS 9.4M1 and earlier releases.

The GraphMinorGridLines:DisplayOpts style reference starting with SAS 9.4M2. If attribute DisplayOpts is not defined in the active style, then FALSE is the default value.

Interaction This option is ignored if the GRIDDISPLAY= option does not display the grid lines.

Tips The GRIDATTRS= option does not affect the appearance of the minor grid lines. To control the minor grid line appearance, use the MINORGRIDATTRS= option.

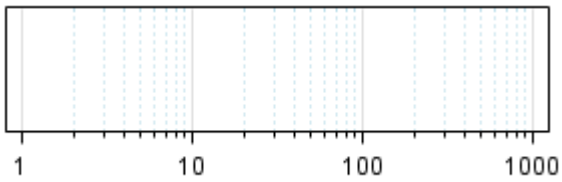
Use the MINORTICKS= option to display the minor tick marks on the axis.

See "boolean " on page xii for other Boolean values that you can use.

MINORGRIDATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the attributes of the minor grid lines. This option does not affect the major grid lines.

The following figure shows the minor grid lines set to light blue, dotted lines on a linear axis. (See the example.)

The following figure shows the minor grid lines set to light blue, dotted lines on a base-10 log axis. (See the example.)



The following figure shows the minor grid lines set to light blue, dotted lines on a time axis. (See the example.)

Defaults The GraphGridLines style element is used starting with SAS 9.4.

The GraphMinorGridLines style element is used starting with SAS 9.4M2.

Interaction This option is ignored when MINORTICKS=FALSE.

Note When *style-element* is specified, only the style element's ContrastColor, LineStyle, and LineThickness attributes are used.

Tip Use the GRIDATTRS= option to control the appearance of the major grid lines.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a style element.

"Line Options" on page 1602 for available line options.

Example Here is an example that specifies light blue, dotted lines for the minor grid.

```
minorgridattrs=(color=lightblue pattern=dot);
```

MINORTICKCOUNT=*positive-integer*
specifies the number of minor ticks that are displayed on the axis.

Default Eight ticks with nine intervals (BASE=10 and TICKINTERVALSTYLE= is LOGEXPAND or LOGEXPONENT.).

Restriction Minor ticks can be displayed only when BASE=10 and TICKINTERVALSTYLE= is LOGEXPAND or LOGEXPONENT.

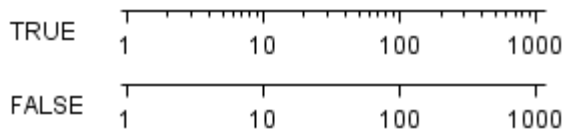
Interactions The DISPLAY= or DISPLAYSECONDARY= option specification must include TICKS for this option to have any effect.

The MINORTICKS= option must specify TRUE for this option to have any effect.

Tip To display *n* intervals between major ticks, use MINORTICKCOUNT=*n*-1.

MINORTICKS=TRUE | FALSE

specifies whether minor ticks are displayed. When MINORTICKS=TRUE, the minor tick marks are displayed on the axis as shown in the following figure.



Default FALSE

Restriction Minor ticks can be displayed only when BASE=10 and TICKINTERVALSTYLE= is LOGEXPAND or LOGEXPONENT.

Interaction If MINORTICKS=TRUE is specified and TICKVALUELIST= specifies nonuniform log tick values such as 10, 20, 30, and 40, then MINORTICK=TRUE is ignored. To display minor tick marks in that case, specify uniform log tick values such as 1, 10, 100, and 1000 in the TICKVALUELIST= option.

Tip Use the MINORGRID= option to display grid lines at the minor tick values.

See “boolean ” on page xii for other Boolean values that you can use.

THRESHOLDMAX=*number*

specifies a bias for including one more tick mark at the maximum end of the axis.

Default 0.30

Range 0–1

Restriction This option applies to log axes only.

Tips If the threshold is set to 0, the potential tick mark is never displayed. If the threshold is set to 1, then the tick mark is always displayed.

Specifying THRESHOLDMIN=0 and THRESHOLDMAX=0 prevents the tick marks from extending beyond the data range.

Specifying THRESHOLDMIN=1 and THRESHOLDMAX=1 ensures that the data range is bounded by tick marks.

See “Adjusting Axis Thresholds” on page 1052

THRESHOLDMIN=*number*
specifies a bias for including one more tick mark at the minimum end of the axis.

Default 0.30

Range 0–1

Restriction This option applies to log axes only.

Tips If the threshold is set to 0, the potential tick mark is never displayed. If the threshold is set to 1, then the tick mark is always displayed.

Specifying THRESHOLDMIN=0 and THRESHOLDMAX=0 prevents the tick marks from extending beyond the data range.

Specifying THRESHOLDMIN=1 and THRESHOLDMAX=1 ensures that the data range is bounded by tick marks.

See "Adjusting Axis Thresholds" on page 1052

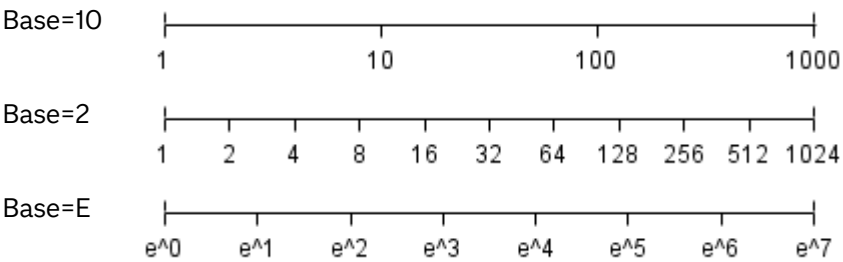
TICKINTERVALSTYLE=AUTO | LOGEXPAND | LOGEXPONENT | LINEAR
specifies how to scale and format the values for major tick marks.

AUTO
selects a LOGEXPAND, LOGEXPONENT, or LINEAR representation automatically based on the range of the data.

When the data range is small (within an order of magnitude), a LINEAR representation is typically used. Data ranges that encompass several orders of magnitude typically use the LOGEXPAND or LOGEXPONENT representation.

LOGEXPAND
places the major tick marks at uniform intervals at integer powers of the base.

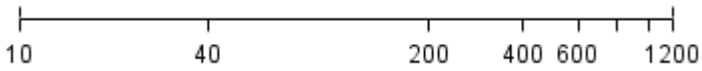
The tick values are expanded as follows:



LOGEXPONENT
places the major tick marks at uniform intervals at integer powers of the base.

The tick values are only the integer exponents for all bases.

LINEAR
places the major tick marks at non-uniform intervals that cover the range of the data.



Default AUTO

Restrictions This option applies to log axes only.

For LOGEXPONENT, formats on data columns contributing to the axis are ignored. For LOGEXPAND, formats on data columns contributing to the axis are ignored, although any "named format" on the column is retained. For LINEAR, ticks values are automatically formatted when the column format is not assigned or one of *w.d*, E*w*., or BEST*w*. Other formats (SAS defined or user-defined) are used if specified.

GTL currently honors most but not every SAS format. For details, see Appendix 4, "Format Support in ODS Graphics," on page 1621.

Note When BASE=10 and LOGEXPAND or LOGEXPONENT is used, an intermediate tick is added whenever the axis data range is less than or equal to 1.5 powers of 10.

Tip If you use TICKINTERVALSTYLE=LOGEXPONENT, then you might want to include information in the axis label about which base is used.

TICKVALUEFORMAT=DATA | *format*
specifies how to format the values for major tick marks.

Note: This feature applies to SAS 9.4M3 and to later releases.

DATA
uses the format that has been assigned to the column that is contributing to the axis (or BEST6 if no format is assigned) in order to control the formatting of the major tick values.

format
specifies a format to apply to the major tick values.

Restriction GTL currently honors most, but not every, SAS format. For details, see Appendix 4, "Format Support in ODS Graphics," on page 1621.

Restriction This option applies to log axes only.

Interactions This option is ignored when TICKINTERVALSTYLE=LOGEXPONENT.

When TICKINTERVALSTYLE=LOGEXPAND, this option is honored for the base 10 and base 2 logarithmic scales, and is ignored for the base E scale.

When TICKINTERVALSTYLE=LINEAR, this option is honored for the base 10, base 2, and base E logarithmic scales.

See BASE=

TICKINTERVALSTYLE=

TICKVALUELIST=(*numeric-list*)
specifies the tick values for a linear axis as a list.

Default Only the tick values specified in the list that fall within the explicit data range set by the VIEWMIN= and VIEWMAX= options or by the implicit data range set by the actual data minimum and data maximum are displayed. An internal algorithm determines the tick marks.

Requirements The tick values must be specified as a space-separated list of numeric values, enclosed in parentheses.

The values that you specify must be appropriate for the VALUESTYPE= specification. Otherwise, unexpected results might occur. If VALUESTYPE=EXPANDED is in effect (default), specify increments of the log base power such as 0.1, 1, 10, 100, and so on, on a base 10 log axis, for example. If VALUESTYPE=EXPONENT is in effect, specify integer increments of the log base power exponent such as 1, 2, 3, and so on.

Interactions The VALUESTYPE= option determines how the values in the list are interpreted.

The VIEWMIN= and VIEWMAX= options alter the axis data range. If the VIEWMIN= option is set to the minimum tick list value and the VIEWMAX= option is set to the maximum tick list value, then all ticks in the tick list are displayed. This might result in some data not being displayed. For example, data might not be displayed when the VIEWMIN= value is greater than the actual data minimum, or when the VIEWMAX= value is less than actual data maximum.

If the VIEWMIN= value is greater than the actual data minimum or the VIEWMAX= value is less than actual data maximum, some data might not be displayed.

This option is ignored if the DISPLAY= or the DISPLAYSECONDARY= option does not display the tick values.

If MINORTICKS=TRUE is specified and TICKVALUELIST= specifies nonuniform log tick values such as 10, 20, 30, and 40, then MINORTICK=TRUE is ignored. To display minor tick marks in

that case, specify uniform log tick values such as 1, 10, 100, and 1000 in the TICKVALUELIST= option.

See VIEWMIN= and VIEWMAX= options for controlling the data range

TICKINTERVALSTYLE= for specifying the scale and format of the major tick values

TICKVALUEPRIORITY= for controlling the behavior of the TICKVALUELIST= option

BASE= for specifying the log base

TICKVALUEPRIORITY=TRUE | FALSE

specifies whether the TICKVALUELIST= specification can extend the axis data range.

TRUE

extends the axis data range (but does not reduce it) to include the minimum and maximum values that are specified by the TICKVALUELIST= option.

If the minimum and maximum of the user-specified values are within the data range, this option has no effect.

FALSE

displays only the tick values that are specified by the TICKVALUELIST= option that fall within the explicit data range set by the VIEWMIN= and VIEWMAX= options or by the implicit data range set by the actual data minimum and data maximum.

Default FALSE

Interactions When this option is set to TRUE, the VIEWMIN= and VIEWMAX= options are ignored.

This option is ignored if the DISPLAY= option or the DISPLAYSECONDARY= option does not display the tick values.

This option is ignored if the TICKVALUELIST= option is not specified.

Note If the minimum and maximum of the specified values are within the data range, then this option has no effect.

See “boolean ” on page xii for other Boolean values that you can use.

VALUESTYPE=EXPANDED | EXPONENT

specifies the scale that the system uses when interpreting the TICKVALUELIST=, VIEWMAX=, and VIEWMIN= option values. Use this option to choose your preferred way of specifying log-axis values.

EXPANDED

values are interpreted as powers of the base such as 0.1, 1, 10, 100, and so on, for base 10, for example.

EXPONENT
values are interpreted as integer exponents of the base such as 1, 2, 3, and so on, for base 10, base 2, and base E.

Default EXPANDED

Note This option does not change the style of the tick values that are displayed on the axis. It changes only how the VIEWMIN=, VIEWMAX=, and TICKVALUELIST= option values are interpreted by the system.

Tip This option is particularly useful when BASE=E.

Examples The following example specifies VIEWMIN= and VIEWMAX= as exponent values instead of as expanded values on an expanded Base 10 log axis. This results in X-axis tick values of 10, 100, 1000, 10000, and 100000.

```
xaxisopts=(type=log
   logopts=(base=10
      tickintervalstyle=logexpand
      valuestype=exponent
      viewmin=1 viewmax=5));
```

The following example specifies TICKVALUELIST= as a list of expanded values instead of exponent values on an exponent Base 10 log axis. This results in X-axis tick values of 1, 2, 3, 4, and 5.

```
xaxisopts=(type=log
   logopts=(base=10
      tickintervalstyle=logexponent
      tickvaluepriority=true
      valuestype=expanded
      tickvaluelist=(10 100 1000 10000 100000));
```

VIEWMAX=*number*
specifies the maximum data value to include in the display.

Default The maximum value in the data for the specified axis.

Requirements If VIEWMIN= is also specified, VIEWMAX= must be greater than VIEWMIN=. Otherwise, the default values are used for VIEWMIN= and VIEWMAX=.

If VIEWMIN= is not specified, VIEWMAX= must be less than the data maximum. Otherwise, a blank graph is drawn.

The value that you specify must be appropriate for the VALUESTYPE= specification and the log base. Otherwise, unexpected results might occur. If VALUESTYPE=EXPANDED is in effect (default), specify an increment of the log base power such as 0.1, 1, 10, 100, and so on, on a base 10 log axis, for example. If VALUESTYPE=EXPONENT is in effect, specify an integer increment of the log base power exponent such as 1, 2, 3, and so on.

Interactions This option is ignored when TICKVALUEPRIORITY= TRUE.

The VALUESTYPE= option determines how the value is interpreted.

Notes

Setting a VIEWMAX= or VIEWMIN= value does not alter the original data or any calculations on it.

If an invalid value is specified for the VIEWMAX= option, the default value for VIEWMAX= is used instead. In that case, if the default value for VIEWMAX= is less than the value specified by the VIEWMIN= option, then the VIEWMIN= and VIEWMAX= values are swapped.

The maximum axis tick value might differ from the VIEWMAX= value. The VIEWMIN= and VIEWMAX= values, and additional factors such as thresholds and the tick values computed by the plot statement, are used to determine the axis tick values.

When BASE=10 and TICKINTERVALSTYLE=LOGEXPAND or TICKINTERVALSTYLE=LOGEXPONENT is used, an intermediate tick is added whenever the axis data range is less than or equal to 1.5 powers of 10.

Tip

To display the VIEWMAX= value as the maximum tick value, use the TICKVALUELIST= option.

See

"Adjusting the Axis View" on page 1051

Examples

The following example specifies a value of 100,000 as an expanded value on a base 10 log axis:

```
VIEWMAX=100000
```

The following example specifies a value of 100,000 as an exponent value on a base 10 log axis:

```
VIEWMAX=5
```

VIEWMIN=*number*

specifies the minimum data value to include in the display.

Default

The minimum value in the data for the specified axis.

Requirements

If VIEWMAX= is also specified, VIEWMIN= must be less than VIEWMAX=. Otherwise, the default values are used for VIEWMAX= and VIEWMIN=.

If VIEWMAX= is not specified, VIEWMIN= must be greater than the data minimum. Otherwise, a blank graph is drawn.

The value that you specify must be appropriate for the VALUESTYPE= specification and the log base. Otherwise, unexpected results might occur. If VALUESTYPE=EXPANDED is in effect (default), specify an increment of the log base power such as 0.1, 1, 10, 100, and so on, on a base 10 log axis, for example. If VALUESTYPE=EXPONENT is in effect, specify an integer

increment of the log base power exponent such as 1, 2, 3, and so on.

Interactions

This option is ignored when TICKVALUEPRIORITY= TRUE.

The VALUESTYPE= option determines how the value is interpreted.

Notes

Setting a VIEWMAX= or VIEWMIN= value does not alter the original data or any calculations on it.

The minimum axis tick value might differ from the VIEWMIN= value. The VIEWMIN= and VIEWMAX= values, and additional factors such as thresholds and the tick values computed by the plot statement, are used to determine the axis tick values.

When BASE=10 and TICKINTERVALSTYLE=LOGEXPAND or TICKINTERVALSTYLE=LOGEXPONENT is used, an intermediate tick is added whenever the axis data range is less than or equal to 1.5 powers of 10.

Tip

To display the VIEWMIN= value as the minimum tick value, use the TICKVALUELIST= option.

See

"Adjusting the Axis View" on page 1051

Examples

The following example specifies a value of 0.1 as an expanded value on a base 10 log axis:

```
VIEWMIN=0.1
```

The following example specifies a value of 0.1 as an exponent value on a base 10 log axis:

```
VIEWMIN=-1
```

Options for Time Axes Only

The options that are documented in this section can be used with the TIMEOPTS= axis option. The following table provides a summary of the options.

Time Axis Option	Description
INCLUDERANGES on page 1108	Specifies one or more ranges for a broken axis.
INTERVAL	Specifies the time interval between major tick marks.
INTERVALMULTIPLIER	Specifies a multiplier to apply to the time interval that is in effect for the axis.
MINORGRID	Specifies whether grid lines are displayed at the minor tick values.

Time Axis Option	Description
MINORGRIDATTRS	Specifies the attributes of the minor grid lines.
MINORTICKINTERVAL	Specifies the time interval between minor ticks.
MINORTICKS	Specifies whether minor ticks are displayed.
SPLITTICKVALUE	Specifies whether to split the tick values on an X or X2 axis, if possible. This option is not available on a Y or Y2 axis.
TICKVALUEFITPOLICY	Specifies a policy for avoiding tick value collision on an X or X2 axis. This option is not available on a Y or Y2 axis.
TICKVALUEFORMAT	Specifies how to format the values for major tick marks.
TICKVALUELIST	Specifies the order of the tick values for a time axis as list.
TICKVALUEPRIORITY	Specifies whether an axis tick specification can extend the axis data range.
TICKVALUEROTATION	Specifies how the tick values are rotated on the X and X2 axes.
VIEWMAX	Specifies the maximum data value to include in the display.
VIEWMIN	Specifies the minimum data value to include in the display.

INCLUDERANGES=(*start–end <start2–end2 startN–endN ...>*)
specifies the ranges for a broken axis.

Note: This option is valid starting in SAS 9.4M1.

start
specifies a SAS time, date, or date-time constant, or the keyword MIN.

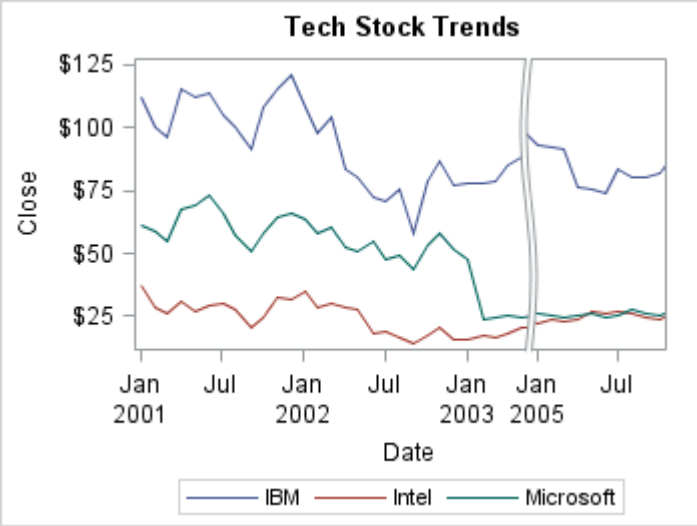
MIN specifies the minimum data value.

end
specifies a SAS time, date, or date-time constant, or the keyword MAX.

MAX specifies the maximum data value.

The following figure shows a linear axis, broken into ranges 50–52 and 56–73.

The following figure shows a time axis, broken into ranges '01Jan2001'd–'01May2003'd and '01Jan2005'd–'01Oct2005'd.



As shown in the figure, break lines are drawn to indicate the break in the axis.

Restrictions

This option is valid for linear and time axes in an OVERLAY layout only.

Only one axis can be broken. If this option is specified for both axes, then it is honored for the vertical axis and ignored for the horizontal axis.

When plots are associated with the X and X2 axes or with Y and Y2 axes, neither axis can be broken.

A binned heat map or histogram axis cannot be broken.

A broken axis is not supported in vector graphics output. When a broken axis is specified and vector graphics output is requested, the graph is converted into an image instead. A note indicating the conversion is written to the SAS log. To restore the vector graphics output in that case, remove the INCLUDERANGES= option from the LINEAROPTS= or TIMEOPTS= option.

Requirements

All of the ranges must be enclosed in parenthesis.

You must specify each range as a starting value, a hyphen, and an ending value. You must separate adjacent ranges with a space.

Each range must be nonzero. A zero range such as 12–12 is considered invalid.

Interactions

When this option is specified, axis options THRESHOLDMIN=, THRESHOLDMAX=, VIEWMIN=, VIEWMAX=, and TICKVALUEPRIORITY= are ignored. Suboption EXTRACTSCALE= of the TICKVALUEFORMAT= option is also ignored.

When this option is specified, data tips are not displayed, and the plot URL= option is ignored.

Notes

When this option is specified, data-clipping might occur for the following: plot markers and marker characters, box-plot outlier markers, fixed-position data labels, needle plots and fringe plots in the X direction, reference lines and drop lines on the broken axis, axis tables, and relative bubble plots.

Curve label positions are based on the contiguous axis data range. When curve labels are specified with a broken axis, the curve label positions might not be ideal.

Tip

Starting with SAS 9.4M3, you can use the AXISBREAKTYPE= and AXISBREAKSYMBOL= options in the BEGINGRAPH statement to display the break in the axis as only a symbol on the axis line.

See

"Creating a Broken Time Axis" in *SAS Graph Template Language: User's Guide*

Example

```
includeranges=('01Jan2001'd-'01May2003'd
   '01Jan2005'd-'01Oct2005'd)
```

INTERVAL=AUTO | SECOND | MINUTE | HOUR | DAY | TENDAY | WEEK | SEMIMONTH | MONTH | QUARTER | SEMIYEAR | YEAR

specifies the time interval between major ticks.

Table 8.1 *Time Intervals*

INTERVAL	Unit	Tick interval	Default tick value format
AUTO	DATE, TIME, or DATETIME	automatically chosen	automatically chosen
SECOND	TIME or DATETIME	second	TIME8.
MINUTE	TIME or DATETIME	minute	TIME8.
HOUR	TIME or DATETIME	hour	TIME8.
DAY	DATE or DATETIME	day	DATE9.
TENDAY	DATE or DATETIME	10 days	DATE9.
WEEK	DATE or DATETIME	7 days	DATE9.

INTERVAL	Unit	Tick interval	Default tick value format
SEMIMONTH	DATE or DATETIME	1st and 16th of each month	DATE9.
MONTH	DATE or DATETIME	month	MONYY7.
QUARTER	DATE or DATETIME	3 months	YYQC6.
SEMIYEAR	DATE or DATETIME	6 months	MONYY7.
YEAR	DATE or DATETIME	year	YEAR4.

Default AUTO. An appropriate interval is chosen based on the data and the column date, date-time, or time format.

Restriction This option applies to time axes only.

Requirement The data column(s) mapped to a time axis must be in the same duration units: TIME, DATE, or DATETIME. The selection of an interval must be consistent with the duration unit. For example, if the data are in time units, you can specify only AUTO, SECOND, MINUTE, HOUR.

Interaction This option is ignored if the TICKVALUELIST= option is used.

INTERVALMULTIPLIER=*positive-integer*
specifies a multiplier to apply to the time interval that is in effect for the axis.

Note: This feature applies to SAS 9.4M3 and to later releases.

Default 1

Restriction This option applies to time axes only.

Interaction This option is ignored if the TICKVALUELIST= option is used.

Tip Use the INTERVAL= option to specify a different time interval.

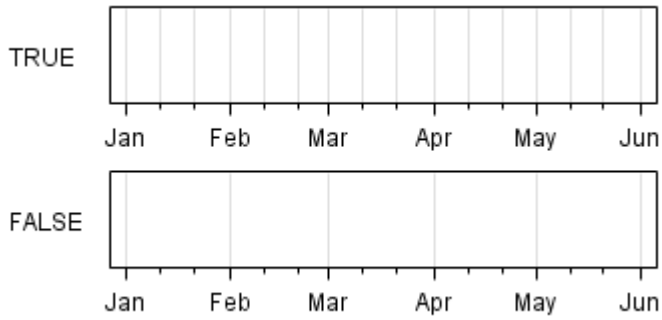
Examples To specify 3-month intervals:

```
INTERVAL=MONTH INTERVALMULTIPLIER=3
```

To specify 10-year intervals:

```
INTERVAL=YEAR INTERVALMULTIPLIER=10
```

MINORGRID=TRUE | FALSE
specifies whether grid lines are displayed at the minor tick marks.



Defaults FALSE in SAS 9.4M1 and earlier releases.

The GraphMinorGridLines:DisplayOpts style reference starting with SAS 9.4M2. If attribute DisplayOpts is not defined in the active style, then FALSE is the default value.

Interaction This option is ignored if the GRIDDISPLAY= option does not display the grid lines.

Tips The GRIDATTRS= option does not affect the appearance of the minor grid lines. To control the minor grid line appearance, use the MINORGRIDATTRS= option.

Use the MINORTICKS= option to display the minor tick marks on the axis.

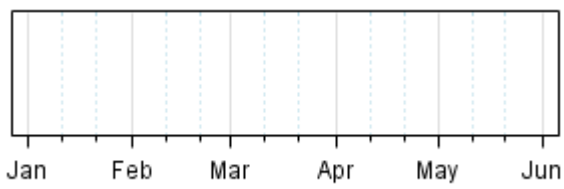
See "boolean " on page xii for other Boolean values that you can use.

MINORGRIDATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the attributes of the minor grid lines. This option does not affect the major grid lines.

The following figure shows the minor grid lines set to light blue, dotted lines on a linear axis. (See the example.)

The following figure shows the minor grid lines set to light blue, dotted lines on a base-10 log axis. (See the example.)

The following figure shows the minor grid lines set to light blue, dotted lines on a time axis. (See the example.)



Defaults The GraphGridLines style element is used starting with SAS 9.4.

The GraphMinorGridLines style element is used starting with SAS 9.4M2.

Interaction This option is ignored when MINORTICKS=FALSE.

Note When *style-element* is specified, only the style element's ContrastColor, LineStyle, and LineThickness attributes are used.

Tip Use the GRIDATTRS= option to control the appearance of the major grid lines.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a style element.

"Line Options" on page 1602 for available line options.

Example Here is an example that specifies light blue, dotted lines for the minor grid.

```
minorgridattrs=(color=lightblue pattern=dot);
```

MINORTICKINTERVAL=*interval*

specifies the time interval between minor ticks. See Table 8.10 on page 1110 for information about the intervals that you can select. The interval that you select must be consistent with the axis data duration units such as TIME, DATE, or DATETIME. For example, if the axis data is in TIME units, then you must specify AUTO, SECOND, MINUTE, or HOUR.

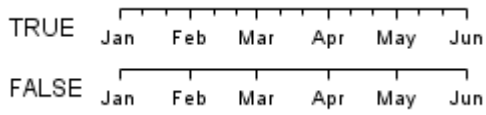
Default AUTO

Interactions This option is ignored if the TICKVALUELIST= option is used.

This option is ignored if the MINORTICKINTERVAL= setting is greater than the INTERVAL= setting.

MINORTICKS=TRUE | FALSE

specifies whether minor ticks are displayed. When MINORTICKS=TRUE, the minor tick marks are displayed on the axis as shown in the following figure.



Default FALSE

Interactions The number of minor ticks is dependent on the value of the MINORTICKINTERVAL= option, if specified. If MINORTICKINTERVAL= is not specified, then it is dependent on the value of the INTERVAL= option.

This option is ignored if the TICKVALUELIST= option is used, or if the DISPLAY= or DISPLAYSECONDARY= option does not display the tick marks.

If MINORTICKS=TRUE is specified with the TICKVALUELIST= option, then MINORTICKS=TRUE is ignored, and minor tick marks are not displayed.

Tip Use the MINORGRID= option to display grid lines at the minor tick values.

See "boolean " on page xii for other Boolean values that you can use.

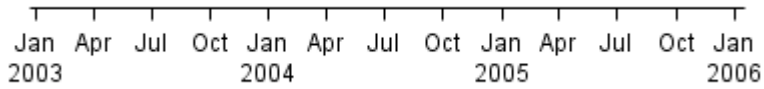
SPLITTICKVALUE=TRUE | FALSE

specifies whether to split the tick values on an X or X2 axis, if possible. This option is not available for a Y or Y2 axis.

TRUE

splits the axis tick values into two lines allowing more tick values to appear.

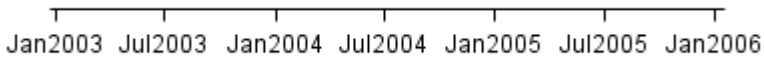
For example, with INTERVAL= MONTH, this is how tick values are split:



FALSE

does not split the axis tick values.

For example, when this option specifies FALSE, this is how the tick values in the previous example appear:



Typically, fewer tick values fit, causing thinning, rotation, or staggering of the values. See the TICKVALUEFITPOLICY= option.

Default TRUE

Restriction This option applies to time axes only.

Interaction This option is ignored if the TICKVALUELIST= or TICKVALUEFORMAT= option is used.

See "boolean " on page xii for other Boolean values that you can use.

TICKVALUEFITPOLICY=*policy*

specifies a policy for avoiding tick value collision on an X or X2 axis. This option is not available for the Y and Y2 axes. The effectiveness of a collision-avoidance policy depends on the number of tick values, their length, and the length of the axis. The following policies are valid:

NONE

makes no attempt to avoid collisions between tick values.

Tick values are displayed even when they collide.

ROTATE

rotates the tick values if a collision occurs.

The TICKVALUEROTATION= option specifies whether the values are rotated to a 45-degree diagonal or a 90-degree vertical position. By default, the values are rotated to a 45-degree diagonal position.

ROTATEALWAYS
rotates the tick values regardless of whether a collision occurs.

The TICKVALUEROTATION= option specifies whether the values are rotated to a 45-degree diagonal or a 90-degree vertical position. By default, the values are rotated to a 45-degree diagonal position.

ROTATETHIN
attempts the ROTATE policy, and then the THIN policy.

STAGGER
alternates the tick values between two rows.

STAGGERROTATE
attempts the STAGGER policy, and then the ROTATE policy.

STAGGERTHIN
attempts the STAGGER policy, and then the THIN policy.

THIN
eliminates alternate tick values.

Default THIN

Restriction This option is valid only for the X and X2 axes.

Interaction When SPLITTICKVALUE= on page 1189TRUE, this option is ignored and only the THIN policy is used.

Note A note is written to the SAS log when tick value thinning occurs.

TICKVALUEFORMAT=*format* | DATA
specifies how to format the values for major tick marks.

format
specifies a SAS date, time, or datetime format to control how the major tick values are displayed.

This format must be in the same duration units as the data column(s) mapped to a time axis: TIME, DATE, or DATETIME and should be appropriate for the value of the INTERVAL= option. For example, if INTERVAL=MONTH and there are two years of data displayed on the axis, then choosing TICKVALUEFORMAT=YEAR. would result in several ticks having the same year value.

DATA
specifies that the SAS date, time, or datetime format associated with the data column assigned to the axis be used to control how the major tick values are displayed.

Default The default format used by the INTERVAL= option. The default does not apply if TICKVALUELIST= is specified.

Restrictions This option applies to time axes only.

GTL currently honors most but not every SAS format. For details, see Appendix 4, "Format Support in ODS Graphics," on page 1621.

TICKVALUELIST=(*time-constant-list* | *date-constant-list* | *datetime-constant-list* | *numeric-list*)

specifies the tick values for a time axis as list.

Default An internal algorithm determines the tick values.

Restrictions This option applies to time axes only.

If TICKVALUEPRIORITY= is set to FALSE, then this option does not extend the data range of the axis. If the values fall within the default data range or that specified by the VIEWMIN= or VIEWMAX= options, then they are used.

Requirement The tick values must be specified as a space-separated list of values enclosed in parentheses. The items in the list must be in the same duration units as the data mapped to the axis: TIME, DATE, or DATETIME. The values can be expressed as SAS TIME, DATE, or DATETIME constants (for example, "13:23"T, "11MAY06"D, or "11MAY06:13:23"DT) or their numeric equivalents.

Interactions The values in the list are formatted according to the format specified on the TICKVALUEFORMAT= option. If TICKVALUEFORMAT= is not used, then the values are formatted according to the column format (the default TICKVALUEFORMAT value is not applied to these values).

If this option is specified, the SPLITTICKVALUE= and INTERVAL= options are ignored.

If MINORTICKS=TRUE is specified with the TICKVALUELIST= option, MINORTICKS=TRUE is ignored, and minor tick marks are not displayed.

TICKVALUEPRIORITY=TRUE | FALSE

specifies whether the TICKVALUELIST= specification can extend the axis data range.

TRUE

extends the axis data range (but does not reduce it) to include the minimum and maximum values that are specified by the TICKVALUELIST= option.

If the minimum and maximum of the user-specified values are within the data range, this option has no effect.

FALSE

displays only the tick values that are specified by the TICKVALUELIST= option that fall within the explicit data range set by the VIEWMIN= and VIEWMAX= options or by the implicit data range set by the actual data minimum and data maximum.

Default FALSE

Interactions When this option is set to TRUE, the VIEWMIN= and VIEWMAX= options are ignored.

This option is ignored if the DISPLAY= option or the DISPLAYSECONDARY= option does not display the tick values.

This option is ignored if the TICKVALUELIST= option is not specified.

This option is ignored when the INCLUDERANGES= option is specified.

Note If the minimum and maximum of the specified values are within the data range, then this option has no effect.

See "boolean " on page xii for other Boolean values that you can use.

TICKVALUEROTATION=DIAGONAL | DIAGONAL2 | VERTICAL
specifies how the tick values are rotated on the X and X2 axes.

DIAGONAL
rotates the tick values to a 45-degree diagonal position.

The X labels read left to right in a downward direction. The X2 labels read left to right in an upward direction.

DIAGONAL2
rotates the tick values to a –45-degree diagonal position.

The X labels read left to right in an upward direction. The X2 labels read left to right in a downward direction.

Note: This feature applies to SAS 9.4M5 and to later releases.

VERTICAL
rotates the labels to a 90-degree vertical position.

The labels are always drawn from bottom to top.

Default DIAGONAL

Restriction This option is valid for XAXISOPTS= and X2AXISOPTS= only.

Interaction The TICKVALUEFITPOLICY= option must be set to ROTATE or ROTATEALWAYS for this option to have any effect.

VIEWMAX=*number*
specifies the maximum data value to include in the display.

Default The maximum value in the data for the specified axis.

Requirements If VIEWMIN= is also specified, VIEWMAX= must be greater than VIEWMIN=. Otherwise, the default values are used for VIEWMIN= and VIEWMAX=.

If VIEWMIN= is not specified, VIEWMAX= must be less than the data maximum. Otherwise, a blank graph is drawn.

Interactions This option is ignored when TICKVALUEPRIORITY= TRUE.

This option is ignored when the INCLUDERANGES= option is specified.

Notes Setting a VIEWMAX= or VIEWMIN= value does not alter the original data or any calculations on it.

The maximum axis tick value might differ from the VIEWMAX= value. The VIEWMIN= and VIEWMAX= values, and additional factors such as thresholds and the tick values computed by the plot statement, are used to determine the axis tick values.

Tip To display the VIEWMAX= value as the maximum tick value, use the TICKVALUELIST= option.

See "Adjusting the Axis View" on page 1051

VIEWMIN=*number*

specifies the minimum data value to include in the display.

Default The minimum value in the data for the specified axis.

Requirements If VIEWMAX= is also specified, VIEWMIN= must be less than VIEWMAX=. Otherwise, the default values are used for VIEWMAX= and VIEWMIN=.

If VIEWMAX= is not specified, VIEWMIN= must be greater than the data minimum. Otherwise, a blank graph is drawn.

Interactions This option is ignored when TICKVALUEPRIORITY= TRUE.

This option is ignored when the INCLUDERANGES= option is specified.

Notes Setting a VIEWMAX= or VIEWMIN= value does not alter the original data or any calculations on it.

The minimum axis tick value might differ from the VIEWMIN= value. The VIEWMIN= and VIEWMAX= values, and additional factors such as thresholds and the tick values computed by the plot statement, are used to determine the axis tick values.

Tip To display the VIEWMIN= value as the minimum tick value, use the TICKVALUELIST= option.

See "Adjusting the Axis View" on page 1051

Details

The LAYOUT OVERLAY statement provides the XAXISOPTS=, YAXISOPTS=, X2AXISOPTS=, Y2AXISOPTS= options that enable you to manage the axis display separately for the X, Y, X2, and Y2 axes. The following example template uses the YAXISOPTS= option to manage the grid lines, tick marks, and tick values on a Y axis:

```
begingraph;
  layout overlay /
    yaxisopts=(
      griddisplay=on
      display=(ticks tickvalues)
    );
    seriesplot x=month y=predict;
  endlayout;
endgraph;
```

Within an OVERLAY layout block, each plot axis is always of a particular type. In the default cases, the axis type is always DISCRETE, LINEAR, or TIME. The TYPE= option enables you to specify an axis type that overrides the default. For example, when appropriate for the data, you can request a LOG axis. When you override the default axis type, you must be sure to specify the correct axis type for the plot(s) that you are defining.

Each axis type has features specific to that type, and the following axis options enable you to specify features for the different types: DISCRETEOPTS= , LINEAROPTS= , LOGOPTS= , and TIMEOPTS= . One or more of these options can be specified for an axis, but the specified settings are applied only to the axis type that supports them.

Axis Options for LAYOUT OVERLAY3D

Axis options for the plots within an OVERLAY3D layout.

Restriction: The OVERLAY3D layout supports linear and time axes only.

Note: Unless otherwise indicated in an option description, each axis option is available for the X, Y, and Z axis.

See: "LAYOUT OVERLAY3D Statement" on page 178

Syntax

Axis options for the plots within an OVERLAY3D layout are specified with the following options on a LAYOUT OVERLAY3D statement:

XAXISOPTS=(*axis-options*)

YAXISOPTS=(*axis-options*)

ZAXISOPTS=(*axis-options*)

General Options for All Axes in an Overlay3D

The options that are documented in this section can be used with either axis type that is supported within an OVERLAY3D layout. Subsequent sections in the chapter document the axis options that are available only for the specific axis type: linear or time.

Statement Option	Description
DISPLAY	Controls which axis features are displayed.
GRIDATTRS	Specifies the attributes of the grid lines.
GRIDDISPLAY	Specifies whether axis grid lines are displayed.
LABEL	Specifies the axis label.
LABELATTRS	Specifies the color and font attributes of the axis label.
LINEAROPTS	Specifies options for a standard numeric interval axis.
OFFSETMAX	Reserves an area at the maximum end of the axis. No tick marks are displayed in the reserved area.
OFFSETMIN	Reserves an area at the minimum end of the axis. No tick marks are displayed in the reserved area.
TICKVALUEATTRS	Specifies the color and font attributes of the axis tick values.
TIMEOPTS	Specifies options for a TIME axis.
TYPE	Specifies the type of axis to use.

DISPLAY=STANDARD | ALL | NONE | (*display-options*)
controls which axis features are displayed on the primary axis.

STANDARD
specifies that the LABEL, LINE, TICKS, and TICKVALUES are displayed

ALL
currently the same as STANDARD

NONE
specifies that no axis features are displayed

(*display-options*)
specifies a space-separated list of one or more display options, enclosed in parentheses.

The list can contain one or more of the following options:

LABEL
displays the axis label

LINE
displays the axis line

TICKS
displays the tick marks

TICKVALUES
displays the values that are represented by the major tick marks

Default STANDARD

Tips The default line attributes for the axis line and axis tick marks are defined in the GraphAxisLine style element.

Use the GRIDDISPLAY= and GRIDATTRS= options to set the axis grid lines.

When LINE is excluded from the DISPLAY= option, the layout wall outline or the default baseline of a bar chart, needle plot, or waterfall chart can appear to be an axis line. To suppress the wall outline, use the WALLDISPLAY= option in the layout statement. To suppress the plot baseline, use the BASELINEATTRS= option in the plot statement.

GRIDATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the attributes of the grid lines.

Default The GraphGridLines style element.

Interaction This option is ignored if the GRIDDISPLAY= option does not display the grid lines.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

GRIDDISPLAY=AUTO_OFF | AUTO_ON | ON | OFF
specifies whether axis grid lines are displayed. This option enables the template to absolutely control the display of grid lines or to allow interaction with the current style to decide whether grid lines are displayed.

AUTO_OFF
specifies that grid lines are not displayed unless the GraphGridLines element in the current style contains DisplayOpts="ON."

AUTO_ON
specifies that grid lines are displayed unless the GraphGridLines element in the current style contains DisplayOpts="OFF."

ON
specifies that grid lines are always displayed.

The current style has no override.

OFF
specifies that grid lines are never displayed.

The current style has no override.

The following table shows the end results for various combinations of the GRIDDISPLAY= option and the DisplayOpts= attribute of the GraphGridLines style element. Most supplied templates use the default setting AUTO_OFF to indicate a preference for not displaying grid lines, but allowing the style to override.

GRIDDISPLAY= option	DisplayOpts= style attribute	Grid Lines Shown?
AUTO_OFF	AUTO	no
AUTO_OFF	ON	yes
AUTO_OFF	OFF	no
AUTO_ON	AUTO	yes
AUTO_ON	ON	yes
AUTO_ON	OFF	no
ON	any value	yes
OFF	any value	no

Default AUTO_OFF

Note Supplied styles use DisplayOpts="AUTO," which means that the style has no preference about grid lines and the graphics template setting for grid lines is always used.

LABEL=*"string"* | (*"string"* ...*"string"*)
specifies the axis label. The string can be either a string literal or a dynamic. The list form implies that all included string literals or dynamic variables will be concatenated.

Default The default label is derived from the primary plot in the layout. For more information, see "When Plots Share Data and a Common Axis" on page 1046.

Interaction This option is ignored if the DISPLAY= option does not display the axis label.

Note If the axis label is too long to fit along the axis, then it is truncated by default.

Tip Use the ODS escape sequence to specify Unicode characters in an axis label. Here is an example that species degrees Fahrenheit in an axis label for temperature:

```
label="Temperature ((*ESC*){unicode '00B0'x}F)"
```

See "Overriding the Default Axis Label" in *SAS Graph Template Language: User's Guide*

LABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font attributes of the axis label.

Default The GraphLabelText style element.

Interaction This option is ignored if the DISPLAY= option does not display the axis label.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Text Options" on page 1606 for available *text-options*.

LINEAROPTS=(*linear-axis-options*)
specifies one or more options for a numeric interval axis. Options must be enclosed in parentheses. Each option is specified as a *name = value* pair and each pair is space separated.

Interaction This option is ignored if the axis type is not LINEAR.

See "Options for Linear Axes Only" on page 1125 for the options that you can use for *linear-axis-options*.

OFFSETMAX=AUTO | *number*
reserves an area at the maximum end of the axis. No tick marks are displayed in the reserved area.

AUTO
reserves just enough area to fully display markers and other graphical features near the maximum end of an axis.

number
specifies the offset as a decimal proportion of the full axis length.

For a continuous axis, the offset follows the highest data value or highest tick value, whichever is greater.

Default AUTO

Range 0–1. The sum of OFFSETMAX= and OFFSETMIN= should not be more than 1.

See "Adjusting Axis Offsets" on page 1053

OFFSETMIN=AUTO | *number*
reserves an area at the minimum end of the axis. No tick marks are displayed in the reserved area.

AUTO
reserves just enough area to fully display markers and other graphical features near the minimum end of an axis.

number
specifies the offset as a decimal proportion of the full axis length.

For a continuous axis, the offset precedes the lowest data value or lowest tick value, whichever is less.

Default AUTO

Range 0–1. The sum of OFFSETMAX= and OFFSETMIN= should not be more than 1.

See "Adjusting Axis Offsets" on page 1053

TICKVALUEATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font attributes of the axis tick values.

Default The GraphValueText style element.

Interaction This option is ignored if the DISPLAY= option does not display tick values.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Text Options" on page 1606 for available *text-options*.

TIMEOPTS=(*time-axis-options*)
specifies one or more options for a time axis.

Requirements Columns associated with a time axis must be in SAS time, SAS date, or SAS datetime units and have an associated SAS time, date, or datetime format.

Options must be enclosed in parentheses. Each option is specified as a *name = value* pair and each pair is space separated.

Interaction This option is ignored if the axis type is not TIME.

See "Options for Time Axes Only" on page 1134 for the options that you can use for *time-axis-options*.

TYPE=AUTO | LINEAR | TIME
specifies the type of axis to use.

AUTO
requests that the axis type be automatically determined by the plot or the overlay contents.

LINEAR
uses a LINEAR axis if possible.

You can add a LINEAROPTS= option list to customize this axis type.

TIME
uses a TIME axis if possible.

Data for this axis must be SAS time, SAS date, or SAS datetime values. You can add a TIMEOPS= option list to customize this axis type.

Default AUTO

Interactions If this option is set to anything other than AUTO, then plots within the layout are dropped from the display if their data types or data ranges do not match the axis type requirements. For more information, see "Plot Axis Types Must Agree on Common Axes" on page 1049.

After the axis type is determined (whether you set a specific type or AUTO is in effect), only options supported by that axis type can be used. For example, if TYPE=TIME, then only the general OVERLAY3D axis options and those available on TIMEOPS= are supported.

Options for Linear Axes Only

This section documents the options that can be used with the LINEAROPTS= axis option. The following table provides a summary of the options.

Linear Axis Option	Description
INTEGER	Specifies that evenly spaced integer values are used for tick marks.
MINORGRID	Specifies whether grid lines are displayed at the minor tick values.
MINORGRIDATTRS	Specifies the attributes of the minor grid lines.
MINORTICKCOUNT	Specifies the number of minor ticks that are displayed on the axis.
MINORTICKS	Specifies whether minor ticks are displayed.
THRESHOLDMAX	Specifies a bias for including one more tick mark at the maximum end of the axis.
THRESHOLDMIN	Specifies a bias for including one more tick mark at the minimum end of the axis.

Linear Axis Option	Description
TICKDISPLAYLIST	Specifies the text that is displayed for the tick values that are defined in the TICKVALUELIST= option.
TICKVALUEFORMAT	Specifies how to format the values for major tick marks.
TICKVALUELIST	Specifies the order of the tick values for a linear axis as list.
TICKVALUEPRIORITY	Specifies whether an axis tick specification (TICKVALUELIST= or TICKVALUESEQUENCE=) can extend the axis data range.
TICKVALUESEQUENCE	Specifies the tick values for a linear axis by start, end, and increment.

INTEGER=TRUE | FALSE
specifies that evenly spaced integer values are used for tick marks.

Default FALSE

Interactions This option is overridden by the TICKVALUELIST= or TICKVALUESEQUENCE= option.

This option overrides the MAXDECIMALS= and PREFERREDDECIMALS= suboptions of the TICKVALUEFORMAT= option.

INTEGER=TRUE is ignored for the X or X2 axis when a histogram plot is the primary plot and BINAXIS=TRUE is specified in the HISTOGRAM or HISTOGRAMPARM statement.

Note This option is ignored when the data exceeds the limits of integer values.

See “boolean ” on page xii for other Boolean values that you can use.

MINORGRID=TRUE | FALSE
specifies whether grid lines are displayed at the minor tick marks.

Defaults FALSE in SAS 9.4M1 and earlier releases.

The GraphMinorGridLines:DisplayOpts style reference starting with SAS 9.4M2. If attribute DisplayOpts is not defined in the active style, then FALSE is the default value.

Interaction This option is ignored if the GRIDDISPLAY= option does not display the grid lines.

Tips The GRIDATTRS= option does not affect the appearance of the minor grid lines. To control the minor grid line appearance, use the MINORGRIDATTRS= option.

Use the MINORTICKS= option to display the minor tick marks on the axis.

See "boolean " on page xii for other Boolean values that you can use.

MINORGRIDATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the attributes of the minor grid lines. This option does not affect the major grid lines.

The following figure shows the minor grid lines set to light blue, dotted lines on a linear axis. (See the example.)

The following figure shows the minor grid lines set to light blue, dotted lines on a base-10 log axis. (See the example.)

The following figure shows the minor grid lines set to light blue, dotted lines on a time axis. (See the example.)

Defaults The GraphGridLines style element is used starting with SAS 9.4.

The GraphMinorGridLines style element is used starting with SAS 9.4M2.

Interaction This option is ignored when MINORTICKS=FALSE.

Note When *style-element* is specified, only the style element's ContrastColor, LineStyle, and LineThickness attributes are used.

Tip Use the GRIDATTRS= option to control the appearance of the major grid lines.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a style element.

"Line Options" on page 1602 for available line options.

Example Here is an example that specifies light blue, dotted lines for the minor grid.

```
minorgridattrs=(color=lightblue pattern=dot);
```

MINORTICKCOUNT=*positive-integer*

specifies the number of minor ticks that are displayed on the axis.

Defaults Four ticks with five intervals in SAS 9.4M1 and earlier releases.

One tick with two intervals starting with SAS 9.4M2.

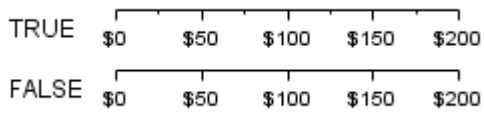
Interactions The DISPLAY= option specification must include TICKS for this option to have any effect.

The MINORTICKS= option must specify TRUE for this option to have any effect.

Tip To display *n* intervals between major ticks, use MINORTICKCOUNT=*n*-1.

MINORTICKS=TRUE | FALSE

specifies whether minor ticks are displayed. When MINORTICKS=TRUE, the minor tick marks are displayed on the axis as shown in the following figure.



Default FALSE

Interactions This option is ignored if the TICKVALUELIST= option is used or if the tick marks are not enabled by the DISPLAY= option.

If MINORTICKS=TRUE is specified and TICKVALUELIST= specifies nonuniform tick values such as 3, 5, 11, and 23, then MINORTICK=TRUE is ignored. To display minor tick marks in that case, specify uniform tick values such as 0, 10, 20, and 30 in the TICKVALUELIST= option.

Tip Use the MINORGRID= option to display grid lines at the minor tick values.

See "boolean " on page xii for other Boolean values that you can use.

THRESHOLDMAX=*number*

specifies a bias for including one more tick mark at the maximum end of the axis.

Default 0.30

Range 0–1

Restriction This option applies to linear axes only.

Interaction This option is ignored if the TICKVALUELIST= or TICKVALUESEQUENCE= option is used.

Tips If the threshold is set to 0, the potential tick mark is never displayed. If the threshold is set to 1, then the tick mark is always displayed.

Specifying THRESHOLDMIN=0 and THRESHOLDMAX=0 prevents the tick marks from extending beyond the data range.

Specifying THRESHOLDMIN=1 and THRESHOLDMAX=1 ensures that the data range is bounded by tick marks.

For the minimum axis length, set the THRESHOLDMIN= and THRESHOLDMAX= options to 0.

See "Adjusting Axis Thresholds" on page 1052

THRESHOLDMIN=*number*

specifies a bias for including one more tick mark at the minimum end of the axis.

Default 0.30

Range 0–1

Restriction This option applies to linear axes only.

Interaction This option is ignored if the TICKVALUELIST= or TICKVALUESEQUENCE= option is used.

Tips If the threshold is set to 0, the potential tick mark is never displayed. If the threshold is set to 1, then the tick mark is always displayed.

Specifying THRESHOLDMIN=0 and THRESHOLDMAX=0 prevents the tick marks from extending beyond the data range.

Specifying THRESHOLDMIN=1 and THRESHOLDMAX=1 ensures that the data range is bounded by tick marks.

For the minimum axis length, set the THRESHOLDMIN= and THRESHOLDMAX= options to 0.

See "Adjusting Axis Thresholds" on page 1052

TICKDISPLAYLIST=(*string-list*)
specifies the text that is displayed for the tick values that are defined in the TICKVALUELIST= option. The string list is a space-separated list of string values that are displayed on the axis in place of the values in the TICKVALUELIST= option. The strings map one-to-one positionally with the values that are listed in the TICKVALUELIST= option.

Default The display of tick values is controlled by the TICKVALUEFORMAT= option.

Requirements The list of values must be enclosed in parentheses.

Each value (character and numeric) must be enclosed in quotation marks and separated from adjacent values by a blank space.

Interaction When this option is specified, the TICKVALUEFORMAT= option is ignored.

Tip This option should be used with the TICKVALUELIST= option. The number of items in the list for this option should equal the number of items in the list for the TICKVALUELIST= option.

TICKVALUEFORMAT=(*format-options*) | DATA | *format*
specifies how to format the values for major tick marks.

(*format-options*)
specifies one or more formatting options for major tick values.

Together, these options provide parameters for determining an optimal format (*w.d*, E*w.*, BEST*w.*) for displaying major tick values.

MAXWIDTH=*integer*
specifies the maximum width for displayed tick values.

Values might be rounded or converted to E notation to fit into this width.

Default 8

MAXDECIMALS=*integer*
specifies the maximum number of decimals for displayed tick values.

Values might be rounded or converted to E notation to fit into this width.

Default 6

Note The MAXWIDTH= option value should be greater than the MAXDECIMALS= option value.

PREFERREDDECIMALS=*integer*
specifies the number of decimal places that you want to display for most values.

The actual number might vary based on other constraints.

Default 2

EXTRACTSCALE=TRUE | FALSE
specifies whether to extract a scale factor from the tick values and use it to reduce the tick value width.

The scale can be a named scale or a scientific-notation scale. The EXTRACTSCALETYPE= option specifies the scale type. The scale that is used is appended to the axis label, as shown in the following example.

```
Total Sales (millions)
```

For long axis labels, if the scale does not fit the available space, then the label is truncated, and the scale is appended to the truncated label. Ellipses indicate that the label was truncated, as shown in the following example.

```
Total Sales for the Fourth Quarter Of ... (millions)
```

In extreme cases in which the scale does not fit even with truncation, the entire axis is dropped.

Default FALSE

Restriction The scale that is extracted by the EXTRACTSCALE= option is derived from the English locale for all locales.

Interactions The scale type is determined by the EXTRACTSCALETYPE= option.

If the axis label is not displayed, then the EXTRACTSCALE=TRUE option is ignored.

Note When EXTRACTSCALE=TRUE and a scale is extracted, the tick values are formatted to provide the best fit on the axis. In that case, the tick value format might differ from the data format even when a named format is applied to the data values.

See “boolean ” on page xii for other Boolean values that you can use.

EXTRACTSCALETYPE=DEFAULT | SCIENTIFIC
specifies whether to extract a named scale or a scientific-notation scale.

DEFAULT
extracts a named scale.

A named scale can be millions, billions, or trillions for values of 999 trillion or less, or a multiple of 10 (denoted as 10^*n*) for values over 999 trillion. For large tick values, the scale factor is set to ensure that the absolute value of the largest value is greater than 1. For small fractional tick values, the scale factor is set to ensure that the absolute value of the smallest value is greater than 1. The scale can be millionth, billionth, or trillionth for values of 1 trillionth or more, or a multiple of 1/10 (10^−*n*) for values less than 1 trillionth.

SCIENTIFIC
extracts a scientific-notation scale.

A scientific-notation scale is a multiple of 10 expressed as 10^*n* for values greater than 1, or a multiple of 1/10 expressed as 10^–*n* for values less than 1.

Default DEFAULT

Restriction The scale is derived from the English locale for all locales.

DATA
uses the format that has been assigned to the column that is contributing to the axis (or BEST6 if no format is assigned) in order to control the formatting of the major tick values.

format
specifies a format to apply to the major tick values.

Restriction GTL currently honors most, but not every, SAS format. For details, see Appendix 4, "Format Support in ODS Graphics," on page 1621 .

Note If you specify a format that significantly reduces precision, because of tick-value rounding, the plot data elements might not align properly with the axis tick values. In that case, specify a tick-value format with a higher precision.

Default (MAXWIDTH=8, MAXDECIMALS=6, PREFERREDDECIMALS=2, EXTRACTSCALE=FALSE, EXTRACTSCALETYPE=DEFAULT)

Interaction This option is ignored when the TICKDISPLAYLIST= option is specified.

TICKVALUELIST=(*numeric-list*)
specifies the tick values for a linear axis as a list.

Default An internal algorithm determines the tick values.

Restriction This option applies to linear axes only.

Requirement The tick values must be specified as a space-separated list of numeric values, enclosed in parentheses.

Interactions This option overrides the INTEGER= option.

This option is ignored if the TICKVALUESEQUENCE= option is specified, or if the DISPLAY= option does not display tick values.

If MINORTICKS=TRUE is specified and TICKVALUELIST= specifies nonuniform tick values such as 3, 5, 11, and 23, then MINORTICK=TRUE is ignored. To display minor tick marks in that case, specify uniform tick values such as 0, 10, 20, and 30 in the TICKVALUELIST= option.

Tip The values in the list are formatted according to the setting for the TICKVALUEFORMAT= option.

TICKVALUEPRIORITY=TRUE | FALSE
specifies whether an axis tick specification (TICKVALUELIST= or TICKVALUESEQUENCE=) can extend the axis data range.

TRUE
extends the axis data range (but does not reduce it) to include the minimum and maximum values that are specified by either the TICKVALUELIST= or TICKVALUESEQUENCE= option.

If the minimum and maximum of the user-specified values are within the data range, this option has no effect.

FALSE
displays only the tick values that are specified by the TICKVALUELIST= option that fall within the explicit data range set by the actual data minimum and data maximum.

Default FALSE

Restriction This option applies to linear axes only.

Interactions This option is ignored if the TICKVALUELIST= or TICKVALUESEQUENCE= option is not specified.

This option is ignored if the DISPLAY= option does not display the tick values.

Note If the minimum and maximum of the specified values are within the data range, then this option has no effect.

See "boolean " on page xii for other Boolean values that you can use.

TICKVALUESEQUENCE=(START=*number* END=*number* INCREMENT=*number*)
specifies the tick values by start, end, and increment.

START=*number*
specifies the value for the first tick mark.

END=*number*
specifies the value for the last tick mark.

INCREMENT=*number*
specifies the increment for intermediate tick marks between the first and last tick marks.

The END value always controls the last tick mark. The interval between the last tick mark and the previous tick mark might not necessarily be the INCREMENT value.

Default An internal algorithm determines the tick marks.

Interactions This option overrides the INTEGER= option.

If TICKVALUEPRIORITY= TRUE, then the tick sequence might extend the explicit data range of the axis, but never reduce it.

This option is ignored if the DISPLAY= option does not display tick marks.

Tip The values in the sequence are formatted according to the setting for the TICKVALUEFORMAT= option.

See TICKVALUELIST= option as an alternative for customizing tick marks.

Options for Time Axes Only

This section documents the options that can be used with the TIMEOPTS= axis option. The following table provides a summary of the options.

Time Axis Option	Description
INTERVAL	Specifies the time interval between major tick marks.
INTERVALMULTIPLIER	Specifies a multiplier to apply to the time interval that is in effect for the axis.
MINORGRID	Specifies whether grid lines are displayed at the minor tick values.
MINORGRIDATTRS	Specifies the attributes of the minor grid lines.
MINORTICKINTERVAL	Specifies the time interval between minor ticks.
MINORTICKS	Specifies whether minor ticks are displayed.
TICKVALUEFORMAT	Specifies how to format the values for major tick marks.
TICKVALUELIST	Specifies the order of the tick values for a time axis as list.

INTERVAL=AUTO | SECOND | MINUTE | HOUR | DAY | TENDAY | WEEK | SEMIMONTH | MONTH | QUARTER | SEMIYEAR | YEAR
specifies the time interval between major ticks.

Table 8.2 *Time Intervals*

INTERVAL	Unit	Tick interval	Default tick value format
AUTO	DATE, TIME, or DATETIME	automatically chosen	automatically chosen
SECOND	TIME or DATETIME	second	TIME8.
MINUTE	TIME or DATETIME	minute	TIME8.
HOUR	TIME or DATETIME	hour	TIME8.
DAY	DATE or DATETIME	day	DATE9.
TENDAY	DATE or DATETIME	10 days	DATE9.
WEEK	DATE or DATETIME	7 days	DATE9.
SEMIMONTH	DATE or DATETIME	1st and 16th of each month	DATE9.
MONTH	DATE or DATETIME	month	MONYY7.
QUARTER	DATE or DATETIME	3 months	YYQC6.
SEMIYEAR	DATE or DATETIME	6 months	MONYY7.
YEAR	DATE or DATETIME	year	YEAR4.

Default AUTO. An appropriate interval is chosen based on the data and the column date, date-time, or time format.

Restriction This option applies to time axes only.

Requirement The data column(s) mapped to a time axis must be in the same duration units: TIME, DATE, or DATETIME. The selection of an interval must be consistent with the duration unit. For example, if

the data are in time units, you can specify only AUTO, SECOND, MINUTE, HOUR.

Interaction This option is ignored if the TICKVALUELIST= option is used.

INTERVALMULTIPLIER=*positive-integer*

specifies a multiplier to apply to the time interval that is in effect for the axis.

Note: This feature applies to SAS 9.4M3 and to later releases.

Default 1

Restriction This option applies to time axes only.

Interaction This option is ignored if the TICKVALUELIST= option is used.

Tip Use the INTERVAL= option to specify a different time interval.

Examples To specify 3-month intervals:

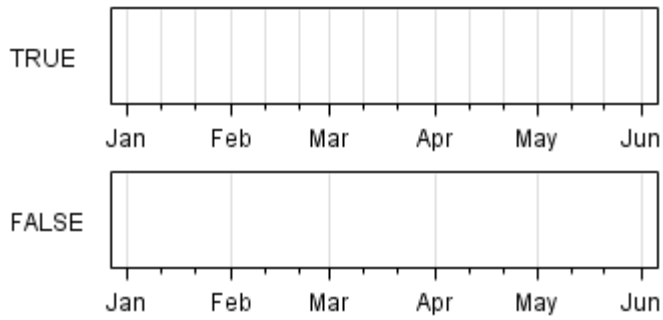
```
INTERVAL=MONTH INTERVALMULTIPLIER=3
```

To specify 10-year intervals:

```
INTERVAL=YEAR INTERVALMULTIPLIER=10
```

MINORGRID=TRUE | FALSE

specifies whether grid lines are displayed at the minor tick marks.



Defaults FALSE in SAS 9.4M1 and earlier releases.

The GraphMinorGridLines:DisplayOpts style reference starting with SAS 9.4M2. If attribute DisplayOpts is not defined in the active style, then FALSE is the default value.

Interaction This option is ignored if the GRIDDISPLAY= option does not display the grid lines.

Tips The GRIDATTRS= option does not affect the appearance of the minor grid lines. To control the minor grid line appearance, use the MINORGRIDATTRS= option.

Use the MINORTICKS= option to display the minor tick marks on the axis.

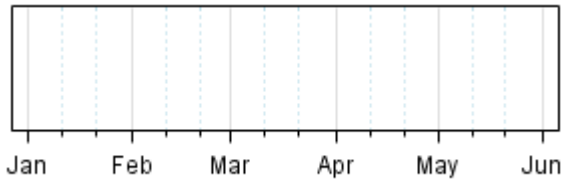
See "boolean " on page xii for other Boolean values that you can use.

MINORGRIDATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the attributes of the minor grid lines. This option does not affect the major grid lines.

The following figure shows the minor grid lines set to light blue, dotted lines on a linear axis. (See the example.)

The following figure shows the minor grid lines set to light blue, dotted lines on a base-10 log axis. (See the example.)

The following figure shows the minor grid lines set to light blue, dotted lines on a time axis. (See the example.)



Defaults The GraphGridLines style element is used starting with SAS 9.4.

The GraphMinorGridLines style element is used starting with SAS 9.4M2.

Interaction This option is ignored when MINORTICKS=FALSE.

Note When *style-element* is specified, only the style element's ContrastColor, LineStyle, and LineThickness attributes are used.

Tip Use the GRIDATTRS= option to control the appearance of the major grid lines.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a style element.

"Line Options" on page 1602 for available line options.

Example Here is an example that specifies light blue, dotted lines for the minor grid.

```
minorgridattrs=(color=lightblue pattern=dot);
```

MINORTICKINTERVAL=*interval*
specifies the time interval between minor ticks. See Table 8.11 on page 1135 for information about the intervals that you can select. The interval that you select must be consistent with the axis data duration units such as TIME, DATE, or DATETIME. For example, if the axis data is in TIME units, then you must specify AUTO, SECOND, MINUTE, or HOUR.

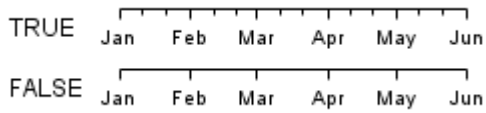
Default AUTO

Interactions This option is ignored if the TICKVALUELIST= option is used.

This option is ignored if the MINORTICKINTERVAL= setting is greater than the INTERVAL= setting.

MINORTICKS=TRUE | FALSE

specifies whether minor ticks are displayed. When MINORTICKS=TRUE, the minor tick marks are displayed on the axis as shown in the following figure.



Default FALSE

Interactions The number of minor ticks is dependent on the value of the MINORTICKINTERVAL= option, if specified. If MINORTICKINTERVAL= is not specified, then it is dependent on the value of the INTERVAL= option.

This option is ignored if the TICKVALUELIST= option is used or if the tick marks are not enabled by the DISPLAY= option.

If MINORTICKS=TRUE is specified with the TICKVALUELIST= option, then MINORTICKS=TRUE is ignored, and minor tick marks are not displayed.

Tip Use the MINORGRID= option to display grid lines at the minor tick values.

See "boolean " on page xii for other Boolean values that you can use.

TICKVALUEFORMAT=*format* | DATA

specifies how to format the values for major tick marks.

format

specifies a SAS date, time, or datetime format to control how the major tick values are displayed.

This format must be in the same duration units as the data column(s) mapped to a time axis: TIME, DATE, or DATETIME and should be appropriate for the value of the INTERVAL= option. For example, if INTERVAL=MONTH and there are two years of data displayed on the axis, then choosing TICKVALUEFORMAT=YEAR. would result in several ticks having the same year value.

DATA

specifies that the SAS date, time, or datetime format associated with the data column assigned to the axis be used to control how the major tick values are displayed.

Default The default format used by the INTERVAL= option. The default does not apply if TICKVALUELIST= is specified.

Restrictions This option applies to time axes only.

GTL currently honors most but not every SAS format. For details, see Appendix 4, "Format Support in ODS Graphics," on page 1621.

TICKVALUELIST=(*time-constant-list* | *date-constant-list* | *datetime-constant-list* | *numeric-list*)

specifies the tick values for a time axis as list.

Default An internal algorithm determines the tick values.

Restrictions This option applies to time axes only.

If TICKVALUEPRIORITY= is set to FALSE, then this option does not extend the data range of the axis. If the values fall within the default data range, then they are used.

Requirement The tick values must be specified as a space-separated list of values enclosed in parentheses. The items in the list must be in the same duration units as the data mapped to the axis: TIME, DATE, or DATETIME. The values can be expressed as SAS TIME, DATE, or DATETIME constants (for example, "13:23"T, "11MAY06"D, or "11MAY06:13:23"DT) or their numeric equivalents.

Interactions The values in the list are formatted according to the format specified on the TICKVALUEFORMAT= option. If TICKVALUEFORMAT= is not used, then the values are formatted according to the column format (the default TICKVALUEFORMAT value is not applied to these values).

If this option is specified, then the INTERVAL= option is ignored.

If MINORTICKS=TRUE is specified with the TICKVALUELIST= option, MINORTICKS=TRUE is ignored, and minor tick marks are not displayed.

Details

The LAYOUT OVERLAY3D statement provides XAXISOPTS=, YAXISOPTS=, and ZAXISOPTS= options that enable you to manage the axis display separately for the X, Y, and Z axes. The following example template uses the YAXISOPTS= option to manage the display of grid lines, tick marks, and tick values on a Y axis:

```
begingraph;
  layout overlay3d /
    yaxisopts=(
      griddisplay=on
      display=(ticks tickvalues)
    );
    bihistogram3dparm x=rater y=customer z=percent;
  endlayout;
endgraph;
```

Within an OVERLAY3D layout block, each plot axis is always either a linear or a time axis. The default axis-type setting is AUTO, which specifies that the axis type be automatically determined by the plot or the overlay contents. The TYPE= option enables you to explicitly specify either a LINEAR or a TIME axis type. When you override the default axis type, you must be sure to specify the correct axis type for the plot(s) that you are defining.

Each axis type has features specific to that type, and the axis options LINEAROPTS= and TIMEOPS= enable you to specify features for a linear or a time axis. You can combine one or more general axis options with the options for the specific axis type. However, specified settings are applied only to the axis type that supports them. For example, if you specify general axis options with time axis options and the generated graph produces a linear axis type, then the time axis options are ignored.

Row and Column Axis Options for LAYOUT LATTICE

Row and column axis options for the plots within a LATTICE layout.

See: "LAYOUT LATTICE Statement" on page 126

Syntax

Axis options for the plots in a LATTICE layout are specified with the following statements in a LAYOUT LATTICE statement block:

COLUMNAXIS */column-axis-options*

ROWAXIS */row-axis-options*

General Options for All Row and Column Axes in a Lattice

The options that are documented in this section can be used with any of the row or column axis types that are supported in a LAYOUT LATTICE statement. Subsequent sections in the chapter document the axis options that are available only for specific axis types: discrete, linear, log, or time axes.

Statement Option	Description
DISCRETEOPTS	Specifies features for a discrete axis.
DISPLAY	Controls which axis features are displayed on the primary axis.
DISPLAYSECONDARY	Controls which axis features are displayed on the secondary axis.

Statement Option	Description
GRIDATTRS	Specifies the attributes of the grid lines.
GRIDDISPLAY	Specifies whether axis grid lines are displayed.
LABEL	Specifies the axis label.
LABELATTRS	Specifies the color and font attributes of the axis label.
LABELFITPOLICY	Specifies a policy for fitting axis labels in the available space.
LABELPOSITION	Specifies the position of the axis label.
LABELSPLITCHAR	Specifies one or more characters on which the axis labels can be split, if needed.
LABELSPLITCHARDROP	Specifies whether the split characters should be included in the axis labels that are displayed.
LABELSPLITJUSTIFY	Specifies the justification of the strings that are inside the axis label blocks.
LINEAROPTS	Specifies features for a standard numeric interval axis.
LOGOPTS	Specifies features for a log axis.
NAME	Assigns a name to an axis for reference in other statements.
OFFSETMAX	Reserves an area at the maximum end of the axis. No tick marks are displayed in the reserved area.
OFFSETMIN	Reserves an area at the minimum end of the axis. No tick marks are displayed in the reserved area.
REVERSE	Specifies whether the axis origin should be reversed.
SHORTLABEL	Specifies an alternate axis label to use if the default or specified axis label is too long for the axis length.
TICKVALUEATTRS	Specifies the color and font attributes of the axis tick values.

Statement Option	Description
TICKVALUEHALIGN	Specifies the horizontal alignment for all of the tick values that are displayed on the Y and Y2 axes.
TICKVALUEVALIGN	Specifies the vertical alignment for all of the tick values that are displayed on the X and X2 axes.
TIMEOPTS	Specifies features for a TIME axis.
TYPE	Specifies the type of axis to use.

DISCRETEOPTS=(*discrete-axis-options*)
specifies one or more options for a discrete axis. Options must be enclosed in parentheses. Each option is specified as a *name = value* pair and each pair is space separated.

Interaction This option is ignored if the axis type is not DISCRETE.

See "Options for Row and Column Discrete Axes Only" on page 1153 for the options that you can use for *discrete-axis-options*.

DISPLAY=STANDARD | ALL | NONE | (*display-options*)
controls which axis features are displayed on the primary axis.

STANDARD
specifies that the LABEL, LINE, TICKS, and TICKVALUES are displayed

ALL
currently the same as STANDARD

NONE
specifies that no axis features are displayed

(*display-options*)
specifies a space-separated list of one or more display options, enclosed in parentheses.

The list can contain one or more of the following options:

LABEL
displays the axis label

LINE
displays the axis line

TICKS
displays the tick marks

TICKVALUES
displays the values that are represented by the major tick marks

Default STANDARD

Tips The default line attributes for the axis line and axis tick marks are defined in the GraphAxisLine style element.

Use the GRIDDISPLAY= and GRIDATTRS= options to set the axis grid lines.

When LINE is excluded from the DISPLAY= option, the layout wall outline or the default baseline of a bar chart, needle plot, or waterfall chart can appear to be an axis line. To suppress the wall outline, use the WALLDISPLAY= option in the layout statement. To suppress the plot baseline, use the BASELINEATTRS= option in the plot statement.

See "Details" on page 1193 for more information about the primary and secondary axes.

DISPLAYSECONDARY=NONE | ALL | STANDARD | (*display-options*)
controls which axis features are displayed on the secondary axis. A secondary axis is not an independent axis. Rather, it mirrors the primary axis. Thus, for this option to take effect, all plot statements in the layout must map data to the same primary axis. For example, a secondary X2 axis can be displayed on top in the layout, provided all plot statements set XAXIS=X to map data to the primary X axis (bottom). Similarly, a secondary Y2 axis can be displayed to the right in the layout, provided all plot statements set YAXIS=Y to map data to the primary Y axis (left).

NONE
specifies that no axis features are displayed

STANDARD
specifies that the LABEL, LINE, TICKS, and TICKVALUES are displayed on the secondary axis

ALL
currently the same as STANDARD

(*display-options*)
specifies a space-separated list of one or more display options, enclosed in parentheses.

The list can contain one or more of the following options:

LABEL
displays the axis label

LINE
displays the axis line

TICKS
displays the tick marks

TICKVALUES
displays the values that are represented by the major tick marks

Default NONE

Restriction If some plot statements set XAXIS=X and others set XAXIS=X2, both the X and X2 axis are primary and a secondary X axis cannot

be displayed. In that case, this option is ignored. The same applies for the Y axes.

Interactions This option is ignored if the COLUMNAXIS statement appears within a COLUMNAXES block and COLUMN2DATARANGE=UNION or UNIONALL is in effect.

This option is ignored if the COLUMNAXIS statement appears within a COLUMN2AXES block and COLUMNDATARANGE=UNION or UNIONALL is in effect.

Tip Use the GRIDDISPLAY= and GRIDATTRS= options to set the axis grid lines.

See "Details" on page 1193 for more information about the primary and secondary axes.

GRIDATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the attributes of the grid lines.

Default The GraphGridLines style element.

Interaction This option is ignored if the GRIDDISPLAY= option does not display the grid lines.

Tip On a log axis, this option affects the appearance of the major grid lines only. It does not affect the appearance of the minor grid lines. To control the appearance of the minor grid lines on a log axis, use the MINORGRIDATTRS= option.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

GRIDDISPLAY=AUTO_OFF | AUTO_ON | ON | OFF
specifies whether axis grid lines are displayed. This option enables the template to absolutely control the display of grid lines or to allow interaction with the current style to decide whether grid lines are displayed. When displayed, the grids appear in all cells.

AUTO_OFF
specifies that grid lines are not displayed unless the GraphGridLines element in the current style contains DisplayOpts="ON."

AUTO_ON
specifies that grid lines are displayed unless the GraphGridLines element in the current style contains DisplayOpts="OFF."

ON
specifies that grid lines are always displayed.

The current style has no override.

OFF
specifies that grid lines are never displayed.

The current style has no override.

The following table shows the end results for various combinations of the GRIDDISPLAY= option and the DisplayOpts= attribute of the GraphGridLines style element. Most supplied templates use the default setting AUTO_OFF to indicate a preference for not displaying grid lines, but allowing the style to override.

GRIDDISPLAY= option	DisplayOpts= style attribute	Grid Lines Shown?
AUTO_OFF	AUTO	no
AUTO_OFF	ON	yes
AUTO_OFF	OFF	no
AUTO_ON	AUTO	yes
AUTO_ON	ON	yes
AUTO_ON	OFF	no
ON	any value	yes
OFF	any value	no

Default AUTO_OFF

Note Supplied styles use DisplayOpts="AUTO," which means that the style has no preference about grid lines and the graphics template setting for grid lines is always used.

LABEL=*"string"* | (*"string"* ...*"string"*)
specifies the axis label. The string can be either a string literal or a dynamic. The list form implies that all included string literals or dynamic variables will be concatenated.

Default The default label is derived from the primary plot in the layout. For more information, see "When Plots Share Data and a Common Axis" on page 1046.

Interaction This option is ignored if the DISPLAY= option or the DISPLAYSECONDARY= option does not display the axis label.

Note If the axis label is too long to fit along the axis, then it is truncated by default.

Tips Use the SHORTLABEL= option to specify an alternate axis label to be used whenever truncation would normally occur.

Use the ODS escape sequence to specify Unicode characters in an axis label. Here is an example that species degrees Fahrenheit in an axis label for temperature:

```
label="Temperature ((*ESC*){unicode '00B0'x}F)"
```

See "Overriding the Default Axis Label" in *SAS Graph Template Language: User's Guide*

LABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font attributes of the axis label.

Default The GraphLabelText style element.

Interaction This option is ignored if the DISPLAY= or DISPLAYSECONDARY= option does not display the axis label.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Text Options" on page 1606 for available *text-options*.

LABELFITPOLICY=AUTO | SPLITALWAYS | STACKED
specifies a policy for fitting axis labels in the available space.

AUTO
uses the short label, when specified, instead of the original label.

If the short label does not fit, then it is clipped. When no short label is specified, the original label is clipped.

SPLIT
splits the axis label at a split character only when necessary in order to make the label fit the available space.

The split character is specified by the LABELSPLITCHAR= option. The short label is not used. A split does not occur at a split character if a split is not needed at that location. If the label does not contain any of the specified split characters, then it is not split. A label that cannot be split or that does not fit the available space even after splitting might overlap the adjoining space.

SPLITALWAYS
always split the axis label at every occurrence of a split character, which is specified by the LABELSPLITCHAR= option.

If the label cannot be split, then it is clipped.

STACKED
displays the Y or Y2 axis label vertically as stacked letters.

Note: This feature applies to SAS 9.4M5 and to later releases.

Valid in ROWAXIS= only

Default AUTO

Interaction This option has effect only when LABELPOSITION= is CENTER or DATACENTER.

Note When LABELPOSITION=CENTER, the available area is the full axis, including the axis offsets. When LABELPOSITION=DATACENTER, the available area is the tick display area, excluding the axis offsets.

LABELPOSITION=CENTER | DATACENTER

specifies the position of the axis label.

CENTER

centers each row or column axis label in its axis area.

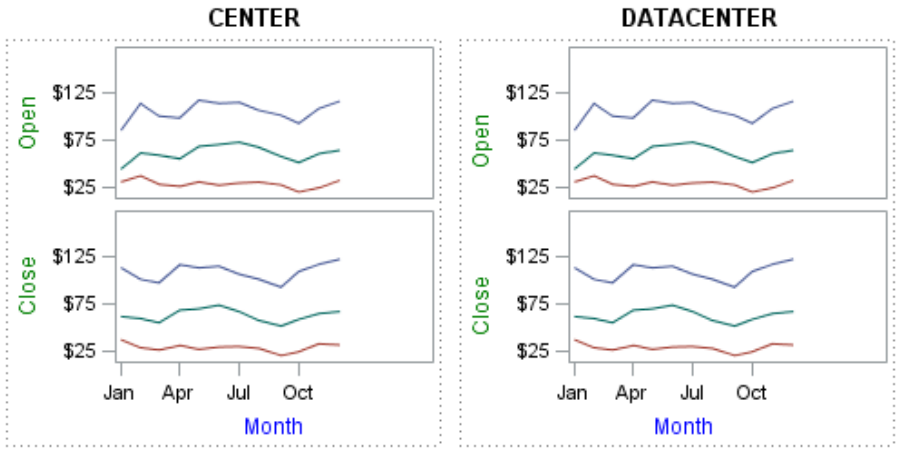
For the row Y and Y2 axes, the label is oriented vertically and is centered in the axis area (including the offsets) of its row. It is positioned to the left of the tick values for the Y axis or to the right of the axis values for the Y2 axis. For the column X and X2 axes, the label is centered in the axis area (including the offsets) of its column. It is positioned below the tick values for the X axis or above the axis values for the X2 axis.

DATACENTER

centers each row or column axis label in its axis tick display area.

For the row Y and Y2 axes, each label is oriented vertically and is centered in the axis tick display area (excluding the offsets) of its row. The labels are positioned to the left of the tick values for the Y axis or to the right of the axis values for the Y2 axis. For the column X and X2 axes, each label is centered in the axis tick display area (excluding the offsets) of its column. The labels are positioned below the tick values for the X axis or above the axis values for the X2 axis.

The following figure shows the CENTER and DATACENTER positions for row Y-axis labels Open and Close, and column X-axis label Month. An offset is applied to the maximum end of each axis for demonstration purposes.



Default CENTER

LABELSPLITCHAR="*character-list*"
specifies one or more characters on which the axis labels can be split, if needed. When multiple split characters are specified, each character in the list is treated as a separate split character unless the specified characters appear consecutively in the axis label. In that case, all of the specified split characters together are treated as a single split character.

When LABELFITPOLICY=SPLIT, if the axis label does not fit the available space, then it is split on a specified split character only if a split is needed at that point to make the label fit. In this case, a split might not occur on every split character. When LABELFITPOLICY=SPLITALWAYS, the axis label is split unconditionally on every occurrence of a split character. If the axis label does not contain any of the specified split characters, the label is not split.

"character-list"
one or more characters with no space between each character and enclosed in quotation marks.

Default A blank space

Requirements The list of characters must be enclosed in quotation marks.

Multiple characters must be specified with no space between them. For example, to specify the split characters a, b, and c, use the following option:

```
labelsplitchar="abc"
```

Interactions This option has effect only when LABELPOSITION= is CENTER or DATACENTER.

The LABELSPLITCHARDROP= option specifies whether the split characters are included in the displayed data label or are dropped.

Notes When multiple characters are specified, the order of the characters in the list is not significant.

The split characters are case sensitive.

Tip Use the LABELSPLITJUSTIFY= option to specify the justification of the strings in the axis label block.

LABELSPLITCHARDROP=TRUE | FALSE
specifies whether the split characters are included in the displayed axis labels.

TRUE
drops the split characters from the axis label display.

FALSE
includes the split characters in the axis label display.

When the label is split while LABELSPLITCHARDROP=FALSE is in effect, each split character remains as the last character in the current line. The characters that follow the split character, up to and including the next split character, are then wrapped to the next line.

Default TRUE. The split characters are dropped from the axis label.

Interactions This option has effect only when LABELPOSITION= is CENTER or DATACENTER.

The LABELSPLITCHAR= option specifies the split characters.

See "boolean " on page xii for other Boolean values that you can use.

LABELSPLITJUSTIFY=*justification*
specifies the justification of the strings that are inside the axis label blocks.

justification

CENTER
LEFT
RIGHT
specifies the justification for the X or X2 axis label.

CENTER
TOP
BOTTOM
specifies the justification for the Y or Y2 axis label.

Default CENTER

Interaction This option has effect only when LABELPOSITION= is CENTER or DATACENTER.

LINEAROPTS=(*linear-axis-options*)
specifies one or more options for a numeric interval axis. Options must be enclosed in parentheses. Each option is specified as a *name = value* pair and each pair is space separated.

Interaction This option is ignored if the axis type is not LINEAR.

See "Options for Row and Column Linear Axes Only" on page 1162 for the options that you can use for *linear-axis-options*.

LOGOPTS=(*log-axis-options*)
specifies one or more options for a log axis. Options must be enclosed in parentheses. Each option is specified as a *name = value* pair and each pair is space separated.

Interaction This option is ignored if the axis type is not LOG.

See "Options for Row and Column Log Axes Only" on page 1174 for the options that you can use for *log-axis-options*.

NAME="*string*"
assigns a name to an axis for reference in other statements. Currently, it is used only in an AXISLEGEND statement.

Restriction This option does not support variables that are created by the DYNAMIC, MVAR, and NMVAR template statements.

Interactions This option is ignored unless the axis is discrete. The axis can be discrete by default, or explicitly set to discrete with a TYPE= DISCRETE setting.

For this option to take effect, an axis legend must be enabled. To enable an axis legend, the DISCRETEOPTS= option must set the TICKVALUEFITPOLICY to either EXTRACT or EXTRACTALWAYS. In addition, an AXISLEGEND statement must be specified to generate the axis legend.

OFFSETMAX=AUTO | AUTOCOMPRESS | *number*
reserves an area at the maximum end of the axis. No tick marks are displayed in the reserved area.

AUTO
reserves just enough area to fully display markers and other graphical features near the maximum end of an axis.

AUTOCOMPRESS
applies an automatic offset that prevents axis labels and tick values from extending beyond the axis length.

number
specifies the offset as a decimal proportion of the full axis length.

Default AUTO

Range 0–1. The sum of OFFSETMAX= and OFFSETMIN= should not be more than 1.

See "Adjusting Axis Offsets" on page 1053

OFFSETMIN=AUTO | AUTOCOMPRESS | *number*
reserves an area at the minimum end of the axis. No tick marks are displayed in the reserved area.

AUTO
reserves just enough area to fully display markers and other graphical features near the maximum end of an axis.

AUTOCOMPRESS
applies an automatic offset that prevents axis labels and tick values from extending beyond the axis length.

number
specifies the offset as a decimal proportion of the full axis length.

Default AUTO

Range 0–1. The sum of OFFSETMAX= and OFFSETMIN= should not be more than 1.

See "Adjusting Axis Offsets" on page 1053.

REVERSE=TRUE | FALSE
specifies whether tick values should appear in the reverse order.

Default FALSE

See "boolean " on page xii for other Boolean values that you can use.

SHORTLABEL="*string*"
specifies an alternate axis label to display when the default label or the label specified by the LABEL= option is too long to fit the available space.

Interaction This option is ignored if the DISPLAY= option or the DISPLAYSECONDARY= option does not display the axis label.

Note If the specified label is itself too long for the axis, it is truncated in the display.

TICKVALUEATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font attributes of the axis tick values.

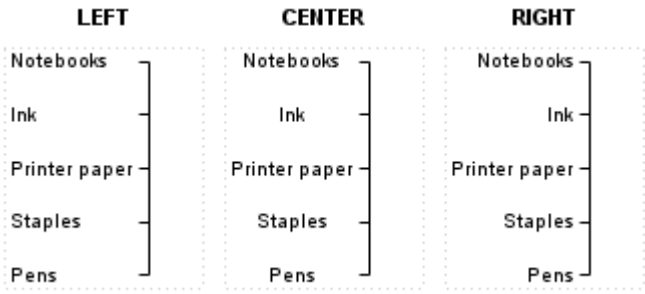
Default The GraphValueText style element.

Interaction This option is ignored if the DISPLAY= or DISPLAYSECONDARY= option does not display tick values.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Text Options" on page 1606 for available *text-options*.

TICKVALUEHALIGN=LEFT | CENTER | RIGHT
specifies the horizontal alignment for all of the tick values that are displayed on the Y and Y2 axes.

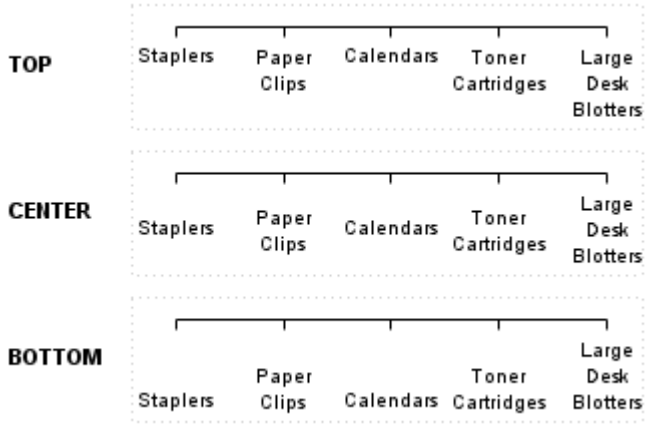


Defaults RIGHT for a Y axis

LEFT for a Y2 axis

Restriction This option is valid for the Y and Y2 axes only.

TICKVALUEVALIGN=TOP | CENTER | BOTTOM
specifies the vertical alignment for all of the tick values that are displayed on the X and X2 axes.



Defaults TOP for an X axis

BOTTOM for an X2 axis

Restriction This option is valid for the X and X2 axes only.

TIMEOPTS=(*time-axis-options*)
specifies one or more options for a time axis.

Requirements Columns associated with a time axis must be in SAS time, SAS date, or SAS datetime units and have an associated SAS time, date, or datetime format.

Options must be enclosed in parentheses. Each option is specified as a *name = value* pair and each pair is space separated.

Interaction This option is ignored if the axis type is not TIME.

See "Options for Row and Column Time Axes Only" on page 1184 for the options that you can use for *time-axis-options*.

TYPE=AUTO | DISCRETE | LINEAR | TIME | LOG
specifies the type of axis to use.

AUTO
requests that the axis type be automatically determined, based on the overlay contents.

DISCRETE
uses a DISCRETE axis if possible.

The data for discrete axes can be character or numeric. You can add a DISCRETEOPTS= option list to customize this axis type.

LINEAR
uses a LINEAR axis if possible.

You can add a LINEAROPTS= option list to customize this axis type.

TIME
uses a TIME axis if possible.

Data for this axis must be SAS time, SAS date, or SAS datetime values. You can add a TIMEOPTS= option list to customize this axis type.

LOG
uses a LOG axis if possible.

You can add a LOGOPTS= option list to customize this axis type.

Interaction If a log axis is requested and the axis data contains 0 or negative values, the axis reverts to a linear axis. This outcome can occur for the response axis of a bar chart, line chart, needle plot, or waterfall chart when a baseline intercept of 0 or less is specified. It can also occur for the response axis of a waterfall chart when an initial bar value of 0 or less is specified. To get a log response axis in those cases, set the baseline intercept or initial bar value to a positive value.

Default AUTO

Interactions If this option is set to anything other than AUTO, then plots within the layout are dropped from the display if their data types or data ranges do not match the axis type requirements. For more information, see "Plot Axis Types Must Agree on Common Axes" on page 1049.

After the axis type is determined (whether you set a specific type or AUTO is in effect), you can use only options that are supported by that axis type. For example, if TYPE=TIME, then only the general OVERLAY axis options and those available on TIMEOPTS= are supported.

Options for Row and Column Discrete Axes Only

The options that are documented in this section can be used with the DISCRETEOPTS= axis option. The following table provides a summary of the options.

Discrete Axis Option	Description
TICKDISPLAYLIST	Specifies the text that is displayed for the tick values that are defined in the TICKVALUELIST= option.
TICKTYPE	Specifies the position of the axis tick mark.
TICKVALUEFITPOLICY	Specifies a policy for avoiding tick value collision on an axis.
TICKVALUEFORMAT	Specifies how to format the values for major tick marks.

Discrete Axis Option	Description
TICKVALUELIST	Specifies the text that is to be displayed for the tick values that are defined in the TICKVALUELIST= option.
TICKVALUEROTATION	Specifies how the tick values are rotated on the X and X2 axes.
TICKVALUESPLITCHAR	Specifies a list of characters on which the tick values can be split, if needed.
TICKVALUESPLITCHARDROP	Specifies whether the split characters are included in the displayed tick values.
TICKVALUESPLITJUSTIFY	Specifies justification of the strings that are inside the tick value block.

TICKDISPLAYLIST=(*string-list*)
specifies the text that is displayed for the tick values that are defined in the TICKVALUELIST= option. The string list is a space-separated list of string values that are displayed on the axis in place of the values in the TICKVALUELIST= option. The strings map one-to-one positionally with the values that are listed in the TICKVALUELIST= option.

Default Determined by the system or by the TICKVALUELIST= option.

Requirements The list of values must be enclosed in parentheses.

Each value (character and numeric) must be enclosed in quotation marks and separated from adjacent values by a blank space.

Tip This option should be used with the TICKVALUELIST= option. The number of items in the list for this option should equal the number of items in the list for the TICKVALUELIST= option.

Example The following example specifies the axis tick values 10, 20, 30, and 40, and the tick display values A, B, C, and D:

```
tickvaluelist=("10" "20" "30" "40");
tickdisplaylist=("A" "B" "C" "D");
```

TICKTYPE=MIDPOINT | INBETWEEN
specifies the position of the axis tick marks.

MIDPOINT
places the tick marks at the midpoint value location.

INBETWEEN
places the tick marks half way between adjacent midpoint locations.

Default MIDPOINT

Restriction This option applies to discrete axes only.

Note Starting with SAS 9.4M2, when TICKTYPE=INBETWEEN, the outermost tick marks and grid lines at each end of the axis are not drawn.

TICKVALUEFITPOLICY=*policy*
specifies a policy for avoiding tick value collision on an axis. The effectiveness of a collision-avoidance policy depends on the number of tick values, their length, and the length of the axis. Which policies are valid depends on the axis on which this option is used.

For the Y and Y2 axes, the following policies are valid:

EXTRACT
displays consecutive integers along the axis instead of the actual tick values in order to represent those tick values.

In most cases, this policy is implemented if the system estimates that a collision might occur. If no collision occurs, then the actual tick values are displayed on the axis in the normal manner.

Requirement The EXTRACT policy must be used with an AXISLEGEND statement. For more information, see "Extracting Discrete Axis Tick Values into a Legend" in *SAS Graph Template Language: User's Guide*.

EXTRACTALWAYS
same as EXTRACT, except that the extraction is implemented regardless of whether collision occurs.

Requirement The EXTRACTALWAYS policy must be used with an AXISLEGEND statement. For more information, see "Extracting Discrete Axis Tick Values into a Legend" in *SAS Graph Template Language: User's Guide*.

NONE
makes no attempt to avoid collisions between tick values.

Tick values are displayed even when they collide.

SPLIT
splits the tick value at a split character, which is specified by the TICKVALUESPLITCHAR= option, only when necessary in order to make the value fit the available space.

A split does not occur at a split character if a split is not needed at that location. If the value does not contain any of the specified split characters, then the value is not split. Values that are not split or that do not fit the available space even after splitting might overlap the adjoining space.

See TICKVALUESPLITCHAR= on page 1159

SPLITALWAYS
always splits the axis tick value at every occurrence of a split character that is specified by the TICKVALUESPLITCHAR= option.

See TICKVALUESPLITCHAR= on page 1159

SPLITALWAYSTHIN
same as SPLITALWAYS, except that thinning is performed when long words do not fit the available space.

SPLITTHIN
same as SPLIT, except that thinning is performed when long words do not fit the available space.

THIN
eliminates alternate tick values.

For the X and X2 axes, the following policies are valid:

EXTRACT
displays consecutive integers along the axis instead of the actual tick values in order to represent those tick values.

In most cases, this policy is implemented if the system estimates that a collision might occur. If no collision occurs, then the actual tick values are displayed on the axis in the normal manner.

Requirement The EXTRACT policy must be used with an AXISLEGEND statement. For more information, see "Extracting Discrete Axis Tick Values into a Legend" in *SAS Graph Template Language: User's Guide*.

EXTRACTALWAYS
same as EXTRACT, except that the extraction is implemented regardless of whether collision occurs.

Requirement The EXTRACTALWAYS policy must be used with an AXISLEGEND statement. For more information, see "Extracting Discrete Axis Tick Values into a Legend" in *SAS Graph Template Language: User's Guide*.

NONE
makes no attempt to avoid collisions between tick values.

Tick values are displayed even when they collide.

ROTATE
rotates the tick values if a collision occurs.

The TICKVALUEROTATION= option specifies whether the values are rotated to a 45-degree diagonal or a 90-degree vertical position. By default, the values are rotated to a 45-degree diagonal position.

ROTATEALWAYS
rotates the tick values regardless of whether a collision occurs.

The TICKVALUEROTATION= option specifies whether the values are rotated to a 45-degree diagonal or a 90-degree vertical position. By default, the values are rotated to a 45-degree diagonal position.

ROTATEALWAYSDROP
attempts the ROTATEALWAYS policy, and then drops the tick values if collisions still occur.

ROTATETHIN
attempts the ROTATE policy, and then the THIN policy.

SPLIT
splits the tick value at a split character, which is specified by the TICKVALUESPLITCHAR= option, only when necessary in order to make the value fit the available space.

A split does not occur at a split character if a split is not needed at that location. If the value does not contain any of the specified split characters, then the value is not split. Values that are not split or that do not fit the available space even after splitting might overlap the adjoining space.

See TICKVALUESPLITCHAR= on page 1159

SPLITALWAYS
always splits the axis tick value at every occurrence of a split character that is specified by the TICKVALUESPLITCHAR= option.

See TICKVALUESPLITCHAR= on page 1159

SPLITROTATE
attempts the SPLIT policy, and then the ROTATE policy.

STACKEDALWAYS
always displays the tick values vertically as stacked letters.

Valid in COLUMNAXIS= only

STACKEDALWAYSTHIN
always displays the tick values vertically as stacked letters.

Thinning is performed when the tick values do not fit the available space.

Valid in COLUMNAXIS= only

STAGGER
alternates the tick values between two rows.

STAGGERROTATE
attempts the STAGGER policy, and then the ROTATE policy.

STAGGERTHIN
attempts the STAGGER policy, and then the THIN policy.

STAGGERTRUNCATE
attempts the STAGGER policy, and then the TRUNCATE policy.

THIN
eliminates alternate tick values.

TRUNCATE
shortens the tick labels that exceed 12 characters to 12 characters.

A trailing ellipsis indicates that a label is truncated.

Note Data labels might overlap on a crowded axis.

TRUNCATEROTATE
attempts the TRUNCATE policy, and then the ROTATE policy.

TRUNCATESTAGGER
attempts the TRUNCATE policy, and then the STAGGER policy.

TRUNCATETHIN
attempts the TRUNCATE policy, and then the THIN policy.

Defaults ROTATE for the Y and Y2 axes

THIN for the X and X2 axes

Note A note is written to the SAS log when tick value thinning occurs.

TICKVALUEFORMAT=*format*
specifies how to format the values for major tick marks.

Note: This feature applies to SAS 9.4M3 and to later releases.

Restrictions This option applies only to discrete axes.

Only character formats are supported.

Interaction This option is ignored when the axis tick values are extracted to an axis legend. See TICKVALUEFITPOLICY=EXTRACT | EXTRACTALWAYS.

Tip Use this option when you want to duplicate tick values on an axis.

TICKVALUELIST=(*string-list*)
specifies the list of tick values that are to be displayed on the axis.

string-list
a space-separated list of values, enclosed in parentheses.

You must enclose each value in the list in quotation marks.

Only the tick values that are included in the string list are displayed on the axis. The values are displayed in the order in which they are listed. The data values that are not in the list are dropped. The list can be a subset of the data values. It can also contain values that are not included in the actual data. A tick value that is not included in the data appears on the axis, but no data is represented at its tick mark.

Requirements The list of values must be enclosed in parentheses.

Each value must be enclosed in quotation marks and separated from adjacent values by a blank space.

Notes
: If the string list contains duplicate values, then the first occurrence of the duplicated value in the list is honored and the remaining instances are ignored.

  When the values specified in the list are compared with the actual data values, leading blanks are honored and trailing blanks are ignored.

Tips
: You can use this option to subset the axis values or to display the values in a specific order.

  You can use this option to display values on the axis that are not contained in the data.

Examples
: The following example specifies the axis tick values Sedan, Sports, Wagon, and SUV:

```
tickvaluelist=("Sedan" "Sports" "Wagon" "SUV")
```

  The following example specifies the axis tick values 10, 20, 30, and 40:

```
tickvaluelist=("10" "20" "30" "40")
```

TICKVALUEROTATION=DIAGONAL | DIAGONAL2 | VERTICAL
specifies how the tick values are rotated on the X and X2 axes.

DIAGONAL
rotates the tick values to a 45-degree diagonal position.

The X labels read left to right in a downward direction. The X2 labels read left to right in an upward direction.

DIAGONAL2
rotates the tick values to a –45-degree diagonal position.

The X labels read left to right in an upward direction. The X2 labels read left to right in a downward direction.

Note: This feature applies to SAS 9.4M5 and to later releases.

VERTICAL
rotates the labels to a 90-degree vertical position.

The labels are always drawn from bottom to top.

Default
: DIAGONAL

Restriction
: This option is valid for COLUMNAXIS statements only.

Interaction
: The TICKVALUEFITPOLICY= option must be set to ROTATE or ROTATEALWAYS for this option to have any effect.

TICKVALUESPLITCHAR="*character-list*"
specifies a list of characters on which the tick values can be split, if needed. When multiple characters are specified, each character in the list is treated as a separate split character unless the specified characters appear consecutively in

the tick value. In that case, all of the specified split characters together are treated as a single split character.

When a tick value collision is detected, the tick value is split at each occurrence of any of the characters in the character list or all. If all of the split characters occur consecutively in the tick value, then they are treated as a single split character. If the tick value does not contain any of the specified characters, then the value is not split.

"character-list"
one or more characters with no delimiter between each character.

Default A blank space

Requirements The list of characters must be enclosed in quotation marks.

Multiple characters must be specified with no delimiters. For example, to specify the characters a, b, and c, use the following option:

```
tickvaluesplitchar="abc"
```

Interactions This option is ignored unless option TICKVALUEFITPOLICY= is set to SPLIT, SPLITALWAYS, SPLITTHIN, or SPLITALWAYSTHIN.

The TICKVALUEFITPOLICY= option sets the policy that is used to manage the split behavior of the tick values.

The TICKVALUESPLITCHARDROP= option specifies whether the split characters are displayed or dropped from the display.

Notes When multiple characters are specified, the order of characters in the list is not significant.

The split characters are case sensitive.

Tips Use the TICKVALUESPLITJUSTIFY= option to specify the justification of the strings in the tick value block.

For the X and X2 axis tick values, use the TICKVALUEVALIGN= option to specify the vertical alignment of the tick values.

For the Y and Y2 axis tick values, use the TICKVALUEHALIGN= option to specify the horizontal alignment of the tick values.

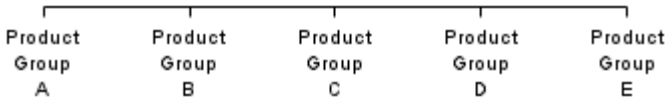
Example The following example specifies a blank space, a comma, and an underscore as split characters:

```
tickvaluesplitchar=" ,_"
```

TICKVALUESPLITCHARDROP=TRUE | FALSE
specifies whether the split characters should be included in the displayed tick values. The split characters are specified by the TICKVALUESPLITCHAR= option.

TRUE
drops the split characters from the tick value display.

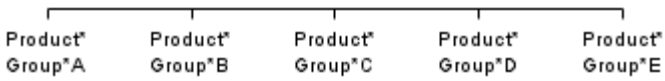
The following figure shows an example in which TICKVALUESPLITCHARDROP=TRUE and three-word, asterisk-delimited tick values are split on the asterisk character by using the SPLITALWAYS policy.



Notice that the asterisk delimiter is not displayed.

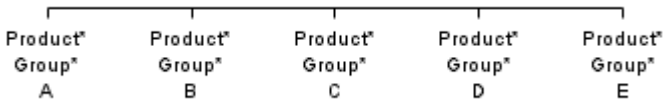
FALSE
includes the split characters in the tick value display.

The fit policy determines how the characters are displayed. If the display policy is SPLIT or SPLITTHIN and TICKVALUESPLITCHARDROP=FALSE, then each tick value is split at a split character only where a split is necessary in order to make the value fit the available space. A split might not occur at every split character in the tick value. At each split point, the split character remains as the last character in the current line. The characters that follow the split character, up to and including the split character at the next split point, are then wrapped to the following line. This process repeats until the entire data tick value is displayed. The following figure shows an example in which TICKVALUESPLITCHARDROP=FALSE and three-word, asterisk-delimited tick values are split on the asterisk character by using the SPLIT policy.



Notice that a split occurs on the first asterisk and not at the second. In this case, a split is not needed at the second asterisk.

If the fit policy is SPLITALWAYS or SPLITALWAYSTHIN, and TICKVALUESPLITCHARDROP=FALSE, then each tick value is split at every instance of a split character in the value regardless of whether a split is actually needed. Each split character remains as the last character in the current line. The characters that follow each split character, up to and including the next split character, are then wrapped to the next line. The following figure shows an example in which TICKVALUESPLITCHARDROP=FALSE and three-word, asterisk-delimited tick values are split on the asterisk character by using the SPLITALWAYS policy.



Notice that a split occurs after each asterisk and each asterisk appears at the end of the line. In this case, three lines are displayed.

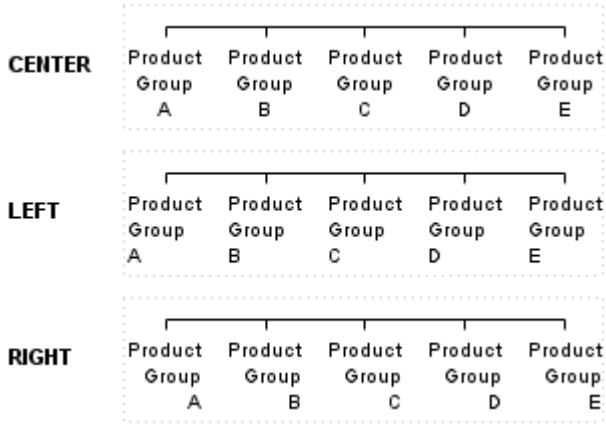
Default TRUE

Interactions The TICKVALUESPLITCHAR= option specifies the split character or characters.

This option is ignored unless option TICKVALUEFITPOLICY= is set to SPLIT, SPLITALWAYS, SPLITTHIN, or SPLITALWAYSTHIN.

See "boolean " on page xii for other Boolean values that you can use.

TICKVALUESPLITJUSTIFY=CENTER | LEFT | RIGHT
specifies justification of the strings that are inside the tick value block. The justification is relative to an individual tick value's display area and does not affect the display of tick values that are not split.



Defaults CENTER for an X or X2 axis

RIGHT for a Y axis

LEFT for a Y2 axis

Interaction This option is ignored unless option TICKVALUEFITPOLICY= is set to SPLIT, SPLITALWAYS, SPLITTHIN, or SPLITALWAYSTHIN.

Options for Row and Column Linear Axes Only

The options that are documented in this section can be used with the LINEAROPTS= axis option. The following table provides a summary of the options.

Linear Axis Option	Description
INTEGER	Specifies that evenly spaced integer values are used for tick marks.
MINORGRID	Specifies whether grid lines are displayed at the minor tick values.
MINORGRIDATTRS	Specifies the attributes of the minor grid lines.

Linear Axis Option	Description
MINORTICKCOUNT	Specifies the number of minor ticks that are displayed on the axis.
MINORTICKS	Specifies whether the minor tick marks are displayed on the axis.
THRESHOLDMAX	Specifies a bias for including one more tick mark at the maximum end of the axis.
THRESHOLDMIN	Specifies a bias for including one more tick mark at the minimum end of the axis.
TICKDISPLAYLIST	Specifies the text that is displayed for the tick values that are defined in the TICKVALUELIST= option.
TICKVALUEFITPOLICY	Specifies a policy for avoiding tick value collision on an X or X2 axis. This option is not available in the ROWAXIS statement.
TICKVALUEFORMAT	Specifies how to format the values for major tick marks.
TICKVALUELIST	Specifies the order of the tick values for a linear axis as list.
TICKVALUEPRIORITY	Specifies whether an axis tick specification can extend the axis data range.
TICKVALUEROTATION	Specifies how the tick values are rotated on the X and X2 axes.
TICKVALUESEQUENCE	Specifies the tick values for a linear axis by start, end, and increment.
VIEWMAX	Specifies the maximum data value to include in the display.
VIEWMIN	Specifies the minimum data value to include in the display.

INTEGER=TRUE | FALSE

specifies that evenly spaced integer values are used for tick marks.

Default FALSE

Interactions This option is overridden by the TICKVALUELIST= or TICKVALUESEQUENCE= option.

This option overrides the MAXDECIMALS= and PREFERREDDECIMALS= suboptions of the TICKVALUEFORMAT= option.

INTEGER=TRUE is ignored for the X or X2 axis when a histogram plot is the primary plot and BINAXIS=TRUE is specified in the HISTOGRAM or HISTOGRAMPARM statement.

Note This option is ignored when the data exceeds the limits of integer values.

See "boolean " on page xii for other Boolean values that you can use.

MINORGRID=TRUE | FALSE
specifies whether grid lines are displayed at the minor tick marks.

Defaults FALSE in SAS 9.4M1 and earlier releases.

The GraphMinorGridLines:DisplayOpts style reference starting with SAS 9.4M2. If attribute DisplayOpts is not defined in the active style, then FALSE is the default value.

Interaction This option is ignored if the GRIDDISPLAY= option does not display the grid lines.

Tips The GRIDATTRS= option does not affect the appearance of the minor grid lines. To control the minor grid line appearance, use the MINORGRIDATTRS= option.

Use the MINORTICKS= option to display the minor tick marks on the axis.

See "boolean " on page xii for other Boolean values that you can use.

MINORGRIDATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the attributes of the minor grid lines. This option does not affect the major grid lines.

The following figure shows the minor grid lines set to light blue, dotted lines on a linear axis. (See the example.)

The following figure shows the minor grid lines set to light blue, dotted lines on a base-10 log axis. (See the example.)

The following figure shows the minor grid lines set to light blue, dotted lines on a time axis. (See the example.)

Defaults The GraphGridLines style element is used starting with SAS 9.4.

The GraphMinorGridLines style element is used starting with SAS 9.4M2.

Interaction This option is ignored when MINORTICKS=FALSE.

Note When *style-element* is specified, only the style element's ContrastColor, LineStyle, and LineThickness attributes are used.

Tip Use the GRIDATTRS= option to control the appearance of the major grid lines.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a style element.

"Line Options" on page 1602 for available line options.

Example Here is an example that specifies light blue, dotted lines for the minor grid.

```
minorgridattrs=(color=lightblue pattern=dot);
```

MINORTICKCOUNT=*positive-integer*

specifies the number of minor ticks that are displayed on the axis.

Defaults Four ticks with five intervals in SAS 9.4M1 and earlier releases.

One tick with two intervals starting with SAS 9.4M2.

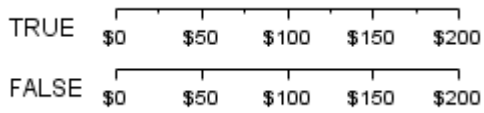
Interactions The DISPLAY= or DISPLAYSECONDARY= option specification must include TICKS for this option to have any effect.

The MINORTICKS= option must specify TRUE for this option to have any effect.

Tip To display *n* intervals between major ticks, use MINORTICKCOUNT=*n*-1.

MINORTICKS=TRUE | FALSE

specifies whether minor ticks are displayed. When MINORTICKS=TRUE, the minor tick marks are displayed on the axis as shown in the following figure.



Default FALSE

Interaction If MINORTICKS=TRUE is specified and TICKVALUELIST= specifies nonuniform tick values such as 3, 5, 11, and 23, then MINORTICK=TRUE is ignored. To display minor tick marks in that case, specify uniform tick values such as 0, 10, 20, and 30 in the TICKVALUELIST= option.

Tip Use the MINORGRID= option to display grid lines at the minor tick values.

See "boolean " on page xii for other Boolean values that you can use.

THRESHOLDMAX=*number*

specifies a bias for including one more tick mark at the maximum end of the axis.

Default 0.30

Range 0–1

Restriction This option applies to linear axes only.

Interaction This option is ignored if the TICKVALUELIST= or TICKVALUESEQUENCE= option is used.

Tips If the threshold is set to 0, the potential tick mark is never displayed. If the threshold is set to 1, then the tick mark is always displayed.

Specifying THRESHOLDMIN=0 and THRESHOLDMAX=0 prevents the tick marks from extending beyond the data range.

Specifying THRESHOLDMIN=1 and THRESHOLDMAX=1 ensures that the data range is bounded by tick marks.

For the minimum axis length, set the THRESHOLDMIN= and THRESHOLDMAX= options to 0.

See "Adjusting Axis Thresholds" on page 1052

THRESHOLDMIN=*number*

specifies a bias for including one more tick mark at the minimum end of the axis.

Default 0.30

Range 0–1

Restriction This option applies to linear axes only.

Interaction This option is ignored if the TICKVALUELIST= or TICKVALUESEQUENCE= option is used.

Tips If the threshold is set to 0, the potential tick mark is never displayed. If the threshold is set to 1, then the tick mark is always displayed.

Specifying THRESHOLDMIN=0 and THRESHOLDMAX=0 prevents the tick marks from extending beyond the data range.

Specifying THRESHOLDMIN=1 and THRESHOLDMAX=1 ensures that the data range is bounded by tick marks.

For the minimum axis length, set the THRESHOLDMIN= and THRESHOLDMAX= options to 0.

See "Adjusting Axis Thresholds" on page 1052

TICKDISPLAYLIST=(*string-list*)
specifies the text that is displayed for the tick values that are defined in the TICKVALUELIST= option. The string list is a space-separated list of string values that are displayed on the axis in place of the values in the TICKVALUELIST= option. The strings map one-to-one positionally with the values that are listed in the TICKVALUELIST= option.

Default The display of tick values is controlled by the TICKVALUEFORMAT= option.

Requirements The list of values must be enclosed in parentheses.

Each value (character and numeric) must be enclosed in quotation marks and separated from adjacent values by a blank space.

Interaction When this option is specified, the TICKVALUEFORMAT= option is ignored.

Tip This option should be used with the TICKVALUELIST= option. The number of items in the list for this option should equal the number of items in the list for the TICKVALUELIST= option.

TICKVALUEFITPOLICY=*policy*
specifies a policy for avoiding tick value collision on an axis. The effectiveness of a collision-avoidance policy depends on the number of tick values, their length, and the length of the axis. Which policies are valid depends on the axis on which this option is used.

For the Y and Y2 axes, the following policies are valid:

NONE
makes no attempt to avoid collisions between tick values.

Tick values are displayed even when they collide.

THIN
eliminates alternate tick values.

For the X and X2 axes, the following policies are valid:

NONE
makes no attempt to avoid collisions between tick values.

Tick values are displayed even when they collide.

ROTATE
rotates the tick values if a collision occurs.

The TICKVALUEROTATION= option specifies whether the values are rotated to a 45-degree diagonal or a 90-degree vertical position. By default, the values are rotated to a 45-degree diagonal position.

ROTATEALWAYS
rotates the tick values regardless of whether a collision occurs.

The TICKVALUEROTATION= option specifies whether the values are rotated to a 45-degree diagonal or a 90-degree vertical position. By default, the values are rotated to a 45-degree diagonal position.

ROTATETHIN
attempts the ROTATE policy, and then the THIN policy.

STAGGER
alternates the tick values between two rows.

STAGGERROTATE
attempts the STAGGER policy, and then the ROTATE policy.

STAGGERTHIN
attempts the STAGGER policy, and then the THIN policy.

THIN
eliminates alternate tick values.

Default THIN

Note A note is written to the SAS log when tick value thinning occurs.

TICKVALUEFORMAT=(*format-options*) | DATA | *format*
specifies how to format the values for major tick marks.

(*format-options*)
specifies one or more formatting options for major tick values.

Together, these options provide parameters for determining an optimal format (*w.d*, E*w*., BEST*w*.) for displaying major tick values.

MAXWIDTH=*integer*
specifies the maximum width for displayed tick values.

Values might be rounded or converted to E notation to fit into this width.

Default 8

MAXDECIMALS=*integer*
specifies the maximum number of decimals for displayed tick values.

Values might be rounded or converted to E notation to fit into this width.

Default 6

Note The MAXWIDTH= option value should be greater than the MAXDECIMALS= option value.

PREFERREDDECIMALS=*integer*
specifies the number of decimal places that you want to display for most values.

The actual number might vary based on other constraints.

Default 2

EXTRACTSCALE=TRUE | FALSE
specifies whether to extract a scale factor from the tick values and use it to reduce the tick value width.

The scale can be a named scale or a scientific-notation scale. The EXTRACTSCALETYPE= option specifies the scale type. The scale that is used is appended to the axis label, as shown in the following example.

```
Total Sales (millions)
```

For long axis labels, if the scale does not fit the available space, then the label is truncated, and the scale is appended to the truncated label. Ellipses indicate that the label was truncated, as shown in the following example.

```
Total Sales for the Fourth Quarter Of ... (millions)
```

In extreme cases in which the scale does not fit even with truncation, the entire axis is dropped.

Default FALSE

Restriction The scale that is extracted by the EXTRACTSCALE= option is derived from the English locale for all locales.

Interactions The scale type is determined by the EXTRACTSCALETYPE= option.

If the axis label is not displayed, then the EXTRACTSCALE=TRUE option is ignored.

Note When EXTRACTSCALE=TRUE and a scale is extracted, the tick values are formatted to provide the best fit on the axis. In that case, the tick value format might differ from the data format even when a named format is applied to the data values.

See “boolean ” on page xii for other Boolean values that you can use.

EXTRACTSCALETYPE=DEFAULT | SCIENTIFIC
specifies whether to extract a named scale or a scientific-notation scale.

DEFAULT
extracts a named scale.

A named scale can be millions, billions, or trillions for values of 999 trillion or less, or a multiple of 10 (denoted as 10^*n*) for values over 999 trillion. For large tick values, the scale factor is set to ensure that the absolute value of the largest value is greater than 1. For small fractional tick values, the scale factor is set to ensure that the absolute value of the smallest value is greater than 1. The scale can be millionth, billionth, or trillionth for values of 1 trillionth or more, or a multiple of 1/10 (10^–*n*) for values less than 1 trillionth.

SCIENTIFIC
extracts a scientific-notation scale.

A scientific-notation scale is a multiple of 10 expressed as 10^*n* for values greater than 1, or a multiple of 1/10 expressed as 10^–*n* for values less than 1.

Default DEFAULT

Restriction The scale is derived from the English locale for all locales.

DATA
uses the format that has been assigned to the column that is contributing to the axis (or BEST6 if no format is assigned) in order to control the formatting of the major tick values.

format
specifies a format to apply to the major tick values.

Restriction GTL currently honors most, but not every, SAS format. For details, see Appendix 4, "Format Support in ODS Graphics," on page 1621 .

Note If you specify a format that significantly reduces precision, because of tick-value rounding, the plot data elements might not align properly with the axis tick values. In that case, specify a tick-value format with a higher precision.

Default (MAXWIDTH=8, MAXDECIMALS=6, PREFERREDDECIMALS=2, EXTRACTSCALE=FALSE, EXTRACTSCALETYPE=DEFAULT)

Interaction This option is ignored when the TICKDISPLAYLIST= option is specified.

TICKVALUELIST=(*numeric-list*)
specifies the tick values for a linear axis as a list.

Default An internal algorithm determines the tick marks, based on the actual axis data range or the data range established by the VIEWMIN= and VIEWMAX= options. By default, when this option is used, the only tick values that appear are the tick values in *numeric-list* that fall within the explicit data range (set by VIEWMIN= and VIEWMAX=) or the implicit data range (set by the actual data minimum and data maximum).

Restriction This option applies to linear axes only.

Requirement The tick values must be specified as a space-separated list of numeric values, enclosed in parentheses.

Interactions This option overrides the INTEGER= option.

This option is ignored if the TICKVALUESEQUENCE= option is specified, or if the DISPLAY= option or the DISPLAYSECONDARY= option does not display tick values.

The VIEWMIN= and VIEWMAX= options alter the axis data range. If the VIEWMIN= option is set to the minimum tick list value and the VIEWMAX= option is set to the maximum tick list value, then all ticks in the tick list are displayed. This might result in some data not being displayed. For example, data might not be displayed when the VIEWMIN= value is greater than the actual data minimum, or when the VIEWMAX= value is less than actual data maximum.

If TICKVALUEPRIORITY= TRUE, then the VIEWMIN= and VIEWMAX= options are ignored if they are fully enclosed by the *numeric-list*. The tick *numeric-list* can extend the implicit data range of the axis, but cannot reduce it.

If MINORTICKS=TRUE is specified and TICKVALUELIST= specifies nonuniform tick values such as 3, 5, 11, and 23, then MINORTICK=TRUE is ignored. To display minor tick marks in that case, specify uniform tick values such as 0, 10, 20, and 30 in the TICKVALUELIST= option.

Tip The values in the list are formatted according to the setting for the TICKVALUEFORMAT= option.

TICKVALUEPRIORITY=TRUE | FALSE

specifies whether an axis tick specification (TICKVALUELIST= or TICKVALUESEQUENCE=) can extend the axis data range.

TRUE

extends the axis data range (but does not reduce it) to include the minimum and maximum values that are specified by either the TICKVALUELIST= or TICKVALUESEQUENCE= option.

If the minimum and maximum of the user-specified values are within the data range, this option has no effect.

FALSE

displays only the tick values that are specified by the TICKVALUELIST= option that fall within the explicit data range set by the VIEWMIN= and VIEWMAX= options or by the implicit data range set by the actual data minimum and data maximum.

Default FALSE

Restriction This option applies to linear axes only.

Interactions When this option is set to TRUE, the VIEWMIN= and VIEWMAX= options are ignored.

This option is ignored if the TICKVALUELIST= or TICKVALUESEQUENCE= option is not specified.

This option is ignored if the DISPLAY= option or the DISPLAYSECONDARY= option does not display the tick values.

Note If the minimum and maximum of the specified values are within the data range, then this option has no effect.

See "boolean " on page xii for other Boolean values that you can use.

TICKVALUEROTATION=DIAGONAL | DIAGONAL2 | VERTICAL
specifies how the tick values are rotated on the X and X2 axes.

DIAGONAL
rotates the tick values to a 45-degree diagonal position.

The X labels read left to right in a downward direction. The X2 labels read left to right in an upward direction.

DIAGONAL2
rotates the tick values to a –45-degree diagonal position.

The X labels read left to right in an upward direction. The X2 labels read left to right in a downward direction.

Note: This feature applies to SAS 9.4M5 and to later releases.

VERTICAL
rotates the labels to a 90-degree vertical position.

The labels are always drawn from bottom to top.

Default DIAGONAL

Restriction This option is valid for COLUMNAXIS statements only.

Interaction The TICKVALUEFITPOLICY= option must be set to ROTATE or ROTATEALWAYS for this option to have any effect.

TICKVALUESEQUENCE=(START=*number* END=*number* INCREMENT=*number*)
specifies the tick values by start, end, and increment.

START=*number*
specifies the value for the first tick mark.

END=*number*
specifies the value for the last tick mark.

INCREMENT=*number*
specifies the increment for intermediate tick marks between the first and last tick marks.

The END value always controls the last tick mark. The interval between the last tick mark and the previous tick mark might not necessarily be the INCREMENT value.

Default An internal algorithm determines the tick marks, based on the actual axis data range or the data range established by the VIEWMIN= and VIEWMAX= options. By default, when this option is used, the only tick values that appear are those that fall within the explicit data range (set by VIEWMIN= and VIEWMAX=) or the implicit data range (set by the actual data minimum and data maximum).

Interactions This option overrides the INTEGER= option.

The VIEWMIN= and VIEWMAX= options alter the axis data range. If the VIEWMIN= option is set to the START= option value and the VIEWMAX= option is set to the END= option value, then all ticks in the tick sequence are displayed.

If TICKVALUEPRIORITY= TRUE, then the tick sequence might extend the explicit data range of the axis, but never reduce it.

This option is ignored if the DISPLAY= option or the DISPLAYSECONDARY= option does not display tick marks.

Tip The values in the sequence are formatted according to the setting for the TICKVALUEFORMAT= option.

See TICKVALUELIST= option as an alternative for customizing tick marks.

VIEWMAX=*number*

specifies the maximum data value to include in the display. The value might be adjusted by the threshold calculation.

Default The maximum value in the data for the specified axis.

Requirements If VIEWMIN= is also specified, VIEWMAX= must be greater than VIEWMIN=. Otherwise, the default values are used for VIEWMIN= and VIEWMAX=.

If VIEWMIN= is not specified, VIEWMAX= must be less than the data maximum. Otherwise, a blank graph is drawn.

Interactions This option does not determine the maximum axis tick value that is displayed. The THRESHOLDMAX= value is used to determine the maximum tick value.

This option is ignored when TICKVALUEPRIORITY= TRUE.

Notes Setting a VIEWMAX= or VIEWMIN= value does not alter the original data or any calculations on it.

The maximum axis tick value might differ from the VIEWMAX= value. The VIEWMIN= and VIEWMAX= values, and additional

factors such as thresholds and the tick values computed by the plot statement, are used to determine the axis tick values.

Tip To display the VIEWMAX= value as the maximum tick value, use the TICKVALUELIST= option.

See "Adjusting the Axis View" on page 1051

VIEWMIN=*number*
specifies the minimum data value to include in the display. The value might be adjusted by the threshold calculation.

Default The minimum value in the data for the specified axis.

Requirements If VIEWMAX= is also specified, VIEWMIN= must be less than VIEWMAX=. Otherwise, the default values are used for VIEWMAX= and VIEWMIN=.

If VIEWMAX= is not specified, VIEWMIN= must be greater than the data minimum. Otherwise, a blank graph is drawn.

Interactions This option does not determine the minimum axis tick value that is displayed. The THRESHOLDMIN= value is used to determine the minimum tick value.

This option is ignored when TICKVALUEPRIORITY= TRUE.

Notes Setting a VIEWMAX= or VIEWMIN= value does not alter the original data or any calculations on it.

The minimum axis tick value might differ from the VIEWMIN= value. The VIEWMIN= and VIEWMAX= values, and additional factors such as thresholds and the tick values computed by the plot statement, are used to determine the axis tick values.

Tip To display the VIEWMIN= value as the minimum tick value, use the TICKVALUELIST= option.

See "Adjusting the Axis View" on page 1051

Options for Row and Column Log Axes Only

The options that are described in this section can be used with the LOGOPTS= axis option. The following table provides a summary of the options.

Log Axis Option	Description
BASE	Specifies the base of the logarithmic scale for the axis values.
MINORGRID	Specifies whether grid lines are displayed at the minor tick marks.

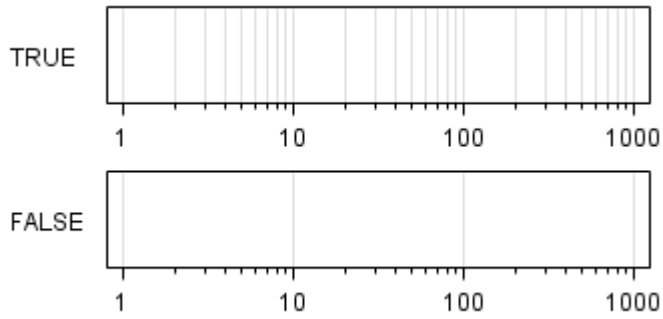
Log Axis Option	Description
MINORGRIDATTRS	Specifies the attributes of the minor grid lines.
MINORTICKCOUNT	Specifies the number of minor ticks that are displayed on the axis.
MINORTICKS	Specifies whether minor ticks are displayed.
TICKINTERVALSTYLE	Specifies how to scale and format the values for major tick marks.
TICKVALUEFORMAT=	Specifies how to format the values for major tick marks.
TICKVALUELIST	Specifies the tick values for a log axis as a space-separated list.
TICKVALUEPRIORITY	Specifies whether the TICKVALUELIST specification can extend the axis data range.
VALUESTYPE	Specifies the scale that the system uses when interpreting the TICKVALUELIST=, VIEWMAX=, and VIEWMIN= option values.
VIEWMAX	Specifies the maximum data value to include in the display.
VIEWMIN	Specifies the minimum data value to include in the display.

BASE=10 | 2 | E
specifies the base of the logarithmic scale for the axis values.

Default 10

Restriction This option applies to log axes only.

MINORGRID=TRUE | FALSE
specifies whether grid lines are displayed at the minor tick marks.



Defaults FALSE in SAS 9.4M1 and earlier releases.

The GraphMinorGridLines:DisplayOpts style reference starting with SAS 9.4M2. If attribute DisplayOpts is not defined in the active style, then FALSE is the default value.

Interaction This option is ignored if the GRIDDISPLAY= option does not display the grid lines.

Tips The GRIDATTRS= option does not affect the appearance of the minor grid lines. To control the minor grid line appearance, use the MINORGRIDATTRS= option.

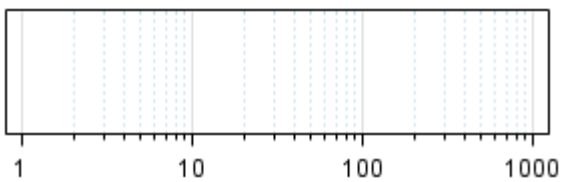
Use the MINORTICKS= option to display the minor tick marks on the axis.

See "boolean " on page xii for other Boolean values that you can use.

MINORGRIDATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the attributes of the minor grid lines. This option does not affect the major grid lines.

The following figure shows the minor grid lines set to light blue, dotted lines on a linear axis. (See the example.)

The following figure shows the minor grid lines set to light blue, dotted lines on a base-10 log axis. (See the example.)



The following figure shows the minor grid lines set to light blue, dotted lines on a time axis. (See the example.)

Defaults The GraphGridLines style element is used starting with SAS 9.4.

The GraphMinorGridLines style element is used starting with SAS 9.4M2.

Interaction This option is ignored when MINORTICKS=FALSE.

Note When *style-element* is specified, only the style element's ContrastColor, LineStyle, and LineThickness attributes are used.

Tip Use the GRIDATTRS= option to control the appearance of the major grid lines.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a style element.

"Line Options" on page 1602 for available line options.

Example Here is an example that specifies light blue, dotted lines for the minor grid.

```
minorgridattrs=(color=lightblue pattern=dot);
```

MINORTICKCOUNT=*positive-integer*

specifies the number of minor ticks that are displayed on the axis.

Default Eight ticks with nine intervals (BASE=10 and TICKINTERVALSTYLE= is LOGEXPAND or LOGEXPONENT.).

Restriction Minor ticks can be displayed only when BASE=10 and TICKINTERVALSTYLE= is LOGEXPAND or LOGEXPONENT.

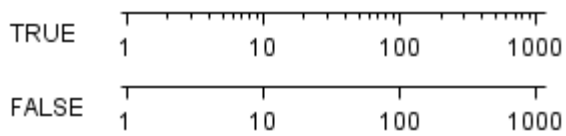
Interactions The DISPLAY= or DISPLAYSECONDARY= option specification must include TICKS for this option to have any effect.

The MINORTICKS= option must specify TRUE for this option to have any effect.

Tip To display *n* intervals between major ticks, use MINORTICKCOUNT=*n*-1.

MINORTICKS=TRUE | FALSE

specifies whether minor ticks are displayed. When MINORTICKS=TRUE, the minor tick marks are displayed on the axis as shown in the following figure.



Default FALSE

Restriction Minor ticks can be displayed only when BASE=10 and TICKINTERVALSTYLE= is LOGEXPAND or LOGEXPONENT.

Requirement If you set this option to TRUE, you must also specify a value for MINORTICKCOUNT=. Otherwise, minor tick marks do not appear on the log axis.

Interaction If MINORTICKS=TRUE is specified and TICKVALUELIST= specifies nonuniform log tick values such as 10, 20, 30, and 40, then MINORTICK=TRUE is ignored. To display minor tick marks in that case, specify uniform log tick values such as 1, 10, 100, and 1000 in the TICKVALUELIST= option.

Tip Use the MINORGRID= option to display grid lines at the minor tick values.

See "boolean " on page xii for other Boolean values that you can use.

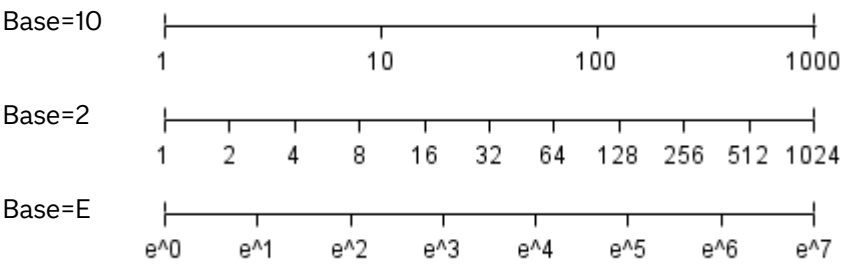
TICKINTERVALSTYLE=AUTO | LOGEXPAND | LOGEXPONENT | LINEAR
specifies how to scale and format the values for major tick marks.

AUTO
selects a LOGEXPAND, LOGEXPONENT, or LINEAR representation automatically based on the range of the data.

When the data range is small (within an order of magnitude), a LINEAR representation is typically used. Data ranges that encompass several orders of magnitude typically use the LOGEXPAND or LOGEXPONENT representation.

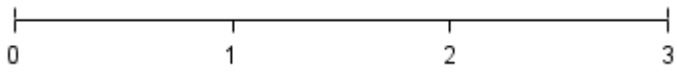
LOGEXPAND
places the major tick marks at uniform intervals at integer powers of the base.

The tick values are expanded as follows:



LOGEXPONENT
places the major tick marks at uniform intervals at integer powers of the base.

The tick values are only the integer exponents for all bases.



LINEAR
places the major tick marks at non-uniform intervals that cover the range of the data.

Default AUTO

Restrictions This option applies to log axes only.

For LOGEXPONENT, formats on data columns contributing to the axis are ignored. For LOGEXPAND, formats on data columns contributing to the axis are ignored, although any "named format" on the column is retained. For LINEAR, ticks values are automatically formatted when the column format is not assigned or one of *w.d*, E*w*., or BEST*w*. Other formats (SAS defined or user-defined) are used if specified.

GTL currently honors most but not every SAS format. For details, see Appendix 4, "Format Support in ODS Graphics," on page 1621.

Note When BASE=10 and LOGEXPAND or LOGEXPONENT is used, an intermediate tick is added whenever the axis data range is less than or equal to 1.5 powers of 10.

Tip If you use TICKINTERVALSTYLE=LOGEXPONENT, then you might want to include information in the axis label about which base is used.

TICKVALUEFORMAT=DATA | *format*
specifies how to format the values for major tick marks.

Note: This feature applies to SAS 9.4M3 and to later releases.

DATA
uses the format that has been assigned to the column that is contributing to the axis (or BEST6 if no format is assigned) in order to control the formatting of the major tick values.

format
specifies a format to apply to the major tick values.

Restriction GTL currently honors most, but not every, SAS format. For details, see Appendix 4, "Format Support in ODS Graphics," on page 1621.

Restriction This option applies to log axes only.

Interactions This option is ignored when TICKINTERVALSTYLE=LOGEXPONENT.

When TICKINTERVALSTYLE=LOGEXPAND, this option is honored for the base 10 and base 2 logarithmic scales, and is ignored for the base E scale.

When TICKINTERVALSTYLE=LINEAR, this option is honored for the base 10, base 2, and base E logarithmic scales.

See BASE=

TICKINTERVALSTYLE=

TICKVALUELIST=(*numeric-list*)
specifies the tick values for a linear axis as a list.

Default
Only the tick values specified in the list that fall within the explicit data range set by the VIEWMIN= and VIEWMAX= options or by the implicit data range set by the actual data minimum and data maximum are displayed. An internal algorithm determines the tick marks.

Requirements
The tick values must be specified as a space-separated list of numeric values, enclosed in parentheses.

The values that you specify must be appropriate for the VALUESTYPE= specification. Otherwise, unexpected results might occur. If VALUESTYPE=EXPANDED is in effect (default), specify increments of the log base power such as 0.1, 1, 10, 100, and so on, on a base 10 log axis, for example. If VALUESTYPE=EXPONENT is in effect, specify integer increments of the log base power exponent such as 1, 2, 3, and so on.

Interactions
The VALUESTYPE= option determines how the values in the list are interpreted.

The VIEWMIN= and VIEWMAX= options alter the axis data range. If the VIEWMIN= option is set to the minimum tick list value and the VIEWMAX= option is set to the maximum tick list value, then all ticks in the tick list are displayed. This might result in some data not being displayed. For example, data might not be displayed when the VIEWMIN= value is greater than the actual data minimum, or when the VIEWMAX= value is less than actual data maximum.

If the VIEWMIN= value is greater than the actual data minimum or the VIEWMAX= value is less than actual data maximum, some data might not be displayed.

This option is ignored if the DISPLAY= or the DISPLAYSECONDARY= option does not display the tick values.

If MINORTICKS=TRUE is specified and TICKVALUELIST= specifies nonuniform log tick values such as 10, 20, 30, and 40, then MINORTICK=TRUE is ignored. To display minor tick marks in that case, specify uniform log tick values such as 1, 10, 100, and 1000 in the TICKVALUELIST= option.

See
TICKINTERVALSTYLE= for specifying the scale and format of the major tick values

TICKVALUEPRIORITY= for controlling the behavior of the TICKVALUELIST= option

BASE= for specifying the log base

TICKVALUEPRIORITY=TRUE | FALSE
specifies whether the TICKVALUELIST= specification can extend the axis data range.

TRUE
extends the axis data range (but does not reduce it) to include the minimum and maximum values that are specified by the TICKVALUELIST= option.

If the minimum and maximum of the user-specified values are within the data range, this option has no effect.

FALSE
displays only the tick values that are specified by the TICKVALUELIST= option that fall within the explicit data range set by the VIEWMIN= and VIEWMAX= options or by the implicit data range set by the actual data minimum and data maximum.

Default FALSE

Interactions When this option is set to TRUE, the VIEWMIN= and VIEWMAX= options are ignored.

This option is ignored if the DISPLAY= option or the DISPLAYSECONDARY= option does not display the tick values.

This option is ignored if the TICKVALUELIST= option is not specified.

Note If the minimum and maximum of the specified values are within the data range, then this option has no effect.

See "boolean " on page xii for other Boolean values that you can use.

VALUESTYPE=EXPANDED | EXPONENT
specifies the scale that the system uses when interpreting the TICKVALUELIST=, VIEWMAX=, and VIEWMIN= option values. Use this option to choose your preferred way of specifying log-axis values.

EXPANDED
values are interpreted as powers of the base such as 0.1, 1, 10, 100, and so on, for base 10, for example.

EXPONENT
values are interpreted as integer exponents of the base such as 1, 2, 3, and so on, for base 10, base 2, and base E.

Default EXPANDED

Note This option does not change the style of the tick values that are displayed on the axis. It changes only how the VIEWMIN=, VIEWMAX=, and TICKVALUELIST= option values are interpreted by the system.

Tip This option is particularly useful when BASE=E.

Examples The following example specifies VIEWMIN= and VIEWMAX= as exponent values instead of as expanded values on an expanded Base

10 log axis. This results in X-axis tick values of 10, 100, 1000, 10000, and 100000.

```
xaxisopts=(type=log
   logopts=(base=10
      tickintervalstyle=logexpand
      valuestype=exponent
      viewmin=1 viewmax=5));
```

The following example specifies TICKVALUELIST= as a list of expanded values instead of exponent values on an exponent Base 10 log axis. This results in X-axis tick values of 1, 2, 3, 4, and 5.

```
xaxisopts=(type=log
   logopts=(base=10
      tickintervalstyle=logexponent
      tickvaluepriority=true
      valuestype=expanded
      tickvaluelist=(10 100 1000 10000 100000));
```

VIEWMAX=*number*

specifies the maximum data value to include in the display.

Default: The maximum value in the data for the specified axis.

Requirements: If VIEWMIN= is also specified, VIEWMAX= must be greater than VIEWMIN=. Otherwise, the default values are used for VIEWMIN= and VIEWMAX=.

If VIEWMIN= is not specified, VIEWMAX= must be less than the data maximum. Otherwise, a blank graph is drawn.

The value that you specify must be appropriate for the VALUESTYPE= specification and the log base. Otherwise, unexpected results might occur. If VALUESTYPE=EXPANDED is in effect (default), specify an increment of the log base power such as 0.1, 1, 10, 100, and so on, on a base 10 log axis, for example. If VALUESTYPE=EXPONENT is in effect, specify an integer increment of the log base power exponent such as 1, 2, 3, and so on.

Interactions: This option is ignored when TICKVALUEPRIORITY= TRUE.

The VALUESTYPE= option determines how the value is interpreted.

Notes: Setting a VIEWMAX= or VIEWMIN= value does not alter the original data or any calculations on it.

If an invalid value is specified for the VIEWMAX= option, the default value for VIEWMAX= is used instead. In that case, if the default value for VIEWMAX= is less than the value specified by the VIEWMIN= option, then the VIEWMIN= and VIEWMAX= values are swapped.

The maximum axis tick value might differ from the VIEWMAX= value. The VIEWMIN= and VIEWMAX= values, and additional

factors such as thresholds and the tick values computed by the plot statement, are used to determine the axis tick values.

When BASE=10 and TICKINTERVALSTYLE=LOGEXPAND or TICKINTERVALSTYLE=LOGEXPONENT is used, an intermediate tick is added whenever the axis data range is less than or equal to 1.5 powers of 10.

Tip To display the VIEWMAX= value as the maximum tick value, use the TICKVALUELIST= option.

See "Adjusting the Axis View" on page 1051

Examples The following example specifies a value of 100,000 as an expanded value on a base 10 log axis:

```
VIEWMAX=100000
```

The following example specifies a value of 100,000 as an exponent value on a base 10 log axis:

```
VIEWMAX=5
```

VIEWMIN=*number*

specifies the minimum data value to include in the display.

Default The minimum value in the data for the specified axis.

Requirements If VIEWMAX= is also specified, VIEWMIN= must be less than VIEWMAX=. Otherwise, the default values are used for VIEWMAX= and VIEWMIN=.

If VIEWMAX= is not specified, VIEWMIN= must be greater than the data minimum. Otherwise, a blank graph is drawn.

The value that you specify must be appropriate for the VALUESTYPE= specification and the log base. Otherwise, unexpected results might occur. If VALUESTYPE=EXPANDED is in effect (default), specify an increment of the log base power such as 0.1, 1, 10, 100, and so on, on a base 10 log axis, for example. If VALUESTYPE=EXPONENT is in effect, specify an integer increment of the log base power exponent such as 1, 2, 3, and so on.

Interactions This option is ignored when TICKVALUEPRIORITY= TRUE.

The VALUESTYPE= option determines how the value is interpreted.

Notes Setting a VIEWMAX= or VIEWMIN= value does not alter the original data or any calculations on it.

The minimum axis tick value might differ from the VIEWMIN= value. The VIEWMIN= and VIEWMAX= values, and additional factors such as thresholds and the tick values computed by the plot statement, are used to determine the axis tick values.

When BASE=10 and TICKINTERVALSTYLE=LOGEXPAND or TICKINTERVALSTYLE=LOGEXPONENT is used, an intermediate tick is added whenever the axis data range is less than or equal to 1.5 powers of 10.

Tip To display the VIEWMIN= value as the minimum tick value, use the TICKVALUELIST= option.

See "Adjusting the Axis View" on page 1051

Examples The following example specifies a value of 0.1 as an expanded value on a base 10 log axis:

```
VIEWMIN=0.1
```

The following example specifies a value of 0.1 as an exponent value on a base 10 log axis:

```
VIEWMIN=-1
```

Options for Row and Column Time Axes Only

The options that are documented in this section can be used with the TIMEOPTS= axis option. The following table provides a summary of the options.

Time Axis Option	Description
INTERVAL	Specifies the time interval between major tick marks.
INTERVALMULTIPLIER	Specifies a multiplier to apply to the time interval that is in effect for the axis.
MINORGRID	Specifies whether grid lines are displayed at the minor tick values.
MINORGRIDATTRS	Specifies the attributes of the minor grid lines.
MINORTICKINTERVAL	Specifies the time interval between minor ticks.
MINORTICKS	Specifies whether minor tick marks are displayed.
SPLITTICKVALUE	Specifies whether to split the tick values on column axes, if possible. This option is not available in the ROWAXIS statement.
TICKVALUEFITPOLICY	Specifies a policy for avoiding tick value collision on column axes. This option is not available in the ROWAXIS statement.
TICKVALUEFORMAT	Specifies how to format the values for major tick marks.

Time Axis Option	Description
TICKVALUELIST	Specifies the order of the tick values for a time axis as list.
TICKVALUEPRIORITY	Specifies whether an axis tick specification can extend the axis data range.
TICKVALUEROTATION	Specifies how the tick values are rotated on the X and X2 axes.
VIEWMAX	Specifies the maximum data value to include in the display.
VIEWMIN	Specifies the minimum data value to include in the display.

INTERVAL=AUTO | SECOND | MINUTE | HOUR | DAY | TENDAY | WEEK | SEMIMONTH | MONTH | QUARTER | SEMIYEAR | YEAR
specifies the time interval between major ticks.

Table 8.3 *Time Intervals*

INTERVAL	Unit	Tick interval	Default tick value format
AUTO	DATE, TIME, or DATETIME	automatically chosen	automatically chosen
SECOND	TIME or DATETIME	second	TIME8.
MINUTE	TIME or DATETIME	minute	TIME8.
HOUR	TIME or DATETIME	hour	TIME8.
DAY	DATE or DATETIME	day	DATE9.
TENDAY	DATE or DATETIME	10 days	DATE9.
WEEK	DATE or DATETIME	7 days	DATE9.
SEMIMONTH	DATE or DATETIME	1st and 16th of each month	DATE9.

INTERVAL	Unit	Tick interval	Default tick value format
MONTH	DATE or DATETIME	month	MONYY7.
QUARTER	DATE or DATETIME	3 months	YYQC6.
SEMIYEAR	DATE or DATETIME	6 months	MONYY7.
YEAR	DATE or DATETIME	year	YEAR4.

Default AUTO. An appropriate interval is chosen based on the data and the column date, date-time, or time format.

Restriction This option applies to time axes only.

Requirement The data column(s) mapped to a time axis must be in the same duration units: TIME, DATE, or DATETIME. The selection of an interval must be consistent with the duration unit. For example, if the data are in time units, you can specify only AUTO, SECOND, MINUTE, HOUR.

Interaction This option is ignored if the TICKVALUELIST= option is used.

INTERVALMULTIPLIER=*positive-integer*
specifies a multiplier to apply to the time interval that is in effect for the axis.

Note: This feature applies to SAS 9.4M3 and to later releases.

Default 1

Restriction This option applies to time axes only.

Interaction This option is ignored if the TICKVALUELIST= option is used.

Tip Use the INTERVAL= option to specify a different time interval.

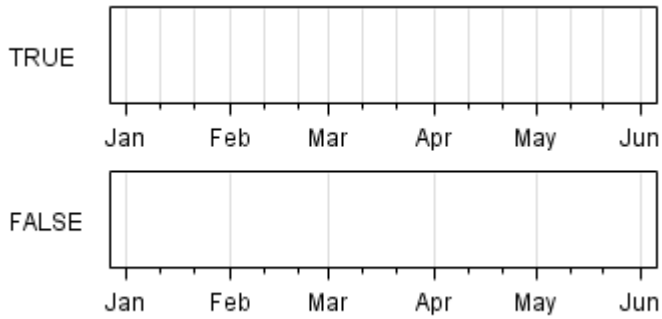
Examples To specify 3-month intervals:

```
INTERVAL=MONTH INTERVALMULTIPLIER=3
```

To specify 10-year intervals:

```
INTERVAL=YEAR INTERVALMULTIPLIER=10
```

MINORGRID=TRUE | FALSE
specifies whether grid lines are displayed at the minor tick marks.



Defaults FALSE in SAS 9.4M1 and earlier releases.

The GraphMinorGridLines:DisplayOpts style reference starting with SAS 9.4M2. If attribute DisplayOpts is not defined in the active style, then FALSE is the default value.

Interaction This option is ignored if the GRIDDISPLAY= option does not display the grid lines.

Tips The GRIDATTRS= option does not affect the appearance of the minor grid lines. To control the minor grid line appearance, use the MINORGRIDATTRS= option.

Use the MINORTICKS= option to display the minor tick marks on the axis.

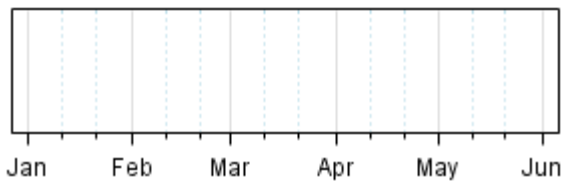
See "boolean " on page xii for other Boolean values that you can use.

MINORGRIDATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the attributes of the minor grid lines. This option does not affect the major grid lines.

The following figure shows the minor grid lines set to light blue, dotted lines on a linear axis. (See the example.)

The following figure shows the minor grid lines set to light blue, dotted lines on a base-10 log axis. (See the example.)

The following figure shows the minor grid lines set to light blue, dotted lines on a time axis. (See the example.)



Defaults The GraphGridLines style element is used starting with SAS 9.4.

The GraphMinorGridLines style element is used starting with SAS 9.4M2.

Interaction This option is ignored when MINORTICKS=FALSE.

Note When *style-element* is specified, only the style element's ContrastColor, LineStyle, and LineThickness attributes are used.

Tip Use the GRIDATTRS= option to control the appearance of the major grid lines.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a style element.

"Line Options" on page 1602 for available line options.

Example Here is an example that specifies light blue, dotted lines for the minor grid.

```
minorgridattrs=(color=lightblue pattern=dot);
```

MINORTICKINTERVAL=*interval*

specifies the time interval between minor ticks. See Table 8.12 on page 1185 for information about the intervals that you can select. The interval that you select must be consistent with the axis data duration units such as TIME, DATE, or DATETIME. For example, if the axis data is in TIME units, then you must specify AUTO, SECOND, MINUTE, or HOUR.

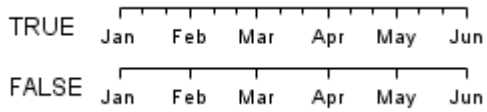
Default AUTO

Interactions This option is ignored if the TICKVALUELIST= option is used.

This option is ignored if the MINORTICKINTERVAL= setting is greater than the INTERVAL= setting.

MINORTICKS=TRUE | FALSE

specifies whether minor ticks are displayed. When MINORTICKS=TRUE, the minor tick marks are displayed on the axis as shown in the following figure.



Default FALSE

Interactions The number of minor ticks is dependent on the value of the MINORTICKINTERVAL= option, if specified. If MINORTICKINTERVAL= is not specified, then it is dependent on the value of the INTERVAL= option.

This option is ignored if the TICKVALUELIST= option is used, or if the DISPLAY= or DISPLAYSECONDARY= option does not display the tick marks.

If MINORTICKS=TRUE is specified with the TICKVALUELIST= option, then MINORTICKS=TRUE is ignored, and minor tick marks are not displayed.

Tip Use the MINORGRID= option to display grid lines at the minor tick values.

See "boolean " on page xii for other Boolean values that you can use.

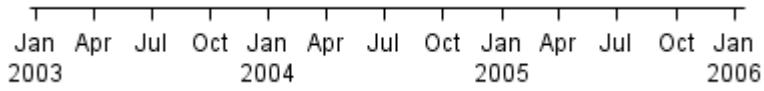
SPLITTICKVALUE=TRUE | FALSE

specifies whether to split the tick values on an X or X2 axis, if possible. This option is not available for a Y or Y2 axis.

TRUE

splits the axis tick values into two lines allowing more tick values to appear.

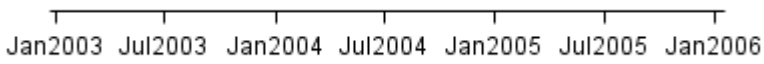
For example, with INTERVAL= MONTH, this is how tick values are split:



FALSE

does not split the axis tick values.

For example, when this option specifies FALSE, this is how the tick values in the previous example appear:



Typically, fewer tick values fit, causing thinning, rotation, or staggering of the values. See the TICKVALUEFITPOLICY= option.

Default TRUE

Restriction This option applies to time axes only.

Interaction This option is ignored if the TICKVALUELIST= or TICKVALUEFORMAT= option is used.

See "boolean " on page xii for other Boolean values that you can use.

TICKVALUEFITPOLICY=*policy*

specifies a policy for avoiding tick value collision on an X or X2 axis. This option is not available for the X and X2 axes. The effectiveness of a collision-avoidance policy depends on the number of tick values, their length, and the length of the axis. The following policies are valid for the X and X2 axes:

NONE

makes no attempt to avoid collisions between tick values.

Tick values are displayed even when they collide.

ROTATE

rotates the tick values if a collision occurs.

The TICKVALUEROTATION= option specifies whether the values are rotated to a 45-degree diagonal or a 90-degree vertical position. By default, the values are rotated to a 45-degree diagonal position.

ROTATEALWAYS
rotates the tick values regardless of whether a collision occurs.

The TICKVALUEROTATION= option specifies whether the values are rotated to a 45-degree diagonal or a 90-degree vertical position. By default, the values are rotated to a 45-degree diagonal position.

ROTATETHIN
attempts the ROTATE policy, and then the THIN policy.

STAGGER
alternates the tick values between two rows.

STAGGERROTATE
attempts the STAGGER policy, and then the ROTATE policy.

STAGGERTHIN
attempts the STAGGER policy, and then the THIN policy.

THIN
eliminates alternate tick values.

Default THIN

Restriction This option is valid only for the X and X2 axes.

Interaction When SPLITTICKVALUE= on page 1189TRUE, this option is ignored and only the THIN policy is used.

Note A note is written to the SAS log when tick value thinning occurs.

TICKVALUEFORMAT=*format* | DATA
specifies how to format the values for major tick marks.

format
specifies a SAS date, time, or datetime format to control how the major tick values are displayed.

This format must be in the same duration units as the data column(s) mapped to a time axis: TIME, DATE, or DATETIME and should be appropriate for the value of the INTERVAL= option. For example, if INTERVAL=MONTH and there are two years of data displayed on the axis, then choosing TICKVALUEFORMAT=YEAR. would result in several ticks having the same year value.

DATA
specifies that the SAS date, time, or datetime format associated with the data column assigned to the axis be used to control how the major tick values are displayed.

Default The default format used by the INTERVAL= option. The default does not apply if TICKVALUELIST= is specified.

Restrictions This option applies to time axes only.

GTL currently honors most but not every SAS format. For details, see Appendix 4, “Format Support in ODS Graphics,” on page 1621.

TICKVALUELIST=(*time-constant-list* | *date-constant-list* | *datetime-constant-list* | *numeric-list*)

specifies the tick values for a time axis as list.

Default An internal algorithm determines the tick values.

Restrictions This option applies to time axes only.

If TICKVALUEPRIORITY= is set to FALSE, then this option does not extend the data range of the axis. If the values fall within the default data range or that specified by the VIEWMIN= or VIEWMAX= options, then they are used.

Requirement The tick values must be specified as a space-separated list of values enclosed in parentheses. The items in the list must be in the same duration units as the data mapped to the axis: TIME, DATE, or DATETIME. The values can be expressed as SAS TIME, DATE, or DATETIME constants (for example, "13:23"T, "11MAY06"D, or "11MAY06:13:23"DT) or their numeric equivalents.

Interactions The values in the list are formatted according to the format specified on the TICKVALUEFORMAT= option. If TICKVALUEFORMAT= is not used, then the values are formatted according to the column format (the default TICKVALUEFORMAT value is not applied to these values).

If this option is specified, the SPLITTICKVALUE= and INTERVAL= options are ignored.

If MINORTICKS=TRUE is specified with the TICKVALUELIST= option, MINORTICKS=TRUE is ignored, and minor tick marks are not displayed.

TICKVALUEPRIORITY=TRUE | FALSE

specifies whether the TICKVALUELIST= specification can extend the axis data range.

TRUE

extends the axis data range (but does not reduce it) to include the minimum and maximum values that are specified by the TICKVALUELIST= option.

If the minimum and maximum of the user-specified values are within the data range, this option has no effect.

FALSE

displays only the tick values that are specified by the TICKVALUELIST= option that fall within the explicit data range set by the VIEWMIN= and VIEWMAX= options or by the implicit data range set by the actual data minimum and data maximum.

Default FALSE

Interactions When this option is set to TRUE, the VIEWMIN= and VIEWMAX= options are ignored.

This option is ignored if the DISPLAY= option or the DISPLAYSECONDARY= option does not display the tick values.

This option is ignored if the TICKVALUELIST= option is not specified.

Note If the minimum and maximum of the specified values are within the data range, then this option has no effect.

See "boolean " on page xii for other Boolean values that you can use.

TICKVALUEROTATION=DIAGONAL | DIAGONAL2 | VERTICAL
specifies how the tick values are rotated on the X and X2 axes.

DIAGONAL
rotates the tick values to a 45-degree diagonal position.

The X labels read left to right in a downward direction. The X2 labels read left to right in an upward direction.

DIAGONAL2
rotates the tick values to a –45-degree diagonal position.

The X labels read left to right in an upward direction. The X2 labels read left to right in a downward direction.

Note: This feature applies to SAS 9.4M5 and to later releases.

VERTICAL
rotates the labels to a 90-degree vertical position.

The labels are always drawn from bottom to top.

Default DIAGONAL

Restriction This option is valid for COLUMNAXIS statements only.

Interaction The TICKVALUEFITPOLICY= option must be set to ROTATE or ROTATEALWAYS for this option to have any effect.

VIEWMAX=*number*
specifies the maximum data value to include in the display.

Default The maximum value in the data for the specified axis.

Requirements If VIEWMIN= is also specified, VIEWMAX= must be greater than VIEWMIN=. Otherwise, the default values are used for VIEWMIN= and VIEWMAX=.

If VIEWMIN= is not specified, VIEWMAX= must be less than the data maximum. Otherwise, a blank graph is drawn.

Notes Setting a VIEWMAX= or VIEWMIN= value does not alter the original data or any calculations on it.

The maximum axis tick value might differ from the VIEWMAX= value. The VIEWMIN= and VIEWMAX= values, and additional factors such as thresholds and the tick values computed by the plot statement, are used to determine the axis tick values.

Tip To display the VIEWMAX= value as the maximum tick value, use the TICKVALUELIST= option.

See "Adjusting the Axis View" on page 1051

VIEWMIN=*number*

specifies the minimum data value to include in the display.

Default The minimum value in the data for the specified axis.

Requirements If VIEWMAX= is also specified, VIEWMIN= must be less than VIEWMAX=. Otherwise, the default values are used for VIEWMAX= and VIEWMIN=.

If VIEWMAX= is not specified, VIEWMIN= must be greater than the data minimum. Otherwise, a blank graph is drawn.

Notes Setting a VIEWMAX= or VIEWMIN= value does not alter the original data or any calculations on it.

The minimum axis tick value might differ from the VIEWMIN= value. The VIEWMIN= and VIEWMAX= values, and additional factors such as thresholds and the tick values computed by the plot statement, are used to determine the axis tick values.

Tip To display the VIEWMIN= value as the minimum tick value, use the TICKVALUELIST= option.

See "Adjusting the Axis View" on page 1051

Details

The LAYOUT LATTICE statement creates a grid of graphs that automatically aligns plot areas, data display areas, axis labels, and headers across the columns and rows of the layout. The axis data ranges can be scaled, and the axes for individual cells in the layout can be managed by row and by column using COLUMNAXIS and ROWAXIS statements. COLUMNAXIS statements are used within a COLUMNAXES or COLUMN2AXES block to externalize column axes for the layout. Similarly, ROWAXIS statements are used within a ROWAXES or ROW2AXES block to externalize row axes for the layout. Each axis block is used to manage the primary axis. The axis that is considered primary depends on the settings for the XAXIS= and YAXIS= options in plot statements that are specified within the layout:

Option Setting	Primary Axis	Axis Block to Use
XAXIS=X	X (bottom)	COLUMNAXES
XAXIS=X2	X2 (top)	COLUMN2AXES
YAXIS=Y	Y (left)	ROWAXES
YAXIS=Y2	Y2 (right)	ROW2AXES

For the specifications to take effect,

- UNION or UNIONALL data scaling must be set for the affected columns and rows. The data scaling is set with the LAYOUT LATTICE statement's COLUMNDATARANGE=, COLUMN2DATARANGE=, ROWDATARANGE=, and ROW2DATARANGE= options.
- Within a COLUMNAXES or COLUMN2AXES block, one COLUMNAXIS statement should be specified for each column that contains axes that you need to manage. Both axes blocks can contain a COLUMNAXIS statement for the same column. For example, to manage the axes in the first column of the layout, the COLUMNAXES block can contain a COLUMNAXIS statement that manages the column's X axes. The COLUMN2AXES block can contain a COLUMNAXIS statement that manages the column's X2 axes.
- Within a ROWAXES or ROW2AXES block, one ROWAXIS statement should be specified for each row that contains axes that you need to manage. Both axes blocks can contain a ROWAXIS statement for the same row. For example, to manage the axes in the first row of the layout, the ROWAXES block can contain a ROWAXIS statement that manages the row's Y axes. The ROW2AXES block can contain a ROWAXIS statement that manages the column's Y2 axes.

In addition to managing the primary axes, you can also display "secondary" axes in the grid. A secondary axis is not an independent axis. Rather, it mirrors the primary axis, but it is displayed on the opposite side and can have different display options. For example, when the X axis (bottom) is primary, you can mirror that axis with a secondary X axis at the top of the grid. Similarly, when the Y2 axis (right) is primary, you can mirror that axis with a secondary Y2 axis on the left of the grid. A secondary axis makes it easier to interpolate values in the cells that are farthest away from the primary axis. To display a secondary axis, use the DISPLAYSECONDARY= option.

For general information about managing primary and secondary axes, see "Plot Data Are Mapped to a Designated Axis" on page 1040. For details about managing the axes within a LAYOUT LATTICE, see the discussion about the LAYOUT LATTICE "Row and Column Axis Statements" on page 146.

The following example shows COLUMNAXIS statements for a lattice with two columns:

```
layout lattice / columns=2 columndatarange=union;
  columnaxes;
    columnaxis / griddisplay=on displaysecondary=(ticks tickvalues);
    columnaxis / griddisplay=on displaysecondary=(ticks tickvalues);
```

```
  endcolumnaxes;

/* rest of lattice definition */

endlayout;
```

COLUMNAXIS and ROWAXIS statements are similar to the XAXISOPTS= and YAXISOPTS= options for LAYOUT OVERLAY, with the following differences:

- When COLUMNAXIS and ROWAXIS are used, any axis options specified on plots within the affected columns or rows are ignored. All axis features for the row and column axes must be specified on the ROWAXIS or COLUMNAXIS statement.
- When ROWAXIS or COLUMNAXIS are used, any LAYOUT OVERLAYEQUATED layouts specified for cells in the affected columns or rows are implemented as LAYOUT OVERLAY layouts. Equated axes are not supported on row and column axes.

In the default cases for each plot in the layout, the axis type is always DISCRETE, LINEAR, or TIME. The TYPE= option enables you to specify an axis type that overrides the default. For example, when appropriate for the data, you can request a LOG axis. When you override the default axis type, you must be sure to specify the correct axis type for the plot(s) that you are defining.

Each axis type has features specific to that type, and the following axis options enable you to specify features for the different types: DISCRETEOPTS= , LINEAROPTS= , LOGOPTS= , and TIMEOPTS= . One or more of these options can be specified for an axis, but the specified settings are applied only to the axis type that supports them.

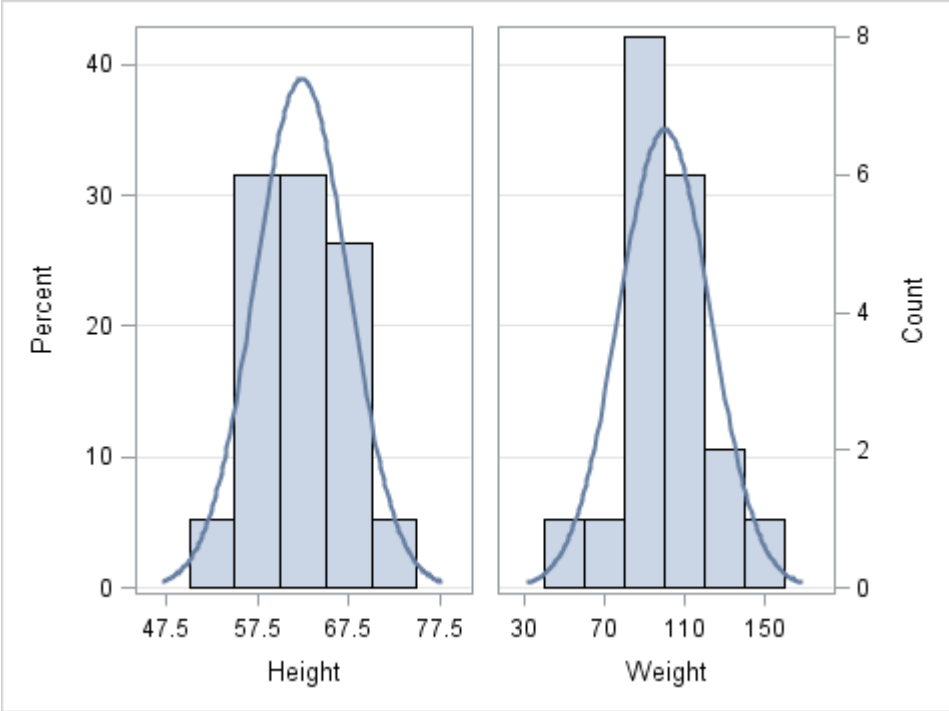
Example: Row and Column Axis Options for LAYOUT LATTICE

This example shows how to externalize axes in a LAYOUT LATTICE and manage the axis features on primary Y and Y2 axes.

- The first HISTOGRAM statement specifies YAXIS=Y2 to make the Y2 axis the primary axis for COUNT measures. The second HISTOGRAM statement specifies YAXIS=Y to make the Y axis the primary axis for PERCENT measures.
- In order to externalize the axes within the layout, the data ranges for the axes must be unified. In the LAYOUT LATTICE statement, the ROWDATARANGE= option unifies the data ranges for the Y axes across the row. The ROW2DATARANGE= option unifies the data ranges for the Y2 axes across the row.
- The ROWAXIS statement is used to manage axis features for the row axes. To manage the primary Y axis, a ROWAXIS statement is specified within a ROWAXES block. To manage the primary Y2 axis, another ROWAXIS statement is specified within a ROW2AXES block.
- Within the ROWAXES block, the ROWAXIS statement consolidates Y axes in the row into a single, column Y axis and also displays grid lines. Within the

ROW2AXES block, the ROWAXIS statement consolidates Y2 axes in the row into a single row Y2 axis, but it does not alter the default features of that axis.

The following graph was generated by the "Example Program" on page 1196 :



Example Program

```
proc template;
  define statgraph y2axis;
    begingraph;
      layout lattice / columns=2 columngutter=10
          rowdatarange=union row2datarange=union ;
        rowaxes;
          rowaxis / griddisplay=on;
        endrowaxes;
        row2axes;
          rowaxis;
        endrow2axes;
        layout overlay;
          histogram height / scale=count yaxis=y2 ;
          histogram height / scale=percent yaxis=y ;
          densityplot height / normal();
        endlayout;
        layout overlay;
          histogram weight / scale=count yaxis=y2 ;
          histogram weight / scale=percent yaxis=y ;
          densityplot weight / normal();
        endlayout;
      endlayout;
    endgraph;
```

```
  end;

proc sgrender data=sashelp.class template=y2axis;
run;
```

Axis Options for LAYOUT OVERLAYEQUATED

Axis options for the plots within an OVERLAYEQUATED layout.

Interaction: The OVERLAYEQUATED's axis options are ignored when the LAYOUT OVERLAYEQUATED statement is nested within another layout type that has external axes in effect. For example, the axis options are ignored when the statement is nested within a LAYOUT LATTICE with a COLUMNAXIS= or ROWAXIS= option in effect.

See: "LAYOUT OVERLAYEQUATED Statement" on page 168

Syntax

Axis options for the plots within an OVERLAYEQUATED layout are specified with the
following options on a LAYOUT OVERLAYEQUATED statement:

COMMONAXISOPTS=(*common-equated-axis-options*)

XAXISOPTS=(*equated-axis-options*)

YAXISOPTS=(*equated-axis-options*)

Options That Apply to Both Equated Axes

The options that are documented in this section are specified with the COMMONAXISOPTS= option and are applied to both the X and Y axes. With the exception of VIEWMAX and VIEWMIN, these options cannot be applied separately to an X or Y axis using the XAXISOPTS= or YAXISOPTS= option. See "Options That Apply Separately to an X or Y Equated Axis" for a list of options that can be applied to a single axis. The following table provides a summary of the common options.

Equated Axis Option	Description
INTEGER	Specifies that evenly spaced integer values are used for tick marks for all axes.
TICKSTYLE	Specifies the placement of tick marks in relation to the axis line.
TICKVALUELIST	Specifies the order of the tick values as list.

Equated Axis Option	Description
TICKVALUEPRIORITY	Specifies whether an axis tick specification can extend the axis data range.
TICKVALUESEQUENCE	Specifies the tick values by start, end, and increment.
VIEWMAX	Specifies the maximum data value to include in the display on the X and Y axes when the axis lengths and major tick values are equal.
VIEWMIN	Specifies the minimum data value to include in the display on the X and Y axes when the axis lengths and major tick values are equal.

INTEGER=TRUE | FALSE

specifies that evenly spaced integer values are used for tick marks.

Default FALSE

Interactions This option is overridden by the TICKVALUELIST= or TICKVALUESEQUENCE= option.

This option overrides the MAXDECIMALS= and PREFERREDDECIMALS= suboptions of the TICKVALUEFORMAT= option.

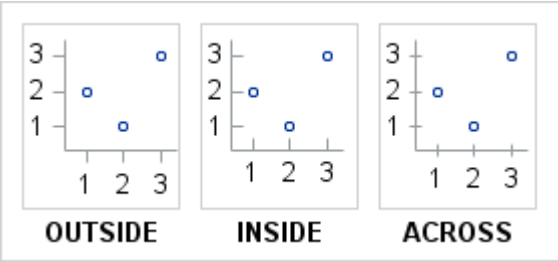
INTEGER=TRUE is ignored for the X or X2 axis when a histogram plot is the primary plot and BINAXIS=TRUE is specified in the HISTOGRAM or HISTOGRAMPARM statement.

Note This option is ignored when the data exceeds the limits of integer values.

See "boolean " on page xii for other Boolean values that you can use.

TICKSTYLE=OUTSIDE | INSIDE | ACROSS

specifies the placement of tick marks in relation to the axis line. The figure shows the tick display for each value.



OUTSIDE

displays tick marks outside of the axis frame.

INSIDE
displays tick marks inside the axis frame.

ACROSS
displays tick marks across the axis line.

Default The GraphAxisLines:TickDisplay style reference.

Restriction This option applies to the major tick marks only. It does not affect the minor tick marks.

Interaction This option is ignored if the DISPLAY= or DISPLAYSECONDARY= option does not display tick marks.

Note This option has no effect on the placement of the tick values, which are always outside the axis frame.

Tip You can use the Annotate facility to draw inside or across minor tick marks in your graphs. See "Creating a Macro That Generates Annotation Data" in *SAS Graph Template Language: User's Guide*.

TICKVALUELIST=(*numeric-list*)
specifies the tick values for a linear axis as a list.

Default An internal algorithm determines the tick marks, based on the actual axis data range or the data range established by the VIEWMIN= and VIEWMAX= options. By default, when this option is used, the only tick values that appear are the tick values in *numeric-list* that fall within the explicit data range (set by VIEWMIN= and VIEWMAX=) or the implicit data range (set by the actual data minimum and data maximum).

Requirement The tick values must be specified as a space-separated list of numeric values, enclosed in parentheses.

Interactions This option overrides the INTEGER= option.

This option is ignored if the LAYOUT OVERLAYEQUATED statement specifies EQUATETYPE=FIT (the default).

This option is ignored if the TICKVALUESEQUENCE= option is specified, or if the DISPLAY= option or the DISPLAYSECONDARY= option does not display tick values.

The VIEWMIN= and VIEWMAX= options alter the axis data range. If the VIEWMIN= option is set to the minimum tick list value and the VIEWMAX= option is set to the maximum tick list value, then all ticks in the tick list are displayed. This might result in some data not being displayed. For example, data might not be displayed when the VIEWMIN= value is greater than the actual data minimum, or when the VIEWMAX= value is less than actual data maximum.

If TICKVALUEPRIORITY= TRUE, then the VIEWMIN= and VIEWMAX= options are ignored if they are fully enclosed by the

numeric-list. The tick *numeric-list* can extend the implicit data range of the axis, but cannot reduce it.

If MINORTICKS=TRUE is specified and TICKVALUELIST= specifies nonuniform tick values such as 3, 5, 11, and 23, then MINORTICK=TRUE is ignored. To display minor tick marks in that case, specify uniform tick values such as 0, 10, 20, and 30 in the TICKVALUELIST= option.

Note Unexpected results can occur when TYPE= in the LAYOUT OVERLAYEQUATED statement is set to anything other than SQUARE and the tick values in TICKVALUELIST= are not suitable for the X and Y data ranges. In that case, specify suitable tick values for X and Y in TICKVALUELIST= or specify TYPE=SQUARE in the LAYOUT OVERLAYEQUATED statement.

Tip The values in the list are formatted according to the setting for the TICKVALUEFORMAT= option.

TICKVALUEPRIORITY=TRUE | FALSE

specifies whether an axis tick specification (TICKVALUELIST= or TICKVALUESEQUENCE=) can extend the axis data range.

TRUE

extends the axis data range (but does not reduce it) to include the minimum and maximum values that are specified by either the TICKVALUELIST= or TICKVALUESEQUENCE= option.

If the minimum and maximum of the user-specified values are within the data range, this option has no effect.

FALSE

displays only the tick values that are specified by the TICKVALUELIST= option that fall within the explicit data range set by the VIEWMIN= and VIEWMAX= options or by the implicit data range set by the actual data minimum and data maximum.

Default FALSE

Interactions When this option is set to TRUE, the VIEWMIN= and VIEWMAX= options are ignored.

This option is ignored if the TICKVALUELIST= or TICKVALUESEQUENCE= option is not specified.

This option is ignored if the DISPLAY= option or the DISPLAYSECONDARY= option does not display the tick values.

Notes If the minimum and maximum of the specified values are within the data range, then this option has no effect.

Unexpected results can occur when TYPE= in the LAYOUT OVERLAYEQUATED statement is set to anything other than SQUARE and the tick values in TICKVALUELIST= or TICKVALUESEQUENCE= are not suitable for the X and Y data ranges. In that case, specify suitable tick values for X and Y in

TICKVALUELIST= or TICKVALUESEQUENCE=, or specify TYPE=SQUARE in the LAYOUT OVERLAYEQUATED statement.

See "boolean " on page xii for other Boolean values that you can use.

TICKVALUESEQUENCE=(START=*number* END=*number* INCREMENT=*number*)
specifies the tick values by start, end, and increment.

START=*number*
specifies the value for the first tick mark.

END=*number*
specifies the value for the last tick mark.

INCREMENT=*number*
specifies the increment for intermediate tick marks between the first and last tick marks.

The END value always controls the last tick mark. The interval between the last tick mark and the previous tick mark might not necessarily be the INCREMENT value.

Default An internal algorithm determines the tick marks, based on the actual axis data range or the data range established by the VIEWMIN= and VIEWMAX= options. By default, when this option is used, the only tick values that appear are those that fall within the explicit data range (set by VIEWMIN= and VIEWMAX=) or the implicit data range (set by the actual data minimum and data maximum).

Interactions This option overrides the INTEGER= option.

The VIEWMIN= and VIEWMAX= options alter the axis data range. If the VIEWMIN= option is set to the START= option value and the VIEWMAX= option is set to the END= option value, then all ticks in the tick sequence are displayed.

If TICKVALUEPRIORITY= TRUE, then the tick sequence might extend the explicit data range of the axis, but never reduce it.

This option is ignored if the LAYOUT OVERLAYEQUATED statement specifies EQUATETYPE=FIT (the default), or if the DISPLAY= option or the DISPLAYSECONDARY= option does not display tick marks.

Note Unexpected results can occur when TYPE= in the LAYOUT OVERLAYEQUATED statement is set to anything other than SQUARE and the tick values in TICKVALUESEQUENCE= are not suitable for the X and Y data ranges. In that case, specify suitable tick values for X and Y in TICKVALUESEQUENCE= or specify TYPE=SQUARE in the LAYOUT OVERLAYEQUATED statement.

Tip The values in the sequence are formatted according to the setting for the TICKVALUEFORMAT= option.

See TICKVALUELIST= option as an alternative for customizing tick marks.

VIEWMAX=*number*

specifies the maximum data value to include in the display on the X and Y axes when the axis lengths and major tick values are equal. The value might be adjusted by the threshold calculation.

Default The maximum value in the data for the X and Y axes.

Restriction This option is honored only when EQUATETYPE=SQUARE.

Requirements If VIEWMIN= is also specified, VIEWMAX= must be greater than VIEWMIN=. Otherwise, the default values are used for VIEWMIN= and VIEWMAX=.

If VIEWMIN= is not specified, VIEWMAX= must be less than the data maximum. Otherwise, a blank graph is drawn.

Interactions This option does not determine the maximum axis tick value that is displayed. The THRESHOLDMAX= value is used to determine the maximum tick value.

This option is ignored when TICKVALUEPRIORITY= TRUE.

Notes Setting a VIEWMAX= or VIEWMIN= value does not alter the original data or any calculations on it.

The maximum axis tick value might differ from the VIEWMAX= value. The VIEWMIN= and VIEWMAX= values, and additional factors such as thresholds and the tick values computed by the plot statement, are used to determine the axis tick values.

Tip To display the VIEWMAX= value as the maximum tick value, use the TICKVALUELIST= option.

See “Adjusting the Axis View” on page 1051

VIEWMIN=*number*

specifies the minimum data value to include in the display on the X and Y axes when the axis lengths and major tick values are equal. The value might be adjusted by the threshold calculation.

Default The minimum value in the data for the X and Y axes.

Restriction This option is honored only when EQUATETYPE=SQUARE.

Requirements If VIEWMAX= is also specified, VIEWMIN= must be less than VIEWMAX=. Otherwise, the default values are used for VIEWMAX= and VIEWMIN=.

If VIEWMAX= is not specified, VIEWMIN= must be greater than the data minimum. Otherwise, a blank graph is drawn.

Interactions: This option does not determine the minimum axis tick value that is displayed. The THRESHOLDMIN= value is used to determine the minimum tick value.

This option is ignored when TICKVALUEPRIORITY= TRUE.

Notes: Setting a VIEWMAX= or VIEWMIN= value does not alter the original data or any calculations on it.

The minimum axis tick value might differ from the VIEWMIN= value. The VIEWMIN= and VIEWMAX= values, and additional factors such as thresholds and the tick values computed by the plot statement, are used to determine the axis tick values.

Tip: To display the VIEWMIN= value as the minimum tick value, use the TICKVALUELIST= option.

See: "Adjusting the Axis View" on page 1051

Options That Apply Separately to an X or Y Equated Axis

The options that are documented in this section can be applied to an X axis with the XAXISOPTS= option, or to the Y axis with the YAXISOPTS= option. See "Options That Apply to Both Equated Axes" on page 1197 for a list of options that apply in common to both axes. The following table provides a summary of the options.

Equated Axis Option	Description
DISPLAY	Controls which axis features are displayed on the primary axis.
DISPLAYSECONDARY	Controls which axis features are displayed on the secondary axis.
GRIDATTRS	Specifies the attributes of the grid lines.
GRIDDISPLAY	Specifies when axis grid lines are displayed.
LABEL	Specifies the axis label.
LABELATTRS	Specifies the color and font attributes of the axis label.
LABELFITPOLICY on page 1208	Specifies a policy for fitting axis labels in the available space.
LABELSPLITCHAR on page 1208	Specifies one or more characters on which the axis labels can be split, if needed.

Equated Axis Option	Description
LABELSPLITCHARDROP on page 1209	Specifies whether the split characters are included in the displayed axis labels.
LINEEXTENT	Specifies the extent of the axis line.
OFFSETMAX	Reserves an area at the maximum end of the axis. No tick marks are displayed in the reserved area.
OFFSETMIN	Reserves an area at the minimum end of the axis. No tick marks are displayed in the reserved area.
REVERSE	Specifies whether tick values should appear in the reverse order.
SHORTLABEL	Specifies an alternate axis label to use if the default or specified axis label is too long for the axis length.
THRESHOLDMAX	Specifies a bias for including one more tick mark at the maximum end of the axis.
THRESHOLDMIN	Specifies a bias for including one more tick mark at the minimum end of the axis.
TICKVALUEATTRS	Specifies the color and font attributes of the axis tick values.
TICKVALUEFITPOLICY	Specifies a policy for avoiding tick value collision. Only the default policy (THIN) is available for a Y or Y2 axis.
TICKVALUEFORMAT	Specifies how to format the values for tick marks.
VIEWMAX	Specifies the maximum data value to include in the display on the X or Y axis when the axis lengths and major tick values are not equal.
VIEWMIN	Specifies the minimum data value to include in the display on the X or Y axis when the axis lengths and major tick values are not equal.

DISPLAY=STANDARD | ALL | NONE | (*display-options*)
controls which axis features are displayed on the primary axis.

STANDARD
specifies that the LABEL, LINE, TICKS, and TICKVALUES are displayed

ALL
currently the same as STANDARD

NONE
specifies that no axis features are displayed

(*display-options*)
specifies a space-separated list of one or more display options, enclosed in parentheses.

The list can contain one or more of the following options:

LABEL
displays the axis label

LINE
displays the axis line

TICKS
displays the tick marks

TICKVALUES
displays the values that are represented by the major tick marks

Default STANDARD

Tips The default line attributes for the axis line and axis tick marks are defined in the GraphAxisLine style element.

Use the GRIDDISPLAY= and GRIDATTRS= options to set the axis grid lines.

When LINE is excluded from the DISPLAY= option, the layout wall outline or the default baseline of a bar chart, needle plot, or waterfall chart can appear to be an axis line. To suppress the wall outline, use the WALLDISPLAY= option in the layout statement. To suppress the plot baseline, use the BASELINEATTRS= option in the plot statement.

DISPLAYSECONDARY=NONE | ALL | STANDARD | (*display-options*)
controls which axis features are displayed on the secondary axis. When data are mapped to the X or Y axis, you can display an X2 or Y2 (secondary) axis using this option. The secondary axis is a duplicate of the X or Y axis but can have different display options.

NONE
specifies that no axis features are displayed

STANDARD
specifies that the LABEL, LINE, TICKS, and TICKVALUES are displayed on the secondary axis

ALL
currently the same as STANDARD

(*display-options*)
specifies a space-separated list of one or more display options, enclosed in parentheses.

The list can contain one or more of the following options:

LABEL
displays the axis label

LINE
displays the axis line

TICKS
displays the tick marks

TICKVALUES
displays the values that are represented by the major tick marks

Default NONE

Tip Use the GRIDDISPLAY= and GRIDATTRS= options to set the axis grid lines.

GRIDATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the attributes of the grid lines.

Default The GraphGridLines style element.

Interaction This option is ignored if the GRIDDISPLAY= option does not display the grid lines.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

GRIDDISPLAY=AUTO_OFF | AUTO_ON | ON | OFF
specifies whether axis grid lines are displayed. This option enables the template to absolutely control the display of grid lines or to allow interaction with the current style to decide whether grid lines are displayed.

AUTO_OFF
specifies that grid lines are not displayed unless the GraphGridLines element in the current style contains DisplayOpts="ON."

AUTO_ON
specifies that grid lines are displayed unless the GraphGridLines element in the current style contains DisplayOpts="OFF."

ON
specifies that grid lines are always displayed.

The current style has no override.

OFF
specifies that grid lines are never displayed.

The current style has no override.

The following table shows the end results for various combinations of the GRIDDISPLAY= option and the DisplayOpts= attribute of the GraphGridLines style element. Most supplied templates use the default setting AUTO_OFF to indicate a preference for not displaying grid lines, but allowing the style to override.

GRIDDISPLAY= option	DisplayOpts= style attribute	Grid Lines Shown?
AUTO_OFF	AUTO	no
AUTO_OFF	ON	yes
AUTO_OFF	OFF	no
AUTO_ON	AUTO	yes
AUTO_ON	ON	yes
AUTO_ON	OFF	no
ON	any value	yes
OFF	any value	no

Default AUTO_OFF

Note Supplied styles use DisplayOpts="AUTO," which means that the style has no preference about grid lines and the graphics template setting for grid lines is always used.

LABEL=*"string"* | (*"string"* ...*"string"*)
specifies the axis label. The string can be either a string literal or a dynamic. The list form implies that all included string literals or dynamic variables will be concatenated.

Default The default label is derived from the primary plot in the layout. For more information, see "When Plots Share Data and a Common Axis" on page 1046.

Note If the axis label is too long to fit along the axis, then it is truncated by default.

Tips Use the SHORTLABEL= option to specify an alternate axis label to be used whenever truncation would normally occur.

Use the ODS escape sequence to specify Unicode characters in an axis label. Here is an example that species degrees Fahrenheit in an axis label for temperature:

```
label="Temperature ((*ESC*){unicode '00B0'x}F)"
```

See "Overriding the Default Axis Label" in *SAS Graph Template Language: User's Guide*

LABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font attributes of the axis label.

Default The GraphLabelText style element.

Interaction This option is ignored if the DISPLAY= or DISPLAYSECONDARY= option does not display the axis label.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Text Options" on page 1606 for available *text-options*.

LABELFITPOLICY=AUTO | SPLIT | SPLITALWAYS | STACKED
specifies a policy for fitting axis labels in the available space.

AUTO
uses the short label, when specified, instead of the original label.

If the short label does not fit, then it is clipped. When no short label is specified, the original label is clipped.

SPLIT
splits the axis label at a split character only when necessary in order to make the label fit the available space.

The split character is specified by the LABELSPLITCHAR= option. The short label is not used. A split does not occur at a split character if a split is not needed at that location. If the label does not contain any of the specified split characters, then it is not split. A label that cannot be split or that does not fit the available space even after splitting might overlap the adjoining space.

SPLITALWAYS
always split the axis label at every occurrence of a split character, which is specified by the LABELSPLITCHAR= option.

If the label cannot be split, then it is clipped.

STACKED
displays the Y or Y2 axis label vertically as stacked letters.

Note: This feature applies to SAS 9.4M5 and to later releases.

Valid in YAXISOPTS= and Y2AXISOPTS only

Default AUTO

LABELSPLITCHAR="*character-list*"
specifies one or more characters on which the axis labels can be split, if needed. When multiple split characters are specified, each character in the list is treated as a separate split character unless the specified characters appear consecutively in the axis label. In that case, all of the specified split characters together are treated as a single split character.

When LABELFITPOLICY=SPLIT, if the axis label does not fit the available space, then it is split on a specified split character only if a split is needed at that point to make the label fit. In this case, a split might not occur on every

split character. When LABELFITPOLICY=SPLITALWAYS, the axis label is split unconditionally on every occurrence of a split character. If the axis label does not contain any of the specified split characters, the label is not split.

"character-list"
one or more characters with no space between each character and enclosed in quotation marks.

Default A blank space

Requirements The list of characters must be enclosed in quotation marks.

Multiple characters must be specified with no space between them. For example, to specify the split characters a, b, and c, use the following option:

```
labelsplitchar="abc"
```

Interactions This option has effect only when LABELPOSITION= is CENTER or DATACENTER.

The LABELSPLITCHARDROP= option specifies whether the split characters are included in the displayed data label or are dropped.

Notes When multiple characters are specified, the order of the characters in the list is not significant.

The split characters are case sensitive.

Tip Use the LABELSPLITJUSTIFY= option to specify the justification of the strings in the axis label block.

LABELSPLITCHARDROP=TRUE | FALSE
specifies whether the split characters are included in the displayed axis labels.

TRUE
drops the split characters from the axis label display.

FALSE
includes the split characters in the axis label display.

When the label is split while LABELSPLITCHARDROP=FALSE is in effect, each split character remains as the last character in the current line. The characters that follow the split character, up to and including the next split character, are then wrapped to the next line.

Default TRUE. The split characters are dropped from the axis label.

Interactions This option has effect only when LABELPOSITION= is CENTER or DATACENTER.

The LABELSPLITCHAR= option specifies the split characters.

See “boolean ” on page xii for other Boolean values that you can use.

LINEEXTENT=FULL | DATA | *number*
specifies the extent of the axis line.

Note: This feature applies to SAS 9.4M3 and to later releases.

FULL
specifies an axis line that extends along the entire length of the axis.

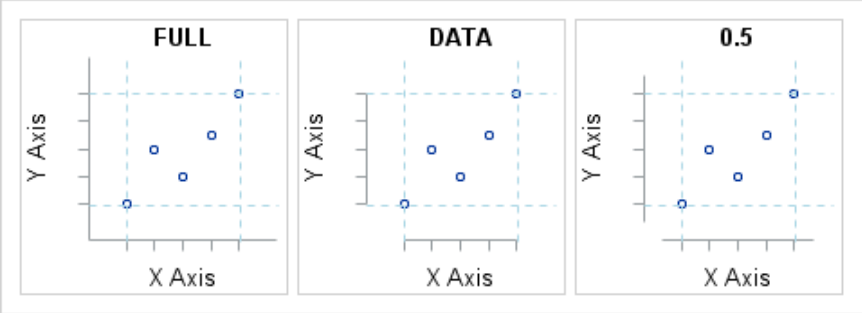
DATA
specifies an axis line that extends through the data range from the minimum offset to the maximum offset.

number
specifies how much the axis line extends from DATA toward FULL as a decimal proportion. A value of 0 is equivalent to DATA, and a value of 1 is equivalent to FULL.

Range 0–1

Tip A numeric value is useful for bar charts when DATA terminates the axis line at the midpoint positions of the minimum and maximum bars. In that case, you can specify a numeric value to lengthen the axis line so that it extends to the full width of both bars.

The following figure shows a simple example of each value for the X axis and Y-axis lines. The light-blue dashed lines depict the minimum and maximum offsets that are set on the axes.



Default FULL

Restriction This option is valid only in OVERLAY and OVERLAYEQUATED layouts.

Interactions This option overrides the AXISLINEEXTENT= option in the BEGINGRAPH statement.

This option overrides the LINEEXTENT= option in COMMONAXISOPTS=.

Tip The graph wall outline might appear to be an axis line. In that case, use the WALLDISPLAY=NONE or WALLDISPLAY=(FILL) option in the layout statement to suppress the wall outline.

OFFSETMAX=AUTO | AUTOCOMPRESS | *number*
reserves an area at the maximum end of the axis. No tick marks are displayed in the reserved area.

AUTO
reserves just enough area to fully display markers and other graphical features near the maximum end of an axis.

AUTOCOMPRESS
applies an automatic offset that prevents axis labels and tick values from extending beyond the axis length.

number
specifies the offset as a decimal proportion of the full axis length.

Default AUTO

Range 0–1. The sum of OFFSETMAX= and OFFSETMIN= should not be more than 1.

See "Adjusting Axis Offsets" on page 1053

OFFSETMIN=AUTO | AUTOCOMPRESS | *number*
reserves an area at the minimum end of the axis. No tick marks are displayed in the reserved area.

AUTO
reserves just enough area to fully display markers and other graphical features near the maximum end of an axis.

AUTOCOMPRESS
applies an automatic offset that prevents axis labels and tick values from extending beyond the axis length.

number
specifies the offset as a decimal proportion of the full axis length.

Default AUTO

Range 0–1. The sum of OFFSETMAX= and OFFSETMIN= should not be more than 1.

See "Adjusting Axis Offsets" on page 1053.

REVERSE=TRUE | FALSE
specifies whether tick values should appear in the reverse order.

Default FALSE

See "boolean " on page xii for other Boolean values that you can use.

SHORTLABEL="*string*"
specifies an alternate axis label to display when the default label or the label specified by the LABEL= option is too long to fit the available space.

Interaction This option is ignored if the DISPLAY= option or the DISPLAYSECONDARY= option does not display the axis label.

Note If the specified label is itself too long for the axis, it is truncated in the display.

THRESHOLDMAX=*number*
specifies a bias for including one more tick mark at the maximum end of the axis.

Default 0.30

Range 0–1

Restriction This option applies to the LAYOUT OVERLAYEQUATED XAXISOPTS= and YAXISOPTS= options only.

Interaction This option is ignored if the TICKVALUELIST= or TICKVALUESEQUENCE= option is used.

Tips If the threshold is set to 0, the potential tick mark is never displayed. If the threshold is set to 1, then the tick mark is always displayed.

Specifying THRESHOLDMIN=0 and THRESHOLDMAX=0 prevents the tick marks from extending beyond the data range.

Specifying THRESHOLDMIN=1 and THRESHOLDMAX=1 ensures that the data range is bounded by tick marks.

For the minimum axis length, set the THRESHOLDMIN= and THRESHOLDMAX= options to 0.

See “Adjusting Axis Thresholds” on page 1052

THRESHOLDMIN=*number*
specifies a bias for including one more tick mark at the minimum end of the axis.

Default 0.30

Range 0–1

Restriction This option applies to the LAYOUT OVERLAYEQUATED XAXISOPTS= and YAXISOPTS= options only.

Interaction This option is ignored if the TICKVALUELIST= or TICKVALUESEQUENCE= option is used.

Tips If the threshold is set to 0, the potential tick mark is never displayed. If the threshold is set to 1, then the tick mark is always displayed.

Specifying THRESHOLDMIN=0 and THRESHOLDMAX=0 prevents the tick marks from extending beyond the data range.

Specifying THRESHOLDMIN=1 and THRESHOLDMAX=1 ensures that the data range is bounded by tick marks.

For the minimum axis length, set the THRESHOLDMIN= and THRESHOLDMAX= options to 0.

See “Adjusting Axis Thresholds” on page 1052

TICKVALUEATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font attributes of the axis tick values.

Default The GraphValueText style element.

Interaction This option is ignored if the DISPLAY= or DISPLAYSECONDARY= option does not display tick values.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Text Options" on page 1606 for available *text-options*.

TICKVALUEFITPOLICY=*policy*
specifies a policy for avoiding tick value collision on an axis. The effectiveness of a collision-avoidance policy depends on the number of tick values, their length, and the length of the axis. Which policies are valid depends on the axis on which this option is used.

For the Y axis, the following policies are valid:

NONE
makes no attempt to avoid collisions between tick values.

Tick values are displayed even when they collide.

THIN
eliminates alternate tick values.

For the X axis, the following policies are valid:

NONE
makes no attempt to avoid collisions between tick values.

Tick values are displayed even when they collide.

ROTATE
rotates the tick values if a collision occurs.

ROTATEALWAYS
rotates the tick values regardless of whether a collision occurs.

ROTATETHIN
attempts the ROTATE policy, and then the THIN policy.

STAGGER
alternates the tick values between two rows.

STAGGERROTATE
attempts the STAGGER policy, and then the ROTATE policy.

STAGGERTHIN
attempts the STAGGER policy, and then the THIN policy.

THIN
eliminates alternate tick values.

Default THIN

Note A note is written to the SAS log when tick value thinning occurs.

TICKVALUEFORMAT=(*format-options*) | DATA | *format*
specifies how to format the values for major tick marks.

(*format-options*)
specifies one or more formatting options for major tick values.

Together, these options provide parameters for determining an optimal format (*w.d*, E*w.*, BEST*w.*) for displaying major tick values.

MAXWIDTH=*integer*
specifies the maximum width for displayed tick values.

Values might be rounded or converted to E notation to fit into this width.

Default 8

MAXDECIMALS=*integer*
specifies the maximum number of decimals for displayed tick values.

Values might be rounded or converted to E notation to fit into this width.

Default 6

Note The MAXWIDTH= option value should be greater than the MAXDECIMALS= option value.

PREFERREDDECIMALS=*integer*
specifies the number of decimal places that you want to display for most values.

The actual number might vary based on other constraints.

Default 2

EXTRACTSCALE=TRUE | FALSE
specifies whether to extract a scale factor from the tick values and use it to reduce the tick value width.

The scale can be a named scale or a scientific-notation scale. The EXTRACTSCALETYPE= option specifies the scale type. The scale that is used is appended to the axis label, as shown in the following example.

```
Total Sales (millions)
```

For long axis labels, if the scale does not fit the available space, then the label is truncated, and the scale is appended to the truncated label. Ellipses indicate that the label was truncated, as shown in the following example.

```
Total Sales for the Fourth Quarter Of ... (millions)
```

In extreme cases in which the scale does not fit even with truncation, the entire axis is dropped.

Default FALSE

Restriction The scale that is extracted by the EXTRACTSCALE= option is derived from the English locale for all locales.

Interactions The scale type is determined by the EXTRACTSCALETYPE= option.

If the axis label is not displayed, then the EXTRACTSCALE=TRUE option is ignored.

Note When EXTRACTSCALE=TRUE and a scale is extracted, the tick values are formatted to provide the best fit on the axis. In that case, the tick value format might differ from the data format even when a named format is applied to the data values.

See "boolean " on page xii for other Boolean values that you can use.

EXTRACTSCALETYPE=DEFAULT | SCIENTIFIC
specifies whether to extract a named scale or a scientific-notation scale.

DEFAULT
extracts a named scale.

A named scale can be millions, billions, or trillions for values of 999 trillion or less, or a multiple of 10 (denoted as 10^*n*) for values over 999 trillion. For large tick values, the scale factor is set to ensure that the absolute value of the largest value is greater than 1. For small fractional tick values, the scale factor is set to ensure that the absolute value of the smallest value is greater than 1. The scale can be millionth, billionth, or trillionth for values of 1 trillionth or more, or a multiple of 1/10 (10^−*n*) for values less than 1 trillionth.

SCIENTIFIC
extracts a scientific-notation scale.

A scientific-notation scale is a multiple of 10 expressed as 10^*n* for values greater than 1, or a multiple of 1/10 expressed as 10^−*n* for values less than 1.

Default DEFAULT

Restriction The scale is derived from the English locale for all locales.

DATA
uses the format that has been assigned to the column that is contributing to the axis (or BEST6 if no format is assigned) in order to control the formatting of the major tick values.

format
specifies a format to apply to the major tick values.

Restriction GTL currently honors most, but not every, SAS format. For details, see Appendix 4, "Format Support in ODS Graphics," on page 1621 .

Note If you specify a format that significantly reduces precision, because of tick-value rounding, the plot data elements might not

align properly with the axis tick values. In that case, specify a tick-value format with a higher precision.

Default (MAXWIDTH=8, MAXDECIMALS=6, PREFERREDDECIMALS=2, EXTRACTSCALE=FALSE, EXTRACTSCALETYPE=DEFAULT)

VIEWMAX=*number*

specifies the maximum data value to include in the display on the X or Y axes when the axis lengths and major tick values are equal. The value might be adjusted by the threshold calculation.

Default The maximum value in the data for the X and Y axes.

Requirements If VIEWMIN= is also specified, VIEWMAX= must be greater than VIEWMIN=. Otherwise, the default values are used for VIEWMIN= and VIEWMAX=.

If VIEWMIN= is not specified, VIEWMAX= must be less than the data maximum. Otherwise, a blank graph is drawn.

Interactions This option is ignored when EQUATETYPE=SQUARE.

This option does not determine the maximum axis tick value that is displayed. The THRESHOLDMAX= value is used to determine the maximum tick value.

Notes Setting a VIEWMAX= or VIEWMIN= value does not alter the original data or any calculations on it.

The maximum axis tick value might differ from the VIEWMAX= value. The VIEWMIN= and VIEWMAX= values, and additional factors such as thresholds and the tick values computed by the plot statement, are used to determine the axis tick values.

Tip To display the VIEWMAX= value as the maximum tick value, use the TICKVALUELIST= option.

See "Adjusting the Axis View" on page 1051

VIEWMIN=*number*

specifies the minimum data value to include in the display on the X or Y axes when the axis lengths and major tick values are equal. The value might be adjusted by the threshold calculation.

Default The minimum value in the data for the X and Y axes.

Requirements If VIEWMAX= is also specified, VIEWMIN= must be less than VIEWMAX=. Otherwise, the default values are used for VIEWMAX= and VIEWMIN=.

If VIEWMAX= is not specified, VIEWMIN= must be greater than the data minimum. Otherwise, a blank graph is drawn.

Interactions This option is ignored when EQUATETYPE=SQUARE.

This option does not determine the minimum axis tick value that is displayed. The THRESHOLDMIN= value is used to determine the minimum tick value.

Notes

Setting a VIEWMAX= or VIEWMIN= value does not alter the original data or any calculations on it.

The minimum axis tick value might differ from the VIEWMIN= value. The VIEWMIN= and VIEWMAX= values, and additional factors such as thresholds and the tick values computed by the plot statement, are used to determine the axis tick values.

Tip

To display the VIEWMIN= value as the minimum tick value, use the TICKVALUELIST= option.

See

"Adjusting the Axis View" on page 1051

Details

The LAYOUT OVERLAYEQUATED statement is used for equated layouts where the X and Y axes always have equal increments between tick values. Because the axes within the equated layout are so closely correlated, some axis adjustments cannot be applied to one axis without applying them to the other.

For example, the INTEGER= option sets evenly spaced integer values for the axis tick marks. That setting must be applied to both axes if the correlation between them is to be maintained. The LAYOUT OVERLAYEQUATED statement provides the COMMONAXISOPTS= option for specifying the INTEGER= option and other options whose settings apply in common to both axes.

Despite the close correlation between the axes, some axis adjustments can be made to one axis without affecting the other. For example, displaying grid lines on one axis has no impact on the other. The XAXISOPTS= and YAXISOPTS= options are available for applying settings separately to the X and Y axes.

The following example template sets evenly spaced integer values for the axis tick marks of both axes. It also specifies the display of grid lines, tick marks, and tick values for the Y axis:

```
begingraph;
  layout overlayequated /
    commonaxisopts=(integer=true);
    yaxisopts=(griddisplay=on display=(ticks tickvalues));
    seriesplot x=var1 y=var2;
  endlayout;
endgraph;
```

Axis Options for LAYOUT DATALATTICE and LAYOUT DATAPANEL

Axis options for the plots within DATALATTICE and DATAPANEL layouts

See: "LAYOUT DATALATTICE Statement" on page 51
"LAYOUT DATAPANEL Statement" on page 79

Syntax

The X and X2 axis options for the plots within DATALATTICE and DATAPANEL layouts are specified with the following options:

COLUMNAXISOPTS=(*axis-options*)

COLUMN2AXISOPTS=(*axis-options*)

The Y and Y2 axis options for the plots within DATALATTICE and DATAPANEL layouts are specified with the following options:

ROWAXISOPTS=(*axis-options*)

ROW2AXISOPTS=(*axis-options*)

General Options for All Axes in the Layout

The options that are documented in this section can be used with any of the axis types that are supported within a DATALATTICE or DATAPANEL layout. Subsequent sections in the chapter document the axis options that are available only for specific axis types: discrete, linear, log, or time axes. The following table provides a summary of the general options.

Statement Option	Description
ALTDISPLAY	Controls which axis features are displayed on second, fourth, and other even row or column occurrences of the primary axis.
ALTDISPLAYSECONDARY	Controls which features are displayed on second, fourth, and other even row or column occurrences of the secondary axis.
DISCRETEOPTS	Specifies options for a discrete axis.
DISPLAY	Controls which axis features are displayed on first, third, and other odd row or column occurrences of the primary axis.

Statement Option	Description
DISPLAYSECONDARY	Controls which axis features are displayed on first, third, and other odd row or column occurrences the secondary axis.
GRIDATTRS	Specifies the attributes of the grid lines.
GRIDDISPLAY	Specifies whether axis grid lines are displayed.
LABEL	Specifies the axis label.
LABELATTRS	Specifies the color and font attributes of the axis label.
LABELFITPOLICY	Specifies a policy for fitting axis labels in the available space.
LABELPOSITION	Specifies the position of the axis label.
LABELSPLITCHAR	Specifies one or more characters on which the axis labels can be split, if needed.
LABELSPLITCHARDROP	Specifies whether the split characters should be included in the axis labels that are displayed.
LABELSPLITJUSTIFY	Specifies the justification of the strings that are inside the axis label blocks.
LINEAROPTS	Specifies options for a standard numeric interval axis.
LOGOPTS	Specifies options for a log axis.
NAME	Assigns a name to an axis for reference in other statements.
OFFSETMAX	Reserves an area at the maximum end of the axis. No tick marks are displayed in the reserved area.
OFFSETMIN	Reserves an area at the minimum end of the axis. No tick marks are displayed in the reserved area.
REVERSE	Specifies whether the tick values should appear in the reverse order.
SHORTLABEL	Specifies an alternate axis label.

Statement Option	Description
TICKVALUEATTRS	Specifies the color and font attributes of the axis tick value labels.
TICKVALUEHALIGN	Specifies the horizontal alignment for all of the tick values that are displayed on the Y and Y2 axes.
TICKVALUEVALIGN	Specifies the vertical alignment for all of the tick values that are displayed on the X and X2 axes.
TIMEOPTS	Specifies options for a TIME axis.
TYPE	Specifies the type of axis to use.

ALTDISPLAY=STANDARD | ALL | NONE | (*display-options*

controls which axis features are displayed on second, fourth, and other even row or column occurrences of the primary axis.

STANDARD
specifies that the LABEL, LINE, TICKS, and TICKVALUES are displayed

ALL
currently the same as STANDARD

NONE
specifies that no axis features are displayed

(*display-options*)
a space-separated list of one or more of the following options enclosed in parentheses:

LABEL
displays the axis label.

A common label is displayed at the center of the grid, and the label applies to all the primary axes in the row or column. This label is overridden by a label specified on the DISPLAY= option.

LINE
displays the axis line.

TICKS
displays the tick marks.

TICKVALUES
displays the values that are represented by the major tick marks.

Default The settings on the DISPLAY= option.

Tips The default line attributes for the axis line and axis tick marks are defined in the GraphAxisLine style element.

This option can be used to obtain the alternating axis information as seen in a ScatterPlotMatrix.

See "Details" on page 1275 for more information about the primary and secondary axes.

GRIDDISPLAY= and GRIDATTRS= for setting axis grid lines.

ALTDISPLAYSECONDARY=NONE | ALL | STANDARD | (*display-options*)
controls which features are displayed on second, fourth, and other even row or column occurrences of the secondary axis. A secondary axis is not an independent axis. Rather, it mirrors the primary axis (though it can use different display features). Thus, for this option to take effect, all plot statements in the LAYOUT PROTOTYPE must map data to the same primary axis. For example, a secondary X2 axis can be displayed on top in the layout, provided all plot statements set XAXIS=X to map data to the primary X axis (bottom). Similarly, a secondary Y2 axis can be displayed to the right in the layout, provided all plot statements set YAXIS=Y to map data to the primary Y axis (left).

NONE
specifies that no axis features are displayed

STANDARD
specifies that the LABEL, LINE, TICKS, and TICKVALUES are displayed on the secondary axis

ALL
currently the same as STANDARD

(*display-options*)
a space-separated list of one or more of the following options enclosed in parentheses:

LABEL
displays the axis label.

A common label is displayed at the center of the grid, and the label applies to all the secondary axes in the row or column. This label is overridden by a label specified on the DISPLAY= option.

LINE
displays the axis line.

TICKS
displays the tick marks.

TICKVALUES
displays the values that are represented by the major tick marks.

Default The settings on the DISPLAYSECONDARY= option.

Restriction If some plot statements set XAXIS=X and others set XAXIS=X2, then both the X and X2 axis are primary and a secondary X axis cannot be displayed. In that case, this option is ignored. The same applies for the Y axes.

Tips The default line attributes for the axis line and axis tick marks are defined in the GraphAxisLine style element.

This option can be used to obtain the alternating axis information as seen in a ScatterPlotMatrix.

See "Details" on page 1275 for more information about the primary and secondary axes.

GRIDDISPLAY= and GRIDATTRS= for setting axis grid lines.

DISCRETEOPTS=(*discrete-axis-options*)
specifies one or more options for a discrete axis. Options must be enclosed in parentheses. Each option is specified as a *name = value* pair and each pair is space separated.

Interaction This option is ignored if the axis type is not DISCRETE.

See "Options for Discrete Axes Only" on page 1235 for the options that you can use for *discrete-axis-options*.

DISPLAY=STANDARD | ALL | NONE | (*display-options*)
controls which axis features are displayed on first, third, and other odd row or column occurrences of the primary axis.

STANDARD
specifies that the LABEL, LINE, TICKS, and TICKVALUES are displayed

ALL
currently the same as STANDARD

NONE
specifies that no axis features are displayed

(*display-options*)
specifies a space-separated list of one or more display options, enclosed in parentheses.

The list can contain one or more of the following options:

LABEL
displays the axis label

LINE
displays the axis line

TICKS
displays the tick marks

TICKVALUES
displays the values that are represented by the major tick marks

Default STANDARD

Note When LABEL is specified, a common label is displayed at the center of the grid, and the label applies to all the primary axes in the row or

column. This label overrides a label specified on the ALTDISPLAY= option.

Tips The default line attributes for the axis line and axis tick marks are defined in the GraphAxisLine style element.

Use the GRIDDISPLAY= and GRIDATTRS= options to set the axis grid lines.

When LINE is excluded from the DISPLAY= option, the layout wall outline or the default baseline of a bar chart, needle plot, or waterfall chart can appear to be an axis line. To suppress the wall outline, use the WALLDISPLAY= option in the layout statement. To suppress the plot baseline, use the BASELINEATTRS= option in the plot statement.

See "Details" on page 1275 for more information about the primary and secondary axes..

DISPLAYSECONDARY=NONE | ALL | STANDARD | (*display-options*)
controls which axis features are displayed on first, third, and other odd row or column occurrences of the secondary axis. A secondary axis is not an independent axis. Rather, it mirrors the primary axis (though it can use different display features). Thus, for this option to take effect, all plot statements in the LAYOUT PROTOTYPE must map data to the same primary axis. For example, a secondary X2 axis can be displayed on top in the layout, provided all plot statements set XAXIS=X to map data to the primary X axis (bottom). Similarly, a secondary Y2 axis can be displayed to the right in the layout, provided all plot statements set YAXIS=Y to map data to the primary Y axis (left).

NONE
specifies that no axis features are displayed

STANDARD
specifies that the LABEL, LINE, TICKS, and TICKVALUES are displayed on the secondary axis

ALL
currently the same as STANDARD

(*display-options*)
specifies a space-separated list of one or more display options, enclosed in parentheses.

The list can contain one or more of the following options:

LABEL
displays the axis label

LINE
displays the axis line

TICKS
displays the tick marks

TICKVALUES
displays the values that are represented by the major tick marks

Default NONE

Restriction If some plot statements set XAXIS=X and others set XAXIS=X2, both the X and X2 axis are primary and a secondary X axis cannot be displayed. In that case, this option is ignored. The same applies for the Y axes.

Note When LABEL is specified, a common label is displayed at the center of the grid, and the label applies to all the primary axes in the row or column. This label overrides a label specified on the ALTDISPLAY= option.

Tip Use the GRIDDISPLAY= and GRIDATTRS= options to set the axis grid lines.

See for more information about the primary and secondary axes."Details" on page 1275 .

GRIDATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the attributes of the grid lines.

Default The GraphGridLines style element.

Interaction This option is ignored if the GRIDDISPLAY= option does not display the grid lines.

Tip On a log axis, this option affects the appearance of the major grid lines only. It does not affect the appearance of the minor grid lines. To control the appearance of the minor grid lines on a log axis, use the MINORGRIDATTRS= option.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

GRIDDISPLAY=AUTO_OFF | AUTO_ON | ON | OFF
specifies whether axis grid lines are displayed. This option enables the template to absolutely control the display of grid lines or to allow interaction with the current style to decide whether grid lines are displayed.

AUTO_OFF
specifies that grid lines are not displayed unless the GraphGridLines element in the current style contains DisplayOpts="ON."

AUTO_ON
specifies that grid lines are displayed unless the GraphGridLines element in the current style contains DisplayOpts="OFF."

ON
specifies that grid lines are always displayed.

The current style has no override.

OFF
specifies that grid lines are never displayed.

The current style has no override.

The following table shows the end results for various combinations of the GRIDDISPLAY= option and the DisplayOpts= attribute of the GraphGridLines style element. Most supplied templates use the default setting AUTO_OFF to indicate a preference for not displaying grid lines, but allowing the style to override.

GRIDDISPLAY= option	DisplayOpts= style attribute	Grid Lines Shown?
AUTO_OFF	AUTO	no
AUTO_OFF	ON	yes
AUTO_OFF	OFF	no
AUTO_ON	AUTO	yes
AUTO_ON	ON	yes
AUTO_ON	OFF	no
ON	any value	yes
OFF	any value	no

Default AUTO_OFF

Note Supplied styles use DisplayOpts="AUTO," which means that the style has no preference about grid lines and the graphics template setting for grid lines is always used.

LABEL=*"string"* | (*"string"* ...*"string"*)
specifies the axis label. The string can be either a string literal or a dynamic. The list form implies that all included string literals or dynamic variables will be concatenated.

Default The default label is derived from the primary plot in the layout. For more information, see "When Plots Share Data and a Common Axis" on page 1046.

Interaction This option is ignored if the DISPLAY= option or the DISPLAYSECONDARY= option does not display the axis label.

Note If the axis label is too long to fit along the axis, then it is truncated by default.

Tips Use the SHORTLABEL= option to specify an alternate axis label to be used whenever truncation would normally occur.

Use the ODS escape sequence to specify Unicode characters in an axis label. Here is an example that species degrees Fahrenheit in an axis label for temperature:

```
label="Temperature ((*ESC*){unicode '00B0'x}F)"
```

See "Overriding the Default Axis Label" in *SAS Graph Template Language: User's Guide*

LABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font attributes of the axis label.

Default The GraphLabelText style element.

Interaction This option is ignored if the DISPLAY= or DISPLAYSECONDARY= option does not display the axis label.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Text Options" on page 1606 for available *text-options*.

LABELFITPOLICY=AUTO | SPLITALWAYS | STACKED
specifies a policy for fitting axis labels in the available space.

AUTO
uses the short label, when specified, instead of the original label.

If the short label does not fit, then it is clipped. When no short label is specified, the original label is clipped.

SPLIT
splits the axis label at a split character only when necessary in order to make the label fit the available space.

The split character is specified by the LABELSPLITCHAR= option. The short label is not used. A split does not occur at a split character if a split is not needed at that location. If the label does not contain any of the specified split characters, then it is not split. A label that cannot be split or that does not fit the available space even after splitting might overlap the adjoining space.

SPLITALWAYS
always split the axis label at every occurrence of a split character, which is specified by the LABELSPLITCHAR= option.

If the label cannot be split, then it is clipped.

STACKED
displays the Y or Y2 axis label vertically as stacked letters.

Note: This feature applies to SAS 9.4M5 and to later releases.

Valid in ROWAXISOPTS= and ROW2AXISOPTS= only

Default AUTO

Interaction This option has effect only when LABELPOSITION= is CENTER or DATACENTER.

Note When LABELPOSITION=CENTER, the available area is the full axis, including the axis offsets. When LABELPOSITION=DATACENTER, the available area is the tick display area, excluding the axis offsets.

LABELPOSITION=CENTER | DATACENTER | TOP | BOTTOM | LEFT | RIGHT
specifies the position of the axis label.

CENTER
centers the axis label in the axis area.

For the Y and Y2 axes, the label is oriented vertically and is centered in the axis area (including the offsets). The label is positioned to the left of the tick values for the Y axis or to the right of the axis values for the Y2 axis. For the X and X2 axes, the label is centered in the axis area (including the offsets). It is positioned below the tick values for the X axis or above the axis values for the X2 axis.

DATACENTER
repeats the axis label for each row or column and centers each label in the axis tick display area of its row or column.

For the Y and Y2 axes, each label is oriented vertically and is centered in the axis tick display area (excluding the offsets) of its row. The labels are positioned to the left of the tick values for the Y axis or to the right of the axis values for the Y2 axis. For the X and X2 axes, each label is centered in the axis tick display area (excluding the offsets) of its column. The labels are positioned below the tick values for the X axis or above axis values for the X2 axis.

TOP
BOTTOM
orients the label horizontally at the top or bottom of the axis area.

The label is right-justified in the axis area for the Y axis and left-justified for the Y2 axis. If there is not sufficient room in the axis area to display the label, then the label grows to the right for the Y axis and to the left for the Y2 axis.

Restriction These options are valid for the Y and Y2 axes only.

Note When TOP or BOTTOM is used, the label might collide with other graphical features. In that case, use CENTER or DATACENTER instead.

LEFT
RIGHT
positions the label to the left or right of the axis area.

The label is centered vertically in the axis area.

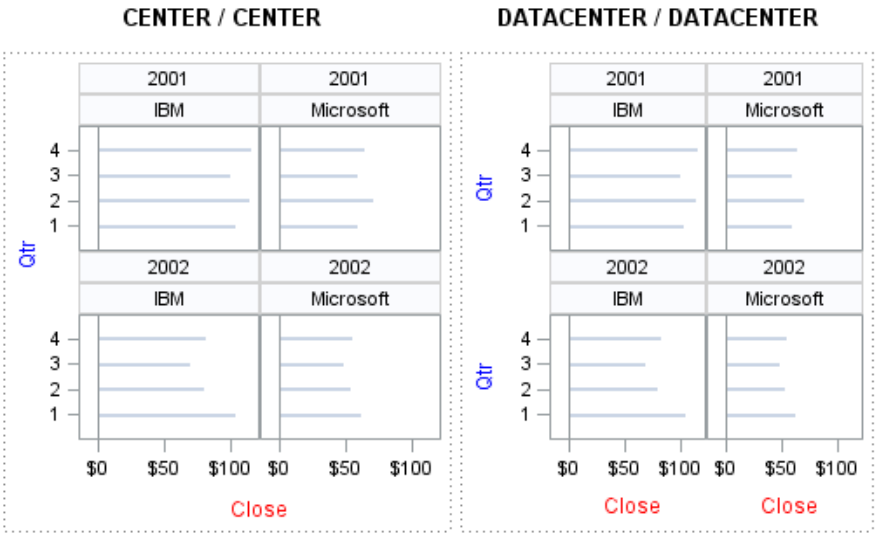
Restriction These options are valid for the X and X2 axes only.

Note When LEFT or RIGHT is used, the label might collide with other graphical features.

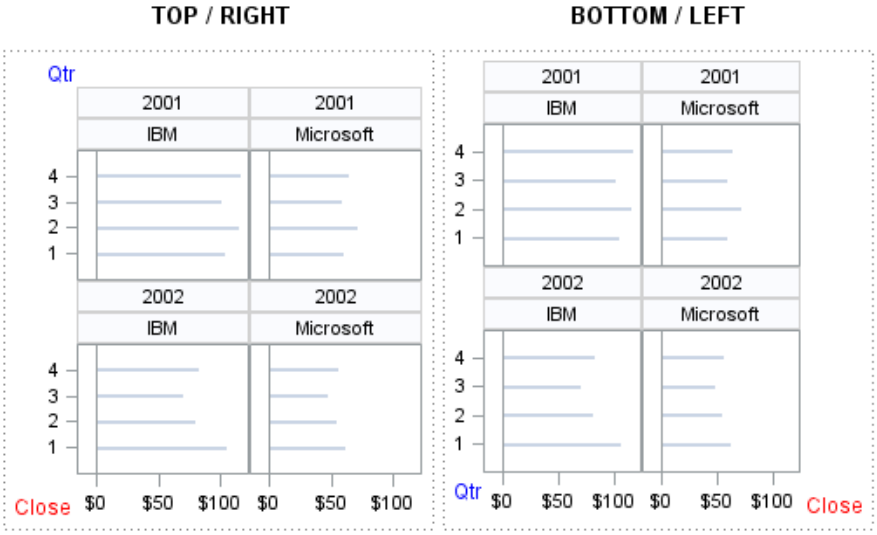
The following figure shows the CENTER and DATACENTER positions for a blue Y-axis label Type and a red X-axis label MPG.

The next figure shows the TOP and LEFT positions, and the BOTTOM and RIGHT positions for the same axis labels.

The following figure shows the CENTER and DATACENTER positions for a blue Y-axis label Qtr and a red X-axis label Close.



The next figure shows the TOP and LEFT positions, and the BOTTOM and RIGHT positions for the same axis labels.



Default CENTER

Restriction This option does not support collision avoidance. In some cases, axis label collisions can occur in the axis area.

Interaction When LEFT, RIGHT, TOP, or BOTTOM is in effect, the SHORTLABEL= option is ignored.

See SHORTLABEL= on page 1232 for information about how short labels are used.

LABELSPLITCHAR="*character-list*"
specifies one or more characters on which the axis labels can be split, if needed. When multiple split characters are specified, each character in the list is treated as a separate split character unless the specified characters appear consecutively in the axis label. In that case, all of the specified split characters together are treated as a single split character.

When LABELFITPOLICY=SPLIT, if the axis label does not fit the available space, then it is split on a specified split character only if a split is needed at that point to make the label fit. In this case, a split might not occur on every split character. When LABELFITPOLICY=SPLITALWAYS, the axis label is split unconditionally on every occurrence of a split character. If the axis label does not contain any of the specified split characters, the label is not split.

"character-list"
one or more characters with no space between each character and enclosed in quotation marks.

Default A blank space

Requirements The list of characters must be enclosed in quotation marks.

Multiple characters must be specified with no space between them. For example, to specify the split characters a, b, and c, use the following option:

```
labelsplitchar="abc"
```

Interactions This option has effect only when LABELPOSITION= is CENTER or DATACENTER.

The LABELSPLITCHARDROP= option specifies whether the split characters are included in the displayed data label or are dropped.

Notes When multiple characters are specified, the order of the characters in the list is not significant.

The split characters are case sensitive.

Tip Use the LABELSPLITJUSTIFY= option to specify the justification of the strings in the axis label block.

LABELSPLITCHARDROP=TRUE | FALSE
specifies whether the split characters are included in the displayed axis labels.

TRUE
drops the split characters from the axis label display.

FALSE
includes the split characters in the axis label display.

When the label is split while LABELSPLITCHARDROP=FALSE is in effect, each split character remains as the last character in the current line. The characters that follow the split character, up to and including the next split character, are then wrapped to the next line.

Default TRUE. The split characters are dropped from the axis label.

Interactions This option has effect only when LABELPOSITION= is CENTER or DATACENTER.

The LABELSPLITCHAR= option specifies the split characters.

See "boolean " on page xii for other Boolean values that you can use.

LABELSPLITJUSTIFY=*justification*
specifies the justification of the strings that are inside the axis label blocks.

justification

CENTER
LEFT
RIGHT
specifies the justification for the X or X2 axis label.

CENTER
TOP
BOTTOM
specifies the justification for the Y or Y2 axis label.

Default CENTER

Interaction This option has effect only when LABELPOSITION= is CENTER or DATACENTER.

LINEAROPTS=(*linear-axis-options*)
specifies one or more options for a numeric interval axis. Options must be enclosed in parentheses. Each option is specified as a *name = value* pair and each pair is space separated.

Interaction This option is ignored if the axis type is not LINEAR.

See "Options for Linear Axes Only" on page 1243 for the options that you can use for *linear-axis-options*.

LOGOPTS=(*log-axis-options*)
specifies one or more options for a log axis. Options must be enclosed in parentheses. Each option is specified as a *name = value* pair and each pair is space separated.

Interaction This option is ignored if the axis type is not LOG.

See "Options for Log Axes Only" on page 1255 for the options that you can use for *log-axis-options*.

NAME="*string*"
assigns a name to an axis for reference in other statements. Currently, it is used only in an AXISLEGEND statement.

Restriction This option does not support variables that are created by the DYNAMIC, MVAR, and NMVAR template statements.

Interactions This option is ignored unless the axis is discrete. The axis can be discrete by default, or explicitly set to discrete with a TYPE= DISCRETE setting.

For this option to take effect, an axis legend must be enabled. To enable an axis legend, the DISCRETEOPTS= option must set the TICKVALUEFITPOLICY to either EXTRACT or EXTRACTALWAYS. In addition, an AXISLEGEND statement must be specified to generate the axis legend.

OFFSETMAX=AUTO | AUTOCOMPRESS | *number*
reserves an area at the maximum end of the axis. No tick marks are displayed in the reserved area.

AUTO
reserves just enough area to fully display markers and other graphical features near the maximum end of an axis.

AUTOCOMPRESS
applies an automatic offset that prevents axis labels and tick values from extending beyond the axis length.

number
specifies the offset as a decimal proportion of the full axis length.

For a continuous axis, the offset follows the highest data value or highest tick value, whichever is greater.

Default AUTOCOMPRESS

Range 0–1. The sum of OFFSETMAX= and OFFSETMIN= should not be more than 1.

See "Adjusting Axis Offsets" on page 1053

OFFSETMIN=AUTO | AUTOCOMPRESS | *number*
reserves an area at the minimum end of the axis. No tick marks are displayed in the reserved area.

AUTO
reserves just enough area to fully display markers and other graphical features near the maximum end of an axis.

AUTOCOMPRESS
applies an automatic offset that prevents axis labels and tick values from extending beyond the axis length.

number
specifies the offset as a decimal proportion of the full axis length.

For a continuous axis, the offset precedes the lowest data value or lowest tick value, whichever is less.

Default AUTOCOMPRESS

Range 0–1. The sum of OFFSETMAX= and OFFSETMIN= should not be more than 1.

See "Adjusting Axis Offsets" on page 1053.

REVERSE=TRUE | FALSE
specifies whether tick values should appear in the reverse order.

Default FALSE

See "boolean " on page xii for other Boolean values that you can use.

SHORTLABEL="*string*"
specifies an alternate axis label to display when the default label or the label specified by the LABEL= option is too long to fit the available space. When LABELPOSITION=CENTER (default), the available space for an axis label is the full axis, including the axis offsets. When LABELPOSITION=DATACENTER, the available space for an axis label is the axis tick display area, which excludes the axis offsets. If the label length exceeds the available space, then the label is anchored at the left or bottom offset. It extends beyond the opposing offset until it reaches the end of the axis where it is truncated. An ellipsis designates the truncation.

Interactions This option is ignored if the DISPLAY= option or the DISPLAYSECONDARY= option does not display the axis label.

This option has effect only when the LABELPOSITION= option is set to CENTER or DATACENTER.

Note If the specified label is itself too long for the grid length or the grid width, then it is truncated in the display.

TICKVALUEATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font attributes of the axis tick values.

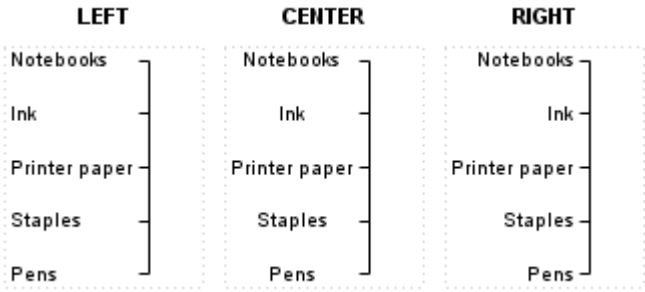
Default The GraphValueText style element.

Interaction This option is ignored if the DISPLAY= or DISPLAYSECONDARY= option does not display tick values.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Text Options" on page 1606 for available *text-options*.

TICKVALUEHALIGN=LEFT | CENTER | RIGHT
specifies the horizontal alignment for all of the tick values that are displayed on the Y and Y2 axes.

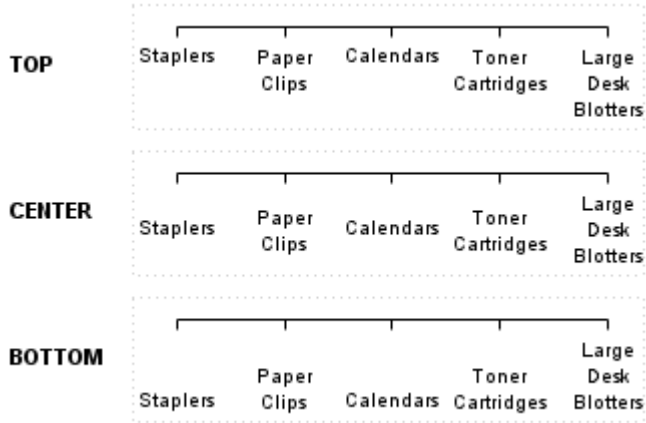


Defaults RIGHT for a Y axis

LEFT for a Y2 axis

Restriction This option is valid for the Y and Y2 axes only.

TICKVALUEVALIGN=TOP | CENTER | BOTTOM
specifies the vertical alignment for all of the tick values that are displayed on the X and X2 axes.



Defaults TOP for an X axis

BOTTOM for an X2 axis

Restriction This option is valid for the X and X2 axes only.

TIMEOPTS=(*time-axis-options*)
specifies one or more options for a time axis.

Requirements Columns associated with a time axis must be in SAS time, SAS date, or SAS datetime units and have an associated SAS time, date, or datetime format.

Options must be enclosed in parentheses. Each option is specified as a *name = value* pair and each pair is space separated.

Interaction This option is ignored if the axis type is not TIME.

See "Options for Time Axes Only" on page 1265 for the options that you can use for *time-axis-options*.

TYPE=AUTO | DISCRETE | LINEAR | TIME | LOG
specifies the type of axis to use.

AUTO
requests that the axis type be automatically determined, based on the overlay contents.

DISCRETE
uses a DISCRETE axis if possible.

The data for discrete axes can be character or numeric. You can add a DISCRETEOPTS= option list to customize this axis type.

LINEAR
uses a LINEAR axis if possible.

You can add a LINEAROPTS= option list to customize this axis type.

TIME
uses a TIME axis if possible.

Data for this axis must be SAS time, SAS date, or SAS datetime values. You can add a TIMEOPTS= option list to customize this axis type.

LOG
uses a LOG axis if possible.

You can add a LOGOPTS= option list to customize this axis type.

Interaction If a log axis is requested and the axis data contains 0 or negative values, the axis reverts to a linear axis. This outcome can occur for the response axis of a bar chart, line chart, needle plot, or waterfall chart when a baseline intercept of 0 or less is specified. It can also occur for the response axis of a waterfall chart when an initial bar value of 0 or less is specified. To get a log response axis in those cases, set the baseline intercept or initial bar value to a positive value.

Default AUTO

Interactions If this option is set to anything other than AUTO, then plots within the layout are dropped from the display if their data types or data ranges do not match the axis type requirements. For more information, see "Plot Axis Types Must Agree on Common Axes" on page 1049.

After the axis type is determined (whether you set a specific type or AUTO is in effect), you can use only options that are supported by that axis type. For example, if TYPE=TIME, then only the general OVERLAY axis options and those available on TIMEOPTS= are supported.

Options for Discrete Axes Only

The options that are documented in this section can be used with the DISCRETEOPTS= axis option. The following table provides a summary of the options.

Discrete Axis Option	Description
TICKDISPLAYLIST	Specifies the text that is displayed for the tick values that are defined in the TICKVALUELIST= option.
TICKTYPE	Specifies the position of the axis tick mark.
TICKVALUEFITPOLICY	Specifies a policy for avoiding tick value collision.
TICKVALUEFORMAT	Specifies how to format the values for major tick marks.
TICKVALUELIST	Specifies the list of tick values that are displayed on the axis.
TICKVALUEROTATION	Specifies how the tick values are rotated on the X and X2 axes.
TICKVALUESPLITCHAR	Specifies a list of characters on which the tick values can be split, if needed.
TICKVALUESPLITCHARDROP	Specifies whether the split characters are included in the displayed tick values.
TICKVALUESPLITJUSTIFY	Specifies justification of the strings that are inside the tick value block.

TICKDISPLAYLIST=(*string-list*)

specifies the text that is displayed for the tick values that are defined in the TICKVALUELIST= option. The string list is a space-separated list of string values that are displayed on the axis in place of the values in the TICKVALUELIST= option. The strings map one-to-one positionally with the values that are listed in the TICKVALUELIST= option.

Default: Determined by the system or by the TICKVALUELIST= option.

Requirements: The list of values must be enclosed in parentheses.

Each value (character and numeric) must be enclosed in quotation marks and separated from adjacent values by a blank space.

Tip: This option should be used with the TICKVALUELIST= option. The number of items in the list for this option should equal the number of items in the list for the TICKVALUELIST= option.

Example The following example specifies the axis tick values 10, 20, 30, and 40, and the tick display values A, B, C, and D:

```
tickvaluelist=("10" "20" "30" "40");
tickdisplaylist=("A" "B" "C" "D");
```

TICKTYPE=MIDPOINT | INBETWEEN
specifies the position of the axis tick marks.

MIDPOINT
places the tick marks at the midpoint value location.

INBETWEEN
places the tick marks half way between adjacent midpoint locations.

Default MIDPOINT

Restriction This option applies to discrete axes only.

Note Starting with SAS 9.4M2, when TICKTYPE=INBETWEEN, the outermost tick marks and grid lines at each end of the axis are not drawn.

TICKVALUEFITPOLICY=*policy*
specifies a policy for avoiding tick value collision on an axis. The effectiveness of a collision-avoidance policy depends on the number of tick values, their length, and the length of the axis. Which policies are valid depends on the axis on which this option is used.

For the Y and Y2 axes, the following policies are valid:

EXTRACT
displays consecutive integers along the axis instead of the actual tick values in order to represent those tick values.

In most cases, this policy is implemented if the system estimates that a collision might occur. If no collision occurs, then the actual tick values are displayed on the axis in the normal manner.

Requirement The EXTRACT policy must be used with an AXISLEGEND statement. For more information, see "Extracting Discrete Axis Tick Values into a Legend" in *SAS Graph Template Language: User's Guide*.

EXTRACTALWAYS
same as EXTRACT, except that the extraction is implemented regardless of whether collision occurs.

Requirement The EXTRACTALWAYS policy must be used with an AXISLEGEND statement. For more information, see "Extracting Discrete Axis Tick Values into a Legend" in *SAS Graph Template Language: User's Guide*.

NONE
makes no attempt to avoid collisions between tick values.

Tick values are displayed even when they collide.

SPLIT
splits the tick value at a split character, which is specified by the TICKVALUESPLITCHAR= option, only when necessary in order to make the value fit the available space.

A split does not occur at a split character if a split is not needed at that location. If the value does not contain any of the specified split characters, then the value is not split. Values that are not split or that do not fit the available space even after splitting might overlap the adjoining space.

See TICKVALUESPLITCHAR= on page 1240

SPLITALWAYS
always splits the axis tick value at every occurrence of a split character that is specified by the TICKVALUESPLITCHAR= option.

See TICKVALUESPLITCHAR= on page 1240

SPLITALWAYSTHIN
same as SPLITALWAYS, except that thinning is performed when long words do not fit the available space.

SPLITTHIN
same as SPLIT, except that thinning is performed when long words do not fit the available space.

THIN
eliminates alternate tick values.

For the X and X2 axes, the following policies are valid:

EXTRACT
displays consecutive integers along the axis instead of the actual tick values in order to represent those tick values.

In most cases, this policy is implemented if the system estimates that a collision might occur. If no collision occurs, then the actual tick values are displayed on the axis in the normal manner.

Requirement The EXTRACT policy must be used with an AXISLEGEND statement. For more information, see "Extracting Discrete Axis Tick Values into a Legend" in *SAS Graph Template Language: User's Guide*.

EXTRACTALWAYS
same as EXTRACT, except that the extraction is implemented regardless of whether collision occurs.

Requirement The EXTRACTALWAYS policy must be used with an AXISLEGEND statement. For more information, see "Extracting Discrete Axis Tick Values into a Legend" in *SAS Graph Template Language: User's Guide*.

NONE
makes no attempt to avoid collisions between tick values.

Tick values are displayed even when they collide.

ROTATE
rotates the tick values if a collision occurs.

The TICKVALUEROTATION= option specifies whether the values are rotated to a 45-degree diagonal or a 90-degree vertical position. By default, the values are rotated to a 45-degree diagonal position.

ROTATEALWAYS
rotates the tick values regardless of whether a collision occurs.

The TICKVALUEROTATION= option specifies whether the values are rotated to a 45-degree diagonal or a 90-degree vertical position. By default, the values are rotated to a 45-degree diagonal position.

ROTATEALWAYSDROP
attempts the ROTATEALWAYS policy, and then drops the tick values if collisions still occur.

ROTATETHIN
attempts the ROTATE policy, and then the THIN policy.

SPLITALWAYS
always splits the axis tick value at every occurrence of a split character that is specified by the TICKVALUESPLITCHAR= option.

See TICKVALUESPLITCHAR= on page 1240

STACKEDALWAYS
always displays the tick values vertically as stacked letters.

Valid in COLUMNAXISOPTS= and COLUMN2AXISOPTS= only

STACKEDALWAYSTHIN
always displays the tick values vertically as stacked letters.

Thinning is performed when the tick values do not fit the available space.

Valid in COLUMNAXISOPTS= and COLUMN2AXISOPTS= only

STAGGER
alternates the tick values between two rows.

STAGGERROTATE
attempts the STAGGER policy, and then the ROTATE policy.

STAGGERTHIN
attempts the STAGGER policy, and then the THIN policy.

STAGGERTRUNCATE
attempts the STAGGER policy, and then the TRUNCATE policy.

THIN
eliminates alternate tick values.

TRUNCATE
shortens the tick labels that exceed 12 characters to 12 characters.

A trailing ellipsis indicates that a label is truncated.

Note Data labels might overlap on a crowded axis.

TRUNCATEROTATE
attempts the TRUNCATE policy, and then the ROTATE policy.

TRUNCATESTAGGER
attempts the TRUNCATE policy, and then the STAGGER policy.

TRUNCATETHIN
attempts the TRUNCATE policy, and then the THIN policy.

Defaults ROTATE for the Y and Y2 axes

THIN for the X and X2 axes

Note A note is written to the SAS log when tick value thinning occurs.

TICKVALUEFORMAT=*format*
specifies how to format the values for major tick marks.

Note: This feature applies to SAS 9.4M3 and to later releases.

Restrictions This option applies only to discrete axes.

Only character formats are supported.

Interaction This option is ignored when the axis tick values are extracted to an axis legend. See TICKVALUEFITPOLICY=EXTRACT | EXTRACTALWAYS.

Tip Use this option when you want to duplicate tick values on an axis.

TICKVALUELIST=(*string-list*)
specifies the list of tick values that are to be displayed on the axis.

string-list
a space-separated list of values, enclosed in parentheses.

You must enclose each value in the list in quotation marks.

Only the tick values that are included in the string list are displayed on the axis. The values are displayed in the order in which they are listed. The data values that are not in the list are dropped. The list can be a subset of the data values. It can also contain values that are not included in the actual data. A tick value that is not included in the data appears on the axis, but no data is represented at its tick mark.

Requirements The list of values must be enclosed in parentheses.

Each value must be enclosed in quotation marks and separated from adjacent values by a blank space.

Notes If the string list contains duplicate values, then the first occurrence of the duplicated value in the list is honored and the remaining instances are ignored.

When the values specified in the list are compared with the actual data values, leading blanks are honored and trailing blanks are ignored.

Tips You can use this option to subset the axis values or to display the values in a specific order.

You can use this option to display values on the axis that are not contained in the data.

Examples The following example specifies the axis tick values Sedan, Sports, Wagon, and SUV:

```
tickvaluelist=("Sedan" "Sports" "Wagon" "SUV")
```

The following example specifies the axis tick values 10, 20, 30, and 40:

```
tickvaluelist=("10" "20" "30" "40")
```

TICKVALUEROTATION=DIAGONAL | DIAGONAL2 | VERTICAL
specifies how the tick values are rotated on the X and X2 axes.

DIAGONAL
rotates the tick values to a 45-degree diagonal position.

The X labels read left to right in a downward direction. The X2 labels read left to right in an upward direction.

DIAGONAL2
rotates the tick values to a −45-degree diagonal position.

The X labels read left to right in an upward direction. The X2 labels read left to right in a downward direction.

Note: This feature applies to SAS 9.4M5 and to later releases.

VERTICAL
rotates the labels to a 90-degree vertical position.

The labels are always drawn from bottom to top.

Default DIAGONAL

Restriction This option is valid for COLUMNAXISOPTS= and COLUMN2AXISOPTS= only.

Interaction The TICKVALUEFITPOLICY= option must be set to ROTATE or ROTATEALWAYS for this option to have any effect.

TICKVALUESPLITCHAR="*character-list*"
specifies a list of characters on which the tick values can be split, if needed. When multiple characters are specified, each character in the list is treated as a separate split character unless the specified characters appear consecutively in the tick value. In that case, all of the specified split characters together are treated as a single split character.

When TICKVALUESPLITPOLICY=SPLIT, if a tick value collision is detected, then the tick value is split on a split character only if necessary at that point in order to avoid collision. In that case, a split might not occur on every split character. When TICKVALUEFITPOLICY=SPLITALWAYS, the tick value is split unconditionally on every occurrence of a split character. If the tick value does not contain any of the specified split characters, then it is not split.

"character-list"
one or more characters with no delimiter between each character.

Default A blank space

Requirements The list of characters must be enclosed in quotation marks.

Multiple characters must be specified with no delimiters. For example, to specify the characters a, b, and c, use the following option:

```
tickvaluesplitchar="abc"
```

Interactions This option is ignored unless option TICKVALUEFITPOLICY= is set to SPLIT, SPLITALWAYS, SPLITTHIN, or SPLITALWAYSTHIN.

The TICKVALUEFITPOLICY= option sets the policy that is used to manage the split behavior of the tick values.

The TICKVALUESPLITCHARDROP= option specifies whether the split characters are displayed or dropped from the display.

Notes When multiple characters are specified, the order of characters in the list is not significant.

The split characters are case sensitive.

Tips Use the TICKVALUESPLITJUSTIFY= option to specify the justification of the strings in the tick value block.

For the X and X2 axis tick values, use the TICKVALUEVALIGN= option to specify the vertical alignment of the tick values.

For the Y and Y2 axis tick values, use the TICKVALUEHALIGN= option to specify the horizontal alignment of the tick values.

Example The following example specifies a blank space, a comma, and an underscore as split characters:

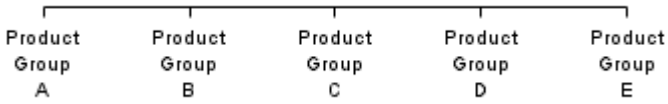
```
tickvaluesplitchar=" ,_"
```

TICKVALUESPLITCHARDROP=TRUE | FALSE
specifies whether the split characters should be included in the displayed tick values. The split characters are specified by the TICKVALUESPLITCHAR= option.

TRUE
drops the split characters from the tick value display.

The following figure shows an example in which TICKVALUESPLITCHARDROP=TRUE and three-word, asterisk-delimited

tick values are split on the asterisk character by using the SPLITALWAYS policy.

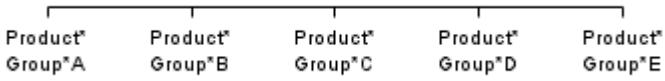


Notice that the asterisk delimiter is not displayed.

FALSE

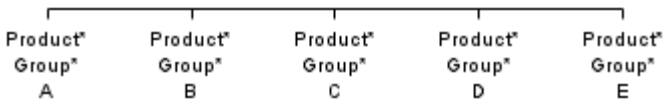
includes the split characters in the tick value display.

The fit policy determines how the characters are displayed. If the display policy is SPLIT or SPLITTHIN and TICKVALUESPLITCHARDROP=FALSE, then each tick value is split at a split character only where a split is necessary in order to make the value fit the available space. A split might not occur at every split character in the tick value. At each split point, the split character remains as the last character in the current line. The characters that follow the split character, up to and including the split character at the next split point, are then wrapped to the following line. This process repeats until the entire data tick value is displayed. The following figure shows an example in which TICKVALUESPLITCHARDROP=FALSE and three-word, asterisk-delimited tick values are split on the asterisk character by using the SPLIT policy.



Notice that a split occurs on the first asterisk and not at the second. In this case, a split is not needed at the second asterisk.

If the fit policy is SPLITALWAYS or SPLITALWAYSTHIN, and TICKVALUESPLITCHARDROP=FALSE, then each tick value is split at every instance of a split character in the value regardless of whether a split is actually needed. Each split character remains as the last character in the current line. The characters that follow each split character, up to and including the next split character, are then wrapped to the next line. The following figure shows an example in which TICKVALUESPLITCHARDROP=FALSE and three-word, asterisk-delimited tick values are split on the asterisk character by using the SPLITALWAYS policy.



Notice that a split occurs after each asterisk and each asterisk appears at the end of the line. In this case, three lines are displayed.

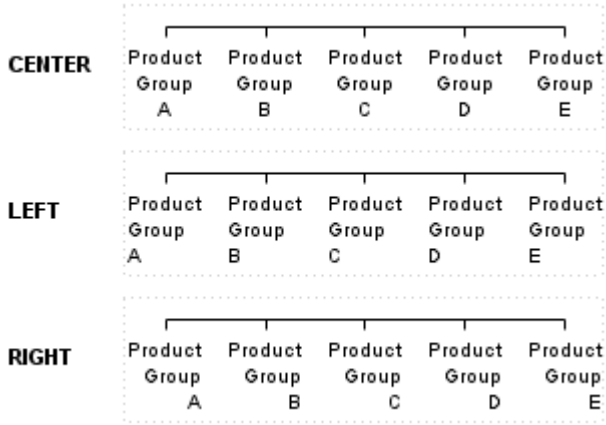
Default TRUE

Interactions The TICKVALUESPLITCHAR= option specifies the split character or characters.

This option is ignored unless option TICKVALUEFITPOLICY= is set to SPLIT, SPLITALWAYS, SPLITTHIN, or SPLITALWAYSTHIN.

See "boolean " on page xii for other Boolean values that you can use.

TICKVALUESPLITJUSTIFY=CENTER | LEFT | RIGHT
specifies justification of the strings that are inside the tick value block. The justification is relative to an individual tick value's display area and does not affect the display of tick values that are not split.



Defaults CENTER for an X or X2 axis

RIGHT for a Y axis

LEFT for a Y2 axis

Interaction This option is ignored unless option TICKVALUEFITPOLICY= is set to SPLIT, SPLITALWAYS, SPLITTHIN, or SPLITALWAYSTHIN.

Options for Linear Axes Only

The options that are documented in this section can be used with the LINEAROPTS= axis option. The following table provides a summary of the options.

Linear Axis Option	Description
INTEGER	Specifies that evenly spaced integer values are used for tick marks.
MINORGRID	Specifies whether grid lines are displayed at the minor tick values.
MINORGRIDATTRS	Specifies the attributes of the minor grid lines.

Linear Axis Option	Description
MINORTICKCOUNT	Specifies the number of minor ticks that are displayed on the axis.
MINORTICKS	Specifies whether the minor tick marks are displayed on the axis.
THRESHOLDMAX	Specifies a bias for including one more tick mark at the maximum end of the axis.
THRESHOLDMIN	Specifies a bias for including one more tick mark at the minimum end of the axis.
TICKDISPLAYLIST	Specifies the text that is displayed for the tick values that are defined in the TICKVALUELIST= option.
TICKVALUEFITPOLICY	Specifies a policy for avoiding tick value collision. Only the default policy (THIN) is available for a Y or Y2 axis.
TICKVALUEFORMAT	Specifies how to format the values for major tick marks.
TICKVALUELIST	Specifies the order of the tick values for a linear axis as list.
TICKVALUEPRIORITY	Specifies whether an axis tick specification can extend the axis data range.
TICKVALUEROTATION	Specifies how the tick values are rotated on the X and X2 axes.
TICKVALUESEQUENCE	Specifies the tick values for a linear axis by start, end, and increment.
VIEWMAX	Specifies the maximum data value to include in the display.
VIEWMIN	Specifies the minimum data value to include in the display.

INTEGER=TRUE | FALSE

specifies that evenly spaced integer values are used for tick marks.

Default FALSE

Interactions This option is overridden by the TICKVALUELIST= or TICKVALUESEQUENCE= option.

This option overrides the MAXDECIMALS= and PREFERREDDECIMALS= suboptions of the TICKVALUEFORMAT= option.

INTEGER=TRUE is ignored for the X or X2 axis when a histogram plot is the primary plot and BINAXIS=TRUE is specified in the HISTOGRAMPARM statement.

Note This option is ignored when the data exceeds the limits of integer values.

See "boolean " on page xii for other Boolean values that you can use.

MINORGRID=TRUE | FALSE

specifies whether grid lines are displayed at the minor tick marks.

Defaults FALSE in SAS 9.4M1 and earlier releases.

The GraphMinorGridLines:DisplayOpts style reference starting with SAS 9.4M2. If attribute DisplayOpts is not defined in the active style, then FALSE is the default value.

Interaction This option is ignored if the GRIDDISPLAY= option does not display the grid lines.

Tips The GRIDATTRS= option does not affect the appearance of the minor grid lines. To control the minor grid line appearance, use the MINORGRIDATTRS= option.

Use the MINORTICKS= option to display the minor tick marks on the axis.

See "boolean " on page xii for other Boolean values that you can use.

MINORGRIDATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)

specifies the attributes of the minor grid lines. This option does not affect the major grid lines.

The following figure shows the minor grid lines set to light blue, dotted lines on a linear axis. (See the example.)

The following figure shows the minor grid lines set to light blue, dotted lines on a base-10 log axis. (See the example.)

The following figure shows the minor grid lines set to light blue, dotted lines on a time axis. (See the example.)

Defaults The GraphGridLines style element is used starting with SAS 9.4.

The GraphMinorGridLines style element is used starting with SAS 9.4M2.

Interaction This option is ignored when MINORTICKS=FALSE.

Note When *style-element* is specified, only the style element's ContrastColor, LineStyle, and LineThickness attributes are used.

Tip Use the GRIDATTRS= option to control the appearance of the major grid lines.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a style element.

"Line Options" on page 1602 for available line options.

Example Here is an example that specifies light blue, dotted lines for the minor grid.

```
minorgridattrs=(color=lightblue pattern=dot);
```

MINORTICKCOUNT=*positive-integer*

specifies the number of minor ticks that are displayed on the axis.

Defaults Four ticks with five intervals in SAS 9.4M1 and earlier releases.

One tick with two intervals starting with SAS 9.4M2.

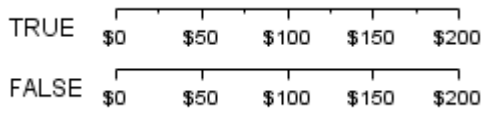
Interactions The DISPLAY= or DISPLAYSECONDARY= option specification must include TICKS for this option to have any effect.

The MINORTICKS= option must specify TRUE for this option to have any effect.

Tip To display *n* intervals between major ticks, use MINORTICKCOUNT=*n*-1.

MINORTICKS=TRUE | FALSE

specifies whether minor ticks are displayed. When MINORTICKS=TRUE, the minor tick marks are displayed on the axis as shown in the following figure.



Default FALSE

Interaction If MINORTICKS=TRUE is specified and TICKVALUELIST= specifies nonuniform tick values such as 3, 5, 11, and 23, then MINORTICK=TRUE is ignored. To display minor tick marks in that case, specify uniform tick values such as 0, 10, 20, and 30 in the TICKVALUELIST= option.

Tip Use the MINORGRID= option to display grid lines at the minor tick values.

See "boolean " on page xii for other Boolean values that you can use.

THRESHOLDMAX=*number*

specifies a bias for including one more tick mark at the maximum end of the axis.

Default 0.30

Range 0–1

Restriction This option applies to linear axes only.

Interaction This option is ignored if the TICKVALUELIST= or TICKVALUESEQUENCE= option is used.

Tips If the threshold is set to 0, the potential tick mark is never displayed. If the threshold is set to 1, then the tick mark is always displayed.

Specifying THRESHOLDMIN=0 and THRESHOLDMAX=0 prevents the tick marks from extending beyond the data range.

Specifying THRESHOLDMIN=1 and THRESHOLDMAX=1 ensures that the data range is bounded by tick marks.

For the minimum axis length, set the THRESHOLDMIN= and THRESHOLDMAX= options to 0.

See "Adjusting Axis Thresholds" on page 1052

THRESHOLDMIN=*number*

specifies a bias for including one more tick mark at the minimum end of the axis.

Default 0.30

Range 0–1

Restriction This option applies to linear axes only.

Interaction This option is ignored if the TICKVALUELIST= or TICKVALUESEQUENCE= option is used.

Tips If the threshold is set to 0, the potential tick mark is never displayed. If the threshold is set to 1, then the tick mark is always displayed.

Specifying THRESHOLDMIN=0 and THRESHOLDMAX=0 prevents the tick marks from extending beyond the data range.

Specifying THRESHOLDMIN=1 and THRESHOLDMAX=1 ensures that the data range is bounded by tick marks.

For the minimum axis length, set the THRESHOLDMIN= and THRESHOLDMAX= options to 0.

See "Adjusting Axis Thresholds" on page 1052

TICKDISPLAYLIST=(*string-list*)
specifies the text that is displayed for the tick values that are defined in the TICKVALUELIST= option. The string list is a space-separated list of string values that are displayed on the axis in place of the values in the TICKVALUELIST= option. The strings map one-to-one positionally with the values that are listed in the TICKVALUELIST= option.

Default The display of tick values is controlled by the TICKVALUEFORMAT= option.

Requirements The list of values must be enclosed in parentheses.

Each value (character and numeric) must be enclosed in quotation marks and separated from adjacent values by a blank space.

Interaction When this option is specified, the TICKVALUEFORMAT= option is ignored.

Tip This option should be used with the TICKVALUELIST= option. The number of items in the list for this option should equal the number of items in the list for the TICKVALUELIST= option.

TICKVALUEFITPOLICY=*policy*
specifies a policy for avoiding tick value collision on an axis. The effectiveness of a collision-avoidance policy depends on the number of tick values, their length, and the length of the axis. Which policies are valid depends on the axis on which this option is used. For the Y and Y2 axes, the following policies are valid:

NONE
makes no attempt to avoid collisions between tick values.

Tick values are displayed even when they collide.

THIN
eliminates alternate tick values.

For the X and X2 axes, the following policies are valid:

NONE
makes no attempt to avoid collisions between tick values.

Tick values are displayed even when they collide.

ROTATE
rotates the tick values if a collision occurs.

The TICKVALUEROTATION= option specifies whether the values are rotated to a 45-degree diagonal or a 90-degree vertical position. By default, the values are rotated to a 45-degree diagonal position.

ROTATEALWAYS
rotates the tick values regardless of whether a collision occurs.

The TICKVALUEROTATION= option specifies whether the values are rotated to a 45-degree diagonal or a 90-degree vertical position. By default, the values are rotated to a 45-degree diagonal position.

ROTATETHIN
attempts the ROTATE policy, and then the THIN policy.

STAGGER
alternates the tick values between two rows.

STAGGERROTATE
attempts the STAGGER policy, and then the ROTATE policy.

STAGGERTHIN
attempts the STAGGER policy, and then the THIN policy.

THIN
eliminates alternate tick values.

Default THIN

Note A note is written to the SAS log when tick value thinning occurs.

TICKVALUEFORMAT=(*format-options*) | DATA | *format*
specifies how to format the values for major tick marks.

(*format-options*)
specifies one or more formatting options for major tick values.

Together, these options provide parameters for determining an optimal format (*w.d*, E*w*., BEST*w*.) for displaying major tick values.

MAXWIDTH=*integer*
specifies the maximum width for displayed tick values.

Values might be rounded or converted to E notation to fit into this width.

Default 8

MAXDECIMALS=*integer*
specifies the maximum number of decimals for displayed tick values.

Values might be rounded or converted to E notation to fit into this width.

Default 6

Note The MAXWIDTH= option value should be greater than the MAXDECIMALS= option value.

PREFERREDDECIMALS=*integer*
specifies the number of decimal places that you want to display for most values.

The actual number might vary based on other constraints.

Default 2

EXTRACTSCALE=TRUE | FALSE
specifies whether to extract a scale factor from the tick values and use it to reduce the tick value width.

The scale can be a named scale or a scientific-notation scale. The EXTRACTSCALETYPE= option specifies the scale type. The scale that is used is appended to the axis label, as shown in the following example.

```
Total Sales (millions)
```

For long axis labels, if the scale does not fit the available space, then the label is truncated, and the scale is appended to the truncated label. Ellipses indicate that the label was truncated, as shown in the following example.

```
Total Sales for the Fourth Quarter Of ... (millions)
```

In extreme cases in which the scale does not fit even with truncation, the entire axis is dropped.

Default FALSE

Restriction The scale that is extracted by the EXTRACTSCALE= option is derived from the English locale for all locales.

Interactions The scale type is determined by the EXTRACTSCALETYPE= option.

If the axis label is not displayed, then the EXTRACTSCALE=TRUE option is ignored.

Note When EXTRACTSCALE=TRUE and a scale is extracted, the tick values are formatted to provide the best fit on the axis. In that case, the tick value format might differ from the data format even when a named format is applied to the data values.

See “boolean ” on page xii for other Boolean values that you can use.

EXTRACTSCALETYPE=DEFAULT | SCIENTIFIC
specifies whether to extract a named scale or a scientific-notation scale.

DEFAULT
extracts a named scale.

A named scale can be millions, billions, or trillions for values of 999 trillion or less, or a multiple of 10 (denoted as 10^*n*) for values over 999 trillion. For large tick values, the scale factor is set to ensure that the absolute value of the largest value is greater than 1. For small fractional tick values, the scale factor is set to ensure that the absolute value of the smallest value is greater than 1. The scale can be millionth, billionth, or trillionth for values of 1 trillionth or more, or a multiple of 1/10 (10^–*n*) for values less than 1 trillionth.

SCIENTIFIC
extracts a scientific-notation scale.

A scientific-notation scale is a multiple of 10 expressed as 10^*n* for values greater than 1, or a multiple of 1/10 expressed as 10^–*n* for values less than 1.

Default DEFAULT

Restriction The scale is derived from the English locale for all locales.

DATA
uses the format that has been assigned to the column that is contributing to the axis (or BEST6 if no format is assigned) in order to control the formatting of the major tick values.

format
specifies a format to apply to the major tick values.

Restriction GTL currently honors most, but not every, SAS format. For details, see Appendix 4, "Format Support in ODS Graphics," on page 1621 .

Note If you specify a format that significantly reduces precision, because of tick-value rounding, the plot data elements might not align properly with the axis tick values. In that case, specify a tick-value format with a higher precision.

Default (MAXWIDTH=8, MAXDECIMALS=6, PREFERREDDECIMALS=2, EXTRACTSCALE=FALSE, EXTRACTSCALETYPE=DEFAULT)

Interaction This option is ignored when the TICKDISPLAYLIST= option is specified.

TICKVALUELIST=(*numeric-list*)
specifies the tick values for a linear axis as a list.

Default An internal algorithm determines the tick marks, based on the actual axis data range or the data range established by the VIEWMIN= and VIEWMAX= options. By default, when this option is used, the only tick values that appear are the tick values in *numeric-list* that fall within the explicit data range (set by VIEWMIN= and VIEWMAX=) or the implicit data range (set by the actual data minimum and data maximum).

Restriction This option applies to linear axes only.

Requirement The tick values must be specified as a space-separated list of numeric values, enclosed in parentheses.

Interactions This option overrides the INTEGER= option.

This option is ignored if the TICKVALUESEQUENCE= option is specified, or if the DISPLAY= option or the DISPLAYSECONDARY= option does not display tick values.

The VIEWMIN= and VIEWMAX= options alter the axis data range. If the VIEWMIN= option is set to the minimum tick list value and the VIEWMAX= option is set to the maximum tick list value, then all ticks in the tick list are displayed. This might result in some data not being displayed. For example, data might not be displayed when the VIEWMIN= value is greater than the actual data minimum, or when the VIEWMAX= value is less than actual data maximum.

If TICKVALUEPRIORITY= TRUE, then the VIEWMIN= and VIEWMAX= options are ignored if they are fully enclosed by the *numeric-list*. The tick *numeric-list* can extend the implicit data range of the axis, but cannot reduce it.

If MINORTICKS=TRUE is specified and TICKVALUELIST= specifies nonuniform tick values such as 3, 5, 11, and 23, then MINORTICK=TRUE is ignored. To display minor tick marks in that case, specify uniform tick values such as 0, 10, 20, and 30 in the TICKVALUELIST= option.

Tip The values in the list are formatted according to the setting for the TICKVALUEFORMAT= option.

TICKVALUEPRIORITY=TRUE | FALSE

specifies whether an axis tick specification (TICKVALUELIST= or TICKVALUESEQUENCE=) can extend the axis data range.

TRUE

extends the axis data range (but does not reduce it) to include the minimum and maximum values that are specified by either the TICKVALUELIST= or TICKVALUESEQUENCE= option.

If the minimum and maximum of the user-specified values are within the data range, this option has no effect.

FALSE

displays only the tick values that are specified by the TICKVALUELIST= option that fall within the explicit data range set by the VIEWMIN= and VIEWMAX= options or by the implicit data range set by the actual data minimum and data maximum.

Default FALSE

Restriction This option applies to linear axes only.

Interactions When this option is set to TRUE, the VIEWMIN= and VIEWMAX= options are ignored.

This option is ignored if the TICKVALUELIST= or TICKVALUESEQUENCE= option is not specified.

This option is ignored if the DISPLAY= option or the DISPLAYSECONDARY= option does not display the tick values.

Note If the minimum and maximum of the specified values are within the data range, then this option has no effect.

See "boolean " on page xii for other Boolean values that you can use.

TICKVALUEROTATION=DIAGONAL | DIAGONAL2 | VERTICAL
specifies how the tick values are rotated on the X and X2 axes.

DIAGONAL
rotates the tick values to a 45-degree diagonal position.

The X labels read left to right in a downward direction. The X2 labels read left to right in an upward direction.

DIAGONAL2
rotates the tick values to a –45-degree diagonal position.

The X labels read left to right in an upward direction. The X2 labels read left to right in a downward direction.

Note: This feature applies to SAS 9.4M5 and to later releases.

VERTICAL
rotates the labels to a 90-degree vertical position.

The labels are always drawn from bottom to top.

Default DIAGONAL

Restriction This option is valid for COLUMNAXISOPTS= and COLUMN2AXISOPTS= only.

Interaction The TICKVALUEFITPOLICY= option must be set to ROTATE or ROTATEALWAYS for this option to have any effect.

TICKVALUESEQUENCE=(START=*number* END=*number* INCREMENT=*number*)
specifies the tick values by start, end, and increment.

START=*number*
specifies the value for the first tick mark.

END=*number*
specifies the value for the last tick mark.

INCREMENT=*number*
specifies the increment for intermediate tick marks between the first and last tick marks.

The END value always controls the last tick mark. The interval between the last tick mark and the previous tick mark might not necessarily be the INCREMENT value.

Default An internal algorithm determines the tick marks, based on the actual axis data range or the data range established by the VIEWMIN= and VIEWMAX= options. By default, when this option is used, the only tick values that appear are those that fall within the explicit data range (set by VIEWMIN= and VIEWMAX=) or the implicit data range (set by the actual data minimum and data maximum).

Interactions This option overrides the INTEGER= option.

The VIEWMIN= and VIEWMAX= options alter the axis data range. If the VIEWMIN= option is set to the START= option value and the VIEWMAX= option is set to the END= option value, then all ticks in the tick sequence are displayed.

If TICKVALUEPRIORITY= TRUE, then the tick sequence might extend the explicit data range of the axis, but never reduce it.

This option is ignored if the DISPLAY= option or the DISPLAYSECONDARY= option does not display tick marks.

Tip The values in the sequence are formatted according to the setting for the TICKVALUEFORMAT= option.

See TICKVALUELIST= option as an alternative for customizing tick marks.

VIEWMAX=*number*

specifies the maximum data value to include in the display. The value might be adjusted by the threshold calculation.

Default The maximum value in the data for the specified axis.

Requirements If VIEWMIN= is also specified, VIEWMAX= must be greater than VIEWMIN=. Otherwise, the default values are used for VIEWMIN= and VIEWMAX=.

If VIEWMIN= is not specified, VIEWMAX= must be less than the data maximum. Otherwise, a blank graph is drawn.

Interactions This option does not determine the maximum axis tick value that is displayed. The THRESHOLDMAX= value is used to determine the maximum tick value.

This option is ignored when TICKVALUEPRIORITY= TRUE.

Notes Setting a VIEWMAX= or VIEWMIN= value does not alter the original data or any calculations on it.

The maximum axis tick value might differ from the VIEWMAX= value. The VIEWMIN= and VIEWMAX= values, and additional

factors such as thresholds and the tick values computed by the plot statement, are used to determine the axis tick values.

Tip To display the VIEWMAX= value as the maximum tick value, use the TICKVALUELIST= option.

See "Adjusting the Axis View" on page 1051

VIEWMIN=*number*
specifies the minimum data value to include in the display. The value might be adjusted by the threshold calculation.

Default The minimum value in the data for the specified axis.

Requirements If VIEWMAX= is also specified, VIEWMIN= must be less than VIEWMAX=. Otherwise, the default values are used for VIEWMAX= and VIEWMIN=.

If VIEWMAX= is not specified, VIEWMIN= must be greater than the data minimum. Otherwise, a blank graph is drawn.

Interactions This option does not determine the minimum axis tick value that is displayed. The THRESHOLDMIN= value is used to determine the minimum tick value.

This option is ignored when TICKVALUEPRIORITY= TRUE.

Notes Setting a VIEWMAX= or VIEWMIN= value does not alter the original data or any calculations on it.

The minimum axis tick value might differ from the VIEWMIN= value. The VIEWMIN= and VIEWMAX= values, and additional factors such as thresholds and the tick values computed by the plot statement, are used to determine the axis tick values.

Tip To display the VIEWMIN= value as the minimum tick value, use the TICKVALUELIST= option.

See "Adjusting the Axis View" on page 1051

Options for Log Axes Only

The options that are documented in this section can be used with the LOGOPTS= axis option. The following table provides a summary of the options.

Log Axis Option	Description
BASE	Specifies the base of the logarithmic scale for the axis values.
MINORGRID	Specifies whether grid lines are displayed at the minor tick marks.

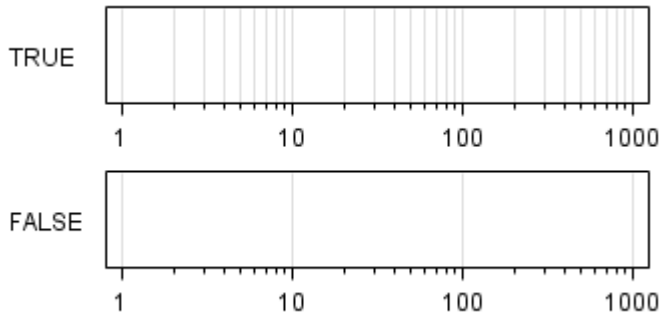
Log Axis Option	Description
MINORGRIDATTRS	Specifies the attributes of the minor grid lines.
MINORTICKCOUNT	Specifies the number of minor ticks that are displayed on the axis.
MINORTICKS	Specifies whether minor ticks are displayed.
TICKINTERVALSTYLE	Specifies how to scale and format the values for major tick marks.
TICKVALUEFORMAT=	Specifies how to format the values for major tick marks.
TICKVALUELIST	Specifies the tick values for a log axis as a space-separated list.
TICKVALUEPRIORITY	Specifies whether the TICKVALUELIST specification can extend the axis data range.
VALUESTYPE	Specifies the scale that the system uses when interpreting the TICKVALUELIST=, VIEWMAX=, and VIEWMIN= option values.
VIEWMAX	Specifies the maximum data value to include in the display.
VIEWMIN	Specifies the minimum data value to include in the display.

BASE=10 | 2 | E
specifies the base of the logarithmic scale for the axis values.

Default 10

Restriction This option applies to log axes only.

MINORGRID=TRUE | FALSE
specifies whether grid lines are displayed at the minor tick marks.



Defaults FALSE in SAS 9.4M1 and earlier releases.

The GraphMinorGridLines:DisplayOpts style reference starting with SAS 9.4M2. If attribute DisplayOpts is not defined in the active style, then FALSE is the default value.

Interaction This option is ignored if the GRIDDISPLAY= option does not display the grid lines.

Tips The GRIDATTRS= option does not affect the appearance of the minor grid lines. To control the minor grid line appearance, use the MINORGRIDATTRS= option.

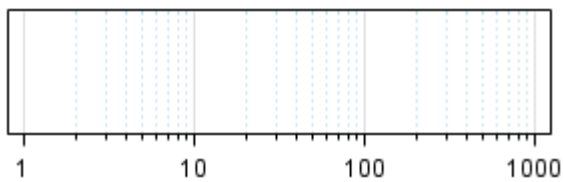
Use the MINORTICKS= option to display the minor tick marks on the axis.

See "boolean " on page xii for other Boolean values that you can use.

MINORGRIDATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the attributes of the minor grid lines. This option does not affect the major grid lines.

The following figure shows the minor grid lines set to light blue, dotted lines on a linear axis. (See the example.)

The following figure shows the minor grid lines set to light blue, dotted lines on a base-10 log axis. (See the example.)



The following figure shows the minor grid lines set to light blue, dotted lines on a time axis. (See the example.)

Defaults The GraphGridLines style element is used starting with SAS 9.4.

The GraphMinorGridLines style element is used starting with SAS 9.4M2.

Interaction This option is ignored when MINORTICKS=FALSE.

Note When *style-element* is specified, only the style element's ContrastColor, LineStyle, and LineThickness attributes are used.

Tip Use the GRIDATTRS= option to control the appearance of the major grid lines.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a style element.

"Line Options" on page 1602 for available line options.

Example Here is an example that specifies light blue, dotted lines for the minor grid.

```
minorgridattrs=(color=lightblue pattern=dot);
```

MINORTICKCOUNT=*positive-integer*

specifies the number of minor ticks that are displayed on the axis.

Default Eight ticks with nine intervals (BASE=10 and TICKINTERVALSTYLE= is LOGEXPAND or LOGEXPONENT.).

Restriction Minor ticks can be displayed only when BASE=10 and TICKINTERVALSTYLE= is LOGEXPAND or LOGEXPONENT.

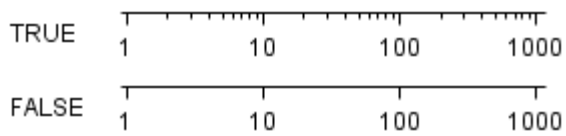
Interactions The DISPLAY= or DISPLAYSECONDARY= option specification must include TICKS for this option to have any effect.

The MINORTICKS= option must specify TRUE for this option to have any effect.

Tip To display *n* intervals between major ticks, use MINORTICKCOUNT=*n*-1.

MINORTICKS=TRUE | FALSE

specifies whether minor ticks are displayed. When MINORTICKS=TRUE, the minor tick marks are displayed on the axis as shown in the following figure.



Default FALSE

Restriction Minor ticks can be displayed only when BASE=10 and TICKINTERVALSTYLE= is LOGEXPAND or LOGEXPONENT.

Requirement If you set this option to TRUE, you must also specify a value for MINORTICKCOUNT=. Otherwise, minor tick marks do not appear on the log axis.

Interaction If MINORTICKS=TRUE is specified and TICKVALUELIST= specifies nonuniform log tick values such as 10, 20, 30, and 40, then MINORTICK=TRUE is ignored. To display minor tick marks in that case, specify uniform log tick values such as 1, 10, 100, and 1000 in the TICKVALUELIST= option.

Tip Use the MINORGRID= option to display grid lines at the minor tick values.

See "boolean " on page xii for other Boolean values that you can use.

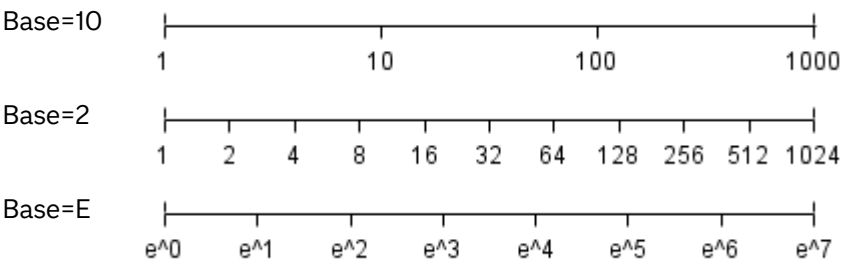
TICKINTERVALSTYLE=AUTO | LOGEXPAND | LOGEXPONENT | LINEAR
specifies how to scale and format the values for major tick marks.

AUTO
selects a LOGEXPAND, LOGEXPONENT, or LINEAR representation automatically based on the range of the data.

When the data range is small (within an order of magnitude), a LINEAR representation is typically used. Data ranges that encompass several orders of magnitude typically use the LOGEXPAND or LOGEXPONENT representation.

LOGEXPAND
places the major tick marks at uniform intervals at integer powers of the base.

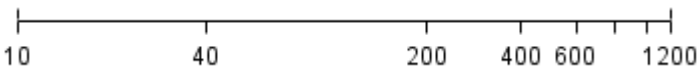
The tick values are expanded as follows:



LOGEXPONENT
places the major tick marks at uniform intervals at integer powers of the base.

The tick values are only the integer exponents for all bases.

LINEAR
places the major tick marks at non-uniform intervals that cover the range of the data.



Default AUTO

Restrictions This option applies to log axes only.

For LOGEXPONENT, formats on data columns contributing to the axis are ignored. For LOGEXPAND, formats on data columns contributing to the axis are ignored, although any "named format" on the column is retained. For LINEAR, ticks values are automatically formatted when the column format is not assigned or one of *w.d*, E*w*., or BEST*w*. Other formats (SAS defined or user-defined) are used if specified.

GTL currently honors most but not every SAS format. For details, see Appendix 4, "Format Support in ODS Graphics," on page 1621.

Note When BASE=10 and LOGEXPAND or LOGEXPONENT is used, an intermediate tick is added whenever the axis data range is less than or equal to 1.5 powers of 10.

Tip If you use TICKINTERVALSTYLE=LOGEXPONENT, then you might want to include information in the axis label about which base is used.

TICKVALUEFORMAT=DATA | *format*
specifies how to format the values for major tick marks.

Note: This feature applies to SAS 9.4M3 and to later releases.

DATA
uses the format that has been assigned to the column that is contributing to the axis (or BEST6 if no format is assigned) in order to control the formatting of the major tick values.

format
specifies a format to apply to the major tick values.

Restriction GTL currently honors most, but not every, SAS format. For details, see Appendix 4, "Format Support in ODS Graphics," on page 1621.

Restriction This option applies to log axes only.

Interactions This option is ignored when TICKINTERVALSTYLE=LOGEXPONENT.

When TICKINTERVALSTYLE=LOGEXPAND, this option is honored for the base 10 and base 2 logarithmic scales, and is ignored for the base E scale.

When TICKINTERVALSTYLE=LINEAR, this option is honored for the base 10, base 2, and base E logarithmic scales.

See BASE=

TICKINTERVALSTYLE=

TICKVALUELIST=(*numeric-list*)
specifies the tick values for a linear axis as a list.

Default
Only the tick values specified in the list that fall within the explicit data range set by the VIEWMIN= and VIEWMAX= options or by the implicit data range set by the actual data minimum and data maximum are displayed. An internal algorithm determines the tick marks.

Requirements
The tick values must be specified as a space-separated list of numeric values, enclosed in parentheses.

The values that you specify must be appropriate for the VALUESTYPE= specification. Otherwise, unexpected results might occur. If VALUESTYPE=EXPANDED is in effect (default), specify increments of the log base power such as 0.1, 1, 10, 100, and so on, on a base 10 log axis, for example. If VALUESTYPE=EXPONENT is in effect, specify integer increments of the log base power exponent such as 1, 2, 3, and so on.

Interactions
The VALUESTYPE= option determines how the values in the list are interpreted.

The VIEWMIN= and VIEWMAX= options alter the axis data range. If the VIEWMIN= option is set to the minimum tick list value and the VIEWMAX= option is set to the maximum tick list value, then all ticks in the tick list are displayed. This might result in some data not being displayed. For example, data might not be displayed when the VIEWMIN= value is greater than the actual data minimum, or when the VIEWMAX= value is less than actual data maximum.

If the VIEWMIN= value is greater than the actual data minimum or the VIEWMAX= value is less than actual data maximum, some data might not be displayed.

This option is ignored if the DISPLAY= or the DISPLAYSECONDARY= option does not display the tick values.

If MINORTICKS=TRUE is specified and TICKVALUELIST= specifies nonuniform log tick values such as 10, 20, 30, and 40, then MINORTICK=TRUE is ignored. To display minor tick marks in that case, specify uniform log tick values such as 1, 10, 100, and 1000 in the TICKVALUELIST= option.

See
VIEWMIN= and VIEWMAX= options for controlling the data range

TICKINTERVALSTYLE= for specifying the scale and format of the major tick values

TICKVALUEPRIORITY= for controlling the behavior of the TICKVALUELIST= option

BASE= for specifying the log base

TICKVALUEPRIORITY=TRUE | FALSE

specifies whether the TICKVALUELIST= specification can extend the axis data range.

TRUE

extends the axis data range (but does not reduce it) to include the minimum and maximum values that are specified by the TICKVALUELIST= option.

If the minimum and maximum of the user-specified values are within the data range, this option has no effect.

FALSE

displays only the tick values that are specified by the TICKVALUELIST= option that fall within the explicit data range set by the VIEWMIN= and VIEWMAX= options or by the implicit data range set by the actual data minimum and data maximum.

Default FALSE

Interactions When this option is set to TRUE, the VIEWMIN= and VIEWMAX= options are ignored.

This option is ignored if the DISPLAY= option or the DISPLAYSECONDARY= option does not display the tick values.

This option is ignored if the TICKVALUELIST= option is not specified.

Note If the minimum and maximum of the specified values are within the data range, then this option has no effect.

See “boolean ” on page xii for other Boolean values that you can use.

VALUESTYPE=EXPANDED | EXPONENT

specifies the scale that the system uses when interpreting the TICKVALUELIST=, VIEWMAX=, and VIEWMIN= option values. Use this option to choose your preferred way of specifying log-axis values.

EXPANDED

values are interpreted as powers of the base such as 0.1, 1, 10, 100, and so on, for base 10, for example.

EXPONENT

values are interpreted as integer exponents of the base such as 1, 2, 3, and so on, for base 10, base 2, and base E.

Default EXPANDED

Note This option does not change the style of the tick values that are displayed on the axis. It changes only how the VIEWMIN=, VIEWMAX=, and TICKVALUELIST= option values are interpreted by the system.

Tip This option is particularly useful when BASE=E.

Examples The following example specifies VIEWMIN= and VIEWMAX= as exponent values instead of as expanded values on an expanded Base

10 log axis. This results in X-axis tick values of 10, 100, 1000, 10000, and 100000.

```
xaxisopts=(type=log
   logopts=(base=10
      tickintervalstyle=logexpand
      valuestype=exponent
      viewmin=1 viewmax=5));
```

The following example specifies TICKVALUELIST= as a list of expanded values instead of exponent values on an exponent Base 10 log axis. This results in X-axis tick values of 1, 2, 3, 4, and 5.

```
xaxisopts=(type=log
   logopts=(base=10
      tickintervalstyle=logexponent
      tickvaluepriority=true
      valuestype=expanded
      tickvaluelist=(10 100 1000 10000 100000));
```

VIEWMAX=*number*

specifies the maximum data value to include in the display.

Default: The maximum value in the data for the specified axis.

Requirements: If VIEWMIN= is also specified, VIEWMAX= must be greater than VIEWMIN=. Otherwise, the default values are used for VIEWMIN= and VIEWMAX=.

If VIEWMIN= is not specified, VIEWMAX= must be less than the data maximum. Otherwise, a blank graph is drawn.

The value that you specify must be appropriate for the VALUESTYPE= specification and the log base. Otherwise, unexpected results might occur. If VALUESTYPE=EXPANDED is in effect (default), specify an increment of the log base power such as 0.1, 1, 10, 100, and so on, on a base 10 log axis, for example. If VALUESTYPE=EXPONENT is in effect, specify an integer increment of the log base power exponent such as 1, 2, 3, and so on.

Interactions: This option is ignored when TICKVALUEPRIORITY= TRUE.

The VALUESTYPE= option determines how the value is interpreted.

Notes: Setting a VIEWMAX= or VIEWMIN= value does not alter the original data or any calculations on it.

If an invalid value is specified for the VIEWMAX= option, the default value for VIEWMAX= is used instead. In that case, if the default value for VIEWMAX= is less than the value specified by the VIEWMIN= option, then the VIEWMIN= and VIEWMAX= values are swapped.

The maximum axis tick value might differ from the VIEWMAX= value. The VIEWMIN= and VIEWMAX= values, and additional

factors such as thresholds and the tick values computed by the plot statement, are used to determine the axis tick values.

When BASE=10 and TICKINTERVALSTYLE=LOGEXPAND or TICKINTERVALSTYLE=LOGEXPONENT is used, an intermediate tick is added whenever the axis data range is less than or equal to 1.5 powers of 10.

Tip To display the VIEWMAX= value as the maximum tick value, use the TICKVALUELIST= option.

See "Adjusting the Axis View" on page 1051

Examples The following example specifies a value of 100,000 as an expanded value on a base 10 log axis:

```
VIEWMAX=100000
```

The following example specifies a value of 100,000 as an exponent value on a base 10 log axis:

```
VIEWMAX=5
```

VIEWMIN=*number*

specifies the minimum data value to include in the display.

Default The minimum value in the data for the specified axis.

Requirements If VIEWMAX= is also specified, VIEWMIN= must be less than VIEWMAX=. Otherwise, the default values are used for VIEWMAX= and VIEWMIN=.

If VIEWMAX= is not specified, VIEWMIN= must be greater than the data minimum. Otherwise, a blank graph is drawn.

The value that you specify must be appropriate for the VALUESTYPE= specification and the log base. Otherwise, unexpected results might occur. If VALUESTYPE=EXPANDED is in effect (default), specify an increment of the log base power such as 0.1, 1, 10, 100, and so on, on a base 10 log axis, for example. If VALUESTYPE=EXPONENT is in effect, specify an integer increment of the log base power exponent such as 1, 2, 3, and so on.

Interactions This option is ignored when TICKVALUEPRIORITY= TRUE.

The VALUESTYPE= option determines how the value is interpreted.

Notes Setting a VIEWMAX= or VIEWMIN= value does not alter the original data or any calculations on it.

The minimum axis tick value might differ from the VIEWMIN= value. The VIEWMIN= and VIEWMAX= values, and additional factors such as thresholds and the tick values computed by the plot statement, are used to determine the axis tick values.

When BASE=10 and TICKINTERVALSTYLE=LOGEXPAND or TICKINTERVALSTYLE=LOGEXPONENT is used, an intermediate tick is added whenever the axis data range is less than or equal to 1.5 powers of 10.

Tip

To display the VIEWMIN= value as the minimum tick value, use the TICKVALUELIST= option.

See

"Adjusting the Axis View" on page 1051

Examples

The following example specifies a value of 0.1 as an expanded value on a base 10 log axis:

```
VIEWMIN=0.1
```

The following example specifies a value of 0.1 as an exponent value on a base 10 log axis:

```
VIEWMIN=-1
```

Options for Time Axes Only

The options that are documented in this section can be used with the TIMEOPTS= axis option. Some of the options are axis-specific. The following tables provide a summary of the time-axes options based on the layout axis option in which it is used.

Table 8.4 *Time-Axis Options for the COLUMNAXIS= or COLUMN2AXIS=Layout Option*

Time Axis Option	Description
INTERVAL	Specifies that evenly spaced integer values are used for tick marks.
INTERVALMULTIPLIER	Specifies a multiplier to apply to the time interval that is in effect for the axis.
MINORGRID	Specifies whether grid lines are displayed at the minor tick values.
MINORGRIDATTRS	Specifies the attributes of the minor grid lines.
MINORTICKINTERVAL	Specifies the time interval between minor ticks.
MINORTICKS	Specifies whether minor ticks are displayed.
SPLITTICKVALUE	Specifies whether to split the tick values on an X or X2 axis, if possible.
TICKVALUEFITPOLICY	Specifies a policy for avoiding tick value collision on an X or X2 axis.

Time Axis Option	Description
TICKVALUEFORMAT	Specifies how to format the values for major tick marks.
TICKVALUELIST	Specifies the order of the tick values for a time axis as list.
TICKVALUEROTATION	Specifies how the tick values are rotated on the X and X2 axes.
VIEWMAX	Specifies the maximum data value to include in the display.
VIEWMIN	Specifies the minimum data value to include in the display.

Table 8.5 *Time-Axis Options for the ROWAXIS= or ROW2AXIS=Layout Option*

Time Axis Option	Description
INTERVAL	Specifies that evenly spaced integer values are used for tick marks.
INTERVALMULTIPLIER	Specifies a multiplier to apply to the time interval that is in effect for the axis.
MINORGRID	Specifies whether grid lines are displayed at the minor tick values.
MINORGRIDATTRS	Specifies the attributes of the minor grid lines.
MINORTICKINTERVAL	Specifies the time interval between minor ticks.
MINORTICKS	Specifies whether minor ticks are displayed.
TICKVALUEFORMAT	Specifies how to format the values for major tick marks.
TICKVALUELIST	Specifies the order of the tick values for a time axis as list.
TICKVALUEPRIORITY	Specifies whether an axis tick specification that is specified with the TICKVALUELIST= option can extend the axis data range.
VIEWMAX	Specifies the maximum data value to include in the display.

Time Axis Option	Description
VIEWMIN	Specifies the minimum data value to include in the display.

INTERVAL=AUTO | SECOND | MINUTE | HOUR | DAY | TENDAY | WEEK | SEMIMONTH | MONTH | QUARTER | SEMIYEAR | YEAR
specifies the time interval between major ticks.

Table 8.6 *Time Intervals*

INTERVAL	Unit	Tick interval	Default tick value format
AUTO	DATE, TIME, or DATETIME	automatically chosen	automatically chosen
SECOND	TIME or DATETIME	second	TIME8.
MINUTE	TIME or DATETIME	minute	TIME8.
HOUR	TIME or DATETIME	hour	TIME8.
DAY	DATE or DATETIME	day	DATE9.
TENDAY	DATE or DATETIME	10 days	DATE9.
WEEK	DATE or DATETIME	7 days	DATE9.
SEMIMONTH	DATE or DATETIME	1st and 16th of each month	DATE9.
MONTH	DATE or DATETIME	month	MONYY7.
QUARTER	DATE or DATETIME	3 months	YYQC6.
SEMIYEAR	DATE or DATETIME	6 months	MONYY7.
YEAR	DATE or DATETIME	year	YEAR4.

Default AUTO. An appropriate interval is chosen based on the data and the column date, date-time, or time format.

Restriction This option applies to time axes only.

Requirement The data column(s) mapped to a time axis must be in the same duration units: TIME, DATE, or DATETIME. The selection of an interval must be consistent with the duration unit. For example, if the data are in time units, you can specify only AUTO, SECOND, MINUTE, HOUR.

Interaction This option is ignored if the TICKVALUELIST= option is used.

INTERVALMULTIPLIER=*positive-integer*
specifies a multiplier to apply to the time interval that is in effect for the axis.

Note: This feature applies to SAS 9.4M3 and to later releases.

Default 1

Restriction This option applies to time axes only.

Interaction This option is ignored if the TICKVALUELIST= option is used.

Tip Use the INTERVAL= option to specify a different time interval.

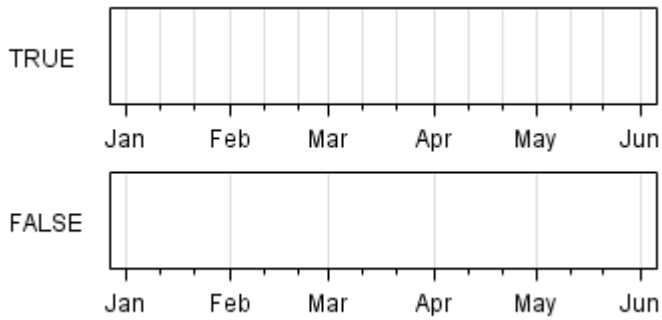
Examples To specify 3-month intervals:

```
INTERVAL=MONTH INTERVALMULTIPLIER=3
```

To specify 10-year intervals:

```
INTERVAL=YEAR INTERVALMULTIPLIER=10
```

MINORGRID=TRUE | FALSE
specifies whether grid lines are displayed at the minor tick marks.



Defaults FALSE in SAS 9.4M1 and earlier releases.

The GraphMinorGridLines:DisplayOpts style reference starting with SAS 9.4M2. If attribute DisplayOpts is not defined in the active style, then FALSE is the default value.

Interaction This option is ignored if the GRIDDISPLAY= option does not display the grid lines.

Tips The GRIDATTRS= option does not affect the appearance of the minor grid lines. To control the minor grid line appearance, use the MINORGRIDATTRS= option.

Use the MINORTICKS= option to display the minor tick marks on the axis.

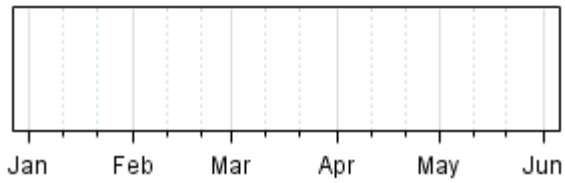
See "boolean " on page xii for other Boolean values that you can use.

MINORGRIDATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the attributes of the minor grid lines. This option does not affect the major grid lines.

The following figure shows the minor grid lines set to light blue, dotted lines on a linear axis. (See the example.)

The following figure shows the minor grid lines set to light blue, dotted lines on a base-10 log axis. (See the example.)

The following figure shows the minor grid lines set to light blue, dotted lines on a time axis. (See the example.)



Defaults The GraphGridLines style element is used starting with SAS 9.4.

The GraphMinorGridLines style element is used starting with SAS 9.4M2.

Interaction This option is ignored when MINORTICKS=FALSE.

Note When *style-element* is specified, only the style element's ContrastColor, LineStyle, and LineThickness attributes are used.

Tip Use the GRIDATTRS= option to control the appearance of the major grid lines.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a style element.

"Line Options" on page 1602 for available line options.

Example Here is an example that specifies light blue, dotted lines for the minor grid.

```
minorgridattrs=(color=lightblue pattern=dot);
```

MINORTICKINTERVAL=*interval*

specifies the time interval between minor ticks. See Table 8.15 on page 1267 for information about the intervals that you can select. The interval that you select must be consistent with the axis data duration units such as TIME, DATE, or DATETIME. For example, if the axis data is in TIME units, then you must specify AUTO, SECOND, MINUTE, or HOUR.

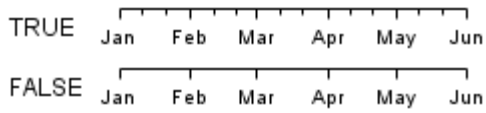
Default AUTO

Interactions This option is ignored if the TICKVALUELIST= option is used.

This option is ignored if the MINORTICKINTERVAL= setting is greater than the INTERVAL= setting.

MINORTICKS=TRUE | FALSE

specifies whether minor ticks are displayed. When MINORTICKS=TRUE, the minor tick marks are displayed on the axis as shown in the following figure.



Default FALSE

Interactions The number of minor ticks is dependent on the value of the MINORTICKINTERVAL= option, if specified. If MINORTICKINTERVAL= is not specified, then it is dependent on the value of the INTERVAL= option.

This option is ignored if the TICKVALUELIST= option is used, or if the DISPLAY= or DISPLAYSECONDARY= option does not display the tick marks.

If MINORTICKS=TRUE is specified with the TICKVALUELIST= option, then MINORTICKS=TRUE is ignored, and minor tick marks are not displayed.

Tip Use the MINORGRID= option to display grid lines at the minor tick values.

See "boolean " on page xii for other Boolean values that you can use.

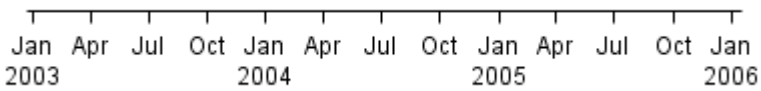
SPLITTICKVALUE=TRUE | FALSE

specifies whether to split the tick values on an X or X2 axis, if possible. This option is not available for a Y or Y2 axis.

TRUE

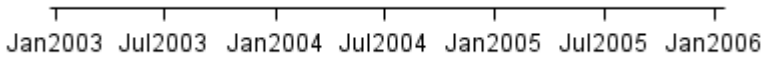
splits the axis tick values into two lines allowing more tick values to appear.

For example, with INTERVAL= MONTH, this is how tick values are split:



FALSE
does not split the axis tick values.

For example, when this option specifies FALSE, this is how the tick values in the previous example appear:



Typically, fewer tick values fit, causing thinning, rotation, or staggering of the values. See the TICKVALUEFITPOLICY= option.

Default TRUE

Restrictions This option applies to time axes only.

This option is valid only in the COLUMNAXIS= and COLUMN2AXIS= layout axis options.

Interaction This option is ignored if the TICKVALUELIST= or TICKVALUEFORMAT= option is used.

See "boolean " on page xii for other Boolean values that you can use.

TICKVALUEFITPOLICY=*policy*
specifies a policy for avoiding tick value collision on an X or X2 axis. This option is not available for the Y and Y2 axes. The effectiveness of a collision-avoidance policy depends on the number of tick values, their length, and the length of the axis. The following policies are valid for the X and X2 axes:

NONE
makes no attempt to avoid collisions between tick values.

Tick values are displayed even when they collide.

ROTATE
rotates the tick values if a collision occurs.

The TICKVALUEROTATION= option specifies whether the values are rotated to a 45-degree diagonal or a 90-degree vertical position. By default, the values are rotated to a 45-degree diagonal position.

ROTATEALWAYS
rotates the tick values regardless of whether a collision occurs.

The TICKVALUEROTATION= option specifies whether the values are rotated to a 45-degree diagonal or a 90-degree vertical position. By default, the values are rotated to a 45-degree diagonal position.

ROTATEALWAYSDROP
attempts the ROTATEALWAYS policy, and then drops the tick values if collisions still occur.

ROTATETHIN
attempts the ROTATE policy, and then the THIN policy.

STAGGER
alternates the tick values between two rows.

STAGGERROTATE
attempts the STAGGER policy, and then the ROTATE policy.

STAGGERTHIN
attempts the STAGGER policy, and then the THIN policy.

THIN
eliminates alternate tick values.

Default THIN

Restriction This option is valid only for the X and X2 axes.

Interaction When SPLITTICKVALUE= on page 1270TRUE, this option is ignored and only the THIN policy is used.

Note A note is written to the SAS log when tick value thinning occurs.

TICKVALUEFORMAT=*format* | DATA
specifies how to format the values for major tick marks.

format
specifies a SAS date, time, or datetime format to control how the major tick values are displayed.

This format must be in the same duration units as the data column(s) mapped to a time axis: TIME, DATE, or DATETIME and should be appropriate for the value of the INTERVAL= option. For example, if INTERVAL=MONTH and there are two years of data displayed on the axis, then choosing TICKVALUEFORMAT=YEAR. would result in several ticks having the same year value.

DATA
specifies that the SAS date, time, or datetime format associated with the data column assigned to the axis be used to control how the major tick values are displayed.

Default The default format used by the INTERVAL= option. The default does not apply if TICKVALUELIST= is specified.

Restrictions This option applies to time axes only.

GTL currently honors most but not every SAS format. For details, see Appendix 4, “Format Support in ODS Graphics,” on page 1621.

TICKVALUELIST=(*time-constant-list* | *date-constant-list* | *datetime-constant-list* | *numeric-list*)
specifies the tick values for a time axis as list.

Default An internal algorithm determines the tick values.

Restrictions This option applies to time axes only.

If TICKVALUEPRIORITY= is set to FALSE, then this option does not extend the data range of the axis. If the values fall within the

default data range or that specified by the VIEWMIN= or VIEWMAX= options, then they are used.

Requirement The tick values must be specified as a space-separated list of values enclosed in parentheses. The items in the list must be in the same duration units as the data mapped to the axis: TIME, DATE, or DATETIME. The values can be expressed as SAS TIME, DATE, or DATETIME constants (for example, "13:23"T, "11MAY06"D, or "11MAY06:13:23"DT) or their numeric equivalents.

Interactions The values in the list are formatted according to the format specified on the TICKVALUEFORMAT= option. If TICKVALUEFORMAT= is not used, then the values are formatted according to the column format (the default TICKVALUEFORMAT value is not applied to these values).

If this option is specified, the SPLITTICKVALUE= and INTERVAL= options are ignored.

If MINORTICKS=TRUE is specified with the TICKVALUELIST= option, MINORTICKS=TRUE is ignored, and minor tick marks are not displayed.

TICKVALUEPRIORITY=TRUE | FALSE

specifies whether the TICKVALUELIST= specification can extend the axis data range.

TRUE

extends the axis data range (but does not reduce it) to include the minimum and maximum values that are specified by the TICKVALUELIST= option.

If the minimum and maximum of the user-specified values are within the data range, this option has no effect.

FALSE

displays only the tick values that are specified by the TICKVALUELIST= option that fall within the explicit data range set by the VIEWMIN= and VIEWMAX= options or by the implicit data range set by the actual data minimum and data maximum.

Default FALSE

Restriction This option is valid only in the ROWAXIS= and ROW2AXIS= layout axis options.

Interactions When this option is set to TRUE, the VIEWMIN= and VIEWMAX= options are ignored.

This option is ignored if the DISPLAY= option or the DISPLAYSECONDARY= option does not display the tick values.

This option is ignored if the TICKVALUELIST= option is not specified.

Note If the minimum and maximum of the specified values are within the data range, then this option has no effect.

See "boolean " on page xii for other Boolean values that you can use.

TICKVALUEROTATION=DIAGONAL | DIAGONAL2 | VERTICAL
specifies how the tick values are rotated on the X and X2 axes.

DIAGONAL
rotates the tick values to a 45-degree diagonal position.

The X labels read left to right in a downward direction. The X2 labels read left to right in an upward direction.

DIAGONAL2
rotates the tick values to a –45-degree diagonal position.

The X labels read left to right in an upward direction. The X2 labels read left to right in a downward direction.

Note: This feature applies to SAS 9.4M5 and to later releases.

VERTICAL
rotates the labels to a 90-degree vertical position.

The labels are always drawn from bottom to top.

Default DIAGONAL

Restriction This option is valid for COLUMNAXISOPTS= and COLUMN2AXISOPTS= only.

Interaction The TICKVALUEFITPOLICY= option must be set to ROTATE or ROTATEALWAYS for this option to have any effect.

VIEWMAX=*number*
specifies the maximum data value to include in the display.

Default The maximum value in the data for the specified axis.

Requirements If VIEWMIN= is also specified, VIEWMAX= must be greater than VIEWMIN=. Otherwise, the default values are used for VIEWMIN= and VIEWMAX=.

If VIEWMIN= is not specified, VIEWMAX= must be less than the data maximum. Otherwise, a blank graph is drawn.

Notes Setting a VIEWMAX= or VIEWMIN= value does not alter the original data or any calculations on it.

The maximum axis tick value might differ from the VIEWMAX= value. The VIEWMIN= and VIEWMAX= values, and additional factors such as thresholds and the tick values computed by the plot statement, are used to determine the axis tick values.

Tip To display the VIEWMAX= value as the maximum tick value, use the TICKVALUELIST= option.

See "Adjusting the Axis View" on page 1051

VIEWMIN=*number*
specifies the minimum data value to include in the display.

Default The minimum value in the data for the specified axis.

Requirements If VIEWMAX= is also specified, VIEWMIN= must be less than VIEWMAX=. Otherwise, the default values are used for VIEWMAX= and VIEWMIN=.

If VIEWMAX= is not specified, VIEWMIN= must be greater than the data minimum. Otherwise, a blank graph is drawn.

Notes Setting a VIEWMAX= or VIEWMIN= value does not alter the original data or any calculations on it.

The minimum axis tick value might differ from the VIEWMIN= value. The VIEWMIN= and VIEWMAX= values, and additional factors such as thresholds and the tick values computed by the plot statement, are used to determine the axis tick values.

Tip To display the VIEWMIN= value as the minimum tick value, use the TICKVALUELIST= option.

See "Adjusting the Axis View" on page 1051

Details

The LAYOUT DATALATTICE and LAYOUT DATAPANEL statements each create a grid of graphs based on the values of one or more classification variables. In the grid, the axes are always external and displayed on the "primary" axes by default. The axes that are considered primary depend on the settings for the XAXIS= and YAXIS= options in plot statements that are specified within the LAYOUT PROTOTYPE. For managing the primary axes, both the LAYOUT DATALATTICE and LAYOUT DATAPANEL statements have COLUMNAXISOPTS=, COLUMN2AXISOPTS=, ROWAXISOPTS=, and ROW2AXISOPTS= options that manage the axis features separately for columns and rows. The settings that are available can manage odd and even columns and rows separately, enabling you to simplify the axis display within the grid.

The following table shows which axis is primary for the XAXIS= and YAXIS= settings, and which axis option to use to manage that primary axis.

Option Setting	Primary Axis	Axis Option to Use
XAXIS=X	X (bottom)	COLUMNAXISOPTS=

Option Setting	Primary Axis	Axis Option to Use
XAXIS=X2	X2 (top)	COLUMN2AXISOPTS=
YAXIS=Y	Y (left)	ROWAXISOPTS=
YAXIS=Y2	Y2 (right)	ROW2AXISOPTS=

The settings that are available for the axis options can manage odd and even columns and rows separately, enabling you to simplify the axis display within the grid.

- To manage the first, third, and odd occurrences of a primary axis, use the DISPLAY= option.
- To manage the second, fourth, and even occurrences of a primary axis, use the ALTDISPLAY= option.

You can also display “secondary” axes in the grid. A secondary axis is not an independent axis. Rather, it mirrors the primary axis, but it is displayed on the opposite side and can have different display options. For example, when the X axis (bottom) is primary, you can mirror that axis with a secondary X axis at the top of the grid. Similarly, when the Y2 axis (right) is primary, you can mirror that axis with a secondary Y2 axis on the left of the grid. A secondary axis makes it easier to interpolate values in the cells that are farthest away from the primary axis.

Secondary axes can be displayed in the graph, provided all plot statements in the LAYOUT PROTOTYPE map data to the same primary axis. For example, a secondary X axis can be displayed at the top of the layout, provided all plot statements set XAXIS=X to map data to the primary X axis (bottom). Similarly, a secondary Y2 axis can be displayed to the left in the layout, provided all plot statements set YAXIS=Y2 to map data to the primary Y2 axis (right). If all plot statements in the LAYOUT PROTOTYPE do not map data to the same primary axis, then the secondary axes are not displayed.

To display secondary axes in the grid, use the DISPLAYSECONDARY= and ALTDISPLAYSECONDARY= options. As with the options for the primary axes, the DISPLAYSECONDARY= option manages the first, third, and odd occurrences of a secondary axis. The ALTDISPLAYSECONDARY= option manages the second, fourth, and even occurrences of a secondary axis.

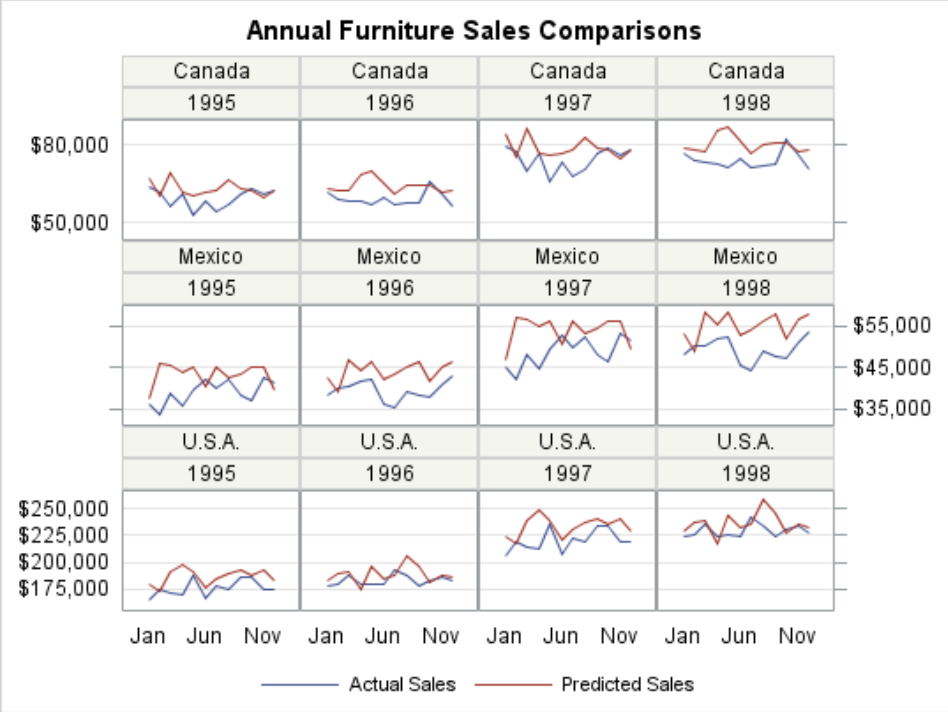
In the default cases for the plots within the layout, the axis type is always DISCRETE, LINEAR, or TIME. The TYPE= option enables you to specify an axis type that overrides the default. For example, when appropriate for the data, you can request a LOG axis. When you override the default axis type, you must be sure to specify the correct axis type for the plot(s) that you are defining.

Each axis type has features specific to that type, and the following axis options enable you to specify features for the different types: DISCRETEOPTS= , LINEAROPTS= , LOGOPTS= , and TIMEOPTS= . One or more of these options can be specified for an axis, but the specified settings are applied only to the axis type that supports them.

Note: Certain plot types or layouts sometimes impose restrictions on what type of axis can be assigned. See the plot or layout documentation for default axis types and any restrictions that might apply.

Example: Axis Options for LAYOUT DATALATTICE and LAYOUT DATAPANEL

The following graph was generated by the "Example Program" on page 1277:



Example Program

This example shows how axis attributes can be managed separately for even and odd columns and rows in the layout grid. In this case, the ROWAXISOPTS= option is used to stagger the Y-axes attributes. On the primary (left) Y axis, DISPLAY= displays TICKS and TICKVALUES on the first and third rows while ALTDISPLAY= displays just TICKS on the second row. On the secondary (right) Y axis, DISPLAYSECONDARY= displays just TICKS on the first and third rows, while ALTDISPLAYSECONDARY= displays TICKS and TICKVALUES on the second row. This alternating pattern could also have been set for the column axes. The pattern is independent of the number of rows and columns.

```
proc template;
 define statgraph layoutdatalattice;
  begingraph;
```

```
    entrytitle "Annual Furniture Sales Comparisons";
    layout datalattice rowvar=country columnvar=year /
      rowdatarange=union
      headerlabellocation=inside
      headerlabeldisplay=value
      headerbackgroundcolor=GraphAltBlock:color
      rowaxisopts=(griddisplay=on
        display=(tickvalues)
        altdisplay=(ticks)
        displaysecondary=(ticks)
        altdisplaysecondary=(ticks tickvalues)
        linearopts=(tickvalueformat=dollar12.))
      columnaxisopts=(display=(tickvalues)
        timeopts=(tickvalueformat=monname3.));
      layout prototype / cycleattrs=true;
        seriesplot x=month y=TotalActual / name="Actual";
        seriesplot x=month y=TotalPredict / name="Predict";
      endlayout;
      sidebar / align=bottom;
        discretelegend "Actual" "Predict" / border=false;
      endsidebar;
    endlayout;
  endgraph;
 end;
run;

proc summary data=sashelp.prdsal2 nway;
  class country year month;
  var actual predict;
  output out=prdsal2 sum=TotalActual TotalPredict;
run;

proc sgrender data=prdsal2 template=layoutdatalattice;
run;
```

PART 6

Legend Statements

Chapter 9
Legend Statements **1281**

9

Legend Statements

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Dictionary

AXISLEGEND Statement

Generates consecutive integers for display as axis-tick values in the graph, and creates a legend that correlates those integers with the actual tick values that they represent.

Requirements: The axis must be named with the axis NAME= option.

The axis must be a discrete axis (TYPE=DISCRETE).

The axis must use the TICKVALUEFITPOLICY=EXTRACT or TICKVALUEFITPOLICY=EXTRACTALWAYS suboption of the DISCRETEOPTS= axis option.

Interactions: If the total legend area in the graph exceeds the percentage that is set by the MAXLEGENDAREA= option in an ODS GRAPHICS statement that is in effect for the output destination, the legend might be dropped

If DISPLAYCLIPPED=FALSE and the full legend cannot be displayed, the legend might be dropped.

Syntax

AXISLEGEND *"axis-name"* < */options* >;

Summary of Optional Arguments

Appearance options

ACROSS=*positive-integer*
: specifies the number of legend entries that are placed horizontally before the next row begins.

BACKGROUNDCOLOR=*style-reference* | *color*
: specifies the color of the legend background.

BORDER=TRUE | FALSE
: specifies whether a border is displayed around the legend.

BORDERATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
: specifies the attributes of the border line around the legend.

DISPLAYCLIPPED=TRUE | FALSE
: specifies whether the legend is displayed when any portion of the legend cannot be rendered entirely.

DOWN=*positive-integer*
: specifies the number of legend entries that are placed vertically before the next column begins.

OPAQUE=TRUE | FALSE
: specifies whether the legend background is opaque (TRUE) or transparent (FALSE).

ORDER=ROWMAJOR | COLUMNMAJOR
: specifies whether legend entries are organized into rows or into columns.

OUTERPAD=AUTO | *dimension* | (*pad-options*)
: specifies the amount of extra space that is added outside the legend border.

PAD=*dimension* | (*pad-options*)
: specifies the amount of extra space that is reserved inside the legend perimeter.

VALUEATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
: specifies the color and font attributes of the legend values.

Location options

AUTOALIGN=NONE | AUTO | (*location-list*)
: specifies whether the legend is automatically aligned within its parent layout when nested within an overlay-type layout.

HALIGN=CENTER | LEFT | RIGHT | *number*
: specifies the horizontal alignment of the legend within its parent layout when nested within an overlay-type or REGION layout.

LOCATION=OUTSIDE | INSIDE
: specifies whether the legend appears inside or outside the plot area when the legend is specified within an overlay-type or REGION layout.

VALIGN=CENTER | TOP | BOTTOM | *number*
specifies the vertical alignment of the legend within its parent layout when nested within an overlay-type or REGION layout.

Text options

TITLE="*string*"
specifies the title of the legend.

TITLEATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font attributes of the legend title.

Required Argument

"axis-name"
references an axis's name. The name controls which axis determines the legend entries.

Requirement The axis name must be enclosed in quotation marks.

Optional Arguments

ACROSS=*positive-integer*
specifies the number of legend entries that are placed horizontally before the next row begins.

Default The entries are placed to best fit the available area. This "best fit" approach works only when the legend is nested in the template's outermost layout.

Interaction This option is ignored if ORDER= COLUMNMAJOR

Tip When a DISCRETELEGEND statement is placed in a nested layout, include the ACROSS= option to specify the number of columns. Otherwise, the legend items might wrap in an unexpected fashion.

AUTOALIGN=NONE | AUTO | (*location-list*)
specifies whether the legend is automatically aligned within its parent layout when nested within an overlay-type layout.

NONE
does not automatically align the legend within its parent layout.

The legend's position is set by the HALIGN= and VALIGN= options.

AUTO
within the parent layout, attempts to center the legend in the area that is farthest from any surrounding data point markers.

(*location-list*)
within the parent layout, restricts the legend's possible locations to those locations in the specified *location-list*, and uses the *location-list* position that least collides with the parent layout's other graphics features.

The *location-list* is space-separated and can contain any of these locations: TOPLEFT, TOP, TOPRIGHT, LEFT, CENTER, RIGHT, BOTTOMLEFT, BOTTOM, and BOTTOMRIGHT.

Default NONE

Restriction AUTO is available only when the parent layout contains a scatter plot. Otherwise, it is ignored.

Interactions This option has no effect unless LOCATION= INSIDE.

When LOCATION=INSIDE and AUTOALIGN= is not NONE, the HALIGN= and VALIGN= options are ignored.

See LAYOUT OVERLAY on page 159 for more information about how child positions are determined in an overlay-type layout.

BACKGROUNDCOLOR=*style-reference* | *color*
specifies the color of the legend background.

style-reference
specifies a style reference in the form *style-element:style-attribute*.

Only the style-attribute named COLOR or CONTRASTCOLOR is used.

Default The Color attribute of the GraphBackground style element.

Interaction OPAQUE= TRUE must be in effect for the color to be seen. By default, OPAQUE=FALSE.

BORDER=TRUE | FALSE
specifies whether a border is displayed around the legend.

Defaults TRUE in SAS 9.4M1 and earlier releases.

The GraphLegendBackground:FrameBorder style reference starting with SAS 9.4M2. If attribute FrameBorder is not defined in the active style, then TRUE is the default value.

Tip The BORDERATTRS= option controls the appearance of the legend border.

See "boolean " on page xii for other Boolean values that you can use.

BORDERATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the attributes of the border line around the legend.

Default The GraphBorderLines style element.

Interaction BORDER= TRUE must be set for this option to have any effect.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*

"Line Options" on page 1602 for available *line-options*.

DISPLAYCLIPPED=TRUE | FALSE
specifies whether the legend is displayed when any portion of the legend cannot be rendered entirely. Based on the legend contents and placement, or when the graph size is reduced, parts of the legend (title, legend symbol, or legend value)

might be clipped (truncated). When clipping occurs and this option is set to FALSE, the entire legend is removed from the graph. The space for that legend is then reclaimed by the remainder of the graph. When this option is set to TRUE, the legend always appears, even if some parts of it have been clipped.

Default FALSE

See "boolean " on page xii for other Boolean values that you can use.

DOWN=*positive-integer*

specifies the number of legend entries that are placed vertically before the next column begins.

Default The entries are placed to best fit the available area. This "best fit" approach works only when the legend is nested in the template's outermost layout.

Restriction This option is ignored if ORDER= ROWMAJOR

HALIGN=CENTER | LEFT | RIGHT | *number*

specifies the horizontal alignment of the legend within its parent layout when nested within an overlay-type or REGION layout.

number

specifies an explicit position in the containing layout.

Range The *number* specification can range from 0 to 1. The *number* represents a fraction of the parent container's width, where 0 is all the way to the left and 1 is all the way to the right.

Interaction For a *number* setting to take effect, LOCATION=INSIDE must be set. A *number* setting is invalid on this option when LOCATION=OUTSIDE.

Default CENTER

Restriction This option is available only when this statement is nested within an overlay-type or REGION layout.

Interactions If LOCATION= OUTSIDE, then the HALIGN= and VALIGN= options cannot both be set to CENTER.

This option is ignored when LOCATION=INSIDE, the AUTOALIGN= option is not NONE, and the parent layout is an overlay-type layout.

See LAYOUT OVERLAY on page 159 for more information about how child positions are determined in an overlay-type or REGION layout.

LOCATION=OUTSIDE | INSIDE

specifies whether the legend appears inside or outside the plot area when the legend is specified within an overlay-type or REGION layout.

Default OUTSIDE

Restriction This option has effect only when the legend statement appears within an overlay-type or REGION layout and at least one standalone plot statement is referenced by the parent layout.

Interactions The actual position is determined by the settings for the LOCATION=, AUTOALIGN= , HALIGN= , and VALIGN= options.

If this option is set to OUTSIDE, then the HALIGN= and VALIGN= options must specify a keyword (LEFT, RIGHT, or CENTER). The *number* setting for the alignment is invalid when the legend is positioned outside of the plot area.

See LAYOUT OVERLAY on page 159 for more information about how child positions are determined in an overlay-type or REGION layout.

OPAQUE=TRUE | FALSE
specifies whether the legend background is opaque (TRUE) or transparent (FALSE).

Default FALSE

Interaction When this option is set to FALSE, the background color is not used.

See "boolean " on page xii for other Boolean values that you can use.

ORDER=ROWMAJOR | COLUMNMAJOR
specifies whether legend entries are organized into rows or into columns.

Default ROWMAJOR

Interaction If ORDER=ROWMAJOR, then use the ACROSS= option to limit the number of entries in a row. If ORDER=COLUMNMAJOR, then use the DOWN= option to limit the number of entries in a column.

OUTERPAD=AUTO | *dimension* | (*pad-options*)
specifies the amount of extra space that is added outside the legend border.

AUTO
specifies that the default outside padding for this component is used.

dimension
specifies a dimension to use for the extra space at the left, right, top, and bottom of the legend border.

(*pad-options*)
a space-separated list of one or more name-value pair pad options, enclosed in parentheses.

The list can include one or more of the following pad options:

LEFT=*dimension*
specifies the amount of extra space added to the left side.

RIGHT=*dimension*
specifies the amount of extra space added to the right side.

TOP=*dimension*
specifies the amount of extra space added to the top.

BOTTOM=*dimension*
specifies the amount of extra space added to the bottom.

Note Sides that are not assigned padding are padded with the default amount.

Tip Use *pad-options* to create non-uniform padding.

Default AUTO

Note The default units for *dimension* are pixels.

See "dimension" on page xiii

PAD=*dimension* | (*pad-options*)
specifies the amount of extra space that is reserved inside the legend perimeter.

dimension
specifies a dimension to use for the extra space at the left, right, top, and bottom of the legend perimeter.

(*pad-options*)
a space-separated list of one or more name-value pair pad options, enclosed in parentheses.

The list can include one or more of the following pad options:

LEFT=*dimension*
specifies the amount of extra space added to the left side.

RIGHT=*dimension*
specifies the amount of extra space added to the right side.

TOP=*dimension*
specifies the amount of extra space added to the top.

BOTTOM=*dimension*
specifies the amount of extra space added to the bottom.

Note Sides that are not assigned padding are padded with the default amount.

Tip Use *pad-options* to create non-uniform padding.

Default Padding for all sides is 0.

Note The default units for *dimension* are pixels.

See "dimension" on page xiii

TITLE="*string*"
specifies the title of the legend.

Default No title

Requirement *string* must be enclosed in quotation marks.

Interaction When the title is placed to the left of the legend, if TITLEBORDER=TRUE is in effect, no separator is displayed between the title and the legend. If TITLEBORDER=FALSE is in effect in that case, a separator is displayed.

TITLEATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font attributes of the legend title.

Default The GraphLabelText style element.

Interactions For this option to have any effect, the TITLE= option must also be specified.

If one or more text options are specified and they do not include all the font properties (color, family, size, weight, style), then non-specified properties will be derived from the GraphLabelText style element.

Note When you specify *style-element*, only the style attributes COLOR, FONTFAMILY, FONTSIZE, FONTSTYLE, and FONTWEIGHT are used.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Text Options" on page 1606 for available *text-options*.

VALIGN=CENTER | TOP | BOTTOM | *number*
specifies the vertical alignment of the legend within its parent layout when nested within an overlay-type or REGION layout.

number
specifies an explicit position in the containing layout.

Range The *number* specification can range from 0 to 1. The *number* represents a fraction of the parent container's height, where 0 is on the bottom and 1 is on the top.

Interaction For a *number* setting to take effect, LOCATION=INSIDE must be set. A *number* setting is invalid on this option when LOCATION=OUTSIDE.

Tip The legend is effectively anchored at its center. Zero corresponds to the containing layout's bottom edge plus half the legend height. Similarly, one corresponds to the containing layout's top edge minus half the legend height.

Default CENTER

Restriction This option is available only when this statement is nested within an overlay-type or REGION layout. It is ignored if the parent layout is not an overlay-type or REGION layout.

Interactions If LOCATION= OUTSIDE, then the VALIGN= and HALIGN= options cannot both be set to CENTER.

This option is ignored when LOCATION=INSIDE, the AUTOALIGN= option is not NONE, and the parent layout is an overlay-type layout.

See LAYOUT OVERLAY on page 159 for more information about how child positions are determined in an overlay-type or REGION layout.

VALUEATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font attributes of the legend values.

Default The GraphValueText style element.

Interaction If one or more text options are specified and they do not include all the font properties (color, family, size, weight, style), then non-specified properties will be derived from the GraphLabelText style element.

Note When you specify *style-element*, only the style attributes COLOR, FONTFAMILY, FONTSIZE, FONTSTYLE, and FONTWEIGHT are used.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Text Options" on page 1606 for available *text-options*.

Details

An AXISLEGEND statement is used to consolidate the axis display so that a large number of tick values can be clearly displayed without collision. In an axis legend, the legend symbol is a positive integer that is generated to represent a specific axis tick position, and the legend value displays the axis tick value. In the "Example: AXISLEGEND Statement" on page 1290 , the first legend symbol is the integer `1` and the first legend value is `Neon SE 4dr`.

To implement an axis legend, all of the following requirements must be met:

- The axis must be a discrete axis. The axis can be discrete by default, or explicitly set to discrete by setting TYPE=DISCRETE among the parent layout's axis-option settings.
- The parent layout's axis options must specify NAME= to assign a name to the axis.
- The parent layout's axis options must use the DISCRETEOPTS= option to specify either TICKVALUEFITPOLICY=EXTRACT or TICKVALUEFITPOLICY=EXTRACTALWAYS. EXTRACT implements an axis legend if the system estimates that a collision might occur. EXTRACTALWAYS implements an axis legend regardless of whether a collision occurs.

- The AXISLEGEND statement must reference the axis name that was specified in the parent layout's NAME= axis option.

When all of these requirements are satisfied, the tick values of the named discrete axis can be replaced with consecutive positive integers. The axis legend displays those integer values and the corresponding tick values that the integers represent.

Within an overlay-type layout, when an axis legend is placed inside the plot area with LOCATION= INSIDE,

- The axis legend is always placed on top of plot lines and markers.
- By default, its background is fully transparent (OPAQUE= FALSE), meaning that underlying lines, markers, and data labels show through the legend.
- Its position can be controlled with the AUTOALIGN= option, or with the HALIGN= and VALIGN= options.

Within an overlay-type layout, when an axis legend is placed outside the plot area with LOCATION=OUTSIDE,

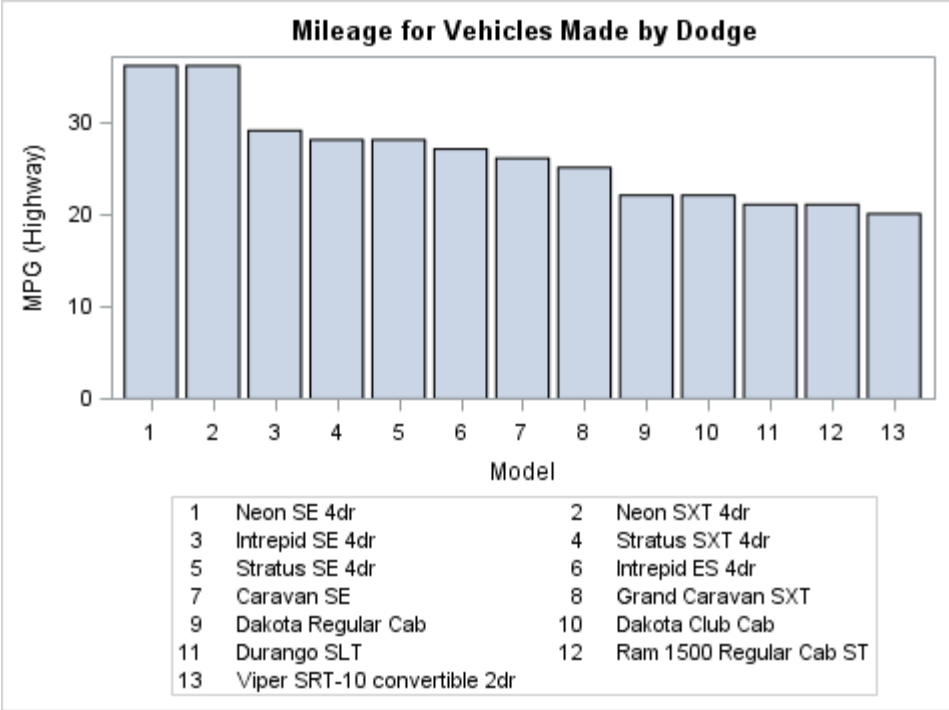
- By default, its background is fully opaque (OPAQUE=TRUE).
- Its position can be controlled with the HALIGN= and VALIGN= options.

When an axis legend is placed within nested layouts, it might be necessary to do one of the following to obtain the desired legend organization:

- use the ACROSS= option and also set ORDER= ROWMAJOR
- use the DOWN= option and also set ORDER=COLUMNMAJOR

Example: AXISLEGEND Statement

The following graph was generated by the "Example Program" on page 1291 . The LAYOUT OVERLAY statement's XAXISOPTS= option uses NAME= to assign a name to the X axis so that it can be referenced in an AXISLEGEND statement. The LAYOUT OVERLAY statement's DISCRETEOPTS= option specifies TICKVALUEFITPOLICY=EXTRACT, which implements the axis legend if a collision occurs in the tick-value display for the X axis. The AXISLEGEND statement references the name that was assigned to the X axis.



Example Program

```
proc template;
 define statgraph axislegend ;
  begingraph;
   entrytitle "Mileage for Vehicles Made by Dodge";
   layout overlay / xaxisopts=(name="xaxis"
       discreteopts=(tickvaluefitpolicy=extract)) ;
     barchart category=model response=mpg_highway / stat=mean ;
     axislegend "xaxis";
   endlayout;
  endgraph;
 end;

proc sort data=sashelp.cars out=dodge; by descending mpg_highway;
  where make="Dodge";

proc sgrender data=dodge template=axislegend;
run;
```

CONTINUOUSLEGEND Statement

Creates a legend with a color ramp corresponding to a range of values.

Syntax

CONTINUOUSLEGEND *"graph-name"* < */options* >;

Summary of Optional Arguments

Appearance options

BACKGROUNDCOLOR=*style-reference* | *color*
: specifies the color of the legend background.

BORDER=TRUE | FALSE
: specifies whether a border is displayed around the legend.

BORDERATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
: specifies the attributes of the border line around the legend.

INTEGER=TRUE | FALSE
: specifies whether only integer tick values are used in the continuous legend.

OPAQUE=TRUE | FALSE
: specifies whether the legend background is opaque (TRUE) or transparent (FALSE).

ORIENT=VERTICAL | HORIZONTAL
: specifies the orientation of the legend.

OUTERPAD=AUTO | *dimension* | (*pad-options*)
: specifies the amount of extra space that is added outside the legend border.

PAD=*dimension* | (*pad-options*)
: specifies the amount of extra space that is reserved inside the legend perimeter.

VALUEATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
: specifies the color and font attributes of the legend values.

Data range options

VALUECOUNTHINT=*positive-integer*
: recommends a number of values for the continuous legend to use to label the data range.

Location options

AUTOALIGN=NONE | AUTO | (*location-list*)
: specifies whether the legend is automatically aligned within its parent layout when nested within an overlay-type layout.

HALIGN=CENTER | LEFT | RIGHT | *number*
: specifies the horizontal alignment of the legend within its parent layout when nested within an overlay-type or REGION layout.

LOCATION=OUTSIDE | INSIDE
: specifies whether the legend appears inside or outside the plot area when the legend is specified within an overlay-type or REGION layout.

VALIGN=CENTER | TOP | BOTTOM | *number*

specifies the vertical alignment of the legend within its parent layout when nested within an overlay-type or REGION layout.

Scale options

EXTRACTSCALE=TRUE | FALSE
specifies whether to extract a scale factor from the tick values and use it to reduce the tick value width.

EXTRACTSCALETYPE=DEFAULT | SCIENTIFIC
specifies whether to extract a named scale or a scientific-notation scale.

Text options

TITLE="*string*"
specifies the title of the legend.

TITLEATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font attributes of the legend title.

Required Argument

"graph-name"
specifies the plot to be represented by the legend. The plot is identified by the name that is assigned to it on the plot statement's NAME= option.

Restriction Unlike the DISCRETELEGEND statement, only a single *graph-name* can be specified.

Requirement *graph-name* must be enclosed in quotation marks.

Optional Arguments

AUTOALIGN=NONE | AUTO | (*location-list*)
specifies whether the legend is automatically aligned within its parent layout when nested within an overlay-type layout.

NONE
does not automatically align the legend within its parent layout.

The legend's position is set by the HALIGN= and VALIGN= options.

AUTO
within the parent layout, attempts to center the legend in the area that is farthest from any surrounding data point markers.

(*location-list*)
within the parent layout, restricts the legend's possible locations to those locations in the specified *location-list*, and uses the *location-list* position that least collides with the parent layout's other graphics features.

The *location-list* is space-separated and can contain any of these locations: TOPLEFT, TOP, TOPRIGHT, LEFT, CENTER, RIGHT, BOTTOMLEFT, BOTTOM, and BOTTOMRIGHT.

Default NONE

Interactions This option has no effect unless LOCATION= INSIDE.

When LOCATION=INSIDE and AUTOALIGN= is not NONE, the HALIGN= and VALIGN= options are ignored.

See LAYOUT OVERLAY on page 159 for more information about how child positions are determined in an overlay-type layout.

BACKGROUNDCOLOR=*style-reference* | *color*
specifies the color of the legend background.

style-reference
specifies a style reference in the form *style-element:style-attribute*.

Only the style-attribute named COLOR or CONTRASTCOLOR is used.

Default The GraphLegendBackground:Color style reference.

Interaction OPAQUE= TRUE must be in effect for the color to be seen. By default, OPAQUE=FALSE.

BORDER=TRUE | FALSE
specifies whether a border is displayed around the legend.

Defaults FALSE in SAS 9.4M1 and earlier releases.

The GraphLegendBackground:FrameBorder style reference starting with SAS 9.4M2. If attribute FrameBorder is not defined in the active style, then FALSE is the default value.

Tip The BORDERATTRS= option controls the appearance of the legend border.

See "boolean " on page xii for other Boolean values that you can use.

BORDERATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the attributes of the border line around the legend.

Default The GraphBorderLines style element.

Interaction BORDER= TRUE must be set for this option to have any effect.

Tip The color of the frame around the color ramp and the color ramp tick lines is controlled by the ContrastColor attribute of the GraphAxisLines style element.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*

"Line Options" on page 1602 for available *line-options*.

EXTRACTSCALE=TRUE | FALSE
specifies whether to extract a scale factor from the tick values and use it to reduce the tick value width. The scale can be a named scale or a scientific-notation scale. The EXTRACTSCALETYPE= option specifies the scale type. The scale used is appended to the legend title as shown in the following example.

```
Total Sales (millions)
```

For long legend titles, if the scale does not fit the available space, then the title is truncated, and the scale is appended to the truncated title. Ellipses indicate that the label was truncated as shown in the following example.

```
Total Sales for the Fourth Quarter Of ... (millions)
```

In extreme cases where the title does not fit even with truncation, the title is dropped.

Restriction The scale that is extracted by the EXTRACTSCALE= option is derived from the English locale.

Interactions The scale type is determined by the EXTRACTSCALETYPE= option.

If the axis label is not displayed, then the EXTRACTSCALE=TRUE option is ignored.

See "boolean " on page xii for other Boolean values that you can use.

EXTRACTSCALETYPE=DEFAULT | SCIENTIFIC
specifies whether to extract a named scale or a scientific-notation scale.

DEFAULT
extracts a named scale.

A named scale can be millions, billions, or trillions for values of 999 trillion or less, or a multiple of 10 (denoted as 10^*n*) for values over 999 trillion. For small fractional tick values, the scale factor is set to ensure that the absolute value of the smallest value is greater than 1. The scale can be millionth, billionth, or trillionth for values of 1 trillionth or more, or a multiple of 1/10 (10^–*n*) for values less than 1 trillionth.

SCIENTIFIC
extracts a scientific-notation scale.

A scientific-notation scale is a multiple of 10 expressed as 10^*n* for values greater than 1, or a multiple of 1/10 expressed as 10^–*n* for values less than 1.

HALIGN=CENTER | LEFT | RIGHT | *number*
specifies the horizontal alignment of the legend within its parent layout when nested within an overlay-type or REGION layout.

number
specifies an explicit position in the containing layout.

Range The *number* specification can range from 0 to 1. The *number* represents a fraction of the parent container's width, where 0 is all the way to the left and 1 is all the way to the right.

Interaction For a *number* setting to take effect, LOCATION=INSIDE must be set. A *number* setting is invalid on this option when LOCATION=OUTSIDE.

Tip The legend is effectively anchored at its center. HALIGN=0 corresponds to the containing layout's left edge plus half the legend width. Similarly, HALIGN=1 corresponds to the containing layout's right edge minus half the legend width.

Defaults If LOCATION=OUTSIDE, then the default is RIGHT.

If LOCATION=INSIDE, then the default is CENTER.

Restriction This option is available only when this statement is nested within an overlay-type or REGION layout.

Interactions If LOCATION= OUTSIDE, then the HALIGN= and VALIGN= options cannot both be set to CENTER.

This option is ignored when LOCATION=INSIDE, the AUTOALIGN= option is not NONE, and the parent layout is an overlay-type layout.

See LAYOUT OVERLAY on page 159 for more information about how child positions are determined in an overlay-type or REGION layout.

INTEGER=TRUE | FALSE

specifies whether only integer tick values are used in the continuous legend.

Note: This feature applies to SAS 9.4M3 and to later releases.

Default FALSE

Restriction This option applies only to smooth color gradients. For leveled gradients such as those used with contour plots of type FILL, LINEFILL or LABELEDLINEFILL, this option is ignored. See CONTOURTYPE=.

Interaction INTEGER=TRUE is ignored when there are no integer values between the minimum and maximum legend values.

LOCATION=OUTSIDE | INSIDE

specifies whether the legend appears inside or outside the plot area when the legend is specified within an overlay-type or REGION layout.

Default OUTSIDE

Restriction This option has effect only when the legend statement appears within a 2-D overlay-type layout and there is at least one standalone plot statement with XY axes that is referenced by the legend.

Interactions The actual position is determined by the settings for the LOCATION=, AUTOALIGN= , HALIGN= , and VALIGN= options.

If this option is set to OUTSIDE, then the HALIGN= and VALIGN= options must specify a keyword (LEFT, RIGHT, or CENTER). The *number* setting for the alignment is invalid when the legend is positioned outside of the plot area.

Within an overlay-type layout, if the ORIENT= option is not set, then the orientation changes depending on the actual position. If

LOCATION=OUTSIDE and the legend is right or left of the plot, then the orientation is vertical. If LOCATION=OUTSIDE and the legend is above or below the plot, then the orientation is horizontal.

See LAYOUT OVERLAY on page 159 for more information about how child positions are determined in an overlay-type or REGION layout.

OPAQUE=TRUE | FALSE
specifies whether the legend background is opaque (TRUE) or transparent (FALSE).

Default FALSE

Interaction When this option is set to FALSE, the background color is not used.

See "boolean " on page xii for other Boolean values that you can use.

ORIENT=VERTICAL | HORIZONTAL
specifies the orientation of the legend.

Default VERTICAL

Restriction In order to use ORIENT=HORIZONTAL when the continuous legend is in an OVERLAY or REGION layout, you must place the legend inside the graph area (LOCATION=INSIDE).

Tip To orient the legend horizontally outside of the graph area in an OVERLAY or REGION layout, use LOCATION=OUTSIDE and VALIGN=BOTTOM instead.

OUTERPAD=AUTO | *dimension* | (*pad-options*)
specifies the amount of extra space that is added outside the legend border.

AUTO
specifies that the default outside padding for this component is used.

dimension
specifies a dimension to use for the extra space at the left, right, top, and bottom of the legend border.

(*pad-options*)
a space-separated list of one or more name-value pair pad options, enclosed in parentheses.

The list can include one or more of the following pad options:

LEFT=*dimension*
specifies the amount of extra space added to the left side.

RIGHT=*dimension*
specifies the amount of extra space added to the right side.

TOP=*dimension*
specifies the amount of extra space added to the top.

BOTTOM=*dimension*
specifies the amount of extra space added to the bottom.

Note Sides that are not assigned padding are padded with the default amount.

Tip Use *pad-options* to create non-uniform padding.

Default AUTO

Note The default units for *dimension* are pixels.

See "dimension" on page xiii

PAD=*dimension* | (*pad-options*)
specifies the amount of extra space that is reserved inside the legend perimeter.

dimension
specifies a dimension to use for the extra space at the left, right, top, and bottom of the legend perimeter.

(*pad-options*)
a space-separated list of one or more name-value pair pad options, enclosed in parentheses.

The list can include one or more of the following pad options:

LEFT=*dimension*
specifies the amount of extra space added to the left side.

RIGHT=*dimension*
specifies the amount of extra space added to the right side.

TOP=*dimension*
specifies the amount of extra space added to the top.

BOTTOM=*dimension*
specifies the amount of extra space added to the bottom.

Note Sides that are not assigned padding are padded with the default amount.

Tip Use *pad-options* to create non-uniform padding.

Default Padding for all sides is 0.

Note The default units for *dimension* are pixels.

See "dimension" on page xiii

TITLE="*string*"
specifies the title of the legend. The title is placed below the legend body.

Default No title

Requirement *string* must be enclosed in quotation marks.

Interaction When the title is placed to the left of the legend, if TITLEBORDER=TRUE is in effect, no separator is displayed

between the title and the legend. If TITLEBORDER=FALSE is in effect in that case, a separator is displayed.

TITLEATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font attributes of the legend title.

Default The GraphLabelText style element.

Interactions For this option to have any effect, the TITLE= option must also be specified.

If one or more text options are specified and they do not include all the font properties (color, family, size, weight, style), then non-specified properties will be derived from the GraphLabelText style element.

Note When you specify *style-element*, only the style attributes COLOR, FONTFAMILY, FONTSIZE, FONTSTYLE, and FONTWEIGHT are used.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Text Options" on page 1606 for available *text-options*.

VALIGN=CENTER | TOP | BOTTOM | *number*
specifies the vertical alignment of the legend within its parent layout when nested within an overlay-type or REGION layout.

number
specifies an explicit position in the containing layout.

Range The *number* specification can range from 0 to 1. The *number* represents a fraction of the parent container's height, where 0 is on the bottom and 1 is on the top.

Interaction For a *number* setting to take effect, LOCATION=INSIDE must be set. A *number* setting is invalid on this option when LOCATION=OUTSIDE.

Tip The legend is effectively anchored at its center. Zero corresponds to the containing layout's bottom edge plus half the legend height. Similarly, one corresponds to the containing layout's top edge minus half the legend height.

Default CENTER

Restriction This option is available only when this statement is nested within an overlay-type or REGION layout. It is ignored if the parent layout is not an overlay-type or REGION layout.

Interactions If LOCATION= OUTSIDE, then the VALIGN= and HALIGN= options cannot both be set to CENTER.

This option is ignored when LOCATION=INSIDE, the AUTOALIGN= option is not NONE, and the parent layout is an overlay-type layout.

See LAYOUT OVERLAY on page 159 for more information about how child positions are determined in an overlay-type or REGION layout.

VALUEATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font attributes of the legend values.

Default The GraphValueText style element.

Interaction If one or more text options are specified and they do not include all the font properties (color, family, size, weight, style), then non-specified properties will be derived from the GraphLabelText style element.

Note When you specify *style-element*, only the style attributes COLOR, FONTFAMILY, FONTSIZE, FONTSTYLE, and FONTWEIGHT are used.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Text Options" on page 1606 for available *text-options*.

VALUECOUNTHINT=*positive-integer*
recommends a number of values for the continuous legend to use to label the data range.

Default 6

Restriction The associated plot must be displayed with smooth gradient for this option to have any effect. For example, in a contour plot, CONTOURTYPE must be set to GRADIENT or LINEGRADIENT.

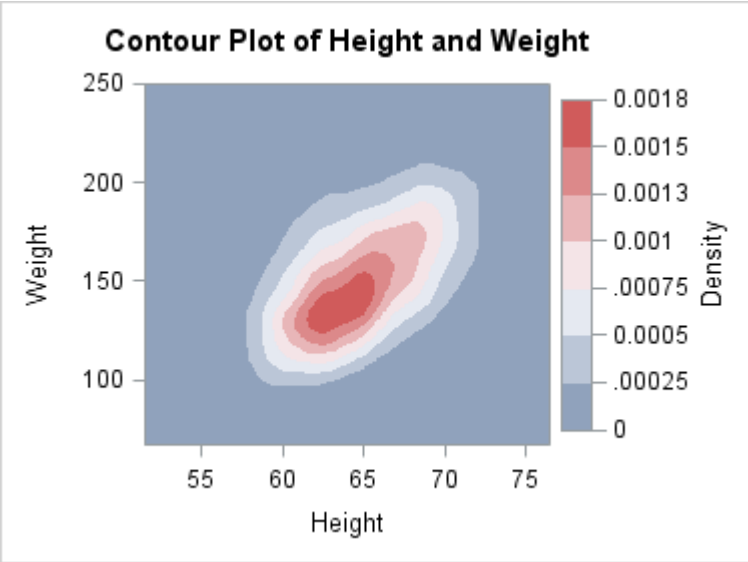
Requirement *positive-integer* must be greater than zero.

Note The legend uses even intervals to label the range.

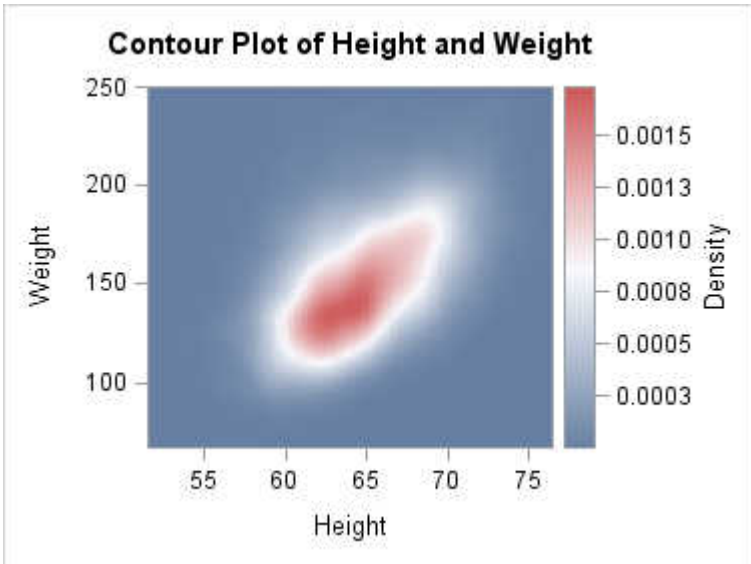
Details

A continuous legend consists of a color ramp and a numeric scale indicating color values.

In the following figure, the continuous legend references a contour plot with a fixed number of levels. The color ramp and legend values automatically reflect these discrete levels. The legend option VALUECOUNTHINT= has no effect.



In this next figure, the continuous legend references a contour plot with a continuous gradient. The number of legend values displayed is automatically determined by the legend, or decided by the contributing plot, such as the CONTOURPLOTPARM with CONTOURTYPE=FILL. For plots with a continuous gradient, you can use the legend option VALUECOUNTHINT= to control how many legend values appear. (This option is ignored if there is no gradient.)



Within an overlay-type layout, when a continuous legend is placed inside the plot area with LOCATION= INSIDE,

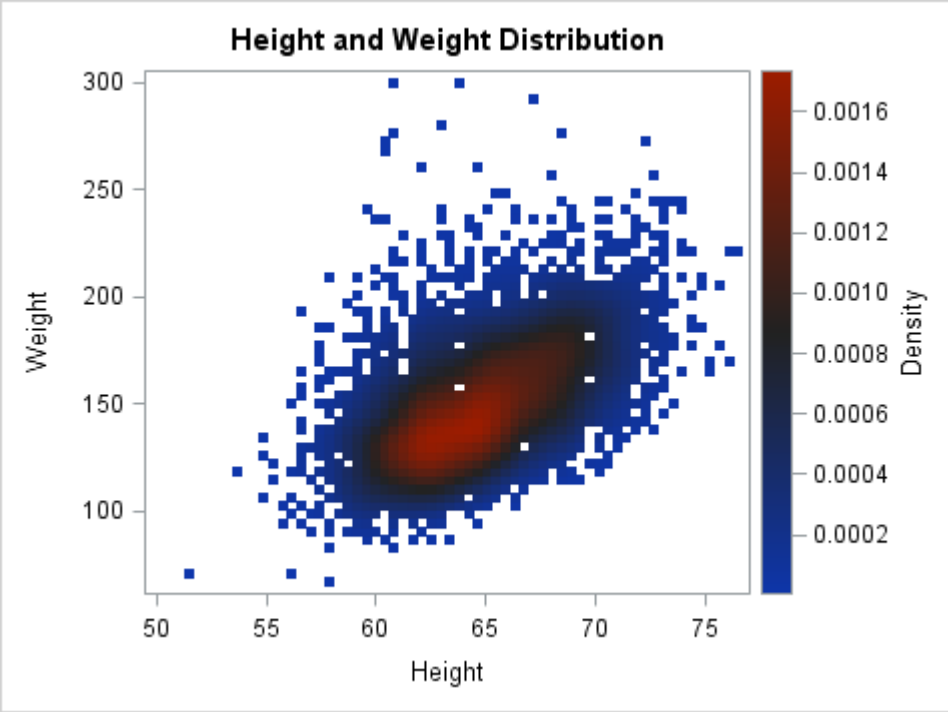
- It is always placed on top of plot lines and markers.
- By default, its background is fully transparent (OPAQUE= FALSE), meaning that underlying lines, markers, and data labels show through the legend.
- Its position can be controlled with the AUTOALIGN= option, or with the HALIGN= and VALIGN= options.

Within an overlay-type layout, when a continuous legend is placed outside the plot area with LOCATION=OUTSIDE,

- By default, its background is fully opaque (OPAQUE=TRUE).
- Its position can be controlled with the HALIGN= and VALIGN= options.

Example: CONTINUOUSLEGEND Statement

The following graph was generated by the "Example Program" on page 1302:



Example Program

```
proc template;
  define statgraph continuouslegend;
    begingraph;
      entrytitle "Height and Weight Distribution";
        layout overlay;
          scatterplot x=height y=weight /
            markercolorgradient=density
            markerattrs=(symbol=squarefilled size=6px)
            name="scatter";
          continuouslegend "scatter" / orient=vertical
            location=outside valign=center halign=right
            valuecounthint=10 title="Density";
        endlayout;
    endgraph;
  end;
run;
ods graphics / reset width=475px;
```

```
proc sgrender data=sashelp.gridded(where=(count>0))
  template=continuouslegend;
run;
```

DISCRETELEGEND, MERGEDLEGEND Statements

Creates a legend with entries that refer to plots, or group values, or both legend items.

Restrictions: The MERGEDLEGEND statement can be used for grouped plots only.

The MERGEDLEGEND statement supports only line and marker overlays.

Notes: Often the data in a plot is classified by a group variable. Or, multiple columns of data are plotted in the same graph. These groups or columns are represented in the graph by different color or line patterns or marker symbols. In these cases, a DISCRETELEGEND can be added to the graph to help decode the data. The MERGEDLEGEND statement can be used to consolidate legend entries when the graph displays grouped data for two plots. The MERGEDLEGEND statement must specify exactly two names that reference the source for the legend entry values.

Prior to SAS 9.4M3, when a discrete attribute map is used for group values in a plot that contributes to a discrete legend and attributes are overridden in the plot statement, the attributes of some plot features and their corresponding legend items might not match. Starting with SAS 9.4M3, the attributes of the legend items always match the attributes of the corresponding plot features.

See: "LEGENDITEM Statement" on page 1322

Syntax

DISCRETELEGEND *"graph-name-1" | "legend-item-name-1" | "discrete-attr-name-1"* <*"graph-name-2" | "legend-item-name-2" | "discrete-attr-name-2"...*> </*options*>;

MERGEDLEGEND *"graph-name" | "legend-item-name" | "discrete-attr-name" "graph-name" | "legend-item-name" | "discrete-attr-name"* </*options*>;

Summary of Optional Arguments

Appearance options

ACROSS=*positive-integer*
: specifies the number of legend entries that are placed horizontally before the next row begins.

AUTOITEMSIZE=TRUE | FALSE
: specifies that all markers, lines, and filled symbols in the legend are sized in proportion to the font size used for the legend entry labels.

BACKGROUNDCOLOR=*style-reference | color*
: specifies the color of the legend background.

BORDER=TRUE | FALSE
: specifies whether a border is displayed around the legend.

BORDERATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
: specifies the attributes of the border line around the legend.

DISPLAYCLIPPED=TRUE | FALSE
: specifies whether the legend is displayed when any portion of the legend cannot be rendered entirely.

DOWN=*positive-integer*
: specifies the number of legend entries that are placed vertically before the next column begins.

FILLITEMOUTLINE=AUTO | ON
: specifies whether the fill swatches are outlined only when enabled by the contributing statements or are always outlined.

ITEMSIZE=(*size-options*)
: specifies the size of specific types of items that are in a discrete or merged legend.

OPAQUE=TRUE | FALSE
: specifies whether the legend background is opaque (TRUE) or transparent (FALSE).

ORDER=ROWMAJOR | COLUMNMAJOR
: specifies whether legend entries are organized into rows or into columns.

OUTERPAD=AUTO | *dimension* | (*pad-options*)
: specifies the amount of extra space that is added outside the legend border.

PAD=*dimension* | (*pad-options*)
: specifies the amount of extra space that is reserved inside the legend perimeter.

SORTBY=LABEL | TEXT
: specifies whether text legend items are sorted by label or by text.

SORTORDER=AUTO | REVERSEAUTO | ASCENDINGFORMATTED | DESCENDINGFORMATTED
: specifies the sort order to use for the legend entry labels.

TITLEBORDER=TRUE | FALSE
: specifies a border around the legend title that separates it from the legend body.

VALUEATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
: specifies the color and font attributes of the legend values.

Content options

ADDITIONALNAMES=("*graph-name*" | "*legend-item-name*" | "*discrete-attr-name*" <"*graph-name*" | "*legend-item-name*" | "*discrete-attr-name*"> ...)
: specifies additional legend items that are to be added to the two items that are required in the MERGEDLEGEND statement.

EXCLUDE=(*item-names*)
: specifies a list of legend entries to exclude from the display.

TYPE=ALL | FILL | FILLCOLOR | LINE | LINECOLOR | LINEPATTERN | MARKER | MARKERCOLOR | MARKERSYMBOL | TEXT
: specifies which visual attributes to display for legend entries in the legend.

Location options

AUTOALIGN=NONE | AUTO | (*location-list*)
: specifies whether the legend is automatically aligned within its parent layout when nested within an overlay-type layout.

HALIGN=CENTER | LEFT | RIGHT | *number*
: specifies the horizontal alignment of the legend within its parent layout when nested within an overlay-type or REGION layout.

LOCATION=OUTSIDE | INSIDE
: specifies whether the legend appears inside or outside the plot area when the legend is specified within an overlay-type or REGION layout.

VALIGN=CENTER | TOP | BOTTOM | *number*
: specifies the vertical alignment of the legend within its parent layout when nested within an overlay-type or REGION layout.

Text options

TITLE="*string*"
: specifies the title of the legend.

TITLEATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
: specifies the color and font attributes of the legend title.

Required Arguments

"graph-name"
: references one or more unique names that are specified by the NAME= option of a plot statement. These names control which plots contribute to the legend, and the order in which the legend entries occur. If a contributing plot uses a GROUP= option, then there is a legend entry for each group value that is present in the data.

Requirements Each *graph-name* must be enclosed in quotation marks.

Each plot that is referenced must be able to be identified by the legend entries. For example, a filled CONTOURPLOTPARM plot *cannot* be specified in the DISCRETELEGEND or MERGEDLEGEND statement because it requires a continuous legend.

"legend-item-name"
: references one or more unique values specified by the NAME= option of a LEGENDITEM statement. Each *legend-item-name* must be enclosed in quotation marks.

See "LEGENDITEM Statement" on page 1322

"discrete-attr-name"
: references one or more unique values that are specified by the NAME= option in a DISCRETEATTRMAP statement. The discrete attribute map that the name references contributes all of its value statements as legend items, regardless of whether they match the data.

Restriction When one or more discrete attribute map names (*discrete-attr-name*) are specified in the DISCRETELEGEND statement, TYPE=ALL

on page 1317 (default) is not supported. If TYPE=ALL is in effect in that case, a discrete legend is not generated. To create a discrete legend for a discrete attribute map, you must also specify an attribute other than ALL in the TYPE= option in the DISCRETELEGEND statement.

See "DISCRETEATTRMAP Statement" on page 1505

Optional Arguments

ACROSS=*positive-integer*

specifies the number of legend entries that are placed horizontally before the next row begins. A legend entry typically consists of two parts, such as a marker symbol and an associated value.

Default The entries are placed to best fit the available area. This "best fit" approach works only when the legend is nested in the template's outermost layout.

Interactions This option is ignored if ORDER= COLUMNMAJOR

This option is ignored when the DISCRETELEGEND statement is in a LAYOUT GLOBALLEGEND block and the TYPE=ROW option is in effect for the layout.

Tip When a DISCRETELEGEND statement is placed in a nested layout, include the ACROSS= option to specify the number of columns. Otherwise, the legend items might wrap in an unexpected fashion.

ADDITIONALNAMES=(*"graph-name"* | *"legend-item-name"* | *"discrete-attr-name"* <*"graph-name"* | *"legend-item-name"* | *"discrete-attr-name"*> ...)

specifies additional legend items that are to be added to the two items that are required in the MERGEDLEGEND statement.

Note: This option is valid starting in SAS 9.4M1.

The items from the sources that are specified in this option are not included in the merging of the legend items. They are appended to the legend after the items from the sources that are specified in the required arguments are merged.

Restriction This option applies to the MERGEDLEGEND statement only.

Requirements The list of names must be enclosed in parentheses.

Each name must be enclosed in quotation marks and separated from adjacent values by a blank space.

See ""*graph-name*"" on page 1305

""*legend-item-name*"" on page 1305

""*discrete-attr-name*"" on page 1305

AUTOALIGN=NONE | AUTO | (*location-list*)
specifies whether the legend is automatically aligned within its parent layout when nested within an overlay-type layout.

NONE
does not automatically align the legend within its parent layout.

The legend's position is set by the HALIGN= and VALIGN= options.

AUTO
within the parent layout, attempts to center the legend in the area that is farthest from any surrounding data point markers.

(*location-list*)
within the parent layout, restricts the legend's possible locations to those locations in the specified *location-list*, and uses the *location-list* position that least collides with the parent layout's other graphics features.

The *location-list* is space-separated and can contain any of these locations: TOPLEFT, TOP, TOPRIGHT, LEFT, CENTER, RIGHT, BOTTOMLEFT, BOTTOM, and BOTTOMRIGHT.

Default NONE

Restriction AUTO is available only when the parent layout contains a scatter plot. Otherwise, it is ignored.

Interactions This option has no effect unless LOCATION= INSIDE.

When LOCATION=INSIDE and AUTOALIGN= is not NONE, the HALIGN= and VALIGN= options are ignored.

Note Prior to SAS 9.4M5, the legend might overlap other legends or insets. Starting with SAS 9.4M5, alignments that cause the legend to overlap another legend or inset are avoided.

See LAYOUT OVERLAY on page 159 for more information about how child positions are determined in an overlay-type layout.

AUTOITEMSIZE=TRUE | FALSE
specifies that all markers, lines, and filled symbols in the legend are sized in proportion to the font size used for the legend entry labels. These proportional sizes take effect regardless of the size reported by the plot or LEGENDITEM. The line segments are drawn as deemed appropriate by the legend, regardless of the line thickness reported by the plot.

Default FALSE

Interaction When set to TRUE, this setting considers the font size in effect from the VALUEATTRS= option.

See "boolean " on page xii for other Boolean values that you can use.

BACKGROUNDCOLOR=*style-reference* | *color*
specifies the color of the legend background.

style-reference
specifies a style reference in the form *style-element:style-attribute*.

Only the style-attribute named COLOR or CONTRASTCOLOR is used.

Default The GraphLegendBackground:Color style reference.

Interaction OPAQUE= TRUE must be in effect for the color to be seen. By default, OPAQUE=FALSE.

BORDER=TRUE | FALSE
specifies whether a border is displayed around the legend.

Defaults TRUE in SAS 9.4M1 and earlier releases.

The GraphLegendBackground:FrameBorder style reference starting with SAS 9.4M2. If attribute FrameBorder is not defined in the active style, then TRUE is the default value.

Tip The BORDERATTRS= option controls the appearance of the legend border.

See "boolean " on page xii for other Boolean values that you can use.

BORDERATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the attributes of the border line around the legend.

Default The GraphBorderLines style element.

Interaction BORDER= TRUE must be set for this option to have any effect.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*

"Line Options" on page 1602 for available *line-options*.

DISPLAYCLIPPED=TRUE | FALSE
specifies whether the legend is displayed when any portion of the legend cannot be rendered entirely. Based on the legend contents and placement, or when the graph size is reduced, parts of the legend (title, legend symbol, or legend value) might be clipped (truncated). When clipping occurs and this option is set to FALSE, the entire legend is removed from the graph. The space for that legend is then reclaimed by the remainder of the graph. When this option is set to TRUE, the legend always appears, even if some parts of it have been clipped.

Default FALSE

See "boolean " on page xii for other Boolean values that you can use.

DOWN=*positive-integer*
specifies the number of legend entries that are placed vertically before the next column begins. A legend entry typically consists of two parts, such as a marker symbol and an associated value.

Default The entries are placed to best fit the available area. This “best fit” approach works only when the legend is nested in the template’s outermost layout.

Restriction This option is ignored if ORDER= ROWMAJOR

Interaction This option is ignored when the DISCRETELEGEND statement is in a LAYOUT GLOBALLEGEND block.

EXCLUDE=(*item-names*)
specifies a list of legend entries to exclude from the display.

Default No items are excluded.

Requirement Each item name must be enclosed in quotation marks and separated from adjacent names by a space.

Note When the specified names are compared with the legend entry names, leading blanks are honored and trailing blanks are ignored.

Tip For plots with groups, you can exclude specific group values.

Example The following example excludes items Truck and Wagon from the legend.

```
exclude=("Truck" "Wagon")
```

FILLITEMOUTLINE=AUTO | ON
specifies whether the fill swatches are outlined only when enabled by the contributing statements or are always outlined.

Note: This feature applies to SAS 9.4M3 and to later releases.

AUTO
honors the DISPLAY= option settings for the contributing plot or the FILLDISPLAY= setting of the legend item.

ON
always outlines the fill swatches.

Default ON

Restriction This option is valid only in the DISCRETELEGEND statement.

Requirement TYPE= on page 1317 must be FILL, FILLCOLOR, or ALL for this option to have any effect.

Note The outlines are always 1 pixel wide with a solid pattern.

Tip To display color swatches with no outline when DISPLAY= includes OUTLINE, specify FILLITEMOUTLINE=AUTO and TYPE=FILLCOLOR.

HALIGN=CENTER | LEFT | RIGHT | *number*
specifies the horizontal alignment of the legend within its parent layout when nested within an overlay-type or REGION layout.

number
specifies an explicit position in the containing layout.

Range The *number* specification can range from 0 to 1. The *number* represents a fraction of the parent container's width, where 0 is all the way to the left and 1 is all the way to the right.

Interaction For a *number* setting to take effect, LOCATION=INSIDE must be set. A *number* setting is invalid on this option when LOCATION=OUTSIDE.

Tip The legend is effectively anchored at its center. HALIGN=0 corresponds to the containing layout's left edge plus half the legend width. Similarly, HALIGN=1 corresponds to the containing layout's right edge minus half the legend width.

Default CENTER

Restriction This option is available only when this statement is nested within an overlay-type or REGION layout.

Interactions If LOCATION= OUTSIDE, then the HALIGN= and VALIGN= options cannot both be set to CENTER.

This option is ignored when LOCATION=INSIDE, the AUTOALIGN= option is not NONE, and the parent layout is an overlay-type layout.

See LAYOUT OVERLAY on page 159 for more information about how child positions are determined in an overlay-type or REGION layout.

ITEMSIZE=(*size-options*)
specifies the size of specific types of items that are in a discrete or merged legend.

Note: This option is valid starting in SAS 9.4M1.

The following size options are supported:

FILLASPECTRATIO=AUTO | GOLDEN | *positive-number*
specifies the aspect ratio for the fill swatches.

Note: This feature applies to SAS 9.4M3 and to later releases.

AUTO
uses an equal width and height for color swatches with solid color fills, or uses the golden ratio for swatches with pattern fills.

GOLDEN
specifies the golden ratio of 1.618 (width = 1.618 * height) for both solid color and pattern fill swatches.

positive-number
specifies a custom aspect ratio.

Default AUTO

Restrictions This option is valid only in the DISCRETELEGEND statement.

This option does not apply to bubble plot fill color swatches (filled circle).

Interactions The legend must display fill entries for this option to have any effect.

This option is ignored when AUTOITEMSIZE=TRUE.

When FILLASPECTRATIO= is specified but neither FILLHEIGHT= nor HEIGHTSCALE= is specified, the height for color swatches with a solid fill and color swatches with a pattern fill differ.

Note FILLHEIGHT=, HEIGHTSCALE=, and FILLASPECTRATIO= also apply to fill-pattern color swatches with no outline.

Tip Use FILLHEIGHT= or HEIGHTSCALE= to specify the height.

FILLHEIGHT=AUTO | BIG | *dimension* | *style-reference*
specifies the height of the fill swatches.

Note: This feature applies to SAS 9.4M3 and to later releases.

AUTO
enables the SAS system to determine the fill color swatch height.

BIG
specifies sizes that were developed as defaults for SAS Visual Analytics, which results in color swatches that are larger than the SAS system defaults.

dimension
specifies a custom height for the fill swatches.

See “dimension” on page xiii

style-reference
specifies a style attribute that controls the height of the fill swatches.

The style reference must provide a valid dimensional value.

See “style-reference ” on page xv

Default AUTO

Restriction This option is valid only in the DISCRETELEGEND statement.

Interactions The legend must display fill entries for this option to have any effect.

This option is ignored when AUTOITEMSIZE=TRUE.

Tip Use FILLASPECTRATIO= to specify the width.

HEIGHTSCALE=*positive-number*
specifies a scale factor that is to be applied to the fill swatch height.

Values greater than 1 increase the height of the fill swatches, and values less than 1 reduce the height.

Note: This feature applies to SAS 9.4M3 and to later releases.

Default 1

Restriction This option is valid only in the DISCRETELEGEND statement.

Interactions The legend must display fill entries for this option to have any effect.

This option is ignored when AUTOITEMSIZE=TRUE.

Tips Use FILLHEIGHT= to change the base height.

Use FILLASPECTRATIO= to specify the width.

LINELENGTH=*dimension*
specifies the length of the line glyph for line entries in the legend.

Default 48 pixels

Interaction The legend must display line entries for this option to have any effect.

See “dimension” on page xiii

LOCATION=OUTSIDE | INSIDE
specifies whether the legend appears inside or outside the plot area when the legend is specified within an overlay-type or REGION layout.

Default OUTSIDE

Restriction This option has effect only when the legend statement appears within an overlay-type or REGION layout and at least one standalone plot statement is referenced by the parent layout.

Interactions The actual position is determined by the settings for the LOCATION=, AUTOALIGN= , HALIGN= , and VALIGN= options.

If this option is set to OUTSIDE, then the HALIGN= and VALIGN= options must specify a keyword (LEFT, RIGHT, or CENTER). The

number setting for the alignment is invalid when the legend is positioned outside of the plot area.

See LAYOUT OVERLAY on page 159 for more information about how child positions are determined in an overlay-type or REGION layout.

OPAQUE=TRUE | FALSE
specifies whether the legend background is opaque (TRUE) or transparent (FALSE).

Default FALSE

Interaction When this option is set to FALSE, the background color is not used.

See "boolean " on page xii for other Boolean values that you can use.

ORDER=ROWMAJOR | COLUMNMAJOR
specifies whether legend entries are organized into rows or into columns.

Default ROWMAJOR

Interaction If ORDER=ROWMAJOR, then use the ACROSS= option to limit the number of entries in a row. If ORDER=COLUMNMAJOR, then use the DOWN= option to limit the number of entries in a column.

OUTERPAD=AUTO | *dimension* | (*pad-options*)
specifies the amount of extra space that is added outside the legend border.

AUTO
specifies that the default outside padding for this component is used.

dimension
specifies a dimension to use for the extra space at the left, right, top, and bottom of the legend border.

(*pad-options*)
a space-separated list of one or more name-value pair pad options, enclosed in parentheses.

The list can include one or more of the following pad options:

LEFT=*dimension*
specifies the amount of extra space added to the left side.

RIGHT=*dimension*
specifies the amount of extra space added to the right side.

TOP=*dimension*
specifies the amount of extra space added to the top.

BOTTOM=*dimension*
specifies the amount of extra space added to the bottom.

Note Sides that are not assigned padding are padded with the default amount.

Tip Use *pad-options* to create non-uniform padding.

Default AUTO

Notes The default units for *dimension* are pixels.

Starting with SAS 9.4M1, the default padding between the discrete legend and the plot area (including the axes) is increased to 10 pixels, depending on the context. If the new default padding is not desirable, then use the OUTERPAD= option to adjust it.

See "dimension" on page xiii

PAD=*dimension* | (*pad-options*)
specifies the amount of extra space that is reserved inside the legend perimeter.

dimension
specifies a dimension to use for the extra space at the left, right, top, and bottom of the legend perimeter.

(*pad-options*)
a space-separated list of one or more name-value pair pad options, enclosed in parentheses.

The list can include one or more of the following pad options:

LEFT=*dimension*
specifies the amount of extra space added to the left side.

RIGHT=*dimension*
specifies the amount of extra space added to the right side.

TOP=*dimension*
specifies the amount of extra space added to the top.

BOTTOM=*dimension*
specifies the amount of extra space added to the bottom.

Note Sides that are not assigned padding are padded with the default amount.

Tip Use *pad-options* to create non-uniform padding.

Default Padding for all sides is 0.

Note The default units for *dimension* are pixels.

See "dimension" on page xiii

SORTBY=LABEL | TEXT
specifies whether text legend items are sorted by label or by text.

Note: This feature applies to SAS 9.4M3 and to later releases.

Default LABEL

Restriction This option is valid only in the DISCRETELEGEND statement.

Interaction This option has an effect only when sorting is performed, TYPE=TEXT is specified in this DISCRETELEGEND statement, and the legend items are defined in either a LEGENDTEXTITEM statement or in a LEGENDITEM statement that specifies TYPE=TEXT.

SORTORDER=AUTO | REVERSEAUTO | ASCENDINGFORMATTED | DESCENDINGFORMATTED

specifies the sort order to use for the legend entry labels.

AUTO

presents groups of legend entries in the order in which they are listed in the legend statement.

The internal ordering of the entries is derived from the constituent plot-statement options.

REVERSEAUTO

presents groups of legend entries in the reverse order in which they are listed in the legend statement.

Note: This feature applies to SAS 9.4M5 and to later releases.

Tip This option is useful for grouped, stacked vertical bar charts when you want the legend entries to be drawn in the same order as the bar group segments.

ASCENDINGFORMATTED
DESCENDINGFORMATTED

performs a linguistic sort on the group items. It has the same effect as sorting the input data, but the data is not changed.

Entries from separate plots, and separate legend items are combined and ordered as a single list.

Default AUTO. Groups of legend entries are presented in the order in which they are listed in the legend statement. The internal ordering of the entries is derived from the constituent plot-statement options.

Interaction This option overrides the order that is set by any constituent plot statement's GROUPORDER= option.

TITLE="*string*"

specifies the title of the legend. The title is placed to the left of the legend body, except in the following cases:

- The legend contains two or more rows of items.
- The legend is in a nested layout.
- The legend is in an OVERLAYEQUATED layout.
- The legend title length exceeds the space that is available on the left side of the legend.

In those cases, the title is placed above the legend body.

Default No title

Requirement *string* must be enclosed in quotation marks.

Interaction When the title is placed to the left of the legend, if TITLEBORDER=TRUE is in effect, no separator is displayed between the title and the legend. If TITLEBORDER=FALSE is in effect in that case, a separator is displayed.

TITLEATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font attributes of the legend title.

Default The GraphLabelText style element.

Interactions For this option to have any effect, the TITLE= option must also be specified.

If one or more text options are specified and they do not include all the font properties (color, family, size, weight, style), then non-specified properties will be derived from the GraphLabelText style element.

Note When you specify *style-element*, only the style attributes COLOR, FONTFAMILY, FONTSIZE, FONTSTYLE, and FONTWEIGHT are used.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Text Options" on page 1606 for available *text-options*.

TITLEBORDER=TRUE | FALSE
specifies a border around the legend title that separates it from the legend body.

Default FALSE

Interactions Prior to SAS 9.4M3, when LOCATION=INSIDE, BORDER=TRUE and the TITLE= option must also be in effect for this option to have any effect. When LOCATION=OUTSIDE, the TITLE= option must also be in effect. The BORDER= option has no effect on the title border in that case.

Starting with SAS 9.4M3, BORDER=TRUE and the TITLE= option must also be in effect for this option to have any effect. The LOCATION= option has no effect on the title border in that case.

Tip The line attributes of the title border are set by the BORDERATTRS= options.

See "boolean " on page xii for other Boolean values that you can use.

TYPE=ALL | FILL | FILLCOLOR | LINE | LINECOLOR | LINEPATTERN | MARKER | MARKERCOLOR | MARKERSYMBOL | TEXT

specifies which visual attributes to display for legend entries in the legend.

Note: TEXT is valid starting with SAS 9.4M3.

The TYPE= option can be used as a filter. If a statement contributing to the legend does not have any visual attributes that match the TYPE specified, then the legend does not display any entries from that statement.

Some keywords can be used to create specialized legends that display a single visual attribute. For example, keywords FILLCOLOR or MARKERSYMBOL result in the display of a single attribute. Other keywords (for example, FILL, LINE, or MARKER) result in legends that display a set of visual attributes. For example, keyword LINE results in the display of both line color and line pattern for legend entries that include lines in their display.

If this option is set to LINEPATTERN or MARKERSYMBOL, then a filled symbol is drawn using the same text color as the color used for the legend entry labels. The symbol is sized automatically, as if the AUTOITEMSIZE= option is set to TRUE. For keywords FILLCOLOR, LINECOLOR, and MARKERCOLOR, the filled symbols are drawn as outlined color swatches. The outline is 1 pixel wide, and its color is controlled by the CONTRASTCOLOR attribute of the GraphOutlines style element.

Default ALL

Restrictions This option is valid only in the DISCRETELEGEND statement.

When one or more discrete attribute map names (discrete-attr-name on page 1305) are specified in the DISCRETELEGEND statement, TYPE=ALL (default) is not supported. If TYPE=ALL is in effect in that case, a discrete legend is not generated. To create a discrete legend for a discrete attribute map, you must also specify an attribute other than ALL in the TYPE= option in the DISCRETELEGEND statement.

A LEGENDITEM statement can be referenced only from a discrete legend of the same attribute type or of an overlapping attribute type. For legends that display multiple visual attributes (use both colors and marker symbols, for example), the default visual properties are derived from the GraphDataDefault style-element.

Starting with SAS 9.4M3, the LEGENDTEXTITEMS statement can be referenced only from a discrete legend of type TEXT or ALL.

VALIGN=CENTER | TOP | BOTTOM | *number*

specifies the vertical alignment of the legend within its parent layout when nested within an overlay-type or REGION layout.

number

specifies an explicit position in the containing layout.

Range The *number* specification can range from 0 to 1. The *number* represents a fraction of the parent container's height, where 0 is on the bottom and 1 is on the top.

Interaction For a *number* setting to take effect, LOCATION=INSIDE must be set. A *number* setting is invalid on this option when LOCATION=OUTSIDE.

Tip The legend is effectively anchored at its center. Zero corresponds to the containing layout's bottom edge plus half the legend height. Similarly, one corresponds to the containing layout's top edge minus half the legend height.

Default CENTER

Restriction This option is available only when this statement is nested within an overlay-type or REGION layout. It is ignored if the parent layout is not an overlay-type or REGION layout.

Interactions If LOCATION= OUTSIDE, then the VALIGN= and HALIGN= options cannot both be set to CENTER.

This option is ignored when LOCATION=INSIDE, the AUTOALIGN= option is not NONE, and the parent layout is an overlay-type layout.

See LAYOUT OVERLAY on page 159 for more information about how child positions are determined in an overlay-type or REGION layout.

VALUEATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font attributes of the legend values.

Default The GraphValueText style element.

Interaction If one or more text options are specified and they do not include all the font properties (color, family, size, weight, style), then non-specified properties will be derived from the GraphLabelText style element.

Note When you specify *style-element*, only the style attributes COLOR, FONTFAMILY, FONTSIZE, FONTSTYLE, and FONTWEIGHT are used.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Text Options" on page 1606 for available *text-options*.

Details

A discrete legend consists of one or more units called legend entries. Each legend entry consists of a legend symbol and a legend value. The legend symbol is typically a marker, line, or filled symbol that represents a specific area in the plot. The legend value is descriptive text that is derived from group values, or that is assigned by the plot's LEGENDLABEL= option or by the LEGENDITEM statement's LABEL= option. To specify a discrete legend, you can use the DISCRETELEGEND statement. To consolidate legend entries for common grouped values that are represented by two separate plots, you can use the MERGEDLEGEND statement.

For grouped plots, a discrete legend represents all of the values that are present in the data. To ensure that legend entries are displayed for group values, regardless of whether those values are present in the data, you can use a discrete attribute map as described in "Displaying Legend Entries for Group Values That Are Not in the Data" on page 1512.

In the DISCRETELEGEND statement, you can specify one or more names that reference the source for the legend entry values. You can use the TYPE= option to control the visual attributes for the legend display.

For legend items that represent fills or colors without a specific shape, a filled symbol with a one-pixel-wide, solid outline is used to represent the data values. If the feature being represented by the legend item has an outline, then the default outline color is derived from the feature's outline color. If the feature being represented is an outline only or is a filled outlined marker, then the outline thickness is derived from the plot. If the feature does not have an outline, then the default outline color for its corresponding legend entry is derived from the GraphOutline style element.

You can use the MERGEDLEGEND statement to consolidate lines and marker symbols from discrete legend entries when a graph displays grouped values for exactly two plots. With a MERGEDLEGEND statement, the legend values from the group variables in two plots are compared. For each common value, the corresponding legend lines and marker symbols are combined, and only one legend entry is created for each matching set of group values. You can use the MERGEDLEGEND statement only for grouped plots. You must specify two names that reference the source for the legend entry values.

When a discrete legend is placed inside the plot area of an overlay type layout and LOCATION= INSIDE, the following conditions apply:

- The discrete legend is always placed on top of plot lines and markers.
- By default, the background of the discrete legend is fully transparent (OPAQUE= FALSE). Underlying lines, markers, and data labels show through the legend.
- You can control the position of the discrete legend with the AUTOALIGN= option, or with the HALIGN= and VALIGN= options. (The AUTOALIGN= option is not available in a LAYOUT OVERLAY3D statement.)

When a discrete legend is placed outside the plot area of an overlay type layout and LOCATION=OUTSIDE, the following conditions apply:

- By default, the background of the discrete legend is fully opaque (OPAQUE=TRUE).
- You can control the position of the discrete legend with the HALIGN= and VALIGN= options.

When a discrete legend is placed within nested layouts, you might need to do one of the following to obtain the legend organization that you want:

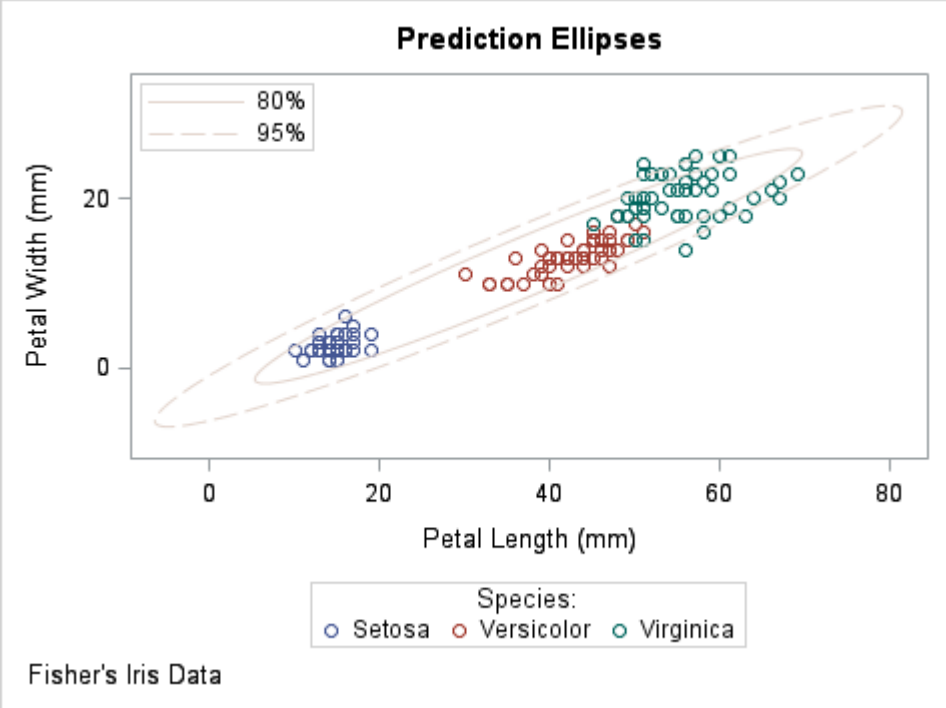
- use the ACROSS= option, and also set ORDER= ROWMAJOR
- use the DOWN= option, and also set ORDER=COLUMNMAJOR

A legend might be dropped if the total legend area in the graph exceeds the percentage that is set by the MAXLEGENDAREA= option in an ODS GRAPHICS ON statement that is in effect for the output destination. A legend might also be dropped if DISPLAYCLIPPED= FALSE and the full legend cannot be displayed.

Examples

Example 1: DISCRETELEGEND Statement

The following graph using the DISCRETELEGEND statement was generated by "Example Program" . It displays two discrete legends, one that shows the confidence limits for two ellipses and a second that shows the values for a GROUP= variable:



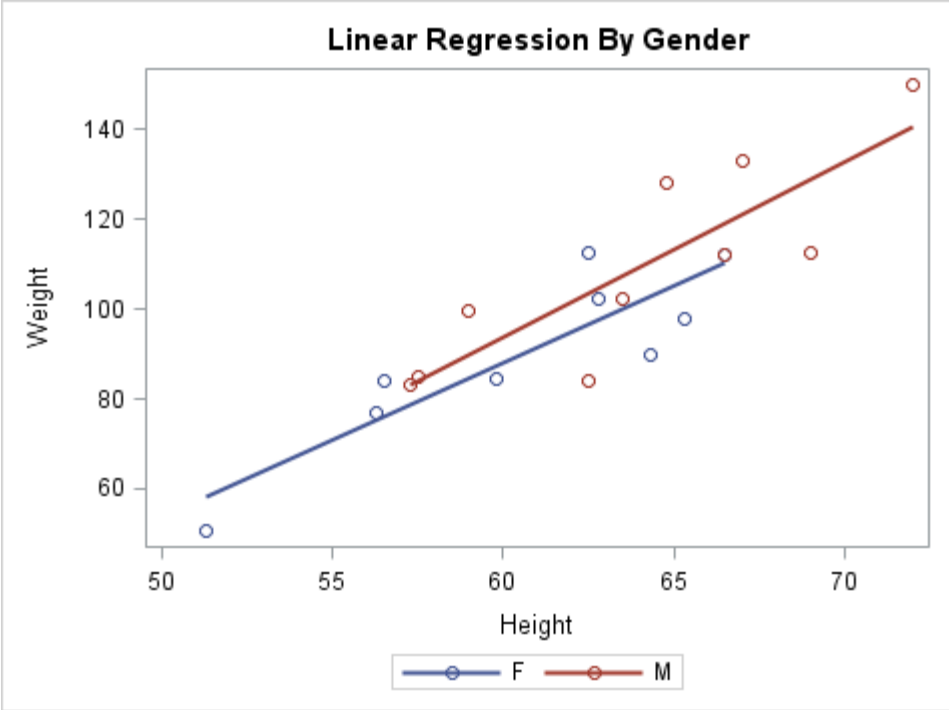
Example Program

```
proc template;
  define statgraph discretelegend;
    begingraph;
     entrytitle "Prediction Ellipses";
     layout overlayequated / equatetype=equate;
      scatterplot x=petallength y=petalwidth /
        group=species name="s";
      ellipse x=petallength y=petalwidth /
        type=predicted  alpha=0.2
        name="p80" legendlabel="80%"
        outlineattrs=graphconfidence;
      ellipse x=petallength y=petalwidth /
        type=predicted  alpha=0.05
        name="p95" legendlabel="95%"
        outlineattrs=graphconfidence2;
      discretelegend "s" / title="Species:" ;
      discretelegend "p80" "p95" / across=1
        autoalign=(topleft) location=inside ;
     endlayout;
     entryfootnote halign=left "Fisher's Iris Data";
    endgraph;
  end;

proc sgrender data=sashelp.iris template=discretelegend;
run;
```

Example 2: MERGEDLEGEND Statement

The following graph using the MERGEDLEGEND statement was generated by "Example Program" . In the template definition, a grouped scatter plot is overlaid with a series plot for each group, and the two plots are referenced by a single merged legend:



Example Program

```
proc sort data=sashelp.class
  out =class;
  by sex;
run;

proc template;
  define statgraph mergedLegend;
  begingraph;
  entrytitle "Linear Regression By Gender";
   layout overlay;
     scatterplot x=height y=weight / group=sex name="scat";
     regressionplot x=height y=weight/ group=sex name="reg";
     mergedlegend "scat" "reg" / border=true;
   endlayout;
  endgraph;
  end;

proc sgrender data=class template=mergedLegend;
run;
```

LEGENDITEM Statement

Creates the definition for a legend item that can be included in a discrete legend.

Restriction: The LEGENDITEM statement is used with the DISCRETELEGEND and MERGEDLEGEND statements only.

Requirements: The LEGENDITEM statement must be a child of the BEGINGRAPH block. It cannot be embedded in any other GTL statement block.

The LEGENDITEM statement must appear in the global definition area of the template between the BEGINGRAPH statement and the first LAYOUT statement.

Note: The LEGENDITEM statement creates the definition for a legend item that can be included in a discrete legend.

See: "DISCRETELEGEND, MERGEDLEGEND Statements" on page 1303

Syntax

LEGENDITEM TYPE=*type* NAME="*string*" </*options*>;

Summary of Optional Arguments

Appearance options

FILLATTRS=*style-element* | *style-element* (*fill-options*) | (*fill-options*)
specifies the color of the fill when TYPE= is set to FILL.

FILLDISPLAY=STANDARD | ALL | (*fill-option*)
specifies whether the fill swatch for this legend item displays fill only or displays fill and outline.

FILLEDOUTLINEDMARKERS=TRUE | FALSE
specifies whether markers are drawn with both fill and an outline.

LINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the appearance of the line when TYPE= is set to LINE or MARKERLINE.

MARKERATTRS=*style-element* | *style-element* (*marker-options*) | (*marker-options*)
specifies the appearance of the marker when TYPE= is set to MARKER or MARKERLINE.

OUTLINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the color of the outline when TYPE= is set to FILL.

TEXT="*string*"
specifies the text to display when TYPE= is set to TEXT.

TEXTATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the font and color attributes of the *string* that is specified on the TEXT= option when TYPE= is set to TEXT.

Label options

LABEL="*string*"
specifies a label to be used for the legend item.

LABELATTRS
specifies the color and font attributes of the legend item's label.

Required Arguments

TYPE=FILL | MARKER | MARKERLINE | LINE | TEXT
specifies a type for the legend item.

FILL
specifies a fill (displayed as a filled square).

The appearance can be managed with the FILLATTRS= and OUTLINEATTRS= options.

MARKER
specifies a marker.

The appearance can be managed with the MARKERATTRS= option.

MARKERLINE
specifies a marker and a line.

The appearance can be managed with the MARKERATTRS= and LINEATTRS= options.

LINE
specifies a line. The appearance can be managed with the LINEATTRS= option.

TEXT
specifies text that can be displayed in the legend area.

The text string is defined with the TEXT= option, and the text appearance can be managed with the TEXTATTRS= option.

NAME="*string*"
assigns a name to the legend item for reference in a DISCRETELEGEND or MERGEDLEGEND statement.

Restrictions The *string* is case sensitive and must define a unique name within the template.

This option does not support variables that are created by the DYNAMIC, MVAR, and NMVAR template statements.

Optional Arguments

FILLATTRS=*style-element* | *style-element* (*fill-options*) | (*fill-options*)
specifies the color of the fill when TYPE= is set to FILL.

Default The GraphDataDefault style element.

Interaction The Transparency attribute cannot be derived from the style element, but it can be set with this option.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Fill Color Options" on page 1600 for available *fill-options*.

FILLDISPLAY=STANDARD | ALL | (*fill-option*)
specifies whether the fill swatch for this legend item displays fill only or displays fill and outline.

Note: This feature applies to SAS 9.4M3 and to later releases.

STANDARD
ALL
displays the fill and outline.

(*fill-option*)
specifies a list of one or more fill options.

The list can include one or both of the following options:

FILL
displays only the fill.

OUTLINE
displays only the outline.

Default STANDARD

Requirement You must specify TYPE=FILL for this option to have any effect.

FILLEDOUTLINEDMARKERS=TRUE | FALSE
specifies whether markers are drawn with both fill and an outline.

TRUE
draws filled markers (marker symbols with the suffix FILLED) using both fill and an outline.

Interaction When this option is TRUE, the marker fill is drawn using the FILLATTRS= specification, and the outline is drawn using the OUTLINEATTRS= specification.

FALSE
draws the markers using fill or an outline, but not both.

Default FALSE

See “boolean ” on page xii for other Boolean values that you can use.

LABEL="*string*"
specifies a label to be used for the legend item.

Default No label is displayed

Tip The font and color attributes for the label are specified by the LABELATTRS= option.

LABELATTRS
specifies the color and font attributes of the legend item’s label.

Default The GraphValueText style element.

Interaction For this option to take effect, the LABEL= option must also be specified.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Text Options" on page 1606 for available *text-options*.

LINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the appearance of the line when TYPE= is set to LINE or MARKERLINE.

Default The GraphDataDefault style element.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

MARKERATTRS=*style-element* | *style-element* (*marker-options*) | (*marker-options*)
specifies the appearance of the marker when TYPE= is set to MARKER or MARKERLINE.

Default The GraphDataDefault style element.

Interaction The Weight attribute cannot be derived from the style element, but it can be set with this option.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Marker Options" on page 1604 for available *marker-options*.

OUTLINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the color of the outline when TYPE= is set to FILL.

Default The GraphDataDefault style element.

Restriction This option uses only the color specification in the style element or line options. The line pattern and line thickness specifications are ignored.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

TEXT="*string*"
specifies the text to display when TYPE= is set to TEXT. The font and color attributes for the text are specified by the TEXTATTRS= option.

Default a blank space

TEXTATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the font and color attributes of the *string* that is specified on the TEXT= option when TYPE= is set to TEXT.

Default The GraphValueText style element.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Text Options" on page 1606 for available *text-options*.

Details

The LEGENDITEM statement creates a definition for a legend item that can be included in a legend. The item that you define is independent of the data and enables you to customize the legend to enhance or replace a standard legend. For example, to display annotation text within the legend area, you can define a LEGENDITEM statement with TYPE=TEXT and specify the text in the TEXT= option.

As demonstrated in the "Example Program" on page 1328, multiple LEGENDITEM statements can be used to replace a plot statement's data-driven legend by defining custom legend items to display in the legend. This use enables you to communicate information that is not in the data. For this use, you would define one or more LEGENDITEM statements to specify legend attributes, and then reference those items in your legend statement. You must not reference the plot statement itself in the legend statement. Although no direct connection would exist between the plot data and the legend, you could communicate the connection by managing the visual attributes in both the plot and the legend.

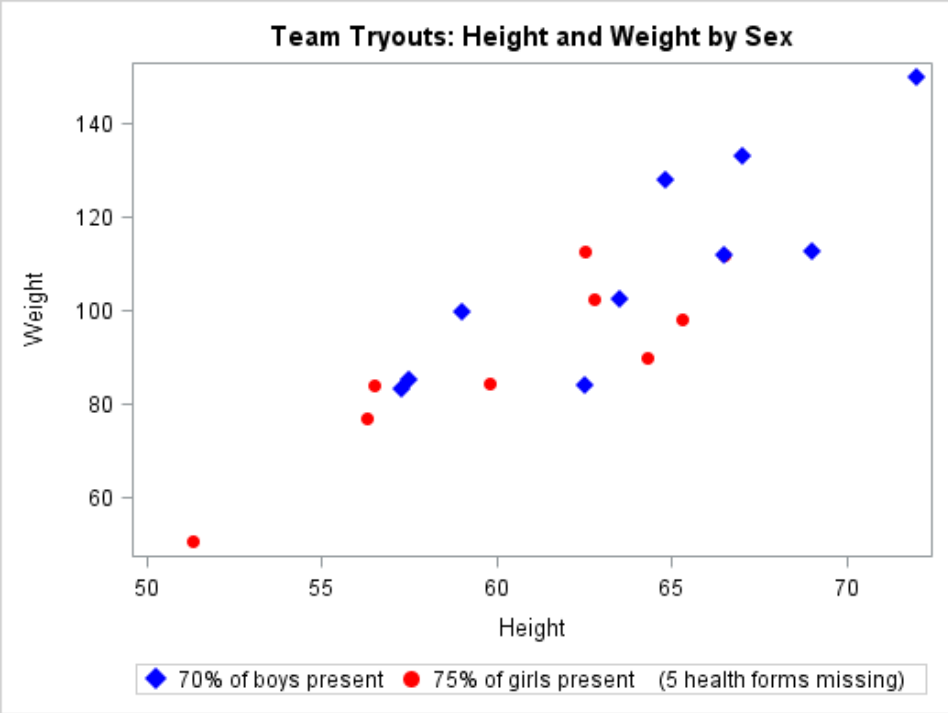
The LEGENDITEM statement must be located within the BEGINGRAPH block but outside of the outermost layout block. You can use multiple LEGENDITEM statements to define multiple definitions. In that case, each definition specifies a single legend entry and each item name must be referenced in the legend statement.

Note: A single legend statement can reference multiple item names and also multiple plot names.

When specifying attribute options for a particular LEGENDITEM statement, options that do not apply to the specified TYPE= value are ignored. For example, the MARKERATTRS= option sets the attributes for a marker and is useful if you set TYPE=MARKER or TYPE=MARKERLINE. However, if TYPE= is set to a value that does not display a marker symbol, then the MARKERATTRS= option is ignored.

Example: LEGENDITEM Statement

The following graph was generated by the "Example Program" on page 1328. The example specifies three LEGENDITEM statements to define graphical properties for two marker symbols and a text string. The NAME= option in each LEGENDITEM statement assigns a name to the definition. Those names are referenced in a DISCRETELEGEND statement so that the definitions are displayed in the graph legend. To correlate the legend with the scatter plot, the example creates an attribute map that matches values M and F to the same graphical properties that are specified in the LEGENDITEM statements. That attribute map is referenced in the scatter plot.



Example Program

```
proc template;
  define statgraph scatterplot;
    begingraph;
      entrytitle "Team Tryouts: Height and Weight by Sex";
      discreteattrmap name="symbols" / ignorecase=true
trimleading=true;
        value "m"    / markerattrs=(color=blue symbol=diamondfilled);
        value "f"    / markerattrs=(color=red  symbol=circlefilled);
      enddiscreteattrmap;
      discreteattrvar attrvar=groupmarkers var=sex attrmap="symbols";
      legendItem type=marker name="m_marker" /
        markerattrs=(color=blue symbol=diamondfilled)
        label="70% of boys present" ;
      legendItem type=marker name="f_marker" /
```

```
        markerattrs=(color=red  symbol=circlefilled)
        label="75% of girls present" ;
      legendItem type=text name="status" /
        text=" (5 health forms missing)" ;
      layout overlay;
        scatterplot x=height y=weight / group=groupmarkers;
        discretelegend "m_marker" "f_marker" "status" /
          autoitemsize=true;
      endlayout;
    endgraph;
  end;
proc sgrender data=sashelp.class template=scatterplot;
run;
```

LEGENDTEXTITEMS Statement

Creates the definition for data-driven text items that can be included in a discrete legend.

Restrictions: The LEGENDTEXTITEMS statement is used only with the DISCRETELEGEND statement.

Grouping is not supported.

The maximum number of items that the LEGENDTEXTITEMS statement can contribute to the legend is 100. If this limit is exceeded, the LEGENDTEXTITEMS statement is dropped. If no other statements contribute to the legend in that case, the legend is not drawn.

Requirements: The LEGENDTEXTITEMS statement must be a child of the BEGINGRAPH block. It cannot be embedded in any other GTL statement block.

The LEGENDTEXTITEMS statement must appear in the global definition area of the template between the BEGINGRAPH statement and the first LAYOUT statement.

The TYPE= option in the legend statement that references this statement must be set to ALL or TEXT.

Note: This feature applies to SAS 9.4M3 and to later releases.

See: "DISCRETELEGEND, MERGEDLEGEND Statements" on page 1303

Syntax

LEGENDTEXTITEMS NAME="*string*" TEXT=*column* </*options*>;

Required Arguments

NAME="string"
assigns a name to the legend items for reference in a DISCRETELEGEND or MERGEDLEGEND statement.

Restriction This option does not support variables that are created by the DYNAMIC, MVAR, and NMVAR template statements.

TEXT=*column*
specifies the column in the plot data set that contains the text items.

Notes One item is added for each observation. Grouping is not supported.

The TEXT column should not contain missing values. A missing TEXT column value is treated as if no text is specified. If an observation contains a missing TEXT column value and a valid LABEL column value, only the label value is added to the legend for that observation. If both values are missing, nothing is added to the legend.

If the plot data is a SAS data set, the text items are arranged in data order in the plot legend. If the plot data is a CAS in-memory table, the text items are arranged in ascending order of the text column values.

Optional Arguments

LABEL=*column*
specifies the column that contains the labels for the legend items.

Default No labels are displayed for the items

Note Each observation that has a LABEL column value should have a corresponding TEXT column value. If an observation contains a valid LABEL column value and a missing TEXT column value, only the label value is added to the legend for that observation.

Tip The font and color attributes for the label are specified by the LABELATTRS= option.

LABELATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font attributes of the legend item labels.

Default The GraphValueText style element.

Note Space is reserved in the legend for the height of the legend label text regardless of whether the LABEL= option is specified.

Tip If you are not using the LABEL= option, specify LABELATTRS=(SIZE=0pt) to reclaim the space that is reserved for the label text height.

See "General Syntax for Attribute Options" on page 1599 for the syntax for using a *style-element* value.

"Text Options" on page 1606 for available *text-options*.

TEXTATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the font and color attributes of the text values that is specified on the TEXT= option.

Default The GraphValueText style element.

See "General Syntax for Attribute Options" on page 1599 for the syntax for using a *style-element* value.

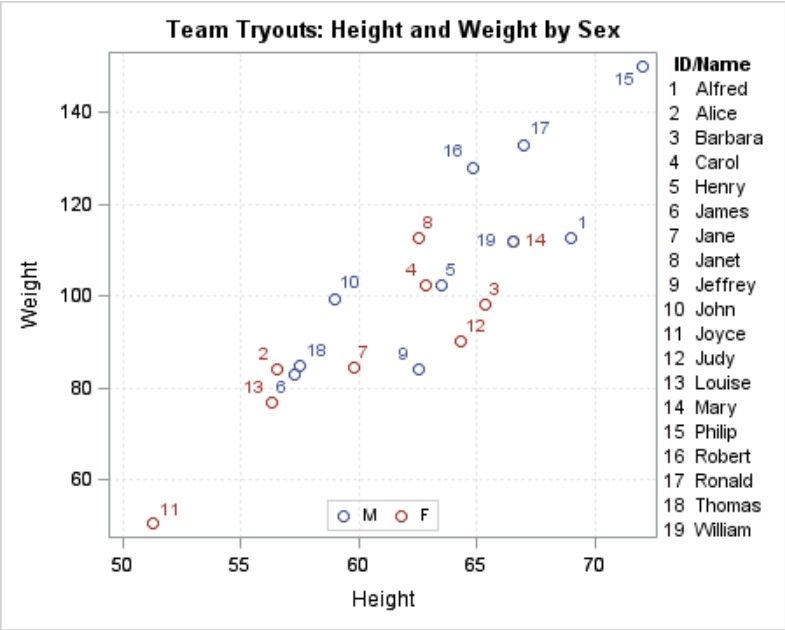
"Text Options" on page 1606 for available *text-options*.

Details

The LEGENDTEXTITEMS statement creates a definition for data-driven text legend items that can be included in a discrete legend. The items that you define in the data are independent of the plot and enable you to customize the legend in order to enhance or replace a standard legend. The text items are stored in the plot data set in the column that is specified by the TEXT= option. The LEGENDTEXTITEMS statement must be located within the BEGINGRAPH block but outside of the outermost layout block. You reference the LEGENDTEXTITEMS statement in your legend statement by the name specified in the NAME= option. You must not reference the plot statement itself in the legend statement. To add items from multiple columns, specify one LEGENDTEXTITEMS statement for each column, and then reference all of the LEGENDTEXTITEMS statements in your legend statement. Although no direct connection would exist between the plot data and the legend, you could communicate the connection by managing the visual attributes in both the plot and the legend.

Example: LEGENDTEXTITEMS Statement

The following graph was generated by the "Example Program" on page 1332. The graph shows a scatter plot of height and weight by sex for 19 participants in a team tryout. To reduce clutter in the plot, a numeric ID is used to label the marker for each individual in the plot. A legend in the right margin of the graph displays the participant name for each ID.



Example Program

In this example program, a LEGENDTEXTITEMS statement is used to create the legend of IDs and names in the right margin of the graph. The name IDLEGEND is assigned to the LEGENDTEXTITEMS statement. The ID column provides the legend text items, and the Name column provides a name as the label for each text item. Here is the SAS code.

```
/* Assign a numeric ID to each name */
data class;
  set sashelp.class;
  id=_N_;
run;

/* Define the template for the graph */
proc template;
  define statgraph scatterplot;
    begingraph;
      entrytitle "Team Tryouts: Height and Weight by Sex";
      legendtextItems name="idlegend" text=id / label=name;
      layout lattice / columns=2 columnweights=(85 15);
        layout overlay /
          xaxisopts=(griddisplay=on
            gridattrs=(color=lightgray pattern=dot))
          yaxisopts=(griddisplay=on
            gridattrs=(color=lightgray pattern=dot));
          scatterplot x=height y=weight / name="scatter"
            group=sex datalabel=id;
          discretelegend "scatter" / location=inside
            autoalign=(bottom bottomright);
        endlayout;
        layout overlay;
```

```
          discretelegend "idlegend" /
            title="ID/Name" titleattrs=(weight=bold)
            valign=top border=false
            order=rowmajor across=1;
        endlayout;
      endlayout;
    endgraph;
  end;

/* Render the graph */
proc sgrender data=class template=scatterplot;
run;
```

PART 7

Text Statements

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10

Managing Text Items

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Overview

The ENTRY, ENTRYTITLE, and ENTRYFOOTNOTE statements all use the same syntax for specifying one or more pieces of text called text items. For example, here is the ENTRYTITLE syntax:

ENTRYTITLE *text-item* <...<*text-item*>> </*options*>;

Each text item can be specified using the following syntax:

<*prefix-option*...<*prefix-option*>> "*string*" | *dynamic* | *character-expression* | {*text-command*}

The simplest specification for each statement is to specify a string in quotation marks. For example, you might specify a graph title as follows:

```
entrytitle "Height and Weight by Sex";
```

In this example, the string “Height and Weight by Sex” is formatted as the graph title and displayed in the title position. If multiple strings are specified, then they are concatenated into a single line of text. This second specification generates the same title:

```
entrytitle "Height " "and " "Weight " "by " "Sex";
```

To provide control over the text, multiple prefix options can precede each text item, and the text item can be a string literal, a dynamic, or a text command. All text items with the same HALIGN= setting are concatenated into one string. Up to three strings with different horizontal alignment can result for each ENTRY statement. Leading and trailing blanks in the concatenated string are always used.

- a string must be enclosed in quotation marks.
- a character expression must be enclosed in an EVAL function.
- a text command must be enclosed in braces. (See “Using Text Commands” on page 1341).

Using Prefix Options

Available Prefix Options

The following prefix options are available on ENTRY, ENTRYTITLE, and ENTRYFOOTNOTE statements:

HALIGN
specifies the horizontal alignment of a text item.

TEXTATTRS
specifies font attributes for a text item.

When used, a prefix option applies not only to immediately following piece of text but also to ALL subsequent text strings and text-commands. If the same prefix option appears more than once, then each use overrides the last used prefix of the same name.

Managing Horizontal Alignment

For the ENTRY, ENTRYTITLE, and ENTRYFOOTNOTE statements, the default horizontal alignment is CENTER.

```
entry "One" " Two" " Three" " Four" " Five" " Six";
```

The HALIGN= option can be used to change the horizontal alignment to LEFT, CENTER, or RIGHT. The following specification left-justifies the text:

```
entry halign=left
 "One" " Two" " Three" " Four" " Five" " Six";
```

Text items are positionally concatenated by alignment area. For example, the following specification left-justifies the first three strings and right-justifies the last three strings:

```
entry halign=left "One" " Two" " Three"
      halign=right "Four" " Five" " Six";
```

Even if the HALIGN= specifications are jumbled, the final text is nevertheless positionally concatenated by alignment area:

```
entry halign=right "Five" halign=left "One"
      halign=right " Six" halign=center "Three"
      halign=left " Two"  halign=center " Four";
```

Note: When long strings are used or the bounding container is constrained, the alignment areas might overlap.

Managing Font Attributes

For the ENTRY, ENTRYTITLE, and ENTRYFOOTNOTE statements, the default font attributes are determined by the active ODS style. The TEXTATTRS= option can be used to change the default font attributes. The TEXTATTRS= option syntax is as follows (see "General Syntax for Attribute Options" on page 1599 for the syntax on using a style element and "Text Options" on page 1606 for available text options):

TEXTATTRS=*style-element* | *style-element(text-options)* | (*text-options*)

For example, the following ENTRYTITLE statement uses prefix options to create this title line:

```
entrytitle textattrs=(color=black) "Center"
  textattrs=(color=red) " Text"
  halign=right textattrs=(color=black size=10pt) "Right "
    textattrs=(color=red size=10pt) "side"
  halign=left
    textattrs=(color=black style=italic size=10pt) "Left"
    textattrs=(color=red style=italic size=10pt) " side";
```

- The TEXTATTRS= options are reset each time a new TEXTATTRS= appears—there is no "carry over" or accumulation of the settings.
- Blanks (spaces) must be provided as needed to achieve the desired concatenation. When concatenating dynamic variables that are stripped of leading and trailing blanks, a literal space must be inserted to separate them, as shown in the following example:

```
entry _DYN1 " " _DYN2;
```

Alternatively, font attributes can be specified by overriding the style element defaults. The following specification overrides the settings of the GraphTitleText style element, which sets the default attributes for ENTRYTITLE text:

```
entrytitle
halign=left
 textattrs=GraphTitleText(color=black style=italic) "Left"
 textattrs=GraphTitleText(color=red style=italic) " side"
halign=center
 textattrs=(color=black) "Center"
 textattrs=(color=red) " Text"
halign=right
 textattrs=GraphTitleText(color=black weight=bold) "Right "
 textattrs=GraphTitleText(color=red weight=bold) "side" ;
```

Dynamic variables can also be used in the text strings. In the following ENTRYTITLE statement, assume that _DEPLABEL and _MODELLABEL are dynamic variables that are specified on PROC TEMPLATE's DYNAMIC statement:

```
entrytitle "Residual by Predicted for " _DEPLABEL
  halign=left textattrs=GraphTitleText _MODELLABEL /
   pad=(bottom=5);
```

- The default style element for ENTRYTITLE is GraphTitleText, so all three text items (one literal and two dynamic variables) get these font properties as a starting point.
- The text *"Residual by Predicted for " _DEPLABEL* is center-aligned by default.
- The prefix options HALIGN= and TEXTATTRS= override the center alignment and font properties for the text _MODELLABEL.

This could have been coded as follows:

```
entrytitle halign=left
  textattrs=GraphTitleText _MODELLABEL
  halign=center textattrs=()
    "Residual by Predicted for " _DEPLABEL;
```

In this example, the second HALIGN= and TEXTATTRS=() are necessary to reset alignment and font properties to their defaults.

The string length of the resolved dynamic _MODELLABEL does not affect the placement of the center-aligned text.

Using Text Commands

Available Text Commands

Text commands on ENTRY, ENTRYTITLE, and ENTRYFOOTNOTE statements are special in-line instructions that either modify the appearance of the text or script special characters. The following text commands are available:

{SUB}
specifies that the string or dynamic appears as a subscript.

{SUP}
specifies that the string or dynamic appears as a superscript.

{UNICODE}
specifies a glyph (graphical character) to be displayed using its Unicode specification or keyword equivalent.

The general form of a text command is

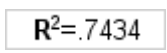
{*command argument(s)*}

The opening and closing braces are required to denote the scope of the command.

Subscripting and Superscripting Text

The {SUB} and {SUP} text commands are used to subscript and superscript text. Each of these text commands accepts a string or a dynamic for its argument(s).

In the following example, if _RSQUARE is an existing dynamic that resolves to the value 0.7434, then the following ENTRY specification superscripts the string value "2" to generate this text:




```
entry textattrs=(weight=bold) "R" {sup "2"}
      textattrs=() "=" _RSQUARE;
```

The `textattrs=()` option cancels all style overrides and reverts to the default text properties.

Using UNICODE Text

The {UNICODE} text command places special characters into the text and accepts any of the following for its argument(s):

- a hexadecimal Unicode Code Point for a character (for example, "03B1"x)
- a reserved keyword for a commonly used code point (for example, BETA)
- a dynamic that resolves to a hexadecimal value or keyword.

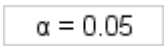
The tables in "Reserved Keywords and Unicode Values" on page 1343 provide a list of the commonly used reserved keywords and Unicode values (the tables are not complete, but they provide an idea about what is possible).

Multiple arguments can be used within the scope of a single UNICODE text command. For example, the following two specifications are equivalent:

```
{unicode "03b1"x beta}
{unicode "03b1"x} {unicode beta}
```

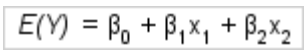
The default formatting for the UNICODE text is derived from the GraphUnicodeText style element.

In the following example, if _ALPHAVAL is an existing dynamic that resolves to the value *0.05*, then the following ENTRY specification generates this text:




```
entry {unicode alpha} " = " _ALPHAVAL;
```

By combining the TEXTATTRS= prefix option with the {SUB} and {UNICODE} text commands, you can generate the following text:




```
Entry textattrs=(style=italic) "E(Y)" textattrs=() " = "
      {unicode beta} {sub "0"} " + "
      {unicode beta} {sub "1"} "x" {sub "1"}
      " + " {unicode beta} {sub "2"} "x" {sub "2"};
```

Rules for Unicode and Special Character Specifications

The following rules apply to Unicode and special character specifications in ODS graphics:

- Each character can be specified by looking up its code and specifying it as a hexadecimal constant. Example: {unicode '221e'x}.
- Lowercase Greek letters can be specified by using names instead of hexadecimal constants. Example: {unicode alpha}.
- Uppercase Greek letters can be specified by using names followed by _u instead of a hexadecimal constant. Example: {unicode alpha_u}.
- Superscript and subscript have special abbreviations. Examples: {sup 2} and {sub 2}.
- The {SUP} and {SUB} specifications must not appear escaped and in quotation marks in GTL. They must appear outside of quotation marks.
- Some characters overprint the character that comes before. Example: 'El nin' {tilde} 'o', which is equivalent to 'El nin' {unicode '0303'x} 'o' creates 'El niño'.
- Specifications inside quotation marks are escaped. Example: "(*ESC*){unicode beta}".
- Specifications outside quotation marks are not escaped. Example: {unicode beta}.

For more information about using text throughout GTL (for example, using Unicode values in labels), see *SAS Graph Template Language: User's Guide*.

Reserved Keywords and Unicode Values

Overview

The tables in this section show some of the reserved keywords and Unicode values that can be used with the UNICODE text command. For information about rendering Unicode characters, see "Managing the String on Text Statements" in *SAS Graph Template Language: User's Guide*.

Note the following:

- Keywords and Unicode values are not case-sensitive: "03B1"x is the same code point as "03b1"x.
- The word blank is the keyword for a blank space.

Lowercase Greek Letters

Keyword	Glyph	Unicode	Description
alpha	α	03B1	lowercase alpha
beta	β	03B2	lowercase beta
gamma	γ	03B3	lowercase gamma
delta	δ	03B4	lowercase delta
epsilon	ε	03B5	lowercase epsilon
zeta	ζ	03B6	lowercase zeta
eta	η	03B7	lowercase eta
theta	θ	03B8	lowercase theta
iota	ι	03B9	lowercase iota
kappa	κ	03BA	lowercase kappa
lambda	λ	03BB	lowercase lambda
mu	μ	03BC	lowercase mu
nu	ν	03BD	lowercase nu
xi	ξ	03BE	lowercase xi
omicron	ο	03BF	lowercase omicron
pi	π	03C0	lowercase pi
rho	ρ	03C1	lowercase rho
sigma	σ	03C3	lowercase sigma
tau	τ	03C4	lowercase tau
upsilon	υ	03C5	lowercase upsilon
phi	φ	03C6	lowercase phi

Keyword	Glyph	Unicode	Description
chi	χ	03C7	lowercase chi
psi	ψ	03C8	lowercase psi
omega	ω	03C9	lowercase omega

Uppercase Greek Letters

Keyword	Glyph	Unicode	Description
alpha_u	Α	0391	uppercase alpha
beta_u	Β	0392	uppercase beta
gamma_u	Γ	0393	uppercase gamma
delta_u	Δ	0394	uppercase delta
epsilon_u	Ε	0395	uppercase epsilon
zeta_u	Ζ	0396	uppercase zeta
eta_u	Η	0397	uppercase eta
theta_u	Θ	0398	uppercase theta
iota_u	Ι	0399	uppercase iota
kappa_u	Κ	039A	uppercase kappa
lambda_u	Λ	039B	uppercase lambda
mu_u	Μ	039C	uppercase mu
nu_u	Ν	039D	uppercase nu
xi_u	Ξ	039E	uppercase xi
omicron_u	Ο	039F	uppercase omicron
pi_u	Π	03A0	uppercase pi

Keyword	Glyph	Unicode	Description
rho_u	Ρ	03A1	uppercase rho
sigma_u	Σ	03A3	uppercase sigma
tau_u	Τ	03A4	uppercase theta
upsilon_u	Υ	03A5	uppercase upsilon
phi_u	Φ	03A6	uppercase phi
chi_u	Χ	03A7	uppercase chi
psi_u	Ψ	03A8	uppercase psi
omega_u	Ω	03A9	uppercase omega

Special Characters

Keyword	Glyph	Unicode	Description
prime	´	00B4	single prime sign
bar	¯	0305	combining overline[1]
bar2	‾	033F	combining double overline[1]
tilde	˜	0303	combining tilde[1]
hat	ˆ	0302	combining circumflex accent[1]

1 This is an overstriking character that requires a Unicode font to render properly.

11

Text Statements

Dictionary **1347**
ENTRY Statement 1347
ENTRYFOOTNOTE Statement 1356
ENTRYTITLE Statement 1364

Dictionary

ENTRY Statement

Displays a line of text in the graphical area.

Requirement: An ENTRY statement must be specified within a LAYOUT, HEADER, SIDEBAR, or CELL statement block.

Syntax

ENTRY *text-item* <*text-item* ...> <*/options*>;

Summary of Optional Arguments

Appearance options

BACKGROUNDCOLOR=*style-reference* | *color*
specifies the color of the text background.

BORDER=TRUE | FALSE

specifies whether a border is displayed around the text.

BORDERATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the attributes of the border line around the text.

OPAQUE=TRUE | FALSE
specifies whether the text background is opaque (TRUE) or transparent (FALSE).

OUTERPAD=AUTO | *dimension* | (*pad-options*)
specifies the amount of extra space to add outside the entry border.

PAD=*dimension* | (*pad-options*)
specifies the amount of extra space that is reserved inside the entry border.

ROTATE=0 | 90 | 180 | 270
specifies the angle of text rotation measured in degrees.

TEXTATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
as a *statement option*, specifies the properties of the text. As a *prefix-option*, specifies the properties of individual *text-items*.

Location options

AUTOALIGN=NONE | AUTO | (*location-list*)
specifies whether the text is automatically aligned within its parent when nested within an overlay-type layout.

VALIGN=CENTER | TOP | BOTTOM
specifies the vertical alignment of the text.

Text options

HALIGN=CENTER | LEFT | RIGHT
as a *statement option*, specifies the horizontal alignment of the text. As a *prefix-option*, specifies the horizontal alignment of individual *text-items*.

Required Argument

***text-item* <...<*text-item*>>**
specifies one or more pieces of text for the entry. Each *text-item* has the following form:

<*prefix-option* <... prefix-option>>"*string*" | *dynamic* | *character-expression* |

{*text-command*}

Each piece of text can have multiple prefix settings that precede the piece of text. A piece of text is either a string literal, a dynamic, or a text command. All *text-items* with the same HALIGN= setting are concatenated into one string. Up to three strings can result for each ENTRY statement. Leading and trailing blanks in the concatenated string are always used.

When a prefix option is used, it applies not only to the text that immediately follows the prefix option, but also to all subsequent text strings and text commands. If the same prefix option appears more than once, then that prefix overrides the last used prefix of the same name for the subsequent text strings and text commands.

Restriction The maximum length for the entry text is 512 characters in SAS 9.4 and earlier releases. Starting with SAS 9.4M1, this restriction is removed.

Requirements *string* must be enclosed in quotation marks.

character-expression must be enclosed in an EVAL function.

text-command must be enclosed in braces.

Note Leading spaces are preserved, and trailing spaces are stripped.

See Chapter 10, "Managing Text Items," on page 1337

Optional Arguments

AUTOALIGN=NONE | AUTO | (*location-list*)
specifies whether the text is automatically aligned within its parent when nested within an overlay-type layout. For more information about how child positions are determined in an overlay-type layout, see the "LAYOUT OVERLAY Statement" on page 159.

NONE
does not automatically align the text within the area.

Alignment is set with HALIGN= and VALIGN= options.

AUTO
within the parent layout, attempts to center the text in the area that is farthest from any surrounding data point markers.

Restriction This option is available only if the parent layout contains a scatter plot. Otherwise, it is ignored.

(*location-list*)
within the available area, restricts the text's possible locations to those locations in the specified *location-list*, and uses the *location-list* position that least collides with the other graphics features in the area.

The *location-list* is space-separated and can contain any of these locations: TOPLEFT, TOP, TOPRIGHT, LEFT, CENTER, RIGHT, BOTTOMLEFT, BOTTOM, and BOTTOMRIGHT.

Example: (TOPRIGHT TOPLEFT)

Default NONE

Requirement For this option to take effect, the ENTRY statement must be in a LAYOUT OVERLAY or LAYOUTOVERLAYEQUATED block.

Interaction When AUTOALIGN= is not NONE and the parent layout is an overlay-type layout, the HALIGN= and the VALIGN= options are ignored.

BACKGROUNDCOLOR=*style-reference* | *color*
specifies the color of the text background.

style-reference
specifies a style reference in the form *style-element:style-attribute*.

Only the style-attribute named COLOR or CONTRASTCOLOR is used.

Default The GraphBackground:Color style reference.

Interaction OPAQUE= TRUE must be in effect in order for the color to be seen. By default, OPAQUE=FALSE.

BORDER=TRUE | FALSE
specifies whether a border is displayed around the text.

Default FALSE

See "boolean " on page xii for other Boolean values that you can use.

BORDERATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the attributes of the border line around the text.

Default The GraphBorderLines style element.

Interaction BORDER= TRUE must be set for this option to have any effect.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

HALIGN=CENTER | LEFT | RIGHT
as a *statement option*, specifies the horizontal alignment of the text. As a *prefix-option*, specifies the horizontal alignment of individual *text-items*. Each *text-item* has a horizontal alignment, and *text-items* with the same alignment are always grouped together.

Default CENTER

Interaction This option is ignored when AUTOALIGN= is not NONE and the parent layout is an overlay-type layout.

OPAQUE=TRUE | FALSE
specifies whether the text background is opaque (TRUE) or transparent (FALSE).

Default FALSE

Interaction When this option is set to FALSE, the background color is not used.

See "boolean " on page xii for other Boolean values that you can use.

OUTERPAD=AUTO | *dimension* | (*pad-options*)
specifies the amount of extra space to add outside the entry border.

AUTO
specifies that the default outside padding for this component is used.

dimension
specifies a dimension to use for the extra space at the left, right, top, and bottom of the entry border.

(*pad-options*)
a space-separated list of one or more name-value pair pad options, enclosed in parentheses.

The list can include one or more of the following pad options:

LEFT=*dimension*
specifies the amount of extra space to add to the left side.

RIGHT=*dimension*
specifies the amount of extra space to add to the right side.

TOP=*dimension*
specifies the amount of extra space to add to the top.

BOTTOM=*dimension*
specifies the amount of extra space to add to the bottom.

Note Sides that are not assigned padding are padded with the default amount.

Tip Use *pad-options* to create non-uniform padding.

Default AUTO

Note The default units for *dimension* are pixels.

See “dimension” on page xiii

PAD=*dimension* | (*pad-options*)
specifies the amount of extra space that is reserved inside the entry border.

dimension
specifies a dimension to use for the extra space at the left, right, top, and bottom of the entry border.

(*pad-options*)
a space-separated list of one or more name-value pair pad options, enclosed in parentheses.

The list can include one or more of the following pad options:

LEFT=*dimension*
specifies the amount of extra space to add to the left side.

RIGHT=*dimension*
specifies the amount of extra space to add to the right side.

TOP=*dimension*
specifies the amount of extra space to add to the top.

BOTTOM=*dimension*
specifies the amount of extra space to add to the bottom.

Note Sides that are not assigned padding are padded with the default amount.

Tip Use *pad-options* to create non-uniform padding.

Defaults Prior to SAS 9.4M6, padding is LEFT=3, RIGHT=3, TOP=0, and BOTTOM=0.

Starting with SAS 9.4M6, if ROTATE=0 on page 1352, the default padding is LEFT=3, RIGHT=3, TOP=0, and BOTTOM=0. If ROTATE= is other than 0, the default padding is LEFT=0, RIGHT=0, TOP=3, and BOTTOM=3.

Note The default units for *dimension* are pixels.

See "dimension" on page xiii

ROTATE=0 | 90 | 180 | 270
specifies the angle of text rotation measured in degrees. The angle is measured from a horizontal line passing through the middle of the bounding box of the text, counter-clockwise starting at the center of the bounding box.

Default 0. No rotation is performed.

Restriction Only angles of 0, 90, 180, or 270 degrees are allowed.

Interaction The bounding box is the determined by the size of the text in the current font plus any horizontal and vertical padding. See TEXTATTRS= and PAD= .

TEXTATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
as a *statement option*, specifies the properties of the text. As a *prefix-option*, specifies the properties of individual *text-items*.

Default The GraphValueText style element.

Notes This option can be used as both a prefix option and a statement option. When used as a prefix option, it overrides the statement option.

When used as a prefix option, TEXTATTRS= cancels the last used TEXTATTRS= prefix option. It resets all text options to those set by 1) the TEXTATTRS= statement option or 2) the default style element for the statement (GraphValueText) if no TEXTATTRS= statement option is used.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Text Options" on page 1606 for available *text-options*.

VALIGN=CENTER | TOP | BOTTOM
specifies the vertical alignment of the text.

Default CENTER

Interaction This option is ignored when AUTOALIGN= is not NONE and the parent layout is an overlay-type layout.

Prefix Options

HALIGN=CENTER | LEFT | RIGHT
specifies the horizontal alignment of the text that follows.

See HALIGN= on page 1350

TEXTATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the properties of the text that follows.

See TEXTATTRS= on page 1352

Text Commands

{ SUB *"string"* | *dynamic* }
text-command that specifies that the string or dynamic is to appear as subscript text.

See "Rules for Unicode and Special Character Specifications" on page 1342

Example
```
entry "y = " b{sub "0"} " + b" {sub "1"} "x";
```

{ SUP *"string"* | *dynamic* }
text-command that specifies that the string or dynamic is to appear as superscript text.

See "Rules for Unicode and Special Character Specifications" on page 1342

Example
```
entry "R" {sup "2"} " = " {format (6.4) RSQUARED} ;
```

{ UNICODE *"hex-string"x* | *keyword* | *dynamic* }
text-command that specifies a glyph (character) to be displayed using its Unicode specification or keyword equivalent.

***"hex-string"*x**
a four-byte hexadecimal constant that represents a UNICODE character in the current font.

For a complete listing, see http://unicode.org/charts/charindex.html.

keyword
a SAS keyword for a UNICODE character.

For a listing of keywords supplied by SAS, see "Reserved Keywords and Unicode Values" on page 1343.

dynamic
a dynamic variable that resolves to either *"hex-string"x* or a keyword for a UNICODE character.

Note The UNICODE text command attempts to access a UNICODE value in the current font. Not all fonts support accessing characters through

their UNICODE value. Some fonts support only a limited set of UNICODE values. If the UNICODE value is not accessible, then the command might be ignored or a nonprintable character might be substituted.

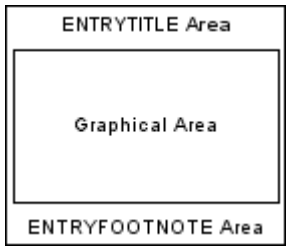
See "Using UNICODE Text" on page 1342

"Rules for Unicode and Special Character Specifications" on page 1342

Example
```
entry {unicode alpha} "=" CONF;
entry {unicode "03B1"x} "=" CONF;
```

Details

An ENTRY statement creates one line of text in the plot area. The statement must be specified within a LAYOUT, HEADER, SIDEBAR, or CELL statement block. It cannot be specified outside of one of these blocks, where global statements like ENTRYTITLE and ENTRYFOOTNOTE are used.



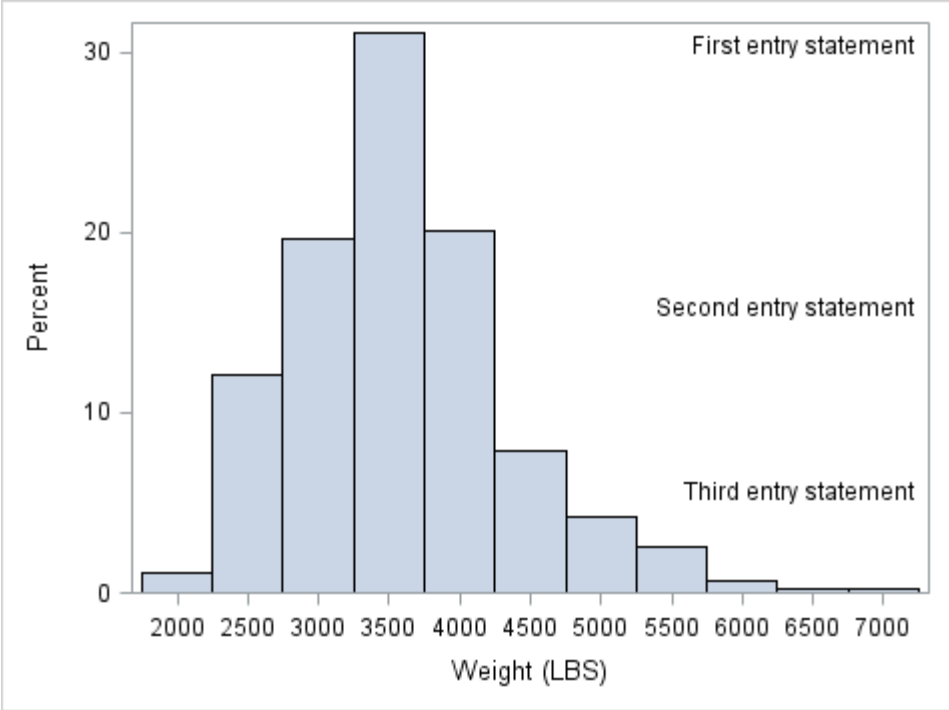
The text line specified in an ENTRY statement can be made of several pieces of the text called *text-items*. Statement options that are used establish properties for the entire line of text (that is, all *text-items*). These properties can be overridden with *prefix-options* that are specific to one or more *text-items*. See "Required Argument" on page 1348 for more information.

You can specify an ENTRY statement inside or outside of a nested statement block:

- When you specify an ENTRY statement inside a nested LAYOUT, HEADER, SIDEBAR, or CELL statement block, then, by default, the text is placed inside the bounding area of the results that the nested statement block creates.
- When you specify an ENTRY statement outside of a nested LAYOUT, HEADER, SIDEBAR, or CELL statement block, then the text is placed outside of the bounding area of the results that the nested statement block creates.

Example: ENTRY Statement

The following graph was generated by the "Example Program" on page 1355:



Example Program

```
proc template;
  define statgraph entry;
    begingraph;
      layout overlay;

        entry halign=right "First entry statement" /
          valign=top;

        histogram weight;

        entry halign=right "Second entry statement";

        entry halign=right "Third entry statement" /
          valign=bottom pad=(bottom=40px);

      endlayout;
    endgraph;
  end;
run;

proc sgrender data=sashelp.cars template=entry;
run;
```

ENTRYFOOTNOTE Statement

Displays a footnote.

Requirement: You must place the ENTRYFOOTNOTE statement directly inside the BEGINGRAPH block. Do not embed it in any other GTL statement block.

Syntax

ENTRYFOOTNOTE *text-item* <*text-item ...*> <*/options*>;

Summary of Optional Arguments

Appearance options

BACKGROUNDCOLOR=*style-reference* | *color*
: specifies the color of the text background.

BORDER=TRUE | FALSE
: specifies whether a border is displayed around the text.

BORDERATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
: specifies the attributes of the border line around the text.

OPAQUE=TRUE | FALSE
: specifies whether the text background is opaque (TRUE) or transparent (FALSE).

OUTERPAD=AUTO | *dimension* | (*pad-options*)
: specifies the amount of extra space to add outside the entry border.

PAD=*dimension* | (*pad-options*)
: specifies the amount of extra space that is reserved inside the entry border.

TEXTATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
: as a *statement option*, specifies the properties of the text. As a *prefix-option*, specifies the properties of individual *text-items*.

Text options

HALIGN=CENTER | LEFT | RIGHT
: as a *statement option*, specifies the horizontal alignment of the text. As a *prefix-option*, specifies the horizontal alignment of individual *text-items*.

HALIGNCENTER=AUTO | GRAPH
: specifies whether the text is centered automatically by the system or is always centered in the graph area.

SHORTTEXT=(*text-item <...text-item>*)
: specifies alternate text to use if the specified text is too long for the output width.

TEXTFITPOLICY=WRAP | SHORT | TRUNCATE
specifies how to handle text that is too long to fit in the output width.

Required Argument

text-item <...text-item>
specifies one or more pieces of text for the footnote. Each *text-item* has the following form:

<prefix-option ...<prefix-option>>"string" | dynamic | character-expression |

{*text-command*}

Each piece of text can have multiple prefix options that precede the piece of text. A piece of text is either a string literal, a dynamic, or a text command. All *text-items* with the same HALIGN= setting are concatenated into one string. Up to three strings can result for each ENTRY statement. Leading and trailing blanks in the concatenated string are always used.

When a prefix option is used, it applies not only to the text that immediately follows the prefix option, but also to all subsequent text strings and text commands. If the same prefix option appears more than once, then that prefix overrides the last used prefix of the same name for the subsequent text strings and text commands.

Restriction The maximum length for the footnote text is 512 characters in SAS 9.4 and earlier releases. Starting with SAS 9.4M1, this restriction is removed.

Requirements *string* must be enclosed in quotation marks.

character-expression must be enclosed in an EVAL function.

text-command must be enclosed in braces.

Note Leading spaces are preserved, and trailing spaces are stripped.

See Chapter 10, “Managing Text Items,” on page 1337

Optional Arguments

BACKGROUNDCOLOR=*style-reference* | *color*
specifies the color of the text background.

style-reference
specifies a style reference in the form *style-element:style-attribute*.

Only the style-attribute named COLOR or CONTRASTCOLOR is used.

Default The GraphBackground:Color style reference.

Interaction OPAQUE= TRUE must be in effect in order for the color to be seen. By default, OPAQUE=FALSE.

BORDER=TRUE | FALSE
specifies whether a border is displayed around the text.

Default FALSE

See "boolean " on page xii for other Boolean values that you can use.

BORDERATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the attributes of the border line around the text.

Default The GraphBorderLines style element.

Interaction BORDER= TRUE must be set for this option to have any effect.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

HALIGN=CENTER | LEFT | RIGHT
as a *statement option*, specifies the horizontal alignment of the text. As a *prefix-option*, specifies the horizontal alignment of individual *text-items*. Each *text-item* has a horizontal alignment, and *text-items* with the same alignment are always grouped together.

Default CENTER

HALIGNCENTER=AUTO | GRAPH
specifies whether the text is centered automatically by the system or is always centered in the graph area.

AUTO
specifies that the system determines how the text is centered.

The text is centered as follows:

- For LAYOUT GRIDDED, LAYOUT OVERLAY3D, and LAYOUT REGION layouts, and for LAYOUT LATTICE, LAYOUT DATAPANEL, and LAYOUT DATALATTICE layouts that have more than one column, center the text in the graph area.
- For LAYOUT OVERLAY and LAYOUT OVERLAYEQUATED layouts, and for LAYOUT LATTICE, LAYOUT DATAPANEL, and LAYOUT DATALATTICE layouts that have only one column, center the text in the graph wall area. If the length of the text exceeds the width of the graph wall area, then center the text in the graph area instead.

GRAPH
specifies that the text is always centered in the graph area.

Default AUTO

Interaction The prefix option HALIGN= must specify CENTER for this option to have any effect.

OPAQUE=TRUE | FALSE
specifies whether the text background is opaque (TRUE) or transparent (FALSE).

Default FALSE

Interaction When this option is set to FALSE, the background color is not used.

See "boolean " on page xii for other Boolean values that you can use.

OUTERPAD=AUTO | *dimension* | (*pad-options*)
specifies the amount of extra space to add outside the entry border.

AUTO
specifies that the default outside padding for this component is used.

dimension
specifies a dimension to use for the extra space at the left, right, top, and bottom of the entry border.

(*pad-options*)
a space-separated list of one or more name-value pair pad options, enclosed in parentheses.

The list can include one or more of the following pad options:

LEFT=*dimension*
specifies the amount of extra space to add to the left side.

RIGHT=*dimension*
specifies the amount of extra space to add to the right side.

TOP=*dimension*
specifies the amount of extra space to add to the top.

BOTTOM=*dimension*
specifies the amount of extra space to add to the bottom.

Note Sides that are not assigned padding are padded with the default amount.

Tip Use *pad-options* to create non-uniform padding.

Default AUTO

Note The default units for *dimension* are pixels.

See "dimension" on page xiii

PAD=*dimension* | (*pad-options*)
specifies the amount of extra space that is reserved inside the entry border.

dimension
specifies a dimension to use for the extra space at the left, right, top, and bottom of the entry border.

(*pad-options*)
a space-separated list of one or more name-value pair pad options, enclosed in parentheses.

The list can include one or more of the following pad options:

LEFT=*dimension*
specifies the amount of extra space to add to the left side.

RIGHT=*dimension*
specifies the amount of extra space to add to the right side.

TOP=*dimension*
specifies the amount of extra space to add to the top.

BOTTOM=*dimension*
specifies the amount of extra space to add to the bottom.

Note Sides that are not assigned padding are padded with the default amount.

Tip Use *pad-options* to create non-uniform padding.

Default LEFT=3, RIGHT=3, TOP=0, and BOTTOM=0

Note The default units for *dimension* are pixels.

See "dimension" on page xiii

SHORTTEXT=(*text-item <...text-item>*)
specifies alternate text to use if the specified text is too long for the output width. If the shortened text is itself too long, then it is truncated.

Interactions This option has no effect unless TEXTFITPOLICY= SHORT.

This option is ignored if any *text-items* include an HALIGN= prefix option.

The horizontal alignment of the shortened text is derived from the horizontal alignment of the text to be shortened.

TEXTATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
as a *statement option*, specifies the properties of the text. As a *prefix-option*, specifies the properties of individual *text-items*.

Default The GraphFootnoteText style element.

Notes This option can be used as both a prefix option and a statement option. When used as a prefix option, it overrides the statement option.

When used as a prefix option, TEXTATTRS= cancels the last used TEXTATTRS= prefix option. It resets all text options to those set by 1) the TEXTATTRS= statement option or 2) the default style element for the statement (GraphValueText) if no TEXTATTRS= statement option is used.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Text Options" on page 1606 for available *text-options*.

TEXTFITPOLICY=WRAP | SHORT | TRUNCATE
specifies how to handle text that is too long to fit in the output width.

WRAP
specifies that the text wraps to the next line(s).

Restriction Text wrapping is available only for ENTRYFOOTNOTE statements that appear in the outermost layout.

SHORT
specifies that the text indicated by the SHORTTEXT= option be substituted when the text does not fit.

Requirement You must specify the SHORTTEXT= option for this option to take effect.

Note If the short text is also too long, then it is truncated.

See "SHORTTEXT=(*text-item <...text-item>*) " on page 1360

TRUNCATE
specifies that the text is truncated to make it fit.

Default WRAP

Prefix Options

HALIGN=CENTER | LEFT | RIGHT
specifies the horizontal alignment of the text that follows.

See HALIGN= on page 1358

TEXTATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the properties of the text that follows.

See TEXTATTRS= on page 1360

Text Commands

{ SUB *"string"* | *dynamic* }
text-command that specifies that the string or dynamic is to appear as subscript text.

See "Rules for Unicode and Special Character Specifications" on page 1342

Example
```
entryfootnote "y = " b{sub "0"} " + b" {sub "1"} "x";
```

{ SUP *"string"* | *dynamic* }
text-command that specifies that the string or dynamic is to appear as superscript text.

See "Rules for Unicode and Special Character Specifications" on page 1342

Example
```
entryfootnote "R" {sup "2"} " = " RSQUARED;
```

{ UNICODE *"hex-string"x* | *keyword* | *dynamic* }

text-command that specifies a glyph (character) to be displayed using its Unicode specification or keyword equivalent.

***"hex-string"*x**

a four-byte hexadecimal constant that represents a UNICODE character in the current font.

For a complete listing, see http://unicode.org/charts/charindex.html.

keyword

a SAS keyword for a UNICODE character.

For a listing of keywords supplied by SAS, see "Reserved Keywords and Unicode Values" on page 1343.

dynamic

a dynamic variable that resolves to either *"hex-string"x* or a keyword for a UNICODE character.

Note The UNICODE text command attempts to access a UNICODE value in the current font. Not all fonts support accessing characters through their UNICODE value. Some fonts support only a limited set of UNICODE values. If the UNICODE value is not accessible, then the command might be ignored or a nonprintable character might be substituted.

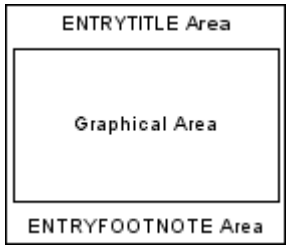
See "Using UNICODE Text" on page 1342

"Rules for Unicode and Special Character Specifications" on page 1342

Example
```
entryfootnote {unicode alpha} "=" CONF;
entryfootnote {unicode "03B1"x} "=" CONF;
```

Details

The ENTRYFOOTNOTE statement places footnote text below the graphical area. More than one ENTRYFOOTNOTE statement can be used. Footnotes appear in the order of the ENTRYFOOTNOTE statements within the template.



When you add an ENTRYFOOTNOTE statement to a template definition, place the statement in the BEGINGRAPH block, but do not embed it in another GTL statement block. The ENTRYFOOTNOTE statement must be placed directly inside the BEGINGRAPH block. The following conditions apply to ENTRYFOOTNOTE statements.

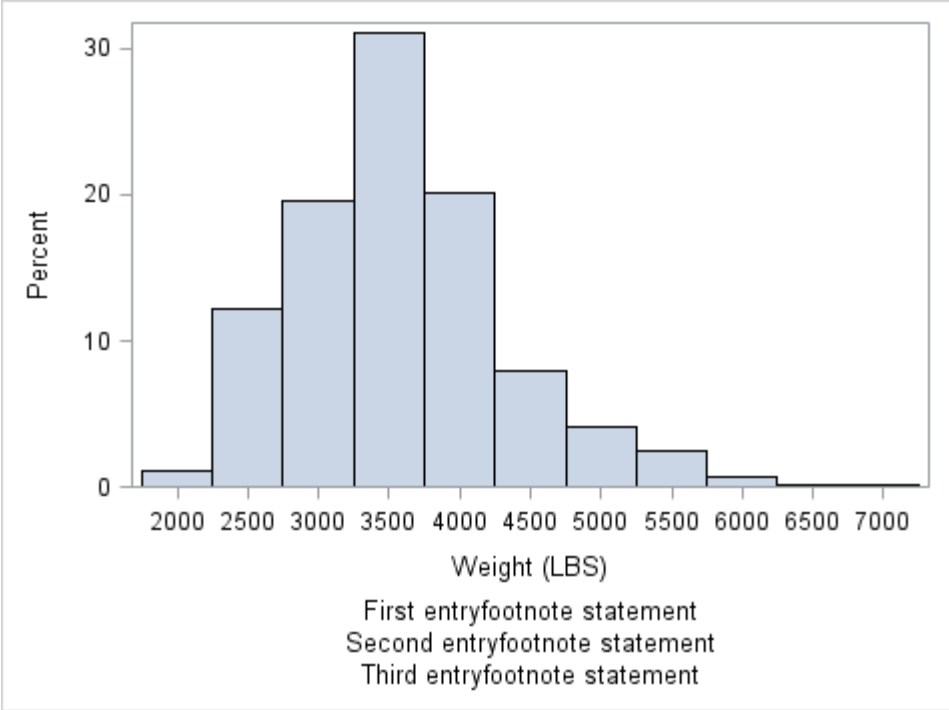
- All ENTRYFOOTNOTE statements that appear in the template are gathered and placed in the ENTRYFOOTNOTE area.
- The placement of an ENTRYFOOTNOTE statement is relevant only in relation to other ENTRYFOOTNOTE statements.
- As the number of ENTRYFOOTNOTE statements increases, the size of the graphical area is reduced.

Footnotes always span the entire width of the output. By default, footnotes are "center-aligned," based on the type of the outermost layout. The meaning of "center-aligned" varies by layout type and the number of columns in the layout:

Layout Type	Default horizontal centering of footnotes
GRIDDED OVERLAY3D LATTICE (COLUMNS > 1) DATAPANEL (COLUMNS > 1) DATALATTICE (COLUMNS > 1)	Centered on width of entire graph
OVERLAY OVERLAYEQUATED LATTICE (COLUMNS=1) DATAPANEL (COLUMNS= 1) DATALATTICE (COLUMNS = 1)	Centered on the plot area

Example: ENTRYFOOTNOTE Statement

The following graph was generated by the "Example Program" on page 1364:



Example Program

```
proc template;
  define statgraph entryfootnote;
    begingraph;

      entryfootnote "First entryfootnote statement" ;

        layout overlay;
          histogram weight;
        endlayout;

      entryfootnote "Second entryfootnote statement" ;
      entryfootnote "Third entryfootnote statement" ;

    endgraph;
  end;
run;

proc sgrender data=sashelp.cars template=entryfootnote;
run;
```

ENTRYTITLE Statement

Displays a title.

Requirement: You must place the ENTRYTITLE statement directly inside the BEGINGRAPH block. Do not embed it in any other GTL statement block.

Syntax

ENTRYTITLE *text-item* <*text-item* ...> </*options*>;

Summary of Optional Arguments

Appearance options

BACKGROUNDCOLOR=*style-reference* | *color*
: specifies the color of the text background.

BORDER=TRUE | FALSE
: specifies whether a border is displayed around the text.

BORDERATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
: specifies the attributes of the border line around the text.

OPAQUE=TRUE | FALSE
: specifies whether the text background is opaque (TRUE) or transparent (FALSE).

OUTERPAD=AUTO | *dimension* | (*pad-options*)
: specifies the amount of extra space to add outside the entry border.

PAD=*dimension* | (*pad-options*)
: specifies the amount of extra space that is reserved inside the entry border.

TEXTATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
: as a *statement option*, specifies the properties of the text. As a *prefix-option*, specifies the properties of individual *text-items*.

Text options

HALIGN=CENTER | LEFT | RIGHT
: as a *statement option*, specifies the horizontal alignment of the text. As a *prefix-option*, specifies the horizontal alignment of individual *text-items*.

HALIGNCENTER=AUTO | GRAPH
: specifies whether the text is centered automatically by the system or is always centered in the graph area.

SHORTTEXT=(*text-item* <*...text-item*>)
: specifies alternate text to use if the specified text is too long for the output width. If the shortened text is itself too long, then it is truncated.

TEXTFITPOLICY=WRAP | SHORT | TRUNCATE
: specifies how to handle text that is too long to fit in the output width.

Required Argument

text-item <text-item ...>
specifies one or more pieces of text for the entry. Each *text-item* has the following form:

<prefix-option <...prefix-option>>"string" | dynamic | character-expression |

{*text-command*}

Each piece of text can have multiple prefix options that precede the piece of text. A piece of text is either a string literal, a dynamic, or a text command. All *text-items* with the same HALIGN= setting are concatenated into one string. Up to three strings can result for each ENTRY statement. Leading and trailing blanks in the concatenated string are always used.

When a prefix option is used, it applies not only to the text that immediately follows the prefix option, but also to all subsequent text strings and text commands. If the same prefix option appears more than once, then that prefix overrides the last used prefix of the same name for the subsequent text strings and text commands.

Restriction The maximum length for the title text is 512 characters in SAS 9.4 and earlier releases. Starting with SAS 9.4M1, this restriction is removed.

Requirements *string* must be enclosed in quotation marks.

character-expression must be enclosed in an EVAL function.

text-command must be enclosed in braces.

Note Leading spaces are preserved, and trailing spaces are stripped.

See Chapter 10, “Managing Text Items,” on page 1337 for more information and several examples.

Optional Arguments

BACKGROUNDCOLOR=*style-reference* | *color*
specifies the color of the text background.

style-reference
specifies a style reference in the form *style-element:style-attribute*.

Only the style-attribute named COLOR or CONTRASTCOLOR is used.

Default The GraphBackground:Color style reference.

Interaction OPAQUE= TRUE must be in effect in order for the color to be seen. By default, OPAQUE=FALSE.

BORDER=TRUE | FALSE
specifies whether a border is displayed around the text.

Default FALSE

See "boolean " on page xii for other Boolean values that you can use.

BORDERATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the attributes of the border line around the text.

Default The GraphBorderLines style element.

Interaction BORDER= TRUE must be set for this option to have any effect.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

HALIGN=CENTER | LEFT | RIGHT
as a *statement option*, specifies the horizontal alignment of the text. As a *prefix-option*, specifies the horizontal alignment of individual *text-items*. Each *text-item* has a horizontal alignment, and *text-items* with the same alignment are always grouped together.

Default CENTER

HALIGNCENTER=AUTO | GRAPH
specifies whether the text is centered automatically by the system or is always centered in the graph area.

AUTO
specifies that the system determines how the text is centered.

The text is centered as follows:

- For LAYOUT GRIDDED, LAYOUT OVERLAY3D, and LAYOUT REGION layouts, and for LAYOUT LATTICE, LAYOUT DATAPANEL, and LAYOUT DATALATTICE layouts that have more than one column, center the text in the graph area.
- For LAYOUT OVERLAY and LAYOUT OVERLAYEQUATED layouts, and for LAYOUT LATTICE, LAYOUT DATAPANEL, and LAYOUT DATALATTICE layouts that have only one column, center the text in the graph wall area. If the length of the text exceeds the width of the graph wall area, then center the text in the graph area instead.

GRAPH
specifies that the text is always centered in the graph area.

Default AUTO

Interaction The prefix option HALIGN= must specify CENTER for this option to have any effect.

OPAQUE=TRUE | FALSE
specifies whether the text background is opaque (TRUE) or transparent (FALSE).

Default FALSE

Interaction When this option is set to FALSE, the background color is not used.

See "boolean " on page xii for other Boolean values that you can use.

OUTERPAD=AUTO | *dimension* | (*pad-options*)
specifies the amount of extra space to add outside the entry border.

AUTO
specifies that the default outside padding for this component is used.

dimension
specifies a dimension to use for the extra space at the left, right, top, and bottom of the entry border.

(*pad-options*)
a space-separated list of one or more name-value pair pad options, enclosed in parentheses.

The list can include one or more of the following pad options:

LEFT=*dimension*
specifies the amount of extra space to add to the left side.

RIGHT=*dimension*
specifies the amount of extra space to add to the right side.

TOP=*dimension*
specifies the amount of extra space to add to the top.

BOTTOM=*dimension*
specifies the amount of extra space to add to the bottom.

Note Sides that are not assigned padding are padded with the default amount.

Tip Use *pad-options* to create non-uniform padding.

Default AUTO

Note The default units for *dimension* are pixels.

See "dimension" on page xiii

PAD=*dimension* | (*pad-options*)
specifies the amount of extra space that is reserved inside the entry border.

dimension
specifies a dimension to use for the extra space at the left, right, top, and bottom of the entry border.

(*pad-options*)
a space-separated list of one or more name-value pair pad options, enclosed in parentheses.

The list can include one or more of the following pad options:

LEFT=*dimension*
specifies the amount of extra space to add to the left side.

RIGHT=*dimension*
specifies the amount of extra space to add to the right side.

TOP=*dimension*
specifies the amount of extra space to add to the top.

BOTTOM=*dimension*
specifies the amount of extra space to add to the bottom.

Note Sides that are not assigned padding are padded with the default amount.

Tip Use *pad-options* to create non-uniform padding.

Default LEFT=3, RIGHT=3, TOP=0, and BOTTOM=0

Note The default units for *dimension* are pixels.

See "dimension" on page xiii

SHORTTEXT=(*text-item <...text-item>*)
specifies alternate text to use if the specified text is too long for the output width. If the shortened text is itself too long, then it is truncated.

Interactions This option has no effect unless TEXTFITPOLICY= SHORT.

This option is ignored if any *text-items* include an HALIGN= prefix option.

The horizontal alignment of the shortened text is derived from the horizontal alignment of the title to be shortened.

TEXTATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
as a *statement option*, specifies the properties of the text. As a *prefix-option*, specifies the properties of individual *text-items*.

Default The GraphTitleText style element.

Notes This option can be used as both a prefix option and a statement option. When used as a prefix option, it overrides the statement option.

When used as a prefix option, TEXTATTRS= cancels the last used TEXTATTRS= prefix option. It resets all text options to those set by 1) the TEXTATTRS= statement option or 2) the default style element for the statement (GraphValueText) if no TEXTATTRS= statement option is used.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Text Options" on page 1606 for available *text-options*.

TEXTFITPOLICY=WRAP | SHORT | TRUNCATE
specifies how to handle text that is too long to fit in the output width.

WRAP
specifies that the text wraps to the next line(s).

Restriction Text wrapping is available only for ENTRYTITLE statements that appear in the outermost layout.

SHORT
specifies that the text indicated by the SHORTTEXT= option be substituted when the text does not fit.

Requirement You must specify the SHORTTEXT= option for this option to take effect.

Note If the short text is also too long, then it is truncated.

See "SHORTTEXT=(*text-item <...text-item>*) " on page 1360

TRUNCATE
specifies that the text is truncated to make it fit.

Default WRAP

Prefix Options

HALIGN=CENTER | LEFT | RIGHT
specifies the horizontal alignment of the text that follows.

See HALIGN= on page 1367

TEXTATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the properties of the text that follows.

See TEXTATTRS= on page 1369

Text Commands

{ SUB *"string"* | *dynamic* }
text-command that specifies that the string or dynamic is to appear as subscript text.

See "Rules for Unicode and Special Character Specifications" on page 1342

Example
```
entrytitle "y = " b{sub "0"} " + b" {sub "1"} "x";
```

{ SUP *"string"* | *dynamic* }
text-command that specifies that the string or dynamic is to appear as superscript text.

See "Rules for Unicode and Special Character Specifications" on page 1342

Example
```
entrytitle "R" {sup "2"} " = " RSQUARED;
```

{ UNICODE *"hex-string"x* | *keyword* | *dynamic* }

text-command that specifies a glyph (character) to be displayed using its Unicode specification or keyword equivalent.

***"hex-string"*x**

a four-byte hexadecimal constant that represents a UNICODE character in the current font.

For a complete listing, see http://unicode.org/charts/charindex.html.

keyword

a SAS keyword for a UNICODE character.

For a listing of keywords supplied by SAS, see "Reserved Keywords and Unicode Values" on page 1343.

dynamic

a dynamic variable that resolves to either *"hex-string"x* or a keyword for a UNICODE character.

Note The UNICODE text command attempts to access a UNICODE value in the current font. Not all fonts support accessing characters through their UNICODE value. Some fonts support only a limited set of UNICODE values. If the UNICODE value is not accessible, then the command might be ignored or a nonprintable character might be substituted.

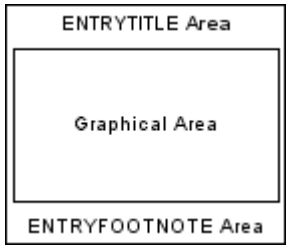
See "Using UNICODE Text" on page 1342

"Rules for Unicode and Special Character Specifications" on page 1342

Example
```
entrytitle {unicode alpha} "=" CONF;
entrytitle {unicode "03B1"x} "=" CONF;
```

Details

The ENTRYTITLE statement places title text above the graphical area. More than one ENTRYTITLE statement can be used. Titles appear in the order of the ENTRYTITLE statements within the template.



When you add an ENTRYTITLE statement to a template definition, place the statement in the BEGINGRAPH block, but do not embed it in another GTL statement block. The ENTRYTITLE statement must be placed directly inside the BEGINGRAPH block. The following conditions apply to ENTRYTITLE statements.

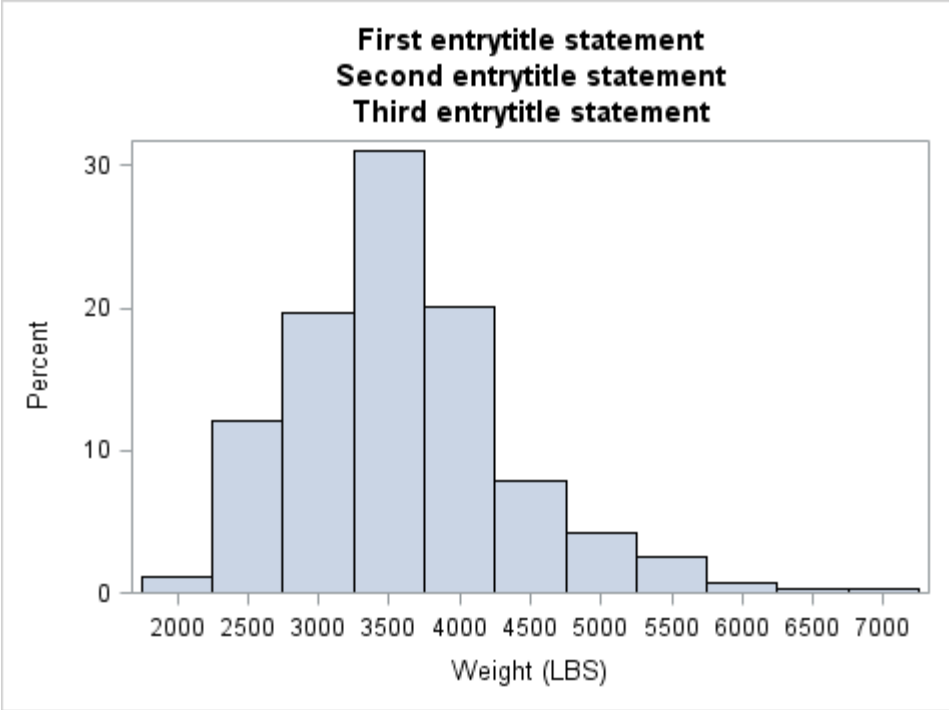
- All ENTRYTITLE statements that appear in the template are gathered and placed in the ENTRYTITLE area.
- The placement of an ENTRYTITLE statement is relevant only in relation to other ENTRYTITLE statements.
- As the number of ENTRYTITLE statements increases, the size of the graphical area is reduced.

Titles always span the entire width of the output. By default, titles are "center-aligned," based on the type of the outermost layout. The meaning of "center-aligned" varies by layout type and the number of columns in the layout:

Layout Type	Default horizontal centering of titles
GRIDDED OVERLAY3D LATTICE (COLUMNS > 1) DATAPANEL (COLUMNS > 1) DATALATTICE (COLUMNS > 1)	Centered on width of entire graph
OVERLAY OVERLAYEQUATED LATTICE (COLUMNS=1) DATAPANEL (COLUMNS= 1) DATALATTICE (COLUMNS = 1)	Centered on the plot area

Example: ENTRYTITLE Statement

The following graph was generated by the "Example Program" on page 1373:



Example Program

```
proc template;
  define statgraph entrytitle;
    begingraph;

      entrytitle "First entrytitle statement" ;

        layout overlay;
          histogram weight;
        endlayout;

      entrytitle "Second entrytitle statement" ;
      entrytitle "Third entrytitle statement" ;

    endgraph;
  end;
run;

proc sgrender data=sashelp.cars template=entrytitle;
run;
```

PART 8

Custom Marker Definition Statements

Chapter 12
Custom Marker Definition Statements **1377**

12

Custom Marker Definition Statements

Dictionary 1377
SYMBOLCHAR Statement 1377
SYMBOLIMAGE Statement 1384

Dictionary

SYMBOLCHAR Statement

Defines a marker symbol using a Unicode character so that the symbol can be referenced in other statements.

Requirement: The SYMBOLCHAR statement must be a child of the BEGINGRAPH block. It cannot be embedded in any other GTL statement block.

Note: This statement is valid starting in SAS 9.4M1.

Syntax

SYMBOLCHAR NAME=*marker-name* CHAR="""*hex-string*x | *keyword* | *dynamic* </ *options*>;

Required Arguments

NAME=*marker-name*
specifies a name for the marker symbol. The name can be used in statements that support marker symbols.

Interaction If the name matches one of the system-provided symbol names such as CIRCLE, then the system symbol is replaced by the user-defined symbol. See "Marker Options" on page 1604 for a list of the system-provided symbols.

Note Do not enclose the name in quotation marks.

See "Details" on page 1380

CHAR="""*hex-string*x | *keyword* | *dynamic*
specifies a glyph (character) to be used as the marker symbol. You specify the character by using its Unicode specification or its keyword equivalent.

***"hex-string"*x**
specifies a four-byte hexadecimal constant that represents a Unicode character in the current font.

You can find a complete listing of the Unicode hexadecimal constants at the following URL:http://www.unicode.org/charts/charindex.html

Requirement You must specify a Unicode character value.

keyword
specifies a SAS keyword for a Unicode character.

See Appendix 2, "Reserved Keywords and Unicode Values," on page 1595

dynamic
specifies a reference to a dynamic variable that resolves to either a *"hex-string"*x constant or a Unicode character keyword.

Tip This statement attempts to access the specified Unicode value in the current font. Some fonts do not support accessing characters by using their Unicode value. Other fonts support only a limited set of Unicode values. If the Unicode value is not accessible, then this statement might be ignored or a nonprintable character might be substituted.

Optional Arguments

HOFFSET=*number*
specifies a horizontal offset for the marker symbol.

Default 0. The marker symbol is centered on its data point.

Range -0.5–+0.5, where 0.5 represents one-half of the original marker size.

Interaction Starting with SAS 9.4M3, the specified offset is also applied to the marker symbol that is displayed in the legend.

Notes Prior to SAS 9.4M3, a positive offset moves the marker symbol bounding box to the right. A negative offset moves it to the left.

Starting with SAS 9.4M3, a positive offset moves the marker symbol to the right within its bounding box, and a negative offset moves it to the left. The bounding box remains centered on the data point. After the offset, size, and rotation are applied to the marker symbol, any portion of the symbol that falls outside of the marker bounding box is clipped.

Tip If clipping occurs, use this option, the VOFFSET= and SCALE= options, and the suboption SIZE= in the MARKERATTRS= option to remove the clipping.

ROTATE=*number*
specifies the angle of rotation for the marker symbol in degrees. Positive angles are measured in the counter-clockwise direction, and negative angles are measured in the clockwise direction.

Default 0. No rotation is performed.

Note An angle that exceeds 360 degrees in absolute value can be specified.

SCALE=*number*
specifies a scale factor for the marker symbol as a percentage. The scale factor is applied to the character's height and width.

Default 1.0 (100%)

Note The outer edges of the image might be clipped by the bounding box when a large scale factor is specified.

TEXTATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the text attributes for the character symbol.

Default The GraphUnicodeText style element.

Restriction Only the text attributes FAMILY=, STYLE=, and WEIGHT= are used. The COLOR= and SIZE= text attributes are derived from the plot statement's MARKERATTRS= option.

Requirement The font family specified in FAMILY= must support Unicode characters.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Text Options" on page 1606 for available *text-options*.

VOFFSET=*number*
specifies a vertical offset for the marker symbol.

Default 0. The marker symbol is centered on its data point.

Range -0.5–+0.5, where 0.5 represents one-half of the original marker size.

Interaction Starting with SAS 9.4M3, the specified offset is also applied to the marker symbol that is displayed in the legend.

Notes Prior to SAS 9.4M3, a positive offset moves the marker symbol bounding box up. A negative offset moves it down.

Starting with SAS 9.4M3, a positive offset moves the marker symbol up within its bounding box, and a negative offset moves it down. The bounding box remains centered on the data point. After the offset, size, and rotation are applied to the marker symbol, any portion of the symbol that falls outside of the marker bounding box is clipped.

Tip If clipping occurs, use this option, the HOFFSET= and SCALE= options, and the suboption SIZE= in the MARKERATTRS= option to remove the clipping.

Details

The SYMBOLCHAR statement defines a custom marker symbol from a Unicode character. You can use the marker symbol that is created in the following options:

- the DATASYMBOLS= option in the BEGINGRAPH statement
- the SYMBOL= suboption of the MARKERATTRS= option, which is supported by the following statements:

DISCRETELEGEND (VALUE statement)	SCATTERPLOT
LEGENDITEM	SCATTERPLOTMATRIX
LINECHART	SERIESPLOT
NEEDLEPLOT	STEPPLOT

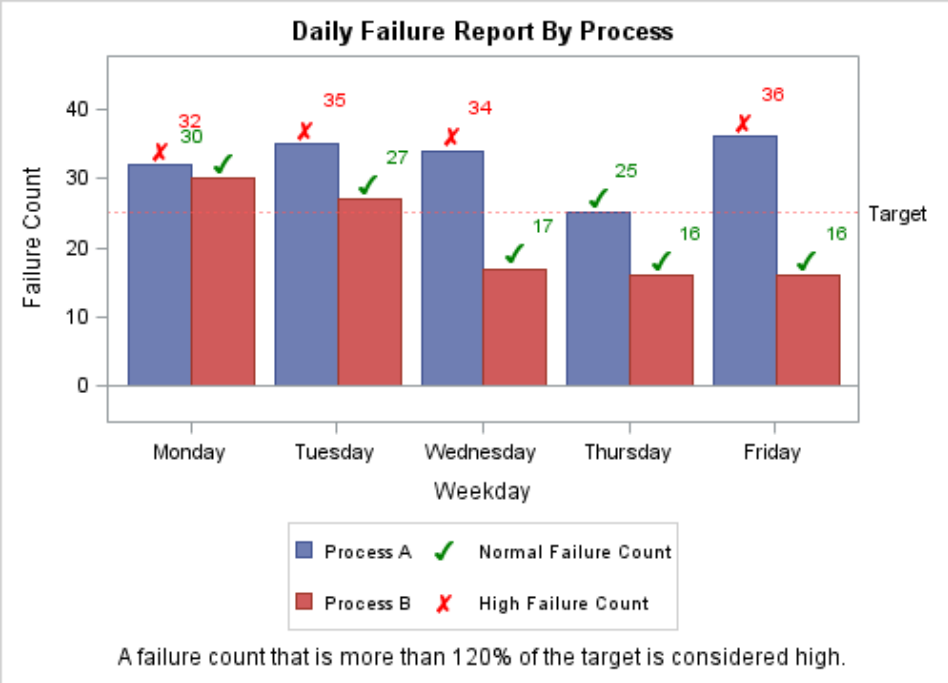
Symbol specifications are not checked for uniqueness. More than one SYMBOLCHAR statement can define the same character. Therefore, you can use SYMBOLCHAR statements in IF/ELSE statements. Symbol specifications also are not validated at compile time. An invalid specification might not generate a warning when the output is rendered and might create unexpected results.

You can use the COLOR=, SIZE=, and TRANSPARENCY= suboptions of the MARKERATTRS= option to modify the appearance of markers that are created by the SYMBOCHAR statement. The WEIGHT= suboption has no effect on these markers.

The markers are clipped to the original marker size after rotation, scaling, and offsets are applied. If clipping occurs, then you can use the SIZE= suboptions of the MARKERATTRS= option in the plot statement and the SCALE= option in the SYMBOLCHAR statement to adjust the size and scaling to eliminate the clipping.

Example: SYMBOLCHAR Statement

This example shows how to create marker symbols from the Unicode ballot X, heavy character ('2718'x) and check mark, heavy character ('2718'x). It also shows you how to use the symbols in a scatter plot and how to add them to a legend. In this example, a grouped bar chart shows the daily failure count for two processes, Process A and Process B. A scatter plot is overlaid on the bar chart in order to show the total failure count above each bar. Acceptable counts are indicated by a green Unicode check mark. High counts are indicated by a red Unicode ballot X. Finally, a legend is used to describe the custom symbols. The following figure shows the output.



Example Program

```
/* Summarize the data in SASHELP.FAILURE to compute the
   failure count by day and process */
proc sort data=sashelp.failure out=temp;
   by day process;
run;

proc summary data=temp;
   by day process;
   var count;
   output out=failure sum=count;
run;

/* Determine the daily status for each process:
   count at or under 120% of target is NORM, over is HIGH */
%let target=25;
```

```
data failure;
   length stat $20;
   set failure;
   if (count <= (&target*1.2)) then
      stat=strip(cat(substr(process,index(process,' '),2),"-NORM"));
   if (count > (&target*1.2)) then
      stat=strip(cat(substr(process,index(process,' '),2),"-HIGH"));
   label day="Weekday" count="Failure Count" stat="Status";
run;

/* Define the template */
proc template;
   define statgraph failures;
      begingraph;

         /* Define the norm/high marker symbols */
         symbolchar name=norm char='2714'x;
         symbolchar name=high char='2718'x;

         /* Create legend entries for the norm/high markers */
         legenditem type=marker name="norm" /
            markerattrs=(symbol=norm size=15pt color=green)
            label="Normal Failure Count";
         legenditem type=marker name="high" /
            markerattrs=(symbol=high size=15pt color=red)
            label="High Failure Count";


         /* Define an attribute map for the status markers */
         discreteattrmap name="statsymmap";
            value "A-NORM" / markerattrs=(symbol=norm color=green);
            value "B-NORM" / markerattrs=(symbol=norm color=green);
            value "A-HIGH" / markerattrs=(symbol=high color=red);
            value "B-HIGH" / markerattrs=(symbol=high color=red);
         enddiscreteattrmap;
         discreteattrvar attrvar=status var=stat attrmap="statsymmap" ;

         /* Define the graph */
         entrytitle "Daily Failure Report By Process";
         entryfootnote "A failure count that is more than 120% of the
 target is considered high.";
         layout overlay / yaxisopts=(offsetmax=0.1);
            barchartparm category=day response=count / name="barchart"
               group=process groupdisplay=cluster;
            scatterplot x=day y=eval(count+2) / datalabel=count
group=status
               groupdisplay=cluster markerattrs=(size=15pt);
            referenceline y=&target /
               lineattrs=(color=lightred pattern=dot)
curvelabel="Target";
            discretelegend "barchart" "norm" "high" / down=2
               order=columnmajor;
         endlayout;
      endgraph;
   end;
run;

proc sgrender data=failure template=failures;
run;
```

Program Description

Here is the SAS code for this example.

Create the graph data. The data in Sashelp.Failure is the source data. To get the daily counts, the data is summarized by weekday and process. The Stat column is then added to indicate whether the count is acceptable or high. Acceptable values are values that do not exceed 120% of the target value. Values over 120% are considered high. Acceptable values are A-NORM and B-NORM, and high values are A-HIGH and B-HIGH, where A and B identify the process.

```
/* Summarize the data in SASHELP.FAILURE to compute the
   failure count by day and process */
proc sort data=sashelp.failure out=temp;
   by day process;
run;

proc summary data=temp;
   by day process;
   var count;
   output out=failure sum=count;
run;

/* Determine the daily status for each process:
   count at or under 120% of target is NORM, over is HIGH */
%let target=25;
data failure;
   length stat $20;
   set failure;
   if (count <= (&target*1.2)) then
      stat=strip(cat(substr(process,index(process,' '),2),"-NORM"));
   if (count > (&target*1.2)) then
      stat=strip(cat(substr(process,index(process,' '),2),"-HIGH"));
   label day="Weekday" count="Failure Count" stat="Status";
run;
```

Open the template definition.

```
/* Define the template */
proc template;
   define statgraph failures;
      begingraph;
```

Define the custom marker symbols. The NAME= option specifies an identifier for the markers, and the CHAR= option specifies the Unicode value. Unicode value '2714'x specifies a heavy check mark, and value '2718'x specifies a heavy ballot X.

```
/* Define the norm/high marker symbols */
symbolchar name=norm char='2714'x;
symbolchar name=high char='2718'x;
```

Create legend entries for the custom markers. Suboption SYMBOL= in the MARKERATTRS= option specifies the identifier of the custom markers.

```
/* Create legend entries for the norm/high markers */
legenditem type=marker name="norm" /
   markerattrs=(symbol=norm size=15pt color=green)
   label="Normal Failure Count";
```

```
            legenditem type=marker name="high" /
               markerattrs=(symbol=high size=15pt color=red)
               label="High Failure Count";
```

Create a discrete attribute map to map the custom markers to the Stat column values. Suboption SYMBOL= in the MARKERATTRS= option specifies the identifier of the custom markers. Suboption COLOR= sets the color of the Unicode marker character and the associated data label. The DISCRETEATTRVAR statement creates attribute map variable STATUS.

```
            /* Define an attribute map for the status markers */
            discreteattrmap name="statsymmap";
               value "A-NORM" / markerattrs=(symbol=norm color=green);
               value "B-NORM" / markerattrs=(symbol=norm color=green);
               value "A-HIGH" / markerattrs=(symbol=high color=red);
               value "B-HIGH" / markerattrs=(symbol=high color=red);
            enddiscreteattrmap;
            discreteattrvar attrvar=status var=stat attrmap="statsymmap" ;
```

Define the graph and close the template definition. The SCATTERPLOT statement GROUP= option references the STATUS attribute map variable. The EVAL statement in the Y= option positions each character just above the top of its bar. The SIZE= suboption of the MARKERATTRS= option sets the marker size. The custom markers are included in the DISCRETELEGEND statement.

```
            /* Define the graph */
            entrytitle "Daily Failure Report By Process";
            entryfootnote "A failure count that is more than 120% of the
    target is considered high.";
            layout overlay / yaxisopts=(offsetmax=0.1);
               barchartparm category=day response=count / name="barchart"
                  group=process groupdisplay=cluster;
               scatterplot x=day y=eval(count+2) / datalabel=count
group=status
                  groupdisplay=cluster markerattrs=(size=15pt);
               referenceline y=&target /
                  lineattrs=(color=lightred pattern=dot)
curvelabel="Target";
               discretelegend "barchart" "norm" "high" / down=2
                  order=columnmajor;
            endlayout;
         endgraph;
      end;
run;
```

Generate the graph.

```
proc sgrender data=failure template=failures;
run;
```

SYMBOLIMAGE Statement

Defines a marker symbol using an image file so that the image can be referenced in other statements.

Requirement: The SYMBOLIMAGE statement must be a child of the BEGINGRAPH block. It cannot be embedded in any other GTL statement block.

Note: This statement is valid starting in SAS 9.4M1.

Syntax

SYMBOLIMAGE NAME=*marker-name* IMAGE="*image-file-spec*" < */ options* >;

Required Arguments

NAME=*marker-name*
specifies a name for the marker symbol. The name can be used in statements that support marker symbols.

Interaction If the name matches one of the system-provided symbol names such as CIRCLE, then the system symbol is replaced by the user-defined symbol. See "Marker Options" on page 1604 for a list of the system-provided symbols.

Note Do not enclose the name in quotation marks.

See "Details" on page 1386

IMAGE="*image-file-spec*"
specifies the name and location of the image file. The supported image types are GIF, JPEG, and PNG.

Requirements The image file specification must be enclosed in quotation marks.

The image file must be located on the local file system. URL access is not supported.

Example
```
image="c:\temp\saslogo.gif"
```

Optional Arguments

HOFFSET=*number*
specifies a horizontal offset for the marker symbol.

Default 0. The marker symbol is centered on its data point.

Range -0.5–+0.5, where 0.5 represents one-half of the original marker size.

Notes A positive offset moves the marker symbol bounding box to the right. A negative offset moves it to the left.

The specified offset is not applied to the image symbol that is displayed in the legend.

ROTATE=*number*
specifies the angle of rotation for the marker symbol in degrees. Positive angles are measured in the counter-clockwise direction, and negative angles are measured in the clockwise direction.

Default 0. No rotation is performed.

Note An angle that exceeds 360 degrees in absolute value can be specified.

SCALE=*number*
specifies a scale factor for the marker symbol as a percentage. The scale factor is applied to the character's height and width.

Default 1.0 (100%)

Note The outer edges of the image might be clipped by the bounding box when a large scale factor is specified.

VOFFSET=*number*
specifies a vertical offset for the marker symbol.

Default 0. The marker symbol is centered on its data point.

Range -0.5–+0.5, where 0.5 represents one-half of the original marker size.

Notes A positive offset moves the marker symbol bounding box up. A negative offset moves it down.

The specified offset is not applied to the image symbol that is displayed in the legend.

Details

The SYMBOLIMAGE statement defines a custom marker symbol from an image that is stored in an image file. The image file must exist on the local file system. URL access is not supported. The supported image formats are GIF, JPG, and PNG. The marker symbol that is created can be used in the following options:

- the DATASYMBOLS= option in the BEGINGRAPH statement
- the SYMBOL= suboption of the MARKERATTRS= option, which is supported by the following statements:

DISCRETELEGEND (VALUE statement)	SCATTERPLOT
LEGENDITEM	SCATTERPLOTMATRIX
LINECHART	SERIESPLOT
NEEDLEPLOT	STEPPLOT

Symbol specifications are not checked for uniqueness. More than one SYMBOLIMAGE statement can define the same character. Therefore, you can use SYMBOLIMAGE statements in IF/ELSE statements.

The following options normally affect the appearance of markers. However, they have no effect on image marker symbols that are created by the SYMBOLIMAGE statement.

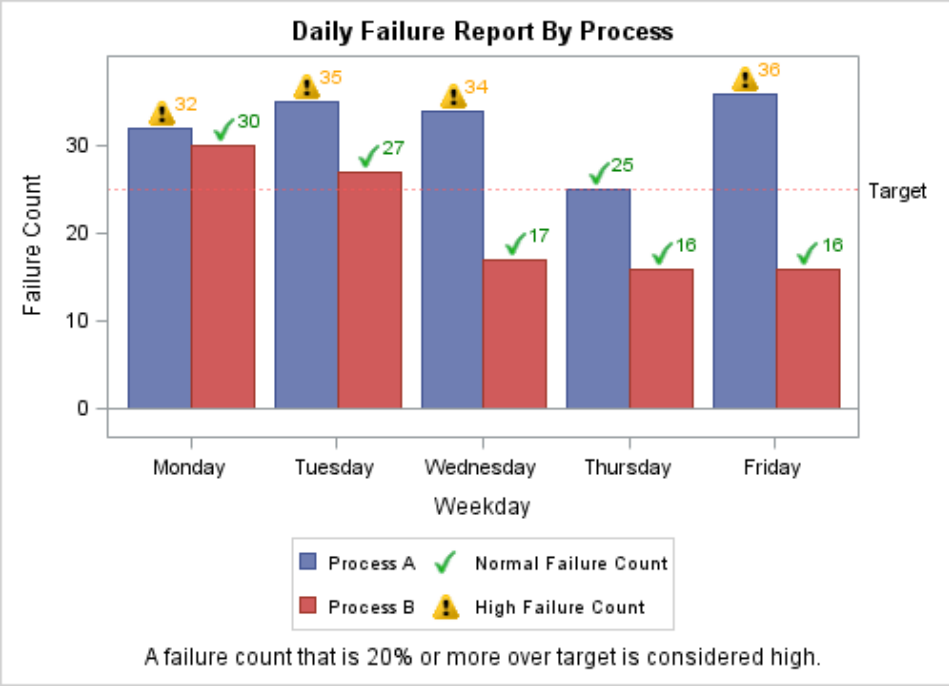
- the BEGINGRAPH statement DATACONTRASTCOLORS= option
- the COLOR= and WEIGHT= suboptions of the MARKERATTRS= option
- the FILLEDOUTLINEDMARKERS= option

The SIZE= and TRANSPARENCY= suboptions of the MARKERATTRS= option do affect the appearance of markers that are created by the SYMBOLIMAGE statement.

The markers are clipped to the original marker size after rotation, scaling, and offsets are applied. If clipping occurs, then you can use the SIZE= suboptions of the MARKERATTRS= option in the plot statement and the SCALE= option in the SYMBOLIMAGE statement to adjust the size and scaling to eliminate the clipping.

Example: SYMBOLIMAGE Statement

This example shows how to create marker symbols from GIF icon image files. It also shows you how to use the symbols in a scatter plot and how to add them to a legend. In this example, a grouped bar chart shows the daily failure count for two processes, Process A and Process B. A scatter plot is overlaid on the bar chart to show the total failure count above each bar. Acceptable counts are indicated by a green check mark icon. High counts are indicated by a caution icon. Finally, a legend is used to describe the custom symbols. The following figure shows the output.



Example Program

```
/* Summarize the data in SASHELP.FAILURE to compute the
   failure count by day and process */
proc sort data=sashelp.failure out=temp;
   by day process;
run;

proc summary data=temp;
   by day process;
   var count;
   output out=failure sum=count;
run;

/* Determine the daily status for each process:
   count at or under 120% of target is NORM, over is HIGH */
%let target=25;
data failure;
   length stat $20;
   set failure;
   if (count <= (&target*1.2)) then
      stat=strip(cat(substr(process,index(process,' '),2),"-NORM"));
   if (count > (&target*1.2)) then
      stat=strip(cat(substr(process,index(process,' '),2),"-HIGH"));
   label day="Weekday" count="Failure Count" stat="Status";
run;

/* Define the template */
proc template;
   define statgraph failures;
      begingraph;

         /* Define the norm/high marker symbols */
         symbolimage name=norm image="C:\temp\check_green.gif" /
            voffset=0.5;
         symbolimage name=high image="C:\temp\alert_orange.gif" /
            voffset=0.5;

         /* Create legend entries for the norm/high markers */
         legenditem type=marker name="norm" /
            markerattrs=(symbol=norm size=16px)
            label="Normal Failure Count";
         legenditem type=marker name="high" /
            markerattrs=(symbol=high size=16px)
            label="High Failure Count";

         /* Define an attribute map for the status markers
            Note: COLOR= affects marker labels only in this case. */
         discreteattrmap name="statsymmap";
            value "A-NORM" / markerattrs=(symbol=norm color=green);
            value "B-NORM" / markerattrs=(symbol=norm color=green);
            value "A-HIGH" / markerattrs=(symbol=high color=orange);
            value "B-HIGH" / markerattrs=(symbol=high color=orange);
         enddiscreteattrmap;
         discreteattrvar attrvar=status var=stat attrmap="statsymmap";

         /* Define the graph */
```

```
         entrytitle "Daily Failure Report By Process";
         entryfootnote "A failure count that is more than 120% of the
 target is considered high.";
         layout overlay / yaxisopts=(offsetmax=0.1);
            barchartparm category=day response=count / name="barchart"
               group=process groupdisplay=cluster;
            scatterplot x=day y=count / datalabel=count group=status
               groupdisplay=cluster markerattrs=(size=16px);
            referenceline y=&target /
               lineattrs=(color=lightred pattern=dot)
curvelabel="Target";
            discretelegend "barchart" "norm" "high" / down=2
               order=columnmajor;
         endlayout;
      endgraph;
   end;
run;

proc sgrender data=failure template=failures;
run;
```

Program Description

Here is the SAS code for this example.

Create the graph data. The data in Sashelp.Failure is the source data. To get the daily counts, the data is summarized by weekday and process. The Stat column is then added to indicate whether the count is acceptable or high. Acceptable values are values that do not exceed 120% of the target value. Values over 120% are considered high. Acceptable values are A-NORM and B-NORM, and high values are A-HIGH and B-HIGH, where A and B identify the process.

```
/* Summarize the data in SASHELP.FAILURE to compute the
   failure count by day and process */
proc sort data=sashelp.failure out=temp;
   by day process;
run;

proc summary data=temp;
   by day process;
   var count;
   output out=failure sum=count;
run;

/* Determine the daily status for each process:
   count at or under 120% of target is NORM, over is HIGH */
%let target=25;
data failure;
   length stat $20;
   set failure;
   if (count <= (&target*1.2)) then
      stat=strip(cat(substr(process,index(process,' '),2),"-NORM"));
   if (count > (&target*1.2)) then
      stat=strip(cat(substr(process,index(process,' '),2),"-HIGH"));
   label day="Weekday" count="Failure Count" stat="Status";
run;
```

Open the template definition.

```
/* Define the template */
proc template;
   define statgraph failures;
      begingraph;
```

Define the custom marker symbols. The NAME= option specifies an identifier for the markers, and the IMAGE= option specifies the image file. The VOFFSET= option raises the markers 50% from their data points in order to prevent them from overlapping the bars in the bar chart.

```
/* Define the norm/high marker symbols */
symbolimage name=norm image="C:\temp\check_green.gif" /
   voffset=0.5;
symbolimage name=high image="C:\temp\alert_orange.gif" /
   voffset=0.5;
```

Create legend entries for the custom markers. Suboption SYMBOL= in the MARKERATTRS= option specifies the identifier of the custom markers.

```
/* Create legend entries for the norm/high markers */
legenditem type=marker name="norm" /
   markerattrs=(symbol=norm size=16px)
   label="Normal Failure Count";
legenditem type=marker name="high" /
   markerattrs=(symbol=high size=16px)
   label="High Failure Count";
```

Create a discrete attribute map to map the custom markers to the Stat column values. Suboption SYMBOL= in the MARKERATTRS= option specifies the identifier of the custom markers. Suboption COLOR= sets the color of the associated data label. It does not affect the color of the image. The DISCRETEATTRVAR statement creates attribute map variable STATUS.

```
/* Define an attribute map for the status markers
   Note: COLOR= affects marker labels only in this case. */
discreteattrmap name="statsymmap";
   value "A-NORM" / markerattrs=(symbol=norm color=green);
   value "B-NORM" / markerattrs=(symbol=norm color=green);
   value "A-HIGH" / markerattrs=(symbol=high color=orange);
   value "B-HIGH" / markerattrs=(symbol=high color=orange);
enddiscreteattrmap;
discreteattrvar attrvar=status var=stat attrmap="statsymmap";
```

Define the graph and close the template definition. The SCATTERPLOT statement GROUP= option references the STATUS attribute map variable. The SIZE= suboption of the MARKERATTRS= option sets the marker size. The custom markers are included in the DISCRETELEGEND statement.

```
/* Define the graph */
entrytitle "Daily Failure Report By Process";
entryfootnote "A failure count that is more than 120% of the
target is considered high.";
layout overlay / yaxisopts=(offsetmax=0.1);
   barchartparm category=day response=count / name="barchart"
      group=process groupdisplay=cluster;
   scatterplot x=day y=count / datalabel=count group=status
      groupdisplay=cluster markerattrs=(size=16px);
```

```
            referenceline y=&target /
               lineattrs=(color=lightred pattern=dot)
curvelabel="Target";
            discretelegend "barchart" "norm" "high" / down=2
               order=columnmajor;
         endlayout;
      endgraph;
   end;
run;
```

Generate the graph.

```
proc sgrender data=failure template=failures;
run;
```

PART 9

Draw Statements

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13

Key Concepts for Using Draw Statements

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Introduction

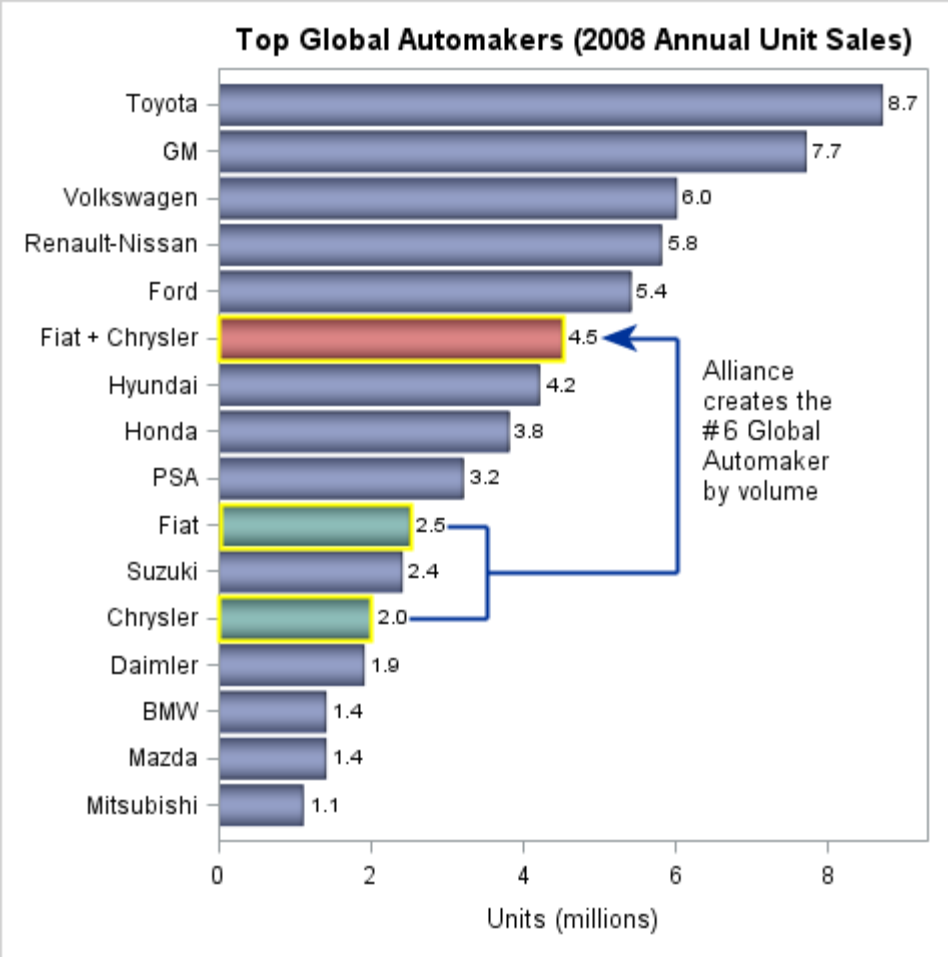
The draw statements enable you to customize a graph by drawing visual elements anywhere within the graph. The following sections provide a comprehensive example and a brief overview to the major drawing concepts. For more details about the individual draw statements and a simple example of each, see the discussion for each individual statement. For complete usage information for the draw statements, consult the *SAS Graph Template Language: User's Guide*.

Example

The following example shows a bar chart of the top global automobile makers in 2008. To focus the graph on the 2008 merger between Chrysler and Fiat, the example uses DRAWRECTANGLE to highlight the three bars in the chart that correspond to the unit sales for the two auto makers. The example also uses a DRAWARROW statement and two BEGINPOLYLINE blocks to point to the sales

figures, and it uses a DRAWTEXT statement to explain the implications of the merger.

All of the draw statements in this example use the data space (see "About the Drawing Space and Drawing Units" on page 1398) to integrate the drawn elements into the graph's data area.




```
/* Create the data and the macro variables for Chrysler, Fiat, and
   Chrysler+Fiat widths */
data mydata;
  length automaker $30;
  input automaker $ 1-30 million_units;
  FORMAT million_units 3.1;

  select (automaker);
     when ("Fiat") do;
           colorvar=1;
           call symput( "fwidth",  million_units);
        end;
     when ("Chrysler") do;
           colorvar=1;
           call symput( "cwidth",  million_units);
        end;
     when ("Fiat + Chrysler") do;
           colorvar=2;
```

```
          call symput( "cfwidth",  million_units);
        end;
     otherwise colorvar=3;
  end;

datalines;
Toyota                          8.7
GM                              7.7
Volkswagen                      6.0
Renault-Nissan                  5.8
Ford                            5.4
Fiat + Chrysler                 4.5
Hyundai                         4.2
Honda                           3.8
PSA                             3.2
Fiat                            2.5
Suzuki                          2.4
Chrysler                        2.0
Daimler                         1.9
BMW                             1.4
Mazda                           1.4
Mitsubishi                      1.1
;

/* Create template definition */
proc template;
 define statgraph automerger;
 begingraph /  drawspace=datavalue;
   entrytitle halign=center
     'Top Global Automakers (2008 Annual Unit Sales)';
   layout lattice / rowdatarange=data columndatarange=data
         rowgutter=10 columngutter=10;
     layout overlay / xaxisopts=(label=('Units (millions)'))
         yaxisopts=(reverse=true display=(ticks tickvalues line));
       barchart category=automaker response=million_units /
group=colorvar
         name='bar(h)' barlabel=true dataskin=pressed
orient=horizontal;
       drawrectangle x=eval(&cwidth/2.0) y="Chrysler"
         width=&cwidth height=0.95 / widthunit=data heightunit=data
         display=(outline) outlineattrs=(color=yellow);
       drawrectangle x=eval(&fwidth/2.0) y="Fiat"
         width=&fwidth height=0.95 /
         widthunit=data heightunit=data
         display=(outline) outlineattrs=(color=yellow);
       drawrectangle x=eval(&cfwidth/2.0) y="Fiat + Chrysler"
         width=&cfwidth height=0.95 / widthunit=data heightunit=data
         display=(outline) outlineattrs=(color=yellow);
       beginpolyline x=eval(&cwidth + 0.5) y="Chrysler";
         draw x=eval(&cwidth + 1.5) y="Chrysler";
         draw x=eval(&cwidth + 1.5)  y="Fiat";
         draw x=eval(&fwidth + 0.5)  y="Fiat";
       endpolyline;
       beginpolyline x=eval(&cwidth + 1.5)  y="Suzuki";
         draw x=eval(&cfwidth + 1.5)  y="Suzuki";
         draw x=eval(&cfwidth  + 1.5) y="Fiat + Chrysler";
```

```
        endpolyline;
        drawarrow x1=eval(&cfwidth + 1.5) x2=eval(&cfwidth + 0.5)
          y1="Fiat + Chrysler" y2="Fiat + Chrysler"
          / arrowheadscale=0.5 arrowheadshape=barbed;
        drawtext "Alliance creates the #6 Global Automaker by volume" /
          y="Honda" x=eval(&cfwidth+2.5) width=2 widthunit=data;
      endlayout;
    endlayout;
  endgraph;
end;

proc sgrender data=mydata template=automerger;
run;
```

Types of Elements That Can Be Drawn

The GTL draw statements enable you to draw the following types of elements in a graph:

- text
- arrows and lines
- geometric shapes like ovals, rectangles, polygons, and polylines (a set of connecting lines)
- images

Using these elements individually and especially by combining them, you can describe the non-data aspects of your graph. For example, you can display a company logo in a specified location within the graph. Or you can create custom features that are difficult to create by other means—for example, you could draw a broken axis. Using the draw statements creatively, you can direct viewer attention to features of interest in the graph by drawing elements that highlight those features.

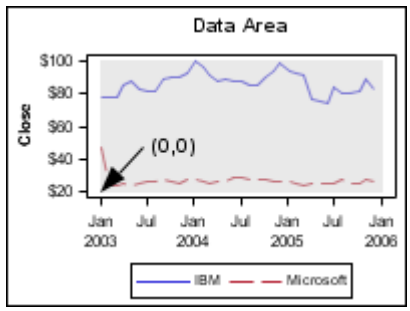
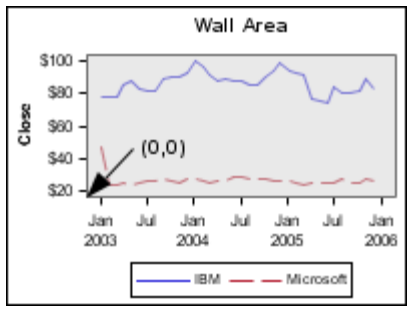
About the Drawing Space and Drawing Units

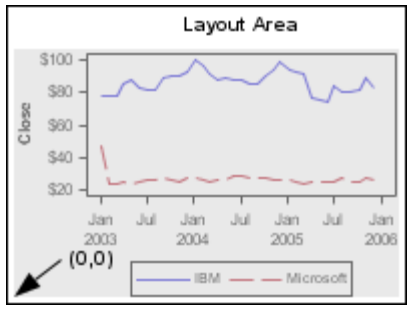
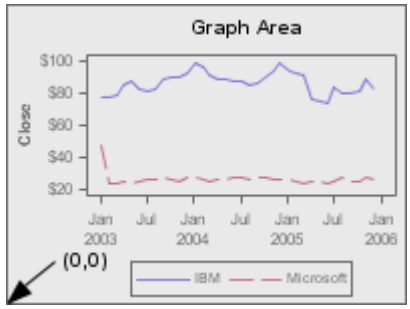
Each draw statement positions a drawn element using Cartesian coordinates that you specify as X and Y values in the statement. The coordinates that you specify are positioned relative to the *drawing space* that is in effect for the statement. The available drawing spaces are the *data area*, the *wall area*, the *layout area*, and the *graph area*. The coordinates can be specified in pixel units, percentage units, or as values that are in the units of the data (available only in the data area).

The images that accompany the following descriptions all use pixel data units. Each, however, was drawn in a different drawing space using this same LAYOUT OVERLAY definition block:

```
layout overlay /
    xaxisopts=(display=(line ticks tickvalues))
    yaxisopts=(display=(line ticks tickvalues));
  scatterplot x=height y=weight;
    drawrectangle x=0 y=0 width=50 height=50 /
      anchor=bottomleft display=(fill) fillattrs=(color=green)
      transparency=0.75 widthunit=pixel heightunit=pixel ;
    drawline x1=0 y1=0 x2=18 y2=18 / lineattrs=(color=red) ;
endlayout;
```

Table 13.1 *Drawing Spaces*

Drawing Space	Drawing Units	Description	Example
Data Area	VALUE, PERCENT, PIXEL	The area where data is displayed in the graph, honoring the offsets that are set for the axes. For a discussion on axis offsets, see "Adjusting Axis Offsets" on page 1053. The data area does not apply to graphs that do not have axes, such as pie charts, which must be drawn in a REGION layout. For graphs produced within LAYOUTDATAPANEL and LAYOUTDATALATTICE layouts, drawn elements are clipped if they extend outside of the wall boundaries.	
Wall Area	PERCENT, PIXEL	The area bounded by orthogonal axis pairs, ignoring the offsets that are set for the axes. In two-dimensional graphs, there is one wall bounded by the XY axes. including the secondary axes, if used. In three-dimensional graphs, there are three walls, bounded by the XY, YZ, and XZ axes. The wall area does not apply to graphs that do not have axes, such as pie charts, which must be drawn in a REGION layout. For graphs produced within LAYOUTDATAPANEL and LAYOUTDATALATTICE layouts, drawn elements that extend outside of the wall boundaries are clipped.	

Drawing Space	Drawing Units	Description	Example
Layout Area	PERCENT, PIXEL	The entire area of the layout container that is the immediate parent container of the draw statement. The figure to the right shows the case where a LAYOUT OVERLAY is the draw statement's layout container. Titles and footnotes are always displayed outside of the outermost layout, so those areas are never part of the layout drawing space.	
Graph Area	PERCENT, PIXEL	The entire area that is available to the graph display, whether a single-cell or multi-cell graph. Because the graph drawing space spans the entire graph, the location of the drawn element in the graph is independent of the draw statement's placement within the template definition, even if the draw statement is specified within a nested layout.	

To specify the drawing space for both the X and the Y dimension, you use the DRAWSPACE= option. To specify the drawing space individually for either the X or the Y dimension, you use the options XSPACE=, X1SPACE=, X2SPACE=, YSPACE=, Y1SPACE=, or Y2SPACE=, depending on the draw statement. The value that you set on any of these options is a single composite value that specifies both the drawing space and the drawing units in the following format:

```
<DrawingSpace><Units>
```

For example, DRAWSPACE=GRAPHPIXEL specifies the GRAPH drawing space with PIXEL drawing units, indicating that the statement's X,Y coordinates are expressed in pixels. Similarly, DRAWSPACE=LAYOUTPERCENT specifies the LAYOUT drawing space with PERCENT drawing units, indicating that the statement's X,Y coordinates are expressed as percentages.

The global DRAWSPACE is LAYOUTPERCENT. The global DRAWSPACE= setting for all of the draw statements is LAYOUTPERCENT. The draw statements inherit the global setting from the DRAWSPACE= setting in the BEGINGRAPH statement.

- To change the global drawing space and drawing units for all of the draw statements within the template definition, use the DRAWSPACE= option in the BEGINGRAPH statement.
- To change the default for an individual draw statement, use that statement's DRAWSPACE= option. If needed, you can specify different settings for the different draw statements within the template definition.

For the DATA drawing space, the VALUE drawing units specify that the coordinates are expressed as values along the axis. When you specify the DATA drawing space, you can use the draw statement's XAXIS= and YAXIS= options to specify which axis scale to use for the coordinates.

- If the specified axis does not exist in the plot or is not valid for the draw statement's layout container, then the draw statement is ignored.
- For a discrete axis, if the statement's specified X or Y value does not exist in the data, then the draw statement is ignored.
- For a continuous axis, if the statement's specified X or Y value does not exist in the data, then the value is extrapolated.

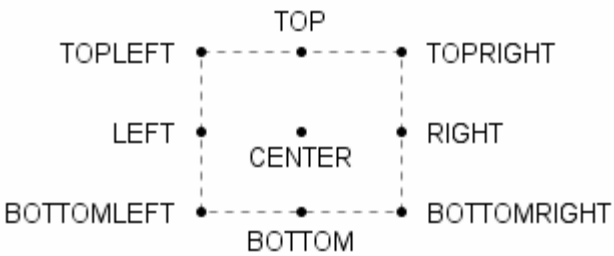
When specifying the drawing space and drawing units, you can set a common setting for all of the X and Y coordinates. Or you can specify different settings for each individual coordinate. The DRAWSPACE= setting in the BEGINGRAPH statement applies the global space and unit settings to all of the draw statements within the BEGINGRAPH/ENDGRAPH block. The DRAWSPACE= setting in an individual draw statement applies the space and unit setting only to the coordinate(s) for that statement. Thus, for lines and arrows, the setting applies to both the X1, Y1 coordinate and the X2, Y2 coordinate.

To specify the drawing space and drawing units separately for the X coordinate and for the Y coordinate, use the XSPACE=, YSPACE=, X1SPACE=, Y1SPACE=, X2SPACE=, and Y2SPACE= options, as applicable, in each draw statement. These options override the DRAWSPACE= option.

How the Drawn Elements Are Anchored

When you specify the X and Y coordinates in a draw statement, the element is drawn from an anchor point that is placed in the drawing area at the X,Y coordinate point.

- For lines and arrows, the anchor point is the starting point of the line or arrow, which is specified with the draw statement's X1= and Y1= values.
- For elements that have height and width, the anchor point can be one of the following points:



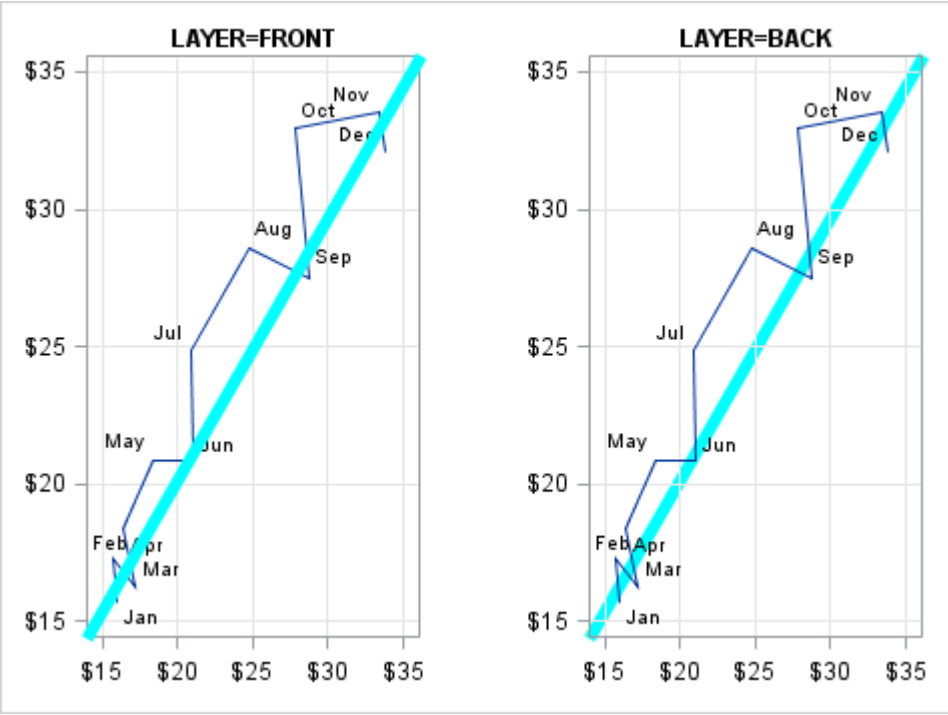
The default anchor position is CENTER. To change the anchor position, use the draw statement's ANCHOR= option.

About Drawing Layers

A draw statement can draw its element in either of two “layers” in the graph: the front layer or the back layer. By default, the statement draws in the front layer, which places the element in front of all other graphics elements, including data points, data labels, axis labels, and so on. In some cases, this might cause the drawn element to block the view of other graphics elements in the graph.

To prevent a drawn element for blocking the view of other graphics elements in the graph, you can use the draw statement’s TRANSPARENCY= option to add transparency to the drawn element. With an appropriate transparency setting, you should be able to see any graphics elements that are behind the drawn element.

Alternatively, you can use the draw statement’s LAYER= option to draw the element in the back layer, which places the drawn element behind all other graphics elements in the graph. For example, the following figure shows two different versions of a graph that uses DRAWLINE to draw a diagonal line across the axis area. The version to the left draws the line in the front layer, which causes the line to cover some of the data labels in the graph and portions of the series line. The version to the right uses LAYER=BACK to draw the line in the back layer. This prevents the line from covering the data labels and the portions of the series line.



The following code fragment shows the code that positions the line in the back layer:

```
layout overlay / walldisplay=(outline)
```

```
    xaxisopts=(griddisplay=on display=(line ticks tickvalues))
    yaxisopts=(griddisplay=on display=(line ticks tickvalues));
  seriesplot x=open y=close / datalabel=date;
  drawline x1=0 y1=0 x2=100 y2=100 /
    x1space=wallpercent y1space=wallpercent
    x2space=wallpercent y2space=wallpercent
    lineattrs=(color=cyan thickness=6) layer=back ;
endlayout;
```

The Back Layer is Behind the Background. Although drawing elements in the back layer prevents them from obstructing other data elements in the graph, it is not always the right solution to the problem.

If a draw statement uses LAYER=BACK, then it draws the element behind all other graphics elements, such as the layout background or a discrete legend's background. To ensure that the element is visible in the graph, you might have to do one or more of the following:

- In overlay-type layouts or in a SCATTERPLOTMATRIX, you can use the parent layout's WALLDISPLAY= option to turn off the display of the plot wall. In the example code just shown, WALLDISPLAY=(OUTLINE) displays an outline around the graph wall but does not display the wall fill. Suppressing the fill ensures that the drawn line is visible behind the plot wall.
- If a layout container uses OPAQUE=TRUE so that it can set visual attributes for the background, then the opaque background covers and therefore hides any drawn element that is behind the background. When assigning visual attributes to a graph background, therefore, it might be better to use TRANSPARENCY= rather than LAYER= to prevent drawn elements from covering other graphics elements in the graph.
- If the results of a plot statement or other *GTL-statement* covers the drawn element, then you can use transparency to reveal the drawn element. For example, you could use a plot statement's DATATRANSPARENCY= option to set an appropriate transparency level for the plot.

14

Draw Statements

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Dictionary

BEGINPOLYGON Statement

Defines the starting point for drawing a polygon in the graph.

Syntax

BEGINPOLYGON X=*constant* | *scalar-expression*
Y=*constant* | *scalar-expression* </*options*>;

  DRAW X=*constant* | *scalar-expression*
    Y=*constant* | *scalar-expression* </*options*>;

  <... *more DRAW statements* ...>
ENDPOLYGON;

Summary of Optional Arguments

Appearance options

DISPLAY=STANDARD | ALL | (*display-options*)
: specifies the features to display for the polygon.

FILLATTRS=*style-element* | *style-element* (*fill-options*) | (*fill-options*)
: specifies the fill attributes for this BEGINPOLYGON block.

LAYER=FRONT | BACK
: specifies the layer on which this BEGINPOLYGON block's output is drawn.

OUTLINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
: specifies the outline attributes for this BEGINPOLYGON block.

TRANSPARENCY=*number*
: specifies the degree of the transparency of this BEGINPOLYGON block's output.

Axes options

DISCRETEOFFSET=*number*
: specifies an amount to offset from the discrete X values, or the discrete Y values, or both.

XAXIS=X | X2
: specifies whether the data value for the arguments X1 and X2 is interpreted using the primary X-axis scale or to the secondary X (X2) axis scale.

YAXIS=Y | Y2
: specifies whether the data value for the arguments Y1 and Y2 is interpreted using the primary Y-axis scale or to the secondary Y (Y2) axis scale.

Drawing space options

DRAWSPACE=GRAPHPERCENT | GRAPHPIXEL | LAYOUTPERCENT | LAYOUTPIXEL | WALLPERCENT | WALLPIXEL | DATAPERCENT | DATAPIXEL | DATAVALUE
: specifies a default drawing space and drawing units for this BEGINPOLYGON block.

XSPACE=GRAPHPERCENT | GRAPHPIXEL | LAYOUTPERCENT | LAYOUTPIXEL | WALLPERCENT | WALLPIXEL | DATAPERCENT | DATAPIXEL | DATAVALUE
: specifies the drawing space and drawing units for interpreting the value that is specified in the X= option.

YSPACE=GRAPHPERCENT | GRAPHPIXEL | LAYOUTPERCENT | LAYOUTPIXEL | WALLPERCENT | WALLPIXEL | DATAPERCENT | DATAPIXEL | DATAVALUE
: specifies the drawing space and drawing units for interpreting the value that is specified in the Y= option.

ODS options

URL="*string*" | *string-expression*

specifies an HTML page that is displayed when the output of this draw statement is selected.

Required Arguments

The following options are required in the BEGINPOLYGON statement and the DRAW statement.

X=*constant | scalar-expression*

specifies the X value for a point in the polygon. When used in the BEGINPOLYGON statement, it specifies the X value of the starting point of the polygon.

Interaction The value that is set for this argument is interpreted using the XSPACE= option. When XSPACE=DATAVALUE, the value is interpreted using the XAXIS= option.

Note When XSPACE=DATAVALUE and a character value is specified, leading blanks are honored and trailing blanks are ignored when the specified value is compared with the data values.

Y=*constant | scalar-expression*

specifies the Y value for a point in the polygon. When used in the BEGINPOLYGON statement, it specifies the Y value of the starting point of the polygon.

Interaction The value that is set for this argument is interpreted using the YSPACE= option. When YSPACE=DATAVALUE, the value is interpreted using the YAXIS= option.

Note When YSPACE=DATAVALUE and a character value is specified, leading blanks are honored and trailing blanks are ignored when the specified value is compared with the data values.

Optional Arguments

The following options can be used in the BEGINPOLYGON statement.

DISCRETEOFFSET=*number*

specifies an amount to offset from the discrete X values, or the discrete Y values, or both.

Default 0 (no offset, output is centered on the discrete X values, or the discrete Y values, or both)

Range −0.5 to +0.5, where 0.5 represents half the distance between discrete ticks. If the X axis is discrete, then a positive offset is to the right. If the Y axis is discrete, then a positive offset is up. If REVERSE=TRUE on the X or Y axis, then the offset direction is also reversed.

Restriction This option applies only when the options XSPACE= or YSPACE= use DATAVALUE, and when X or Y are values on a discrete axis. For nondiscrete axes, this option is ignored.

Tip Setting the discrete offset for the plots does not affect the axis minimum and maximum offsets. In some cases, setting a discrete offset can cause clipping at each end of the axis. In those cases, use the OFFSETMIN= and OFFSETMAX= axis options to increase the axis minimum and maximum offsets to accommodate the discrete offset.

DISPLAY=STANDARD | ALL | (*display-options*)
specifies the features to display for the polygon.

STANDARD
displays an outlined polygon.

ALL
displays an outlined, filled polygon.

(*display-options*)
specifies a space-separated list of one or more display options, enclosed in parentheses.

The list can contain one or both of the following options:

OUTLINE
displays an outlined polygon

FILL
displays a filled polygon

Default STANDARD

Tip Use the OUTLINEATTRS= and FILLATTRS= options to control the appearance of the polygon.

DRAWSPACE=GRAPHPERCENT | GRAPHPIXEL | LAYOUTPERCENT | LAYOUTPIXEL | WALLPERCENT | WALLPIXEL | DATAPERCENT | DATAPIXEL | DATAVALUE
specifies a default drawing space and drawing units for this BEGINPOLYGON block.

Default LAYOUTPERCENT

Interactions This statement and all of the draw statements inherit the global DRAWPSACE= setting from the DRAWSPACE= option in the BEGINGRAPH statement. Setting this option changes the setting for only this BEGINPOLYGON statement.

This option sets the default drawing space, but individual settings in the X or Y dimension can be overridden by the XSPACE= and YSPACE= options.

See "About the Drawing Space and Drawing Units" on page 1398

FILLATTRS=*style-element* | *style-element* (*fill-options*) | (*fill-options*)
specifies the fill attributes for this BEGINPOLYGON block.

Default The GraphAnnoShape style element

Tip The TRANSPARENCY= option sets the transparency for the fill and the outline. You can combine this option with TRANSPARENCY= to set one transparency for the outlines but a different transparency for the fill. Example:

```
transparency=0.2 fillattrs=(transparency=0.6)
```

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Fill Color Options" on page 1600 for available *fill-options*.

LAYER=FRONT | BACK
specifies the layer on which this BEGINPOLYGON block's output is drawn.

FRONT
draws the output on top of the graph.

BACK
draws the output behind the background areas, such as a layout or legend background.

Default FRONT

Tip For elements that are obstructed because they are in the back layer, you can suppress the display of filled areas in the graph. You can also use transparency to manage the element visibility. For more information, see "About Drawing Layers" on page 1402 .

OUTLINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the outline attributes for this BEGINPOLYGON block.

Default The ContrastColor, LineStyle, and LineThickness attributes of the GraphAnnoLine style element.

Interaction For this option to have any effect, the outline must be enabled by the DISPLAY= option.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element* .

"Line Options" on page 1602 for available *line-options*.

TRANSPARENCY=*number*
specifies the degree of the transparency of this BEGINPOLYGON block's output.

Default 0

Range 0 (opaque) to 1 (entirely transparent)

Tip The FILLATTRS option can be used to set transparency for just the polygon's filled area. You can combine this option with FILLATTRS= to set one transparency for the outlines but a different transparency for the fill. Example:

```
transparency=0.2 fillattrs=(transparency=0.6)
```

URL="*string*" | *string-expression*
specifies an HTML page that is displayed when the output of this draw statement is selected.

Note: This option is valid starting in SAS 9.4M1.

"string"
string-expression
specifies a valid HTML page reference (HREF) for the graphical element that is drawn by this draw statement.

Example `http://www.sas.com`

Restriction Links specified with URL= are not supported in SVG output in HTML. In that case, use a raster image format such as PNG.

Requirement To generate selectable graphical elements, you must include an ODS GRAPHICS ON statement that specifies the IMAGEMAP option, and you must write the output to the ODS HTML destination.

Tip By default, drill-down links open in a new browser window (link target _blank). To specify a different target for your drill-down links, such as _self or _parent, add the DRILLTARGET="*target*" option to your ODS GRAPHICS statement. See DRILLTARGET= on page 1568.

XAXIS=X | X2
specifies whether the data value for the arguments X1 and X2 is interpreted using the primary X-axis scale or to the secondary X (X2) axis scale.

Default X

Interaction This option has effect only if XSPACE=DATAVALUE.

XSPACE=GRAPHPERCENT | GRAPHPIXEL | LAYOUTPERCENT | LAYOUTPIXEL | WALLPERCENT | WALLPIXEL | DATAPERCENT | DATAPIXEL | DATAVALUE
specifies the drawing space and drawing units for interpreting the value that is specified in the X= option.

Default The setting that is in effect for the DRAWSPACE= option.

YAXIS=Y | Y2
specifies whether the data value for the arguments Y1 and Y2 is interpreted using the primary Y-axis scale or to the secondary Y (Y2) axis scale.

Default Y

Interaction This option has effect only if YSPACE=DATAVALUE.

YSPACE=GRAPHPERCENT | GRAPHPIXEL | LAYOUTPERCENT | LAYOUTPIXEL | WALLPERCENT | WALLPIXEL | DATAPERCENT | DATAPIXEL | DATAVALUE
specifies the drawing space and drawing units for interpreting the value that is specified in the Y= option.

Default The setting that is in effect for the DRAWSPACE= option.

DRAW Statement Optional Arguments

The following options can be used in the DRAW statement.

Statement Option	Description
DRAWSPACE	Specifies a default drawing space and drawing units for the drawn lines.
XSPACE	Specifies the drawing space and drawing units for interpreting the X value.
YSPACE	Specifies the drawing space and drawing units for interpreting the Y value.

Details

Statement Description

A polygon is built by using the BEGINPOLYGON statement to specify the polygon's starting X,Y coordinate, and then specifying the remaining points by nesting a series of DRAW statements (see "DRAW Statement" on page 1411) within the BEGINPOLYGON block. The block is closed with an ENDPOLYGON statement. To manage the location and drawing units for the polygon, you can use the XAXIS=, YAXIS=, XSPACE=, and YSPACE= options.

For general information about the types of elements that can be drawn with the draw statements, the drawing space and drawing units that they use, and how the drawn elements are anchored, see Chapter 13, "Key Concepts for Using Draw Statements," on page 1395 . For detailed usage information, consult the *SAS Graph Template Language: User's Guide*.

DRAW Statement

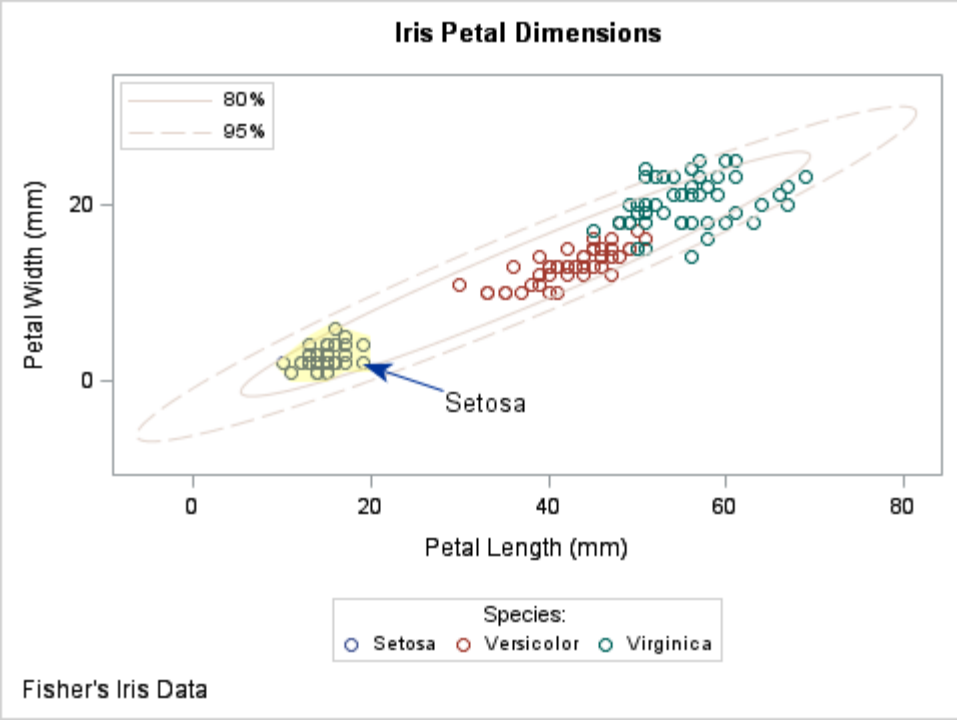
The nested DRAW statements within a BEGINPOLYGON block specify a series of points for a polygon. Each DRAW statement draws a straight line from the previous point to the endpoint that is specified in the DRAW statement's X and Y arguments. The first DRAW statement starts its line from the X,Y point that is specified in the BEGINPOLYGON statement.

You can specify as many DRAW statements as needed to complete the polygon. If the last DRAW statement does not end at the first point in the polygon (specified

in BEGINPOLYGON), then a line is automatically generated to close the polygon shape. For a specific example, see the "Example Program" on page 1412.

Example: BEGINPOLYGON Statement

The following graph was generated by the "Example Program" on page 1412. The example uses a BEGINPOLYGON block to draw a polygon around the Setosa species of Iris in a plot that shows petal sizes for three Iris species. The DRAWSPACE= option in the BEGINGRAPH statements specifies that the polygon be drawn in the data space. The BEGINPOLYGON statement specifies the starting X,Y point. For the BEGINPOLYGON options, DISPLAY= displays only the fill for the polygon. TRANSPARENCY= adds a degree of transparency to the fill, and FILLATTRS= sets the fill color to yellow. The example also uses DRAWARROW and DRAWTEXT statements to draw an annotation for the polygon.



Example Program

```
proc template;
  define statgraph discretelegend;
    begingraph / drawspace=datavalue;
      entrytitle "Iris Petal Dimensions";
      layout overlayequated / equatetype=equate;
        scatterplot x=petallength y=petalwidth / group=species
name="s";
        ellipse x=petallength y=petalwidth / type=predicted  alpha=.2
          name="p80" legendlabel="80%" outlineattrs=graphconfidence;
```

```
          ellipse x=petallength y=petalwidth / type=predicted  alpha=.05
            name="p95" legendlabel="95%" outlineattrs=graphconfidence2;
          beginpolygon x=9 y=2 /display=(fill)
            fillAttrs=(color=yellow transparency=0.75);
            draw x=13 y=5;
            draw x=16 y=7;
            draw x=17 y=6;
            draw x=20 y=5;
            draw x=20 y=1;
            draw x=17 y=1;
            draw x=15 y=0;
            draw x=14 y=0;
            draw x=11 y=0;
          endpolygon;
          drawtext textattrs=(size=11pt) "Setosa" /
            x=33 y=0 width=15 anchor=top;
          drawarrow x1=28 y1=-1 x2=19 y2=2 /
            lineattrs=(thickness=1px)
            arrowheadshape=barbed arrowheadscale=0.1;
          discretelegend "s" / title="Species:";
          discretelegend "p80" "p95" /across=1 autoalign=(topleft)
location=inside;
      endlayout;
      entryfootnote halign=left "Fisher's Iris Data" ;
    endgraph;
  end;
run;

proc sgrender data=sashelp.iris template=discretelegend;
run;
```

BEGINPOLYLINE Statement

Defines the starting point for drawing a polyline in the graph.

Syntax

BEGINPOLYLINE X=*constant | scalar-expression*
Y=*constant | scalar-expression* </*options*>;

  DRAW X=*constant | scalar-expression*
    Y=*constant | scalar-expression* </*options*>;

  <*... more DRAW statements ...*>
ENDPOLYLINE;

Summary of Optional Arguments

Appearance options

LAYER=FRONT | BACK
: specifies the layer on which this BEGINPOLYLINE block's output is drawn.

LINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
: specifies the line attributes for this BEGINPOLYLINE block.

TRANSPARENCY=*number*
: specifies the degree of the transparency of the BEGINPOLYLINE block's output.

Axes options

DISCRETEOFFSET=*number*
: specifies an amount to offset from the discrete X values, or the discrete Y values, or both.

XAXIS=X | X2
: specifies whether the data value for the arguments X1 and X2 is interpreted using the primary X-axis scale or to the secondary X (X2) axis scale.

YAXIS=Y | Y2
: specifies whether the data value for the arguments Y1 and Y2 is interpreted using the primary Y-axis scale or to the secondary Y (Y2) axis scale.

Drawing space options

DRAWSPACE=GRAPHPERCENT | GRAPHPIXEL | LAYOUTPERCENT | LAYOUTPIXEL | WALLPERCENT | WALLPIXEL | DATAPERCENT | DATAPIXEL | DATAVALUE
: specifies a default drawing space and drawing units for this BEGINPOLYLINE block.

XSPACE=GRAPHPERCENT | GRAPHPIXEL | LAYOUTPERCENT | LAYOUTPIXEL | WALLPERCENT | WALLPIXEL | DATAPERCENT | DATAPIXEL | DATAVALUE
: specifies the drawing space and drawing units for interpreting the value that is specified in the X= option.

YSPACE=GRAPHPERCENT | GRAPHPIXEL | LAYOUTPERCENT | LAYOUTPIXEL | WALLPERCENT | WALLPIXEL | DATAPERCENT | DATAPIXEL | DATAVALUE
: specifies the drawing space and drawing units for interpreting the value that is specified in the Y= option.

ODS options

URL=*"string"* | *string-expression*
: specifies an HTML page that is displayed when the output of this draw statement is selected.

Required Arguments

The following options are required in the BEGINPOLYLINE statement and the DRAW statement.

X=*constant* | *scalar-expression*
: specifies the X value for the starting point in the polyline.

Interaction The value that is set for this argument is interpreted using the XSPACE= option. When XSPACE=DATAVALUE, the value is interpreted using the XAXIS= option.

Note When XSPACE=DATAVALUE and a character value is specified, leading blanks are honored and trailing blanks are ignored when the specified value is compared with the data values.

Y=*constant* | *scalar-expression*
specifies the Y value for the starting point in the polyline.

Interaction The value that is set for this argument is interpreted using the YSPACE= option. When YSPACE=DATAVALUE, the value is interpreted using the YAXIS= option.

Note When YSPACE=DATAVALUE and a character value is specified, leading blanks are honored and trailing blanks are ignored when the specified value is compared with the data values.

Optional Arguments

The following options can be used in the BEGINPOLYLINE statement.

DISCRETEOFFSET=*number*
specifies an amount to offset from the discrete X values, or the discrete Y values, or both.

Default 0 (no offset, output is centered on the discrete X values, or the discrete Y values, or both)

Range –0.5 to +0.5, where 0.5 represents half the distance between discrete ticks. If the X axis is discrete, then a positive offset is to the right. If the Y axis is discrete, then a positive offset is up. If REVERSE=TRUE on the X or Y axis, then the offset direction is also reversed.

Restriction This option applies only when the options XSPACE= or YSPACE= use DATAVALUE, and when X or Y are values on a discrete axis. For nondiscrete axes, this option is ignored.

Tip Setting the discrete offset for the plots does not affect the axis minimum and maximum offsets. In some cases, setting a discrete offset can cause clipping at each end of the axis. In those cases, use the OFFSETMIN= and OFFSETMAX= axis options to increase the axis minimum and maximum offsets to accommodate the discrete offset.

DRAWSPACE=GRAPHPERCENT | GRAPHPIXEL | LAYOUTPERCENT | LAYOUTPIXEL | WALLPERCENT | WALLPIXEL | DATAPERCENT | DATAPIXEL | DATAVALUE
specifies a default drawing space and drawing units for this BEGINPOLYLINE block.

Default LAYOUTPERCENT

Interactions This statement and all of the draw statements inherit the global DRAWPSACE= setting from the DRAWSPACE= option in the BEGINGRAPH statement. Setting this option changes the setting for only this BEGINPOLYLINE statement.

This option sets the default drawing space, but individual settings in the X or Y dimension can be overridden by the XSPACE= and YSPACE= options.

See "About the Drawing Space and Drawing Units" on page 1398

LAYER=FRONT | BACK
specifies the layer on which this BEGINPOLYLINE block's output is drawn.

FRONT
draws the output on top of the graph.

BACK
draws the output behind the background areas, such as a layout or legend background.

Default FRONT

Tip For elements that are obstructed because they are in the back layer, you can suppress the display of filled areas in the graph. You can also use transparency to manage the element visibility. For more information, see "About Drawing Layers" on page 1402 .

LINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the line attributes for this BEGINPOLYLINE block.

Default The GraphAnnoLine style element.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element* .

"Line Options" on page 1602 for available *line-options*.

TRANSPARENCY=*number*
specifies the degree of the transparency of the BEGINPOLYLINE block's output.

Default 0

Range 0 (opaque) to 1 (entirely transparent)

URL="*string*" | *string-expression*
specifies an HTML page that is displayed when the output of this draw statement is selected.

Note: This option is valid starting in SAS 9.4M1.

"string"
string-expression
specifies a valid HTML page reference (HREF) for the graphical element that is drawn by this draw statement.

Example `http://www.sas.com`

Restriction Links specified with URL= are not supported in SVG output in HTML. In that case, use a raster image format such as PNG.

Requirement To generate selectable graphical elements, you must include an ODS GRAPHICS ON statement that specifies the IMAGEMAP option, and you must write the output to the ODS HTML destination.

Tip By default, drill-down links open in a new browser window (link target _blank). To specify a different target for your drill-down links, such as _self or _parent, add the DRILLTARGET="*target*" option to your ODS GRAPHICS statement. See DRILLTARGET= on page 1568.

XAXIS=X | X2
specifies whether the data value for the arguments X1 and X2 is interpreted using the primary X-axis scale or to the secondary X (X2) axis scale.

Default X

Interaction This option has effect only if XSPACE=DATAVALUE.

XSPACE=GRAPHPERCENT | GRAPHPIXEL | LAYOUTPERCENT | LAYOUTPIXEL | WALLPERCENT | WALLPIXEL | DATAPERCENT | DATAPIXEL | DATAVALUE
specifies the drawing space and drawing units for interpreting the value that is specified in the X= option.

Default The setting that is in effect for the DRAWSPACE= option.

YAXIS=Y | Y2
specifies whether the data value for the arguments Y1 and Y2 is interpreted using the primary Y-axis scale or to the secondary Y (Y2) axis scale.

Default Y

Interaction This option has effect only if YSPACE=DATAVALUE.

YSPACE=GRAPHPERCENT | GRAPHPIXEL | LAYOUTPERCENT | LAYOUTPIXEL | WALLPERCENT | WALLPIXEL | DATAPERCENT | DATAPIXEL | DATAVALUE
specifies the drawing space and drawing units for interpreting the value that is specified in the Y= option.

Default The setting that is in effect for the DRAWSPACE= option.

DRAW Statement Optional Arguments

The following options can be used in the DRAW statement.

Statement Option	Description
DRAWSPACE	Specifies a default drawing space and drawing units for the drawn lines.
XSPACE	Specifies the drawing space and drawing units for interpreting the X value.
YSPACE	Specifies the drawing space and drawing units for interpreting the Y value.

Details

Statement Description

A polyline is built by using the BEGINPOLYLINE statement to specify the polyline's starting X,Y coordinate, and then specifying the remaining points by nesting a series of DRAW statements (see "DRAW Statement" on page 1418) within the BEGINPOLYLINE block. The block is closed with an ENDPOLYLINE statement. To manage the location and drawing units for the polyline, you can use the XAXIS=, YAXIS=, XSPACE=, and YSPACE= options.

For general information about the types of elements that can be drawn with the draw statements, the drawing space and drawing units that they use, and how the drawn elements are anchored, see Chapter 13, "Key Concepts for Using Draw Statements," on page 1395 . For detailed usage information, consult the *SAS Graph Template Language: User's Guide*.

DRAW Statement

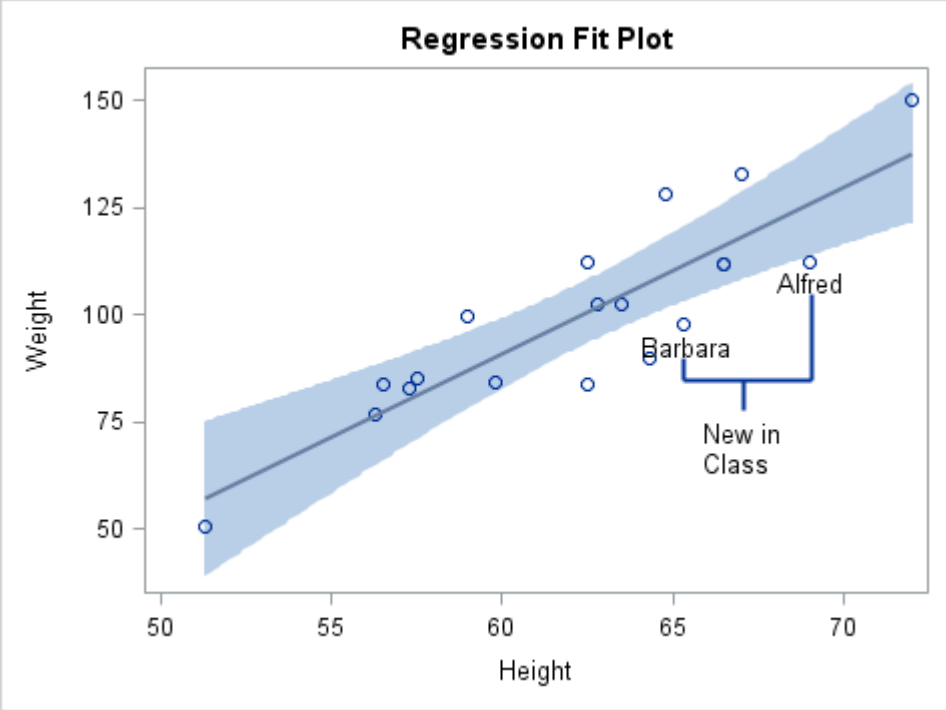
The nested DRAW statements within a BEGINPOLYLINE block specify a series of points for a polyline. Each DRAW statement draws a straight line from the previous point to the endpoint that is specified in the DRAW statement's X and Y arguments. The first DRAW statement starts its line from the X,Y point that is specified in the BEGINPOLYLINE statement. You can specify as many DRAW statements as needed to complete the polyline.

For a specific example, see the "Example Program" on page 1419.

Example: BEGINPOLYLINE Statement

The following graph was generated by the "Example Program" on page 1419. The example uses two BEGINPOLYLINE blocks to highlight two student data points. The DRAWSPACE= option in the BEGINGRAPH statements specifies that the polyline be drawn in the data space. The BEGINPOLYLINE statements specify the starting X,Y points for two polyline, and the DRAW statements complete the lines.

The example also uses two DRAWTEXT statements to label the data points of interest.



Example Program

```
proc template;
  define statgraph drawoval;
    begingraph / drawspace=datavalue;
      entrytitle "Regression Fit Plot";
      layout overlay;
        modelband "myclm";
        scatterplot x=height y=weight;
        regressionplot x=height y=weight / alpha=0.01 clm="myclm";
          drawtext "Alfred" / x=69 y=112 anchor=top;
          drawtext "Barbara" / x=65.4 y=97 anchor=top width=15;
          beginpolyline x=69 y=105 ;
            draw x=69 y=85 ;
            draw x=65.3 y=85 ;
            draw x=65.3 y=90 ;
          endpolyline ;
          beginpolyline x=67 y=85 ;
            draw x=67 y=78 ;
          endpolyline ;
          drawtext "New in Class" / x=67 y=77 anchor=top width=15;
      endlayout;
    endgraph;
  end;

proc sgrender data=sashelp.class template=drawoval;
run;
```

DRAWARROW Statement

Draws an arrow (a directed line segment) from one point to another point.

Syntax

DRAWARROW X1=*constant* | *scalar-expression*
Y1=*constant* | *scalar-expression*
X2=*constant* | *scalar-expression*
Y2=*constant* | *scalar-expression* < */options* >;

Summary of Optional Arguments

Appearance options

LAYER=FRONT | BACK
: specifies the layer on which this draw statement's output is drawn.

LINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
: specifies the line attributes for this draw statement.

TRANSPARENCY=*number*
: specifies the degree of the transparency of this draw statement's output.

Arrow options

ARROWHEADDIRECTION=OUT | IN | BOTH
: specifies the direction of the arrowhead(s) at the end(s) of the arrow shaft.

ARROWHEADSCALE=*positive-number*
: specifies an arrowhead scale factor based on the thickness of the arrow shaft.

ARROWHEADSHAPE=OPEN | CLOSED | FILLED | BARBED
: specifies the shape of the arrowhead(s).

Axes options

DISCRETEOFFSET=*number*
: specifies an amount to offset from the discrete X values, or the discrete Y values, or both.

XAXIS=X | X2
: specifies whether the data value for the arguments X1 and X2 is interpreted using the primary X-axis scale or to the secondary X (X2) axis scale.

YAXIS=Y | Y2

specifies whether the data value for the arguments Y1 and Y2 is interpreted using the primary Y-axis scale or to the secondary Y (Y2) axis scale.

Drawing space options

DRAWSPACE=GRAPHPERCENT | GRAPHPIXEL | LAYOUTPERCENT | LAYOUTPIXEL | WALLPERCENT | WALLPIXEL | DATAPERCENT | DATAPIXEL | DATAVALUE

specifies a default drawing space and drawing units for this draw statement.

X1SPACE=GRAPHPERCENT | GRAPHPIXEL | LAYOUTPERCENT | LAYOUTPIXEL | WALLPERCENT | WALLPIXEL | DATAPERCENT | DATAPIXEL | DATAVALUE

specifies the drawing space and drawing units for interpreting the X1 value.

X2SPACE=GRAPHPERCENT | GRAPHPIXEL | LAYOUTPERCENT | LAYOUTPIXEL | WALLPERCENT | WALLPIXEL | DATAPERCENT | DATAPIXEL | DATAVALUE

specifies the drawing space and drawing units for interpreting the X2 value

Y1SPACE=GRAPHPERCENT | GRAPHPIXEL | LAYOUTPERCENT | LAYOUTPIXEL | WALLPERCENT | WALLPIXEL | DATAPERCENT | DATAPIXEL | DATAVALUE

specifies the drawing space and drawing units for interpreting the Y1 value.

Y2SPACE=GRAPHPERCENT | GRAPHPIXEL | LAYOUTPERCENT | LAYOUTPIXEL | WALLPERCENT | WALLPIXEL | DATAPERCENT | DATAPIXEL | DATAVALUE

specifies the drawing space and drawing units for interpreting the Y2 value

ODS options

URL="*string*" | *string-expression*

specifies an HTML page that is displayed when the output of this draw statement is selected.

Required Arguments

X1=*constant* | *scalar-expression*

specifies the X value of one arrow-shaft endpoint.

Interactions This value that is set for this option is interpreted using the X1SPACE= option.

When X1SPACE=DATAVALUE, the value is interpreted using the XAXIS= option.

Note When X1SPACE=DATAVALUE and a character value is specified, leading blanks are honored and trailing blanks are ignored when the specified value is compared with the data values.

Y1=*constant* | *scalar-expression*
specifies the Y value of one arrow-shaft endpoint.

Interactions This value that is set for this option is interpreted using the Y1SPACE= option.

When Y1SPACE=DATAVALUE, the value is interpreted using the YAXIS= option.

Note When Y1SPACE=DATAVALUE and a character value is specified, leading blanks are honored and trailing blanks are ignored when the specified value is compared with the data values.

X2=*constant* | *scalar-expression*
specifies the X value of one arrow-shaft endpoint.

Interactions This value that is set for this option is interpreted using the X2SPACE= option.

When X2SPACE=DATAVALUE, the value is interpreted using the XAXIS= option.

Note When X2SPACE=DATAVALUE and a character value is specified, leading blanks are honored and trailing blanks are ignored when the specified value is compared with the data values.

Y2=*constant* | *scalar-expression*
specifies the Y value of one arrow-shaft endpoint.

Interactions This value that is set for this option is interpreted using the Y2SPACE= option.

When Y2SPACE=DATAVALUE, the value is interpreted using the YAXIS= option.

Note When Y2SPACE=DATAVALUE and a character value is specified, leading blanks are honored and trailing blanks are ignored when the specified value is compared with the data values.

Optional Arguments

ARROWHEADDIRECTION=OUT | IN | BOTH
specifies the direction of the arrowhead(s) at the end(s) of the arrow shaft.

OUT
specifies a single arrowhead drawn at (X2,Y2) and pointing away from (X1,Y1)

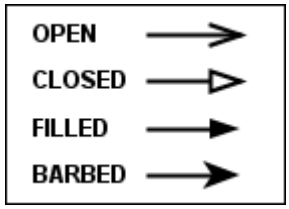
IN
specifies a single arrowhead drawn at (X1,Y1) and pointing away from (X2,Y2)

BOTH
specifies two arrowheads, one at the IN position and one at the OUT position

Default OUT

Tip Use the ARROWHEADSHAPE= option to control the arrowhead appearance.

ARROWHEADSHAPE=OPEN | CLOSED | FILLED | BARBED
specifies the shape of the arrowhead(s). The following figure shows the arrowhead shapes.



Default OPEN

Tip Use the ARROWHEADDIRECTION= option to control the arrow direction.

ARROWHEADSCALE=*positive-number*
specifies an arrowhead scale factor based on the thickness of the arrow shaft.

Default 1.0

Restriction The minimum size for arrowheads is 8 pixels. If you specify a value for ARROWHEADSCALE= that scales the arrowhead below 8 pixels, an 8-pixel arrowhead is used instead. There is no restriction on the maximum size.

Tip Use a factor greater than 1.0 to make a larger arrowhead.

DISCRETEOFFSET=*number*
specifies an amount to offset from the discrete X values, or the discrete Y values, or both.

Default 0 (no offset, output is centered on the discrete X values, or the discrete Y values, or both)

Range –0.5 to +0.5, where 0.5 represents half the distance between discrete ticks. If the X axis is discrete, then a positive offset is to the right. If the Y axis is discrete, then a positive offset is up. If REVERSE=TRUE on the X or Y axis, then the offset direction is also reversed.

Restriction This option applies only when the options X1SPACE=, X2SPACE=, Y1SPACE=, or Y2SPACE= use DATAVALUE, and when X1, X2, Y1, or Y2 are values on a discrete axis. For nondiscrete axes, this option is ignored.

Tip Setting the discrete offset for the plots does not affect the axis minimum and maximum offsets. In some cases, setting a discrete offset can cause clipping at each end of the axis. In those cases, use

the OFFSETMIN= and OFFSETMAX= axis options to increase the axis minimum and maximum offsets to accommodate the discrete offset.

DRAWSPACE=GRAPHPERCENT | GRAPHPIXEL | LAYOUTPERCENT | LAYOUTPIXEL | WALLPERCENT | WALLPIXEL | DATAPERCENT | DATAPIXEL | DATAVALUE

specifies a default drawing space and drawing units for this draw statement.

Default LAYOUTPERCENT

Interactions This statement and all of the draw statements inherit the global DRAWPSACE= setting from the DRAWSPACE= option in the BEGINGRAPH statement. Setting this option changes the setting for only this draw statement.

This option sets the default drawing space, but individual settings in the X or Y dimension can be overridden by the options X1SPACE=, Y1SPACE=, X2SPACE=, or Y2SPACE=.

See "About the Drawing Space and Drawing Units" on page 1398

LAYER=FRONT | BACK

specifies the layer on which this draw statement's output is drawn.

FRONT
draws the output on top of the graph.

BACK
draws the output behind the background areas, such as a layout or legend background.

Default FRONT

Tip For elements that are obstructed because they are in the back layer, you can suppress the display of filled areas in the graph. You can also use transparency to manage the element visibility. For more information, see "About Drawing Layers" on page 1402 .

LINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)

specifies the line attributes for this draw statement.

Default The GraphAnnoLine style element.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

TRANSPARENCY=*number*

specifies the degree of the transparency of this draw statement's output.

Default 0

Range 0–1, where 0 is opaque and 1 is entirely transparent

URL="*string*" | *string-expression*
specifies an HTML page that is displayed when the output of this draw statement is selected.

Note: This option is valid starting in SAS 9.4M1.

"string"
string-expression
specifies a valid HTML page reference (HREF) for the graphical element that is drawn by this draw statement.

Example `http://www.sas.com`

Restriction Links specified with URL= are not supported in SVG output in HTML. In that case, use a raster image format such as PNG.

Requirement To generate selectable graphical elements, you must include an ODS GRAPHICS ON statement that specifies the IMAGEMAP option, and you must write the output to the ODS HTML destination.

Tip By default, drill-down links open in a new browser window (link target _blank). To specify a different target for your drill-down links, such as _self or _parent, add the DRILLTARGET="*target*" option to your ODS GRAPHICS statement. See DRILLTARGET= on page 1568.

XAXIS=X | X2
specifies whether the data value for the arguments X1 and X2 is interpreted using the primary X-axis scale or to the secondary X (X2) axis scale.

Default X

Interaction This option has effect only if X1SPACE=DATAVALUE.

X1SPACE=GRAPHPERCENT | GRAPHPIXEL | LAYOUTPERCENT | LAYOUTPIXEL | WALLPERCENT | WALLPIXEL | DATAPERCENT | DATAPIXEL | DATAVALUE
specifies the drawing space and drawing units for interpreting the X1 value.

Default The setting that is in effect for the DRAWSPACE= option.

Interaction This option overrides the DRAWSPACE= setting only for the X1 value.

X2SPACE=GRAPHPERCENT | GRAPHPIXEL | LAYOUTPERCENT | LAYOUTPIXEL | WALLPERCENT | WALLPIXEL | DATAPERCENT | DATAPIXEL | DATAVALUE
specifies the drawing space and drawing units for interpreting the X2 value

Default The setting that is in effect for the DRAWSPACE= option.

Interaction This option overrides the DRAWSPACE= setting only for the X2 value.

YAXIS=Y | Y2
specifies whether the data value for the arguments Y1 and Y2 is interpreted using the primary Y-axis scale or to the secondary Y (Y2) axis scale.

Default Y

Interaction This option has effect only if Y1SPACE=DATAVALUE.

Y1SPACE=GRAPHPERCENT | GRAPHPIXEL | LAYOUTPERCENT | LAYOUTPIXEL | WALLPERCENT | WALLPIXEL | DATAPERCENT | DATAPIXEL | DATAVALUE
specifies the drawing space and drawing units for interpreting the Y1 value.

Default The setting that is in effect for the DRAWSPACE= option.

Interaction This option overrides the DRAWSPACE= setting only for the Y1 value.

Y2SPACE=GRAPHPERCENT | GRAPHPIXEL | LAYOUTPERCENT | LAYOUTPIXEL | WALLPERCENT | WALLPIXEL | DATAPERCENT | DATAPIXEL | DATAVALUE
specifies the drawing space and drawing units for interpreting the Y2 value

Default The setting that is in effect for the DRAWSPACE= option.

Interaction This option overrides the DRAWSPACE= setting only for the Y2 value.

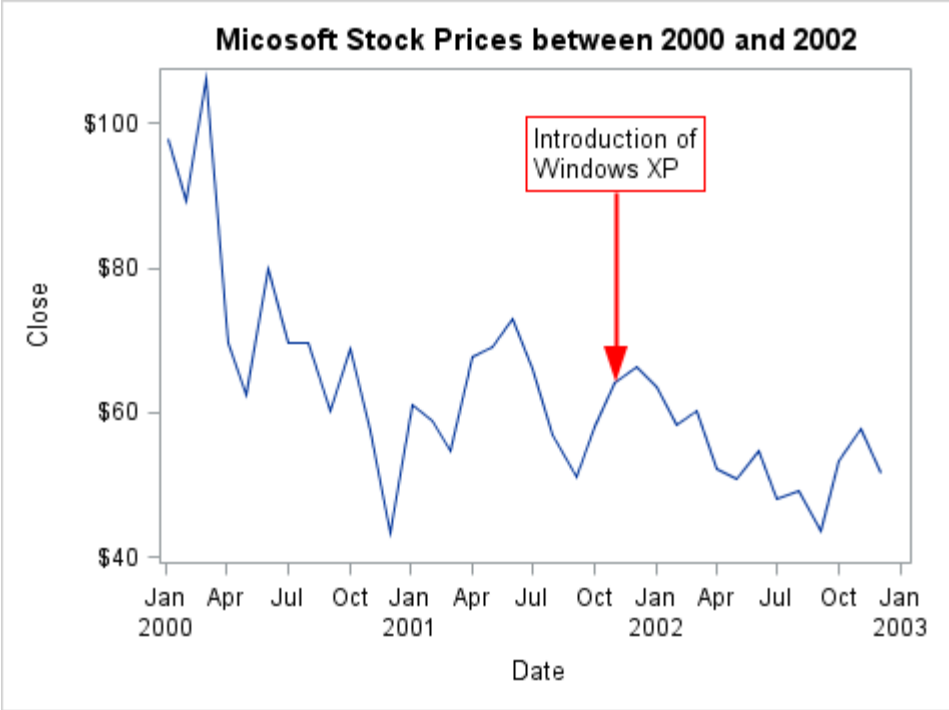
Details

A DRAWARROW statement draws a line (arrow shaft) from a specified starting point (X1,Y1) to a specified ending point (X2,Y2). It also displays an arrowhead at either or both ends of the line. DRAWARROW is similar to a DRAWLINE statement, using many of the same options, but it has additional options for controlling the arrowhead(s).

For general information about the types of elements that can be drawn with the draw statements, the drawing space and drawing units that they use, and how the drawn elements are anchored, see Chapter 13, "Key Concepts for Using Draw Statements," on page 1395 . For detailed usage information, consult the *SAS Graph Template Language: User's Guide*.

Example: DRAWARROW Statement

The following graph was generated by the "Example Program" on page 1427. The example shows a common application of a DRAWARROW and DRAWTEXT statements to identify a specific part of the graph and add explanatory text.



Example Program

```
proc template;
  define statgraph arrow;
    begingraph;
      entrytitle "Micosoft Stock Prices between 2000 and 2002";
      layout overlay;
        seriesplot x=date y=close;
        drawarrow x1="01NOV2001"d  y1=75 x2="01NOV2001"d y2=64.21 /
           x1space=datavalue y1space=wallpercent
           x2space=datavalue y2space=datavalue
           arrowheadshape=filled lineattrs=(color=red) ;
        drawtext "Introduction of Windows XP" / width=25 anchor=bottom
           border=true borderattrs=(color=red)
           x="01NOV2001"d y=75 xspace=datavalue yspace=wallpercent;
      endlayout;
    endgraph;
  end;

proc sgrender data=sashelp.stocks template=arrow;
  where stock="Microsoft" and Year(date) between 2000 and 2002;
run;
```

DRAWIMAGE Statement

Draws an image in the graph.

Syntax

DRAWIMAGE *"image-file-spec"* < */options* >;

Summary of Optional Arguments

Appearance options

BORDER=TRUE | FALSE
: specifies whether a border is drawn around the image.

BORDERATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
: specifies the border line attributes for this draw statement.

LAYER=FRONT | BACK
: specifies the layer on which this draw statement's output is drawn.

ROTATE=*number*
: specifies the angle of rotation for the image, measured in degrees.

TRANSPARENCY=*number*
: specifies the degree of the transparency of this draw statement's output.

Axes options

DISCRETEOFFSET=*number*
: specifies an amount to offset from the discrete X values, or the discrete Y values, or both.

XAXIS=X | X2
: specifies whether the data value for the arguments X1 and X2 is interpreted using the primary X-axis scale or to the secondary X (X2) axis scale.

YAXIS=Y | Y2
: specifies whether the data value for the arguments Y1 and Y2 is interpreted using the primary Y-axis scale or to the secondary Y (Y2) axis scale.

Drawing space options

DRAWSPACE=GRAPHPERCENT | GRAPHPIXEL | LAYOUTPERCENT | LAYOUTPIXEL | WALLPERCENT | WALLPIXEL | DATAPERCENT | DATAPIXEL | DATAVALUE
: specifies a default drawing space and drawing units for this draw statement.

XSPACE=GRAPHPERCENT | GRAPHPIXEL | LAYOUTPERCENT | LAYOUTPIXEL | WALLPERCENT | WALLPIXEL | DATAPERCENT | DATAPIXEL | DATAVALUE
: specifies the drawing space and drawing units for interpreting the value that is specified in the X= option.

YSPACE=GRAPHPERCENT | GRAPHPIXEL | LAYOUTPERCENT | LAYOUTPIXEL | WALLPERCENT | WALLPIXEL | DATAPERCENT | DATAPIXEL | DATAVALUE
: specifies the drawing space and drawing units for interpreting the value that is specified in the Y= option.

Location options

ANCHOR=CENTER | TOPLEFT | TOP | TOPRIGHT | LEFT | RIGHT | BOTTOMLEFT | BOTTOM | BOTTOMRIGHT
: specifies an anchor point for the image.

X=*constant* | *scalar-expression*
: specifies the anchor point's X coordinate.

Y=*constant* | *scalar-expression*
: specifies the anchor point's Y coordinate.

ODS options

URL="*string*" | *string-expression*
: specifies an HTML page that is displayed when the output of this draw statement is selected.

Size options

HEIGHT=*positive-number*
: specifies the height of the image's bounding box.

HEIGHTUNIT=PERCENT | PIXEL | DATA
: specifies whether the *positive-number* that is specified in the HEIGHT= option is interpreted as a percentage value, a pixel value, or a value that is in the units of the data.

SCALE=FIT | FITHEIGHT | FITWIDTH | TILE
: specifies how the image is scaled within the bounding box.

SIZEUNIT=PERCENT | PIXEL | DATA
: specifies whether the default units for the size of the image's bounding box are percentage values, or pixel values, or values that are in the unit of the data.

WIDTH=*positive-number*
: specifies the width of the image's bounding box.

WIDTHUNIT=PERCENT | PIXEL | DATA
: specifies whether the *positive-number* that is specified in the WIDTH= option is interpreted as a percentage value, a pixel value, or a value that is in the units of the data.

Required Argument

image-file-spec

specifies the name, image type, and location of the image. The *image-file-spec* value must be enclosed in double quotation marks and must be specified as a local, physical file path (for example, "`c:\temp\saslogo.gif`"). The supported image types are GIF, JPEG, and PNG raster or bitmap format.

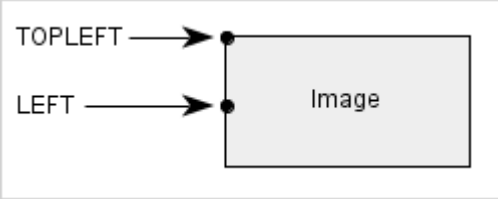
Restrictions
: URL access to image files is not supported. The image file must exist on the file system.

  In SAS 9.4 and earlier releases, you cannot use a dynamic variable for the *image-file-spec* value. This restriction is removed starting with SAS 9.4M1.

Optional Arguments

ANCHOR=CENTER | TOPLEFT | TOP | TOPRIGHT | LEFT | RIGHT | BOTTOMLEFT | BOTTOM | BOTTOMRIGHT

specifies an anchor point for the image. The anchor point is relative to the unrotated image. The anchor point can be at the center of the image or at eight points on the border of the image bounding box. The following figure shows the anchor points for TOPLEFT and LEFT.



The coordinates of the anchor point are set by the X= and Y= options, and by the XSPACE= and YSPACE= options. The XAXIS= and YAXIS= option might affect positioning when the XSPACE= or YSPACE= options are set to DATAPIXEL, DATAPERCENT, or DATAVALUE.

The image has a fixed height and a fixed width, determined by the HEIGHT=, HEIGHTUNIT=, WIDTH= and WIDTHUNIT= options. The height of the text grows in a direction that is related to the anchor point. For example, if ANCHOR=TOPLEFT, then the image height extends downward from the anchor point and its width extends to the right. If ANCHOR=CENTER, then half the image width and half the image height extend equally left and right, as well as top to bottom from the anchor point. If ANCHOR=BOTTOM, then the image height extends upward from the anchor point and the image width is centered at the anchor point.

When the image is rotated, the anchor point remains relative to the unrotated image while the image is rotated on its anchor point. See ROTATE= on page 1432.

Default CENTER

BORDER=TRUE | FALSE

specifies whether a border is drawn around the image.

Default FALSE

Tip Use the BORDERATTRS= option to control the appearance of the border.

See “boolean ” on page xii for other Boolean values that you can use.

BORDERATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)

specifies the border line attributes for this draw statement.

Default The GraphBorderLines style element.

Interaction BORDER=TRUE must be set for this option to have any effect.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

DISCRETEOFFSET=*number*
specifies an amount to offset from the discrete X values, or the discrete Y values, or both.

Default 0 (no offset, output is centered on the discrete X values, or the discrete Y values, or both)

Range –0.5 to +0.5, where 0.5 represents half the distance between discrete ticks. If the X axis is discrete, then a positive offset is to the right. If the Y axis is discrete, then a positive offset is up. If REVERSE=TRUE on the X or Y axis, then the offset direction is also reversed.

Restriction This option applies only when the options XSPACE= or YSPACE= use DATAVALUE, and when X or Y are values on a discrete axis. For nondiscrete axes, this option is ignored.

Tip Setting the discrete offset for the plots does not affect the axis minimum and maximum offsets. In some cases, setting a discrete offset can cause clipping at each end of the axis. In those cases, use the OFFSETMIN= and OFFSETMAX= axis options to increase the axis minimum and maximum offsets to accommodate the discrete offset.

DRAWSPACE=GRAPHPERCENT | GRAPHPIXEL | LAYOUTPERCENT | LAYOUTPIXEL | WALLPERCENT | WALLPIXEL | DATAPERCENT | DATAPIXEL | DATAVALUE
specifies a default drawing space and drawing units for this draw statement.

Default LAYOUTPERCENT

Interactions This statement and all of the draw statements inherit the global DRAWPSACE= setting from the DRAWSPACE= option in the BEGINGRAPH statement. Setting this option changes the setting for only this draw statement.

This option sets the default drawing space, but individual settings in the X or Y dimension can be overridden by the options XSPACE=, YSPACE=, HEIGHTUNIT=, or WIDTHUNIT=.

See "About the Drawing Space and Drawing Units" on page 1398

HEIGHT=*positive-number*
specifies the height of the image's bounding box.

Default The height of the image.

Interaction The interpretation of this height setting is determined by the combined settings of the HEIGHTUNIT= and YSPACE= options.

HEIGHTUNIT=PERCENT | PIXEL | DATA

specifies whether the *positive-number* that is specified in the HEIGHT= option is interpreted as a percentage value, a pixel value, or a value that is in the units of the data.

Default PERCENT

Interaction This setting combines with the YSPACE= setting to interpret the height that is set in the HEIGHT= option.

LAYER=FRONT | BACK

specifies the layer on which this draw statement's output is drawn.

FRONT
draws the output on top of the graph.

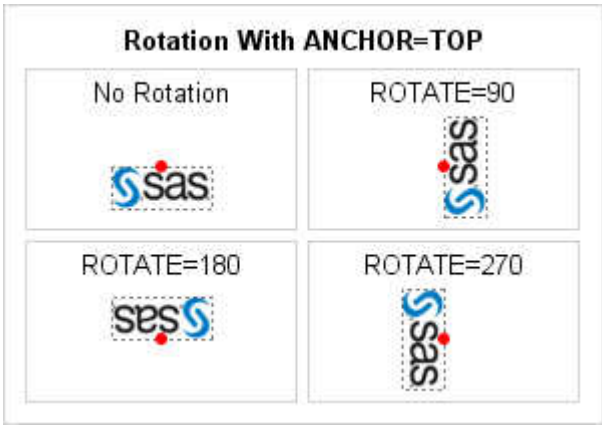
BACK
draws the output behind the background areas, such as a layout or legend background.

Default FRONT

Tip For elements that are obstructed because they are in the back layer, you can suppress the display of filled areas in the graph. You can also use transparency to manage the element visibility. For more information, see "About Drawing Layers" on page 1402 .

ROTATE=*number*

specifies the angle of rotation for the image, measured in degrees. The image is rotated around its anchor point. The angle is measured from a horizontal line passing through the anchor point of the image to the right. The following figure shows the rotation of an image around a top anchor point.



Positive angles rotate the image counter clockwise, and negative angles rotate the image clockwise. The angle specification can exceed 360 degrees in absolute value.

Default 0. No rotation is performed.

Note If you specify the SVG format for your graph and your graph includes a rotated image, then the graph is rendered as a bitmapped image rather

than an SVG image. In that case, a note is written to the SAS log indicating the change in format.

See ANCHOR= on page 1430

SCALE=FIT | FITHEIGHT | FITWIDTH | TILE
specifies how the image is scaled within the bounding box.

FIT
scales the image to fit the bounding box.

Aspect ratio is not maintained.

FITHEIGHT
scales the image to fit the height of the bounding box.

The width is computed from the height and the image's aspect ratio.

FITWIDTH
scales the image to fit the width of the bounding box.

The height is computed from the width and the image's aspect ratio.

TILE
tiles the image as needed to fit the bounding image.

The last tile in a row or column might be clipped by the bounding box.

Default FIT

SIZEUNIT=PERCENT | PIXEL | DATA
specifies whether the default units for the size of the image's bounding box are percentage values, or pixel values, or values that are in the unit of the data.

Default PERCENT

Interaction If the HEIGHTUNIT= or WIDTHUNIT= option is also used, then it overrides this option for that dimension.

TRANSPARENCY=*number*
specifies the degree of the transparency of this draw statement's output.

Default 0

Range 0–1, where 0 is opaque and 1 is entirely transparent

Note This option also affects the image border.

URL="*string*" | *string-expression*
specifies an HTML page that is displayed when the output of this draw statement is selected.

Note: This option is valid starting in SAS 9.4M1.

"string"
string-expression
specifies a valid HTML page reference (HREF) for the graphical element that is drawn by this draw statement.

Example `http://www.sas.com`

Restriction Links specified with URL= are not supported in SVG output in HTML. In that case, use a raster image format such as PNG.

Requirement To generate selectable graphical elements, you must include an ODS GRAPHICS ON statement that specifies the IMAGEMAP option, and you must write the output to the ODS HTML destination.

Tip By default, drill-down links open in a new browser window (link target _blank). To specify a different target for your drill-down links, such as _self or _parent, add the DRILLTARGET="*target*" option to your ODS GRAPHICS statement. See DRILLTARGET= on page 1568.

WIDTH=*positive-number*
specifies the width of the image's bounding box.

Default The width of the image.

WIDTHUNIT=PERCENT | PIXEL | DATA
specifies whether the *positive-number* that is specified in the WIDTH= option is interpreted as a percentage value, a pixel value, or a value that is in the units of the data.

Default PERCENT

Interaction This setting combines with the XSPACE= setting to interpret the width that is set in the WIDTH= option.

X=*constant* | *scalar-expression*
specifies the anchor point's X coordinate.

Default 50

Interactions The DRAWSPACE= option determines the default interpretation of the units for this setting. You can override the default with the XSPACE= option.

If XSPACE=DATAVALUE, then this option's value is interpreted using the XAXIS= option.

Note When XSPACE=DATAVALUE and a character value is specified, leading blanks are honored and trailing blanks are ignored when the specified value is compared with the data values.

XAXIS=X | X2
specifies whether the data value for the arguments X1 and X2 is interpreted using the primary X-axis scale or to the secondary X (X2) axis scale.

Default X

Interaction This option has effect only if XSPACE=DATAVALUE.

XSPACE=GRAPHPERCENT | GRAPHPIXEL | LAYOUTPERCENT | LAYOUTPIXEL | WALLPERCENT | WALLPIXEL | DATAPERCENT | DATAPIXEL | DATAVALUE
specifies the drawing space and drawing units for interpreting the value that is specified in the X= option.

Default The setting that is in effect for the DRAWSPACE= option.

Y=*constant* | *scalar-expression*
specifies the anchor point's Y coordinate.

Default 50

Interactions The DRAWSPACE= option determines the default interpretation of the units for this setting. You can override the default with the YSPACE= option.

If YSPACE=DATAVALUE, then this option's value is interpreted using the YAXIS= option.

Note When YSPACE=DATAVALUE and a character value is specified, leading blanks are honored and trailing blanks are ignored when the specified value is compared with the data values.

YAXIS=Y | Y2
specifies whether the data value for the arguments Y1 and Y2 is interpreted using the primary Y-axis scale or to the secondary Y (Y2) axis scale.

Default Y

Interaction This option has effect only if YSPACE=DATAVALUE.

YSPACE=GRAPHPERCENT | GRAPHPIXEL | LAYOUTPERCENT | LAYOUTPIXEL | WALLPERCENT | WALLPIXEL | DATAPERCENT | DATAPIXEL | DATAVALUE
specifies the drawing space and drawing units for interpreting the value that is specified in the Y= option.

Default The setting that is in effect for the DRAWSPACE= option.

Details

A DRAWIMAGE statement draws an image in a graph. By default, the image is drawn in the center of the graph. You can change the default position with the options ANCHOR=, X=, Y=, XSPACE=, and YSPACE=. By default, the image is drawn in the actual image size. You can change the default size with the WIDTH= and HEIGHT= options.

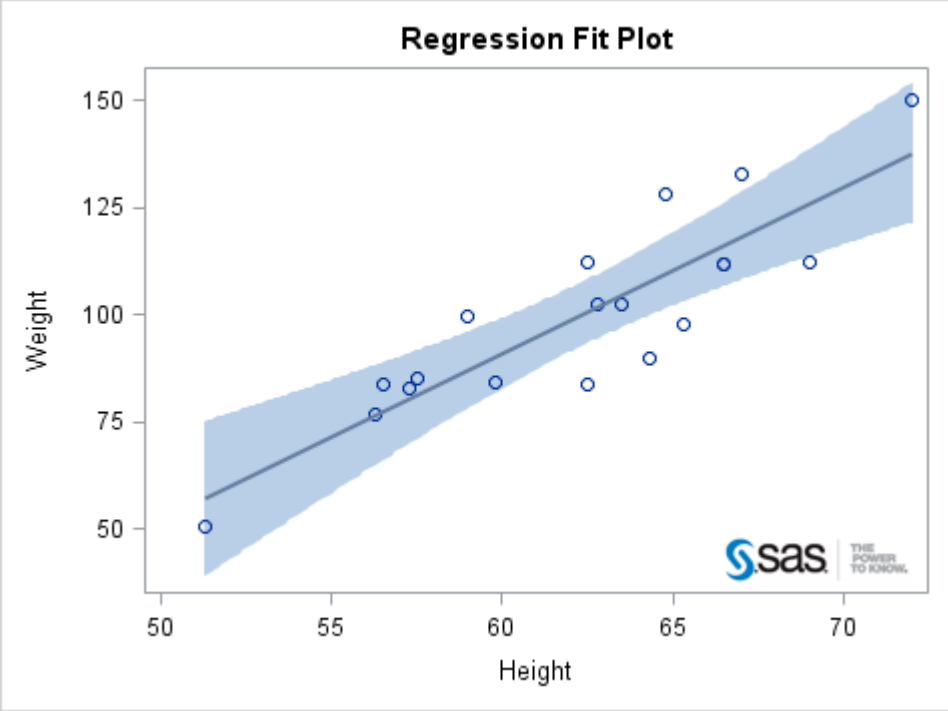
For general information about the types of elements that can be drawn with the draw statements, the drawing space and drawing units that they use, and how the

drawn elements are anchored, see Chapter 13, "Key Concepts for Using Draw Statements," on page 1395 . For detailed usage information, consult the *SAS Graph Template Language: User's Guide*.

Example: DRAWIMAGE Statement

Example Graph

The following graph was generated by the "Example Program" on page 1436. The example shows how to display an image in the bottom right corner of the graph wall.



Example Program

```
proc template;
  define statgraph image;
    begingraph;
      entrytitle "Regression Fit Plot";
      layout overlay;
        modelband "myclm";
        scatterplot x=height y=weight / primary=true;
        regressionplot x=height y=weight / alpha=0.01 clm="myclm";
        drawimage "c:\temp\saslogo.gif" /
```

```
            anchor=bottomright x=98 y=2
            drawspace=wallpercent ;
        endlayout;
      endgraph;
    end;

proc sgrender data=sashelp.class template=image;
run;
```

DRAWLINE Statement

Draws a line from one point to another point.

Syntax

DRAWLINE X1=*constant* | *scalar-expression*
Y1=*constant* | *scalar-expression*
X2=*constant* | *scalar-expression*
Y2=*constant* | *scalar-expression* < */options* >;

Summary of Optional Arguments

Appearance options

LAYER=FRONT | BACK
: specifies the layer on which this draw statement's output is drawn.

LINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
: specifies the line attributes for this draw statement.

TRANSPARENCY=*number*
: specifies the degree of the transparency of this draw statement's output.

Axes options

DISCRETEOFFSET=*number*
: specifies an amount to offset from the discrete X values, or the discrete Y values, or both.

XAXIS=X | X2
: specifies whether the data value for the arguments X1 and X2 is interpreted using the primary X-axis scale or to the secondary X (X2) axis scale.

YAXIS=Y | Y2
: specifies whether the data value for the arguments Y1 and Y2 is interpreted using the primary Y-axis scale or to the secondary Y (Y2) axis scale.

Drawing space options

DRAWSPACE=GRAPHPERCENT | GRAPHPIXEL | LAYOUTPERCENT | LAYOUTPIXEL | WALLPERCENT | WALLPIXEL | DATAPERCENT | DATAPIXEL | DATAVALUE
: specifies a default drawing space and drawing units for this draw statement.

X1SPACE=GRAPHPERCENT | GRAPHPIXEL | LAYOUTPERCENT | LAYOUTPIXEL | WALLPERCENT | WALLPIXEL | DATAPERCENT | DATAPIXEL | DATAVALUE
: specifies the drawing space and drawing units for interpreting the X1 value.

X2SPACE=GRAPHPERCENT | GRAPHPIXEL | LAYOUTPERCENT | LAYOUTPIXEL | WALLPERCENT | WALLPIXEL | DATAPERCENT | DATAPIXEL | DATAVALUE
: specifies the drawing space and drawing units for interpreting the X2 value

Y1SPACE=GRAPHPERCENT | GRAPHPIXEL | LAYOUTPERCENT | LAYOUTPIXEL | WALLPERCENT | WALLPIXEL | DATAPERCENT | DATAPIXEL | DATAVALUE
: specifies the drawing space and drawing units for interpreting the Y1 value.

Y2SPACE=GRAPHPERCENT | GRAPHPIXEL | LAYOUTPERCENT | LAYOUTPIXEL | WALLPERCENT | WALLPIXEL | DATAPERCENT | DATAPIXEL | DATAVALUE
: specifies the drawing space and drawing units for interpreting the Y2 value

ODS options

URL="*string*" | *string-expression*
: specifies an HTML page that is displayed when the output of this draw statement is selected.

Required Arguments

X1=*constant* | *scalar-expression*

specifies the X value of the starting point for the line.

Interactions
: This value that is set for this option is interpreted using the X1SPACE= option.

  When X1SPACE=DATAVALUE, the value is interpreted using the XAXIS= option.

Note
: When X1SPACE=DATAVALUE and a character value is specified, leading blanks are honored and trailing blanks are ignored when the specified value is compared with the data values.

Y1=*constant* | *scalar-expression*

specifies the Y value of the starting point for the line.

Interactions
: This value that is set for this option is interpreted using the Y1SPACE= option.

When Y1SPACE=DATAVALUE, the value is interpreted using the YAXIS= option.

Note When Y1SPACE=DATAVALUE and a character value is specified, leading blanks are honored and trailing blanks are ignored when the specified value is compared with the data values.

X2=*constant* | *scalar-expression*
specifies the X value of the endpoint for the line.

Interactions This value that is set for this option is interpreted using the X2SPACE= option.

When X2SPACE=DATAVALUE, the value is interpreted using the XAXIS= option.

Note When X2SPACE=DATAVALUE and a character value is specified, leading blanks are honored and trailing blanks are ignored when the specified value is compared with the data values.

Y2=*constant* | *scalar-expression*
specifies the Y value of the endpoint for the line.

Interactions This value that is set for this option is interpreted using the Y2SPACE= option.

When Y2SPACE=DATAVALUE, the value is interpreted using the YAXIS= option.

Note When Y2SPACE=DATAVALUE and a character value is specified, leading blanks are honored and trailing blanks are ignored when the specified value is compared with the data values.

Optional Arguments

DISCRETEOFFSET=*number*
specifies an amount to offset from the discrete X values, or the discrete Y values, or both.

Default 0 (no offset, output is centered on the discrete X values, or the discrete Y values, or both)

Range −0.5 to +0.5, where 0.5 represents half the distance between discrete ticks. If the X axis is discrete, then a positive offset is to the right. If the Y axis is discrete, then a positive offset is up. If REVERSE=TRUE on the X or Y axis, then the offset direction is also reversed.

Restriction This option applies only when the options X1SPACE=, X2SPACE=, Y1SPACE=, or Y2SPACE= use DATAVALUE, and when X1, X2, Y1, or Y2 are values on a discrete axis. For nondiscrete axes, this option is ignored.

Tip Setting the discrete offset for the plots does not affect the axis minimum and maximum offsets. In some cases, setting a discrete offset can cause clipping at each end of the axis. In those cases, use the OFFSETMIN= and OFFSETMAX= axis options to increase the axis minimum and maximum offsets to accommodate the discrete offset.

DRAWSPACE=GRAPHPERCENT | GRAPHPIXEL | LAYOUTPERCENT | LAYOUTPIXEL | WALLPERCENT | WALLPIXEL | DATAPERCENT | DATAPIXEL | DATAVALUE

specifies a default drawing space and drawing units for this draw statement.

Default LAYOUTPERCENT

Interactions This statement and all of the draw statements inherit the global DRAWPSACE= setting from the DRAWSPACE= option in the BEGINGRAPH statement. Setting this option changes the setting for only this draw statement.

This option sets the default drawing space, but individual settings in the X or Y dimension can be overridden by the options X1SPACE=, Y1SPACE=, X2SPACE=, or Y2SPACE=.

See "About the Drawing Space and Drawing Units" on page 1398

LAYER=FRONT | BACK

specifies the layer on which this draw statement's output is drawn.

FRONT
draws the output on top of the graph.

BACK
draws the output behind the background areas, such as a layout or legend background.

Default FRONT

Tip For elements that are obstructed because they are in the back layer, you can suppress the display of filled areas in the graph. You can also use transparency to manage the element visibility. For more information, see "About Drawing Layers" on page 1402 .

LINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)

specifies the line attributes for this draw statement.

Default The GraphAnnoLine style element.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

TRANSPARENCY=*number*

specifies the degree of the transparency of this draw statement's output.

Default 0

Range 0–1, where 0 is opaque and 1 is entirely transparent

URL="*string*" | *string-expression*
specifies an HTML page that is displayed when the output of this draw statement is selected.

Note: This option is valid starting in SAS 9.4M1.

"string"
string-expression
specifies a valid HTML page reference (HREF) for the graphical element that is drawn by this draw statement.

Example `http://www.sas.com`

Restriction Links specified with URL= are not supported in SVG output in HTML. In that case, use a raster image format such as PNG.

Requirement To generate selectable graphical elements, you must include an ODS GRAPHICS ON statement that specifies the IMAGEMAP option, and you must write the output to the ODS HTML destination.

Tip By default, drill-down links open in a new browser window (link target _blank). To specify a different target for your drill-down links, such as _self or _parent, add the DRILLTARGET="*target*" option to your ODS GRAPHICS statement. See DRILLTARGET= on page 1568.

XAXIS=X | X2
specifies whether the data value for the arguments X1 and X2 is interpreted using the primary X-axis scale or to the secondary X (X2) axis scale.

Default X

Interaction This option has effect only if X1SPACE=DATAVALUE.

X1SPACE=GRAPHPERCENT | GRAPHPIXEL | LAYOUTPERCENT | LAYOUTPIXEL | WALLPERCENT | WALLPIXEL | DATAPERCENT | DATAPIXEL | DATAVALUE
specifies the drawing space and drawing units for interpreting the X1 value.

Default The setting that is in effect for the DRAWSPACE= option.

Interaction This option overrides the DRAWSPACE= setting only for the X1 value.

X2SPACE=GRAPHPERCENT | GRAPHPIXEL | LAYOUTPERCENT | LAYOUTPIXEL | WALLPERCENT | WALLPIXEL | DATAPERCENT | DATAPIXEL | DATAVALUE
specifies the drawing space and drawing units for interpreting the X2 value

Default The setting that is in effect for the DRAWSPACE= option.

Interaction This option overrides the DRAWSPACE= setting only for the X2 value.

YAXIS=Y | Y2
specifies whether the data value for the arguments Y1 and Y2 is interpreted using the primary Y-axis scale or to the secondary Y (Y2) axis scale.

Default Y

Interaction This option has effect only if Y1SPACE=DATAVALUE.

Y1SPACE=GRAPHPERCENT | GRAPHPIXEL | LAYOUTPERCENT | LAYOUTPIXEL | WALLPERCENT | WALLPIXEL | DATAPERCENT | DATAPIXEL | DATAVALUE
specifies the drawing space and drawing units for interpreting the Y1 value.

Default The setting that is in effect for the DRAWSPACE= option.

Interaction This option overrides the DRAWSPACE= setting only for the Y1 value.

Y2SPACE=GRAPHPERCENT | GRAPHPIXEL | LAYOUTPERCENT | LAYOUTPIXEL | WALLPERCENT | WALLPIXEL | DATAPERCENT | DATAPIXEL | DATAVALUE
specifies the drawing space and drawing units for interpreting the Y2 value

Default The setting that is in effect for the DRAWSPACE= option.

Interaction This option overrides the DRAWSPACE= setting only for the Y2 value.

Details

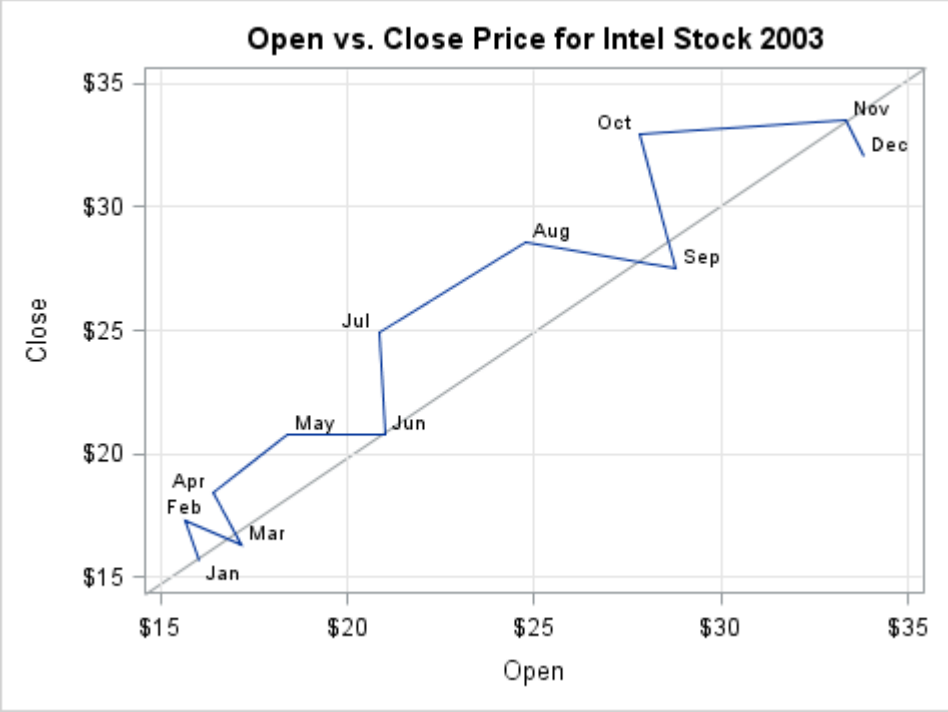
A DRAWLINE statement draws a line from a starting point that is specified with the X1 and Y1 arguments, to an ending point that is specified with the X2 and Y2 arguments. DRAWLINE is similar to a DRAWARROW statement, using many of the same options, but without the options for controlling the arrowhead(s).

For general information about the types of elements that can be drawn with the draw statements, the drawing space and drawing units that they use, and how the drawn elements are anchored, see Chapter 13, "Key Concepts for Using Draw Statements," on page 1395 . For detailed usage information, consult the *SAS Graph Template Language: User's Guide*.

Example: DRAWLINE Statement

The following graph was generated by the "Example Program" on page 1443. The example shows how to draw a diagonal reference line. One endpoint is point 0,0 and the other is point 100,100. Both points are specified in the WALL area with PERCENT units, making it easy to position the line without regard to the axis data ranges or the axis offsets. To draw the line behind the series line and grid lines, you

can set LAYER= BACK and use the parent layout statement to turn off the display of the wall.



Example Program

```
proc template;
  define statgraph diagonal;
    begingraph;
      entrytitle "Open vs. Close Price for Intel Stock 2003";
      layout overlay / walldisplay=(outline)
          xaxisopts=(griddisplay=on)
          yaxisopts=(griddisplay=on);
        seriesplot x=open y=close / datalabel=date;
        drawline x1=0 y1=0 x2=100 y2=100 /
          x1space=wallpercent y1space=wallpercent
          x2space=wallpercent y2space=wallpercent
          lineattrs=GraphReference layer=back ;
      endlayout;
    endgraph;
  end;

proc sgrender data=sashelp.stocks template=diagonal;
  where stock="Intel" and year(date)=2003;
  format date monname3.;
run;
```

DRAWOVAL Statement

Draws an oval in the graph.

Syntax

DRAWOVAL X=*constant* | *scalar-expression*
Y=*constant* | *scalar-expression*
WIDTH=*constant* | *scalar-expression*
HEIGHT=*constant* | *scalar-expression* < */options* >;

Summary of Optional Arguments

Appearance options

DISPLAY=STANDARD | ALL | (*display-options*)
: specifies the features to display for the oval.

FILLATTRS=*style-element* | *style-element* (*fill-options*) | (*fill-options*)
: specifies the fill attributes for this draw statement.

LAYER=FRONT | BACK
: specifies the layer on which this draw statement's output is drawn.

OUTLINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
: specifies the outline attributes for this draw statement.

ROTATE=*number*
: specifies the angle of rotation for the oval, measured in degrees.

TRANSPARENCY=*number*
: specifies the degree of the transparency of this draw statement's output.

Axes options

DISCRETEOFFSET=*number*
: specifies an amount to offset from the discrete X values, or the discrete Y values, or both.

XAXIS=X | X2
: specifies whether the data value for the arguments X1 and X2 is interpreted using the primary X-axis scale or to the secondary X (X2) axis scale.

YAXIS=Y | Y2
: specifies whether the data value for the arguments Y1 and Y2 is interpreted using the primary Y-axis scale or to the secondary Y (Y2) axis scale.

Drawing space options

DRAWSPACE=GRAPHPERCENT | GRAPHPIXEL | LAYOUTPERCENT | LAYOUTPIXEL | WALLPERCENT | WALLPIXEL | DATAPERCENT | DATAPIXEL | DATAVALUE
: specifies a default drawing space and drawing units for this draw statement.

XSPACE=GRAPHPERCENT | GRAPHPIXEL | LAYOUTPERCENT | LAYOUTPIXEL | WALLPERCENT | WALLPIXEL | DATAPERCENT | DATAPIXEL | DATAVALUE
: specifies the drawing space and drawing units for interpreting the value that is specified in the X= option.

YSPACE=GRAPHPERCENT | GRAPHPIXEL | LAYOUTPERCENT | LAYOUTPIXEL | WALLPERCENT | WALLPIXEL | DATAPERCENT | DATAPIXEL | DATAVALUE
: specifies the drawing space and drawing units for interpreting the value that is specified in the Y= option.

Location options

ANCHOR=CENTER | TOPLEFT | TOP | TOPRIGHT | LEFT | RIGHT | BOTTOMLEFT | BOTTOM | BOTTOMRIGHT
: specifies an anchor point for the oval.

ODS options

URL="*string*" | *string-expression*
: specifies an HTML page that is displayed when the output of this draw statement is selected.

Size options

HEIGHTUNIT=PERCENT | PIXEL | DATA
: specifies whether the *positive-number* that is specified in the HEIGHT= option is interpreted as a percentage value, a pixel value, or a value that is in the units of the data.

WIDTHUNIT=PERCENT | PIXEL | DATA
: specifies whether the *positive-number* that is specified in the WIDTH= option is interpreted as a percentage value, a pixel value, or a value that is in the units of the data.

Required Arguments

X=*constant* | *scalar-expression*
specifies the X value of the anchor point.

Interactions
: The value that is set for this argument is interpreted using the XSPACE= option.

  When XSPACE=DATAVALUE, the value is interpreted using the XAXIS= option.

Note
: When XSPACE=DATAVALUE and a character value is specified, leading blanks are honored and trailing blanks are ignored when the specified value is compared with the data values.

Y=*constant* | *scalar-expression*
specifies the Y value of the anchor point.

Interactions The value that is set for this argument is interpreted using the YSPACE= option.

When YSPACE=DATAVALUE, the value is interpreted using the YAXIS= option.

Note When YSPACE=DATAVALUE and a character value is specified, leading blanks are honored and trailing blanks are ignored when the specified value is compared with the data values.

WIDTH=*constant* | *scalar-expression*
specifies the width of the oval.

Interactions The value that is set for this argument is interpreted using the WIDTHUNIT= and XSPACE= options.

When WIDTHUNIT=DATA, the value is interpreted using the XAXIS= option.

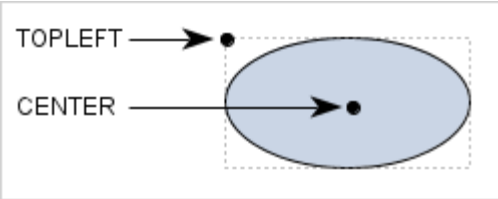
HEIGHT=*constant* | *scalar-expression*
specifies the height of the oval.

Interactions The value that is set for this argument is interpreted using the HEIGHTUNIT= and YSPACE= options.

When HEIGHTUNIT=DATA, the value is interpreted using the YAXIS= option.

Optional Arguments

ANCHOR=CENTER | TOPLEFT | TOP | TOPRIGHT | LEFT | RIGHT | BOTTOMLEFT | BOTTOM | BOTTOMRIGHT
specifies an anchor point for the oval. The anchor point is relative to the unrotated oval. The anchor point can be at the center of the oval or at eight points on the bounding box of the rectangle. The following figure shows the anchor points for TOPLEFT and CENTER.



The coordinates of the anchor point are set by the statement's X and Y values, and by the settings for the XSPACE= and YSPACE= options. The XAXIS= and YAXIS= option might affect positioning when the XSPACE= or YSPACE= options are set to DATAPIXEL, DATAPERCENT, or DATAVALUE.

When the oval is rotated, the anchor point remains relative to the unrotated oval while the oval is rotated on its anchor point. See ROTATE= on page 1449.

Default CENTER

DISCRETEOFFSET=*number*
specifies an amount to offset from the discrete X values, or the discrete Y values, or both.

Default 0 (no offset, output is centered on the discrete X values, or the discrete Y values, or both)

Range –0.5 to +0.5, where 0.5 represents half the distance between discrete ticks. If the X axis is discrete, then a positive offset is to the right. If the Y axis is discrete, then a positive offset is up. If REVERSE=TRUE on the X or Y axis, then the offset direction is also reversed.

Restriction This option applies only when the options XSPACE= or YSPACE= use DATAVALUE, and when X or Y are values on a discrete axis. For nondiscrete axes, this option is ignored.

Tip Setting the discrete offset for the plots does not affect the axis minimum and maximum offsets. In some cases, setting a discrete offset can cause clipping at each end of the axis. In those cases, use the OFFSETMIN= and OFFSETMAX= axis options to increase the axis minimum and maximum offsets to accommodate the discrete offset.

DISPLAY=STANDARD | ALL | (*display-options*)
specifies the features to display for the oval.

STANDARD
displays an outlined oval.

ALL
displays an outlined, filled oval.

(*display-options*)
specifies a space-separated list of one or more display options, enclosed in parentheses.

The list can contain one or both of the following options:

OUTLINE displays an outlined oval

FILL displays a filled oval

Default STANDARD

Tip Use the OUTLINEATTRS= and FILLATTRS= options to control the appearance of the oval.

DRAWSPACE=GRAPHPERCENT | GRAPHPIXEL | LAYOUTPERCENT | LAYOUTPIXEL | WALLPERCENT | WALLPIXEL | DATAPERCENT | DATAPIXEL | DATAVALUE
specifies a default drawing space and drawing units for this draw statement.

Default LAYOUTPERCENT

Interactions This statement and all of the draw statements inherit the global DRAWPSACE= setting from the DRAWSPACE= option in the BEGINGRAPH statement. Setting this option changes the setting for only this draw statement.

This option sets the default drawing space, but individual settings in the X or Y dimension can be overridden by the options XSPACE=, YSPACE=, HEIGHTUNIT=, or WIDTHUNIT=.

See "About the Drawing Space and Drawing Units" on page 1398

FILLATTRS=*style-element* | *style-element* (*fill-options*) | (*fill-options*)
specifies the fill attributes for this draw statement.

Default The GraphAnnoShape style element Color attribute

Tip The TRANSPARENCY= option sets the transparency for the fill and the outline. You can combine this option with TRANSPARENCY= to set one transparency for the outline but a different transparency for the fill. Example:

```
transparency=0.2 fillattrs=(transparency=0.6)
```

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Fill Color Options" on page 1600 for available *fill-options*.

HEIGHTUNIT=PERCENT | PIXEL | DATA
specifies whether the *positive-number* that is specified in the HEIGHT= option is interpreted as a percentage value, a pixel value, or a value that is in the units of the data.

Default PERCENT

Interaction This setting combines with the YSPACE= setting to interpret the height that is set in the HEIGHT= option.

LAYER=FRONT | BACK
specifies the layer on which this draw statement's output is drawn.

FRONT
draws the output on top of the graph.

BACK
draws the output behind the background areas, such as a layout or legend background.

Default FRONT

Tip For elements that are obstructed because they are in the back layer, you can suppress the display of filled areas in the graph. You can also use transparency to manage the element visibility. For more information, see "About Drawing Layers" on page 1402 .

OUTLINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the outline attributes for this draw statement.

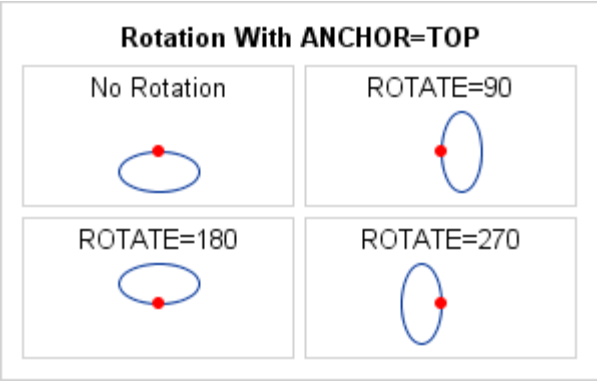
Default The GraphAnnoLine style element.

Interaction For this option to have any effect, the outline must be enabled by the DISPLAY= option or by the ODS style that is in effect.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

ROTATE=*number*
specifies the angle of rotation for the oval, measured in degrees. The angle is measured as if a horizontal line extended to the right through the oval anchor point as shown in the following figure.



Positive angles rotate the oval counter clockwise, and negative angles rotate the oval clockwise. The angle specification can exceed 360 degrees in absolute value.

Default 0. No rotation is performed

See ANCHOR= on page 1446

TRANSPARENCY=*number*
specifies the degree of the transparency of this draw statement's output.

Default 0

Range 0–1, where 0 is opaque and 1 is entirely transparent

Tip The FILLATTRS= option can be used to set transparency for just the filled area. You can combine this option with FILLATTRS= to set one transparency for the outline but a different transparency for the fill. Here is an example:

```
transparency=0.2 fillattrs=(transparency=0.6)
```

URL="*string*" | *string-expression*
specifies an HTML page that is displayed when the output of this draw statement is selected.

Note: This option is valid starting in SAS 9.4M1.

"string"
string-expression
specifies a valid HTML page reference (HREF) for the graphical element that is drawn by this draw statement.

Example `http://www.sas.com`

Restriction Links specified with URL= are not supported in SVG output in HTML. In that case, use a raster image format such as PNG.

Requirement To generate selectable graphical elements, you must include an ODS GRAPHICS ON statement that specifies the IMAGEMAP option, and you must write the output to the ODS HTML destination.

Tip By default, drill-down links open in a new browser window (link target _blank). To specify a different target for your drill-down links, such as _self or _parent, add the DRILLTARGET="*target*" option to your ODS GRAPHICS statement. See DRILLTARGET= on page 1568.

WIDTHUNIT=PERCENT | PIXEL | DATA
specifies whether the *positive-number* that is specified in the WIDTH= option is interpreted as a percentage value, a pixel value, or a value that is in the units of the data.

Default PERCENT

Interaction This setting combines with the XSPACE= setting to interpret the width that is set in the WIDTH= option.

XAXIS=X | X2
specifies whether the data value for the arguments X1 and X2 is interpreted using the primary X-axis scale or to the secondary X (X2) axis scale.

Default X

Interaction This option has effect only if XSPACE=DATAVALUE.

XSPACE=GRAPHPERCENT | GRAPHPIXEL | LAYOUTPERCENT | LAYOUTPIXEL | WALLPERCENT | WALLPIXEL | DATAPERCENT | DATAPIXEL | DATAVALUE
specifies the drawing space and drawing units for interpreting the value that is specified in the X= option.

Default The setting that is in effect for the DRAWSPACE= option.

YAXIS=Y | Y2
specifies whether the data value for the arguments Y1 and Y2 is interpreted using the primary Y-axis scale or to the secondary Y (Y2) axis scale.

Default Y

Interaction This option has effect only if YSPACE=DATAVALUE.

YSPACE=GRAPHPERCENT | GRAPHPIXEL | LAYOUTPERCENT | LAYOUTPIXEL | WALLPERCENT | WALLPIXEL | DATAPERCENT | DATAPIXEL | DATAVALUE
specifies the drawing space and drawing units for interpreting the value that is specified in the Y= option.

Default The setting that is in effect for the DRAWSPACE= option.

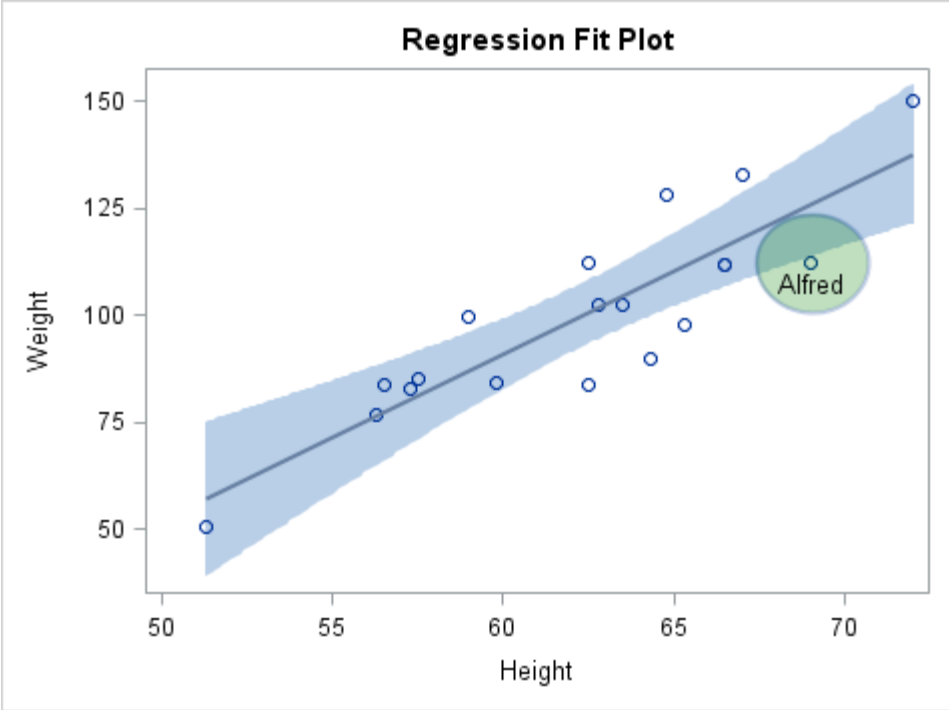
Details

A DRAWOVAL statement draws an oval in a graph. The oval position is determined by the X and Y anchor points, and the size is determined by the HEIGHT and WIDTH settings. You can manage the oval position with the options ANCHOR= , XSPACE= , and YSPACE= . You can manage the oval size with the HEIGHTUNIT= and WIDTHUNIT= options.

For general information about the types of elements that can be drawn with the draw statements, the drawing space and drawing units that they use, and how the drawn elements are anchored, see Chapter 13, “Key Concepts for Using Draw Statements,” on page 1395 . For detailed usage information, consult the *SAS Graph Template Language: User’s Guide*.

Example: DRAWOVAL Statement

The following graph was generated by the “Example Program” on page 1452. The example uses DRAWOVAL to highlight a student’s data point. It draws an oval around the marker symbol that represents the student’s height and weight, and it displays the student’s name inside the oval. In the BEGINGRAPH statement, the setting for the DRAWSPACE= option sets the drawing space and drawing units for the DRAWOVAL and DRAWTEXT statements. In the DRAWOVAL statement, setting TRANSPARENCY=0.75 ensures that the marker for Alfred is visible behind the oval. The DRAWTEXT statement draws the text that identifies the student’s name, using the ANCHOR=, X=, and Y= options to position the text within the oval.



Example Program

```
proc template;
  define statgraph drawoval;
    begingraph / drawspace=datavalue;
      entrytitle "Regression Fit Plot";
      layout overlay;
        modelband "myclm";
        scatterplot x=height y=weight;
        regressionplot x=height y=weight / alpha=0.01 clm="myclm";
          drawoval x=69 y=112.5 width=15 height=20 /
            display=all fillattrs=(color=green)
            transparency=0.75 ;
          drawtext "Alfred" / x=69 y=112 anchor=top;
      endlayout;
    endgraph;
  end;

proc sgrender data=sashelp.class template=drawoval;
run;
```

DRAWRECTANGLE Statement

Draws a rectangle in the graph.

Syntax

DRAWRECTANGLE X=*constant* | *scalar-expression*
Y=*constant* | *scalar-expression*
WIDTH=*constant* | *scalar-expression*
HEIGHT=*constant* | *scalar-expression* < /*options* >;

Summary of Optional Arguments

Appearance options

CORNERRADIUS=*number*
: specifies the radius of the rectangle corners.

DISPLAY=STANDARD | ALL | (*display-options*)
: specifies the features to display for the rectangle.

FILLATTRS=*style-element* | *style-element* (*fill-options*) | (*fill-options*)
: specifies the fill attributes for this draw statement.

LAYER=FRONT | BACK
: specifies the layer on which this draw statement's output is drawn.

OUTLINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
: specifies the outline attributes for this draw statement.

ROTATE=*number*
: specifies the angle of rotation for the rectangle, measured in degrees.

TRANSPARENCY=*number*
: specifies the degree of the transparency of this draw statement's output.

Axes options

DISCRETEOFFSET=*number*
: specifies an amount to offset from the discrete X values, or the discrete Y values, or both.

XAXIS=X | X2
: specifies whether the data value for the arguments X1 and X2 is interpreted using the primary X-axis scale or to the secondary X (X2) axis scale.

YAXIS=Y | Y2
: specifies whether the data value for the arguments Y1 and Y2 is interpreted using the primary Y-axis scale or to the secondary Y (Y2) axis scale.

Drawing space options

DRAWSPACE=GRAPHPERCENT | GRAPHPIXEL | LAYOUTPERCENT | LAYOUTPIXEL | WALLPERCENT | WALLPIXEL | DATAPERCENT | DATAPIXEL | DATAVALUE
: specifies a default drawing space and drawing units for this draw statement.

XSPACE=GRAPHPERCENT | GRAPHPIXEL | LAYOUTPERCENT | LAYOUTPIXEL | WALLPERCENT | WALLPIXEL | DATAPERCENT | DATAPIXEL | DATAVALUE

specifies the drawing space and drawing units for interpreting the value that is specified in the X= option.

YSPACE=GRAPHPERCENT | GRAPHPIXEL | LAYOUTPERCENT | LAYOUTPIXEL | WALLPERCENT | WALLPIXEL | DATAPERCENT | DATAPIXEL | DATAVALUE

specifies the drawing space and drawing units for interpreting the value that is specified in the Y= option.

Location options

ANCHOR=CENTER | TOPLEFT | TOP | TOPRIGHT | LEFT | RIGHT | BOTTOMLEFT | BOTTOM | BOTTOMRIGHT

specifies an anchor point for the rectangle.

ODS options

URL="*string*" | *string-expression*

specifies an HTML page that is displayed when the output of this draw statement is selected.

Size options

HEIGHTUNIT=PERCENT | PIXEL | DATA

specifies whether the *positive-number* that is specified in the HEIGHT= option is interpreted as a percentage value, a pixel value, or a value that is in the units of the data.

WIDTHUNIT=PERCENT | PIXEL | DATA

specifies whether the *positive-number* that is specified in the WIDTH= option is interpreted as a percentage value, a pixel value, or a value that is in the units of the data.

Required Arguments

X=*constant* | *scalar-expression*

specifies the X value of the anchor point.

Interactions The value that is set for this argument is interpreted using the XSPACE= option.

When XSPACE=DATAVALUE, the value is interpreted using the XAXIS= option.

Note When XSPACE=DATAVALUE and a character value is specified, leading blanks are honored and trailing blanks are ignored when the specified value is compared with the data values.

Y=*constant* | *scalar-expression*

specifies the Y value of the anchor point.

Interactions The value that is set for this argument is interpreted using the YSPACE= option.

When YSPACE=DATAVALUE, the value is interpreted using the YAXIS= option.

Note When YSPACE=DATAVALUE and a character value is specified, leading blanks are honored and trailing blanks are ignored when the specified value is compared with the data values.

WIDTH=*constant* | *scalar-expression*
specifies the width of the rectangle.

Interactions The value that is set for this argument is interpreted using the WIDTHUNIT= and XSPACE= options.

When WIDTHUNIT=DATA, the value is interpreted using the XAXIS= option.

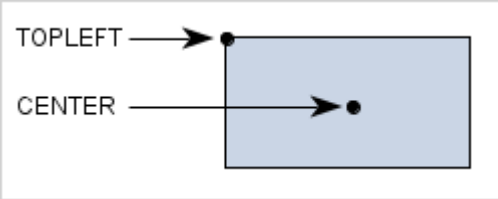
HEIGHT=*constant* | *scalar-expression*
specifies the height of the rectangle.

Interactions The value that is set for this argument is interpreted using the HEIGHTUNIT= and YSPACE= options.

When HEIGHTUNIT=DATA, the value is interpreted using the YAXIS= option.

Optional Arguments

ANCHOR=CENTER | TOPLEFT | TOP | TOPRIGHT | LEFT | RIGHT | BOTTOMLEFT | BOTTOM | BOTTOMRIGHT
specifies an anchor point for the rectangle. The anchor point is relative to the unrotated rectangle. The anchor point can be at the center of the rectangle or at eight points on the rectangle border. The following figure shows the anchor points for TOPLEFT and CENTER.



The coordinates of the anchor point are set by the statement's X and Y values, and by the settings for the XSPACE= and YSPACE= options. The XAXIS= and YAXIS= option might affect positioning when the XSPACE= or YSPACE= options are set to DATAPIXEL, DATAPERCENT, or DATAVALUE.

When the rectangle is rotated, the anchor point remains relative to the unrotated rectangle while the rectangle is rotated on its anchor point. See ROTATE= on page 1458.

Default CENTER

CORNERRADIUS=*number*
specifies the radius of the rectangle corners.

Default 0

Range 0–1, where 0 specifies square corners and 1 specifies the most rounded corners

Example `cornerradius=0.2`

DISCRETEOFFSET=*number*
specifies an amount to offset from the discrete X values, or the discrete Y values, or both.

Default 0 (no offset, output is centered on the discrete X values, or the discrete Y values, or both)

Range –0.5 to +0.5, where 0.5 represents half the distance between discrete ticks. If the X axis is discrete, then a positive offset is to the right. If the Y axis is discrete, then a positive offset is up. If REVERSE=TRUE on the X or Y axis, then the offset direction is also reversed.

Restriction This option applies only when the options XSPACE= or YSPACE= use DATAVALUE, and when X or Y are values on a discrete axis. For nondiscrete axes, this option is ignored.

Tip Setting the discrete offset for the plots does not affect the axis minimum and maximum offsets. In some cases, setting a discrete offset can cause clipping at each end of the axis. In those cases, use the OFFSETMIN= and OFFSETMAX= axis options to increase the axis minimum and maximum offsets to accommodate the discrete offset.

DISPLAY=STANDARD | ALL | (*display-options*)
specifies the features to display for the rectangle.

STANDARD
displays an outlined rectangle.

ALL
displays an outlined, filled rectangle.

(*display-options*)
specifies a space-separated list of one or more display options, enclosed in parentheses.

The list can contain one or bothj of the following options:

OUTLINE	displays an outlined rectangle
FILL	displays a filled rectangle

Default STANDARD

Tip Use the OUTLINEATTRS= and FILLATTRS= options to control the appearance of the rectangle.

DRAWSPACE=GRAPHPERCENT | GRAPHPIXEL | LAYOUTPERCENT | LAYOUTPIXEL | WALLPERCENT | WALLPIXEL | DATAPERCENT | DATAPIXEL | DATAVALUE
specifies a default drawing space and drawing units for this draw statement.

Default LAYOUTPERCENT

Interactions This statement and all of the draw statements inherit the global DRAWPSACE= setting from the DRAWSPACE= option in the BEGINGRAPH statement. Setting this option changes the setting for only this draw statement.

This option sets the default drawing space, but individual settings in the X or Y dimension can be overridden by the options XSPACE=, YSPACE=, HEIGHTUNIT=, or WIDTHUNIT=.

See "About the Drawing Space and Drawing Units" on page 1398

FILLATTRS=*style-element* | *style-element* (*fill-options*) | (*fill-options*)
specifies the fill attributes for this draw statement.

Default The GraphAnnoShape style element Color attribute

Tip The TRANSPARENCY= option sets the transparency for the fill and the outline. You can combine this option with TRANSPARENCY= to set one transparency for the outline but a different transparency for the fill. Example:

```
transparency=0.2 fillattrs=(transparency=0.6)
```

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Fill Color Options" on page 1600 for available *fill-options*.

HEIGHTUNIT=PERCENT | PIXEL | DATA
specifies whether the *positive-number* that is specified in the HEIGHT= option is interpreted as a percentage value, a pixel value, or a value that is in the units of the data.

Default PERCENT

Interaction This setting combines with the YSPACE= setting to interpret the height that is set in the HEIGHT= option.

LAYER=FRONT | BACK
specifies the layer on which this draw statement's output is drawn.

FRONT
draws the output on top of the graph.

BACK
draws the output behind the background areas, such as a layout or legend background.

Default FRONT

Tip For elements that are obstructed because they are in the back layer, you can suppress the display of filled areas in the graph. You can also use transparency to manage the element visibility. For more information, see "About Drawing Layers" on page 1402 .

OUTLINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the outline attributes for this draw statement.

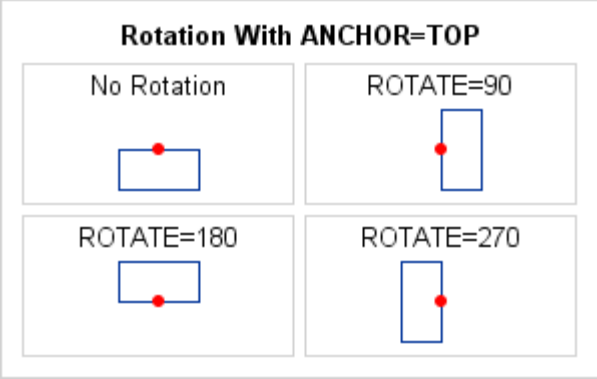
Default The GraphAnnoLine style element.

Interaction For this option to have any effect, the outline must be enabled by the DISPLAY= option or by the ODS style that is in effect.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

ROTATE=*number*
specifies the angle of rotation for the rectangle, measured in degrees. The angle is measured as if a horizontal line extended to the right through the rectangle anchor point as shown in the following figure.



Positive angles rotate the rectangle counter clockwise, and negative angles rotate the rectangle clockwise. The angle specification can exceed 360 degrees in absolute value.

Default 0. No rotation is performed

See ANCHOR= on page 1455

TRANSPARENCY=*number*
specifies the degree of the transparency of this draw statement's output.

Default 0

Range 0–1, where 0 is opaque and 1 is entirely transparent

Tip The FILLATTRS= option can be used to set transparency for just the filled area. You can combine this option with FILLATTRS= to set one transparency for the outline but a different transparency for the fill. Here is an example:

```
transparency=0.2 fillattrs=(transparency=0.6)
```

URL="*string*" | *string-expression*
specifies an HTML page that is displayed when the output of this draw statement is selected.

Note: This option is valid starting in SAS 9.4M1.

"string"
string-expression
specifies a valid HTML page reference (HREF) for the graphical element that is drawn by this draw statement.

Example **`http://www.sas.com`**

Restriction Links specified with URL= are not supported in SVG output in HTML. In that case, use a raster image format such as PNG.

Requirement To generate selectable graphical elements, you must include an ODS GRAPHICS ON statement that specifies the IMAGEMAP option, and you must write the output to the ODS HTML destination.

Tip By default, drill-down links open in a new browser window (link target _blank). To specify a different target for your drill-down links, such as _self or _parent, add the DRILLTARGET="*target*" option to your ODS GRAPHICS statement. See DRILLTARGET= on page 1568.

WIDTHUNIT=PERCENT | PIXEL | DATA
specifies whether the *positive-number* that is specified in the WIDTH= option is interpreted as a percentage value, a pixel value, or a value that is in the units of the data.

Default PERCENT

Interaction This setting combines with the XSPACE= setting to interpret the width that is set in the WIDTH= option.

XAXIS=X | X2
specifies whether the data value for the arguments X1 and X2 is interpreted using the primary X-axis scale or to the secondary X (X2) axis scale.

Default X

Interaction This option has effect only if XSPACE=DATAVALUE.

XSPACE=GRAPHPERCENT | GRAPHPIXEL | LAYOUTPERCENT | LAYOUTPIXEL | WALLPERCENT | WALLPIXEL | DATAPERCENT | DATAPIXEL | DATAVALUE
specifies the drawing space and drawing units for interpreting the value that is specified in the X= option.

Default The setting that is in effect for the DRAWSPACE= option.

YAXIS=Y | Y2
specifies whether the data value for the arguments Y1 and Y2 is interpreted using the primary Y-axis scale or to the secondary Y (Y2) axis scale.

Default Y

Interaction This option has effect only if YSPACE=DATAVALUE.

YSPACE=GRAPHPERCENT | GRAPHPIXEL | LAYOUTPERCENT | LAYOUTPIXEL | WALLPERCENT | WALLPIXEL | DATAPERCENT | DATAPIXEL | DATAVALUE
specifies the drawing space and drawing units for interpreting the value that is specified in the Y= option.

Default The setting that is in effect for the DRAWSPACE= option.

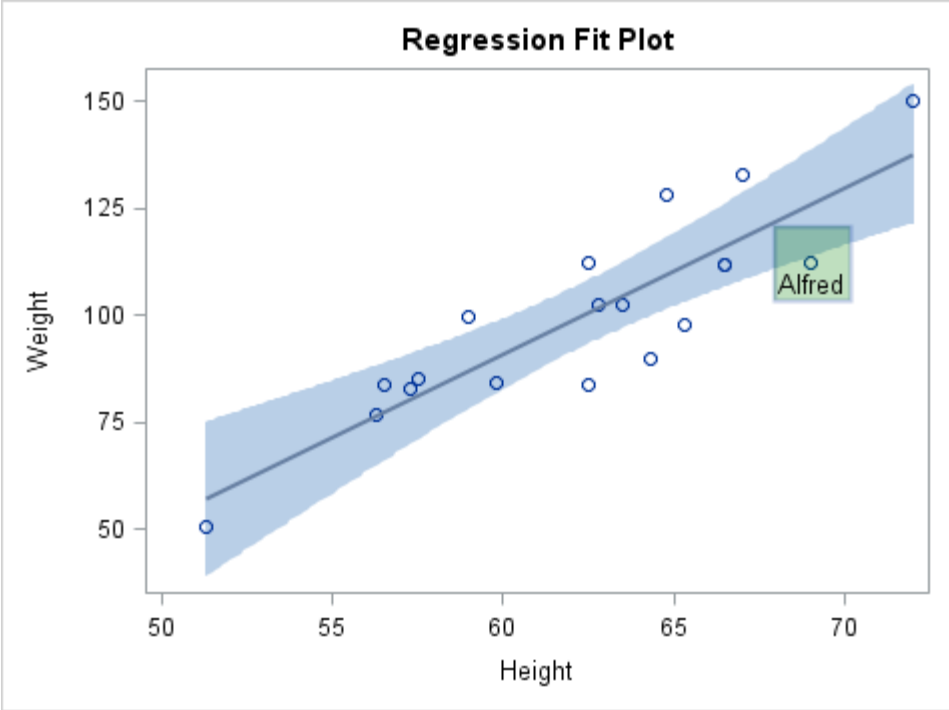
Details

A DRAWRECTANGLE statement draws a rectangle in a graph. The rectangle position is determined by the X and Y anchor points, and the size is determined by the HEIGHT and WIDTH settings. You can manage the rectangle position with the options ANCHOR= , XSPACE= , and YSPACE= . You can manage the rectangle size with the HEIGHTUNIT= and WIDTHUNIT= options.

For general information about the types of elements that can be drawn with the draw statements, the drawing space and drawing units that they use, and how the drawn elements are anchored, see Chapter 13, "Key Concepts for Using Draw Statements," on page 1395 . For detailed usage information, consult the *SAS Graph Template Language: User's Guide*.

Example: DRAWRECTANGLE Statement

The following graph was generated by the "Example Program" on page 1461. The example uses DRAWRECTANGLE to highlight a student's data point. It draws a rectangle around the marker symbol that represents the student's height and weight, and it displays the student's name inside the rectangle. In the BEGINGRAPH statement, the setting for the DRAWSPACE= option sets the drawing space and drawing units for the DRAWRECTANGLE and DRAWTEXT statements. In the DRAWRECTANGLE statement, setting TRANSPARENCY=0.75 ensures that the marker for Alfred is visible behind the rectangle. The DRAWTEXT statement draws the text that identifies the student's name, using the ANCHOR=, X=, and Y= options to position the text within the rectangle.



Example Program

```
proc template;
  define statgraph drawrectangle;
    begingraph / drawspace=datavalue;
      entrytitle "Regression Fit Plot";
      layout overlay;
        modelband "myclm";
        scatterplot x=height y=weight;
        regressionplot x=height y=weight / alpha=0.01 clm="myclm";
          drawrectangle x=69 y=112.5 width=10 height=15 /
            display=all fillattrs=(color=green)
            transparency=0.75 ;
          drawtext "Alfred" / x=69 y=112 anchor=top;
      endlayout;
    endgraph;
  end;

proc sgrender data=sashelp.class template=drawrectangle;
run;
```

DRAWTEXT Statement

Draws and anchors in a graph a text box that contains one or more lines of formatted text.

Syntax

DRAWTEXT *text-item* <*text-item* ...> < */options* >;

Summary of Optional Arguments

Appearance options

BORDER=TRUE | FALSE
: specifies whether a border is drawn around the text box.

BORDERATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
: specifies the border line attributes for this draw statement.

LAYER=FRONT | BACK
: specifies the layer on which this draw statement's output is drawn.

PAD=*dimension* | (*pad-options*)
: specifies the amount of extra space that is reserved inside the text box's border.

ROTATE=*number*
: specifies the angle of rotation of the text box, measured in degrees.

TRANSPARENCY=*number*
: specifies the degree of the transparency of this draw statement's output.

Axes options

DISCRETEOFFSET=*number*
: specifies an amount to offset from the discrete X values, or the discrete Y values, or both.

XAXIS=X | X2
: specifies whether the data value for the arguments X1 and X2 is interpreted using the primary X-axis scale or to the secondary X (X2) axis scale.

YAXIS=Y | Y2
: specifies whether the data value for the arguments Y1 and Y2 is interpreted using the primary Y-axis scale or to the secondary Y (Y2) axis scale.

Drawing space options

DRAWSPACE=GRAPHPERCENT | GRAPHPIXEL | LAYOUTPERCENT | LAYOUTPIXEL | WALLPERCENT | WALLPIXEL | DATAPERCENT | DATAPIXEL | DATAVALUE
: specifies a default drawing space and drawing units for this draw statement.

XSPACE=GRAPHPERCENT | GRAPHPIXEL | LAYOUTPERCENT | LAYOUTPIXEL | WALLPERCENT | WALLPIXEL | DATAPERCENT | DATAPIXEL | DATAVALUE
: specifies the drawing space and drawing units for interpreting the value that is specified in the X= option.

YSPACE=GRAPHPERCENT | GRAPHPIXEL | LAYOUTPERCENT | LAYOUTPIXEL | WALLPERCENT | WALLPIXEL | DATAPERCENT | DATAPIXEL | DATAVALUE
specifies the drawing space and drawing units for interpreting the value that is specified in the Y= option.

Location options

ANCHOR=CENTER | TOPLEFT | TOP | TOPRIGHT | LEFT | RIGHT | BOTTOMLEFT | BOTTOM | BOTTOMRIGHT
specifies an anchor point for the text box.

JUSTIFY=LEFT | CENTER | RIGHT
specifies the alignment of text that wraps within the text box.

X=*constant* | *scalar-expression*
specifies the anchor point's X coordinate.

Y=*constant* | *scalar-expression*
specifies the anchor point's Y coordinate.

ODS options

URL="*string*" | *string-expression*
specifies an HTML page that is displayed when the output of this draw statement is selected.

Size options

WIDTH=*positive-number*
specifies the width of the text box.

WIDTHUNIT=PERCENT | PIXEL | DATA
specifies whether the *positive-number* that is specified in the WIDTH= option is interpreted as a percentage value, a pixel value, or a value that is in the units of the data.

Required Argument

***text-item* <...*text-item*>**
specifies one or more pieces of text for the text box. Each *text-item* has the following form:

<*prefix-option*> "*string*" | *dynamic* | *character-expression* | {*text-command*}

Each piece of text can have a prefix setting that precedes the piece of text. A piece of text is either a string literal, a dynamic, or a text command. All *text-items* are concatenated into one string, which might be wrapped, based on the settings for the WIDTH= and WIDTHUNIT= settings. Leading and trailing blanks in the concatenated string are always used.

When used, a prefix option applies to the immediately following piece of text and also to all subsequent text strings and text-commands until another prefix option is specified.

Requirements *string* must be enclosed in quotation marks.

character-expression must be enclosed in an EVAL function.

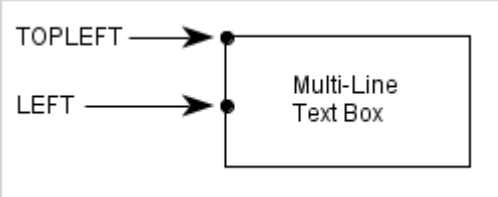
text-command must be enclosed in braces.

Note Leading and trailing spaces are preserved.

See Chapter 10, “Managing Text Items,” on page 1337

Optional Arguments

ANCHOR=CENTER | TOPLEFT | TOP | TOPRIGHT | LEFT | RIGHT | BOTTOMLEFT | BOTTOM | BOTTOMRIGHT
specifies an anchor point for the text box. The anchor point is relative to the unrotated text. It can be at the center of the text box or at eight points on the border of the text box bounding box. The following figure shows the anchor points for TOPLEFT and LEFT.



The coordinates of the anchor point are set by the X= and Y= options, and by the XSPACE= and YSPACE= options. The XAXIS= and YAXIS= option might affect positioning when the XSPACE= or YSPACE= options are set to DATAPIXEL, DATAPERCENT, or DATAVALUE.

The text box has a fixed width, determined by the WIDTH= and WIDTHUNIT= options. The height of the text box is based on the amount of text specified and the font size. The height of the text grows in a direction that is related to the anchor point. For example, if ANCHOR=TOPLEFT, then the text box height extends downward from the anchor point and its width extends to the right. If ANCHOR=CENTER, then half the text box width and half the text box height extend equally left and right, as well as top to bottom from the anchor point. If ANCHOR=BOTTOM, the text box height extends upward from the anchor point and the text box width is centered at the anchor point.

When the text is rotated, the anchor point remains relative to the unrotated text box while the text box is rotated on its anchor point. See ROTATE= on page 1467.

Default CENTER

BORDER=TRUE | FALSE
specifies whether a border is drawn around the text box.

Default FALSE

Tip Use the BORDERATTRS= option to control the appearance of the border.

See “boolean ” on page xii for other Boolean values that you can use.

BORDERATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the border line attributes for this draw statement.

Default The GraphBorderLines style element.

Interaction BORDER=TRUE must be set for this option to have any effect.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

DISCRETEOFFSET=*number*
specifies an amount to offset from the discrete X values, or the discrete Y values, or both.

Default 0 (no offset, output is centered on the discrete X values, or the discrete Y values, or both)

Range −0.5 to +0.5, where 0.5 represents half the distance between discrete ticks. If the X axis is discrete, then a positive offset is to the right. If the Y axis is discrete, then a positive offset is up. If REVERSE=TRUE on the X or Y axis, then the offset direction is also reversed.

Restriction This option applies only when the options XSPACE= or YSPACE= use DATAVALUE, and when X or Y are values on a discrete axis. For nondiscrete axes, this option is ignored.

Tip Setting the discrete offset for the plots does not affect the axis minimum and maximum offsets. In some cases, setting a discrete offset can cause clipping at each end of the axis. In those cases, use the OFFSETMIN= and OFFSETMAX= axis options to increase the axis minimum and maximum offsets to accommodate the discrete offset.

DRAWSPACE=GRAPHPERCENT | GRAPHPIXEL | LAYOUTPERCENT | LAYOUTPIXEL | WALLPERCENT | WALLPIXEL | DATAPERCENT | DATAPIXEL | DATAVALUE
specifies a default drawing space and drawing units for this draw statement.

Default LAYOUTPERCENT

Interactions This statement and all of the draw statements inherit the global DRAWPSACE= setting from the DRAWSPACE= option in the BEGINGRAPH statement. Setting this option changes the setting for only this draw statement.

This option sets the default drawing space, but individual settings in the X or Y dimension can be overridden by the options XSPACE=, YSPACE=, HEIGHTUNIT=, or WIDTHUNIT=.

See "About the Drawing Space and Drawing Units" on page 1398

JUSTIFY=LEFT | CENTER | RIGHT
specifies the alignment of text that wraps within the text box.

LEFT
forces the first character of each line to appear at the left margin (distance from the left border plus the left pad amount).

CENTER
forces each line to be centered in the text box between the left and right pad amounts.

RIGHT
forces the last character of each line to appear at the right margin (distance from the right border minus the right pad amount).

Default LEFT

Interaction Text is wrapped based on the width of the specified text, the font size, and the setting in the PAD= option.

LAYER=FRONT | BACK
specifies the layer on which this draw statement's output is drawn.

FRONT
draws the output on top of the graph.

BACK
draws the output behind the background areas, such as a layout or legend background.

Default FRONT

Tip For elements that are obstructed because they are in the back layer, you can suppress the display of filled areas in the graph. You can also use transparency to manage the element visibility. For more information, see "About Drawing Layers" on page 1402 .

PAD=*dimension* | (*pad-options*)
specifies the amount of extra space that is reserved inside the text box's border.

dimension
specifies a dimension to use for the extra space at the left, right, top, and bottom of the text box border.

(*pad-options*)
a space-separated list of one or more name-value-pair pad options enclosed in parentheses.

The list can include one or more of the following pad options:

LEFT=*dimension*
specifies the amount of extra space added to the left side.

RIGHT=*dimension*
specifies the amount of extra space added to the right side.

TOP=*dimension*
specifies the amount of extra space added to the top.

BOTTOM=*dimension*
specifies the amount of extra space added to the bottom.

Note Sides that are not assigned padding are padded with the default amount.

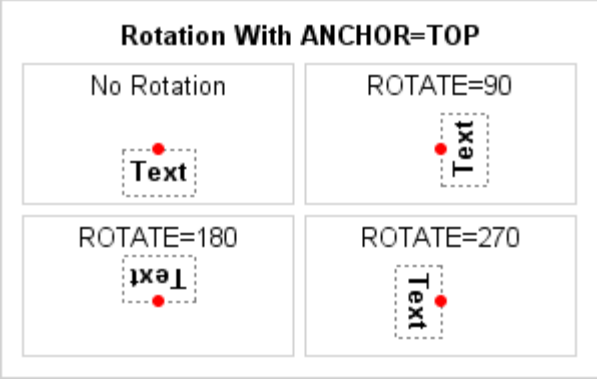
Tip Use *pad-options* to create non-uniform padding.

Default (LEFT=3 RIGHT=3 TOP=0 BOTTOM=0)

Note The default units for *dimension* are pixels.

See "dimension" on page xiii

ROTATE=*number*
specifies the angle of rotation of the text box, measured in degrees. The text box is rotated around its anchor point. The angle is measured from a horizontal line passing through the anchor point of the text box to the right. The following figure shows the rotation of text around a top anchor point.



Positive angles rotate the text box counter clockwise, and negative angles rotate the text box clockwise. The angle specification can exceed 360 degrees in absolute value.

Default 0. No rotation is performed

See ANCHOR= on page 1464

TRANSPARENCY=*number*
specifies the degree of the transparency of this draw statement's output.

Default 0

Range 0–1, where 0 is opaque and 1 is entirely transparent

URL="*string*" | *string-expression*
specifies an HTML page that is displayed when the output of this draw statement is selected.

Note: This option is valid starting in SAS 9.4M1.

"string"
string-expression
specifies a valid HTML page reference (HREF) for the graphical element that is drawn by this draw statement.

Example `http://www.sas.com`

Restriction Links specified with URL= are not supported in SVG output in HTML. In that case, use a raster image format such as PNG.

Requirement To generate selectable graphical elements, you must include an ODS GRAPHICS ON statement that specifies the IMAGEMAP option, and you must write the output to the ODS HTML destination.

Tip By default, drill-down links open in a new browser window (link target _blank). To specify a different target for your drill-down links, such as _self or _parent, add the DRILLTARGET="*target*" option to your ODS GRAPHICS statement. See DRILLTARGET= on page 1568.

WIDTH=*positive-number*
specifies the width of the text box.

Default 10

Interaction This option's value is interpreted using the WIDTHUNIT= option.

WIDTHUNIT=PERCENT | PIXEL | DATA
specifies whether the *positive-number* that is specified in the WIDTH= option is interpreted as a percentage value, a pixel value, or a value that is in the units of the data.

Default PERCENT

Interaction This setting combines with the XSPACE= setting to interpret the width that is set in the WIDTH= option.

X=*constant* | *scalar-expression*
specifies the anchor point's X coordinate.

Default 50

Interactions The DRAWSPACE= option determines the default interpretation of the units for this setting. You can override the default with the XSPACE= option.

If XSPACE=DATAVALUE, then this option's value is interpreted using the XAXIS= option.

Note When XSPACE=DATAVALUE and a character value is specified, leading blanks are honored and trailing blanks are ignored when the specified value is compared with the data values.

XAXIS=X | X2
specifies whether the data value for the arguments X1 and X2 is interpreted using the primary X-axis scale or to the secondary X (X2) axis scale.

Default X

Interaction This option has effect only if XSPACE=DATAVALUE.

XSPACE=GRAPHPERCENT | GRAPHPIXEL | LAYOUTPERCENT | LAYOUTPIXEL | WALLPERCENT | WALLPIXEL | DATAPERCENT | DATAPIXEL | DATAVALUE
specifies the drawing space and drawing units for interpreting the value that is specified in the X= option.

Default The setting that is in effect for the DRAWSPACE= option.

Y=*constant* | *scalar-expression*
specifies the anchor point's Y coordinate.

Default 50

Interactions The DRAWSPACE= option determines the default interpretation of the units for this setting. You can override the default with the YSPACE= option.

If YSPACE=DATAVALUE, then this option's value is interpreted using the YAXIS= option.

Note When YSPACE=DATAVALUE and a character value is specified, leading blanks are honored and trailing blanks are ignored when the specified value is compared with the data values.

YAXIS=Y | Y2
specifies whether the data value for the arguments Y1 and Y2 is interpreted using the primary Y-axis scale or to the secondary Y (Y2) axis scale.

Default Y

Interaction This option has effect only if YSPACE=DATAVALUE.

YSPACE=GRAPHPERCENT | GRAPHPIXEL | LAYOUTPERCENT | LAYOUTPIXEL | WALLPERCENT | WALLPIXEL | DATAPERCENT | DATAPIXEL | DATAVALUE
specifies the drawing space and drawing units for interpreting the value that is specified in the Y= option.

Default The setting that is in effect for the DRAWSPACE= option.

Prefix Option

TEXTATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the color and font properties of the entire text string or individual *text-items*.

Default The GraphAnnoText style element.

Interaction When multiple TEXTATTRS= prefix options are used, each one cancels the last, resetting all text properties to the default set by the GraphAnnoText style element. Subsequent *text-items* to the right are then assigned the text properties specified in the closest TEXTATTRS= setting to their left. Thus, to vary the text properties across *text-items*, you do not have to override settings from a previous TEXTATTRS= setting. Each TEXTATTRS= specification resets all text properties to the default so that only the new settings are applied to subsequent *text-items*.

Tip To ensure that all text has the same text properties, use this prefix option once only and place it before the first *text-item*.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Text Options" on page 1606 for available *text-options*.

Text Commands

{ SUB *"string"* | *dynamic* }

text-command that specifies that the string or dynamic is to appear as subscript text.

See "Rules for Unicode and Special Character Specifications" on page 1342

Example
```
drawtext "y = " b{sub "0"} " + b" {sub "1"} "x";
```

{ SUP *"string"* | *dynamic* }

text-command that specifies that the string or dynamic is to appear as superscript text.

See "Rules for Unicode and Special Character Specifications" on page 1342

Example
```
drawtext "R" {sup "2"} " = " {format (6.4) RSQUARED} ;
```

{ UNICODE *"hex-string"x* | *keyword* | *dynamic* }

text-command that specifies a glyph (character) to be displayed using its Unicode specification or keyword equivalent.

***"hex-string"*x**
a four-byte hexadecimal constant that represents a UNICODE character in the current font. For a complete listing, see http://unicode.org/charts/charindex.html.

keyword
a SAS keyword for a UNICODE character.

For a listing of SAS supplied keywords, see Appendix 2, "Reserved Keywords and Unicode Values," on page 1595.

dynamic
a dynamic variable that resolves to either *"hex-string"x* or a keyword for a UNICODE character.

Note The UNICODE text command attempts to access a UNICODE value in the current font. Not all fonts support accessing characters through their UNICODE value. Some fonts support only a limited set of UNICODE values. If the UNICODE value is not accessible, then the command might be ignored or a nonprintable character might be substituted.

See "Using UNICODE Text" on page 1342

"Rules for Unicode and Special Character Specifications" on page 1342

Example The following statements show how to use the {UNICODE} text command:

```
drawtext {unicode alpha} "=" CONF;

drawtext {unicode "03B1"x} "=" CONF;
```

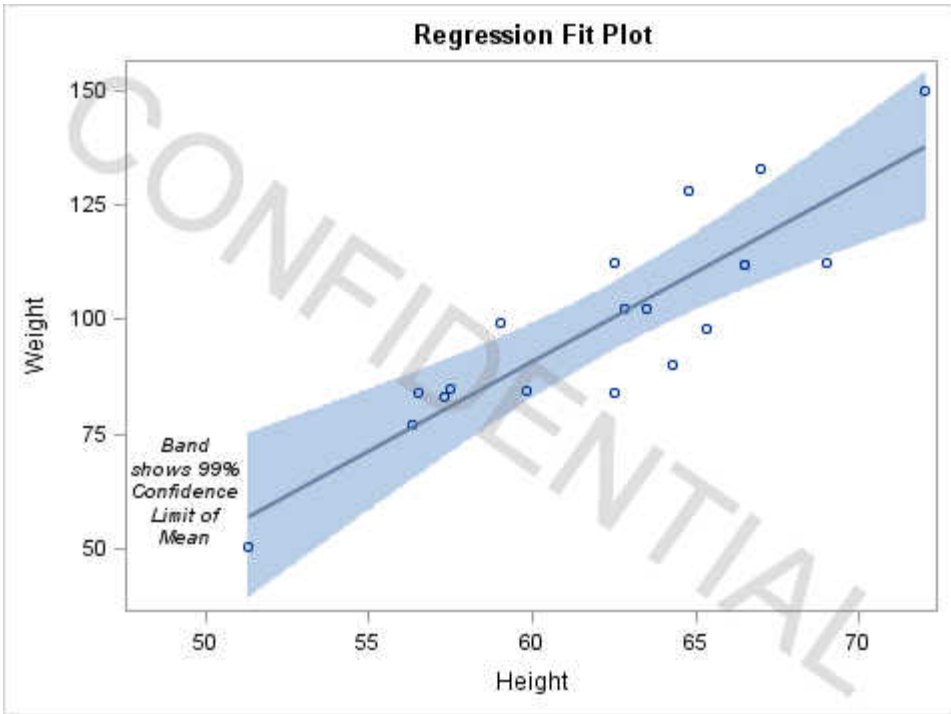
Details

A DRAWTEXT statement draws a text box that contains one or more lines of text. The text can be formatted, using the TEXTATTRS= prefix option. By default, the text box is drawn in the center of the graph. You can change the default position with the options ANCHOR= , X= , Y= , XSPACE= , and YSPACE= .

For general information about the types of elements that can be drawn with the draw statements, the drawing space and drawing units that they use, and how the drawn elements are anchored, see Chapter 13, "Key Concepts for Using Draw Statements," on page 1395 . For detailed usage information, consult the *SAS Graph Template Language: User's Guide*.

Example: DRAWTEXT Statement

The following graph was generated by the "Example Program" on page 1472. The first DRAWTEXT statement shows how to draw multiple lines of text in a specific position within the graph. The second DRAWTEXT statement shows how to create a watermark, which is achieved by applying transparency to text that is rotated within the graph.



Example Program

```
proc template;
 define statgraph modelfit;
  begingraph;
    entrytitle "Regression Fit Plot";
    layout lattice;
      layout overlay / xaxisopts=(offsetmin=0.1);
        drawtext textattrs=(style=italic size=8pt)
          "Band shows 99% Confidence Limit of Mean" /
          anchor=bottomleft width=15 widthunit=percent
          xspace=wallpercent yspace=wallpercent
          x=0 y=10 justify=center ;
        modelband "myclm";
        scatterplot x=height y=weight / primary=true;
        regressionplot x=height y=weight / alpha=0.01 clm="myclm";
      endlayout;
    endlayout;
    drawtext textattrs=(color=gray size=52pt) "CONFIDENTIAL" /
      transparency=0.75 rotate=-35
      width=110 widthunit=percent justify=center ;
  endgraph;
 end;

proc sgrender data=sashelp.class template=modelfit;
run;
```

PART 10

GTL Annotation Facility

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About the GTL Annotation Facility

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Data-Set-Driven Annotations

GTL supports data-set-driven annotations, which enable you to add the following graphics elements to your graphs:

- text
- lines and arrows
- circles and ovals
- squares and rectangles
- polygons and polylines
- images

Unlike graphics elements that are drawn using GTL draw statements in a GTL template, data-set-driven annotations are drawn from graphics instructions that are stored in a SAS data set. The GTL annotation facility is similar to the SAS/GRAPH Annotate facility. The GTL annotation facility enables you to separate your annotation instructions from your template statements. To change your

annotations, you can specify a different annotation data set or modify the instructions in the original data set. You do not have to modify your template code.

The following items are required in order to use the GTL annotation facility:

- a SAS data set that contains the annotation instructions. The annotation instructions must be stored in a SAS data set. Annotation instructions stored in a Cloud Analytic Services (CAS) in-memory table are not supported.
- at least one ANNOTATE statement in your GTL template.
- an SGRENDER statement that includes the SGANNO=*data-set-name* option, which specifies the name of the data set that contains the annotation instructions.

This section describes the requirements for using the GTL annotation facility. For examples of how to use the facility to annotate your graphs, see "Adding Data-Driven Annotations to Your Graph" in *SAS Graph Template Language: User's Guide*.

Annotation Data Set

About the Annotation Data Set

The annotation data set contains the instructions for drawing annotations. Each observation in the data set contains columns for an annotation instruction. The following information is typically stored in these columns:

- the annotation function name
- the coordinates of the annotation location
- the drawing space
- the attributes of the annotation, such as color, font, and so on

The information that is required for each instruction is function-dependent. See "Annotation Data Requirements" on page 1477.

To create the annotation data set, use the same methods that you would use to create any SAS data set. You must store the annotation instructions in a SAS data set. Annotation instructions stored in a CAS in-memory table are not supported. The most common method for creating a data set is to use a DATA step. For more information about the DATA step, see *SAS Programmer's Guide: Essentials*. Macros are available that you can run in your DATA step to create the observations for your annotations. See "Using the SGANNO Macros" on page 1480.

Annotation Data Requirements

Each observation in the annotation data set must provide sufficient information to complete an annotation instruction. To provide this information, certain columns must be included in each observation. All instructions require a Function column, which is a character column that stores the name of the function that is to be performed. An annotation function draws an annotation, such as a line, arrow, oval, and so on. The Function column can specify one of the following function names:

ARROW	POLYGON	TEXT
IMAGE	POLYLINE	TEXTCONT
LINE	POLYCONT	
OVAL	RECTANGLE	

For more information about these functions, see "SG Annotation Function Dictionary" in *SAS ODS Graphics: Procedures Guide*.

Each function requires one or more additional columns that provide required information such as the location coordinates, dimensions, and so on. The following table lists the additional columns that are required for each function. At a minimum, you must include the Function column and the columns listed in the following table in each observation in your annotation data set.

FUNCTION	Additional Columns Required[1]	Description
ARROW	X1 or XC1 Y1 or YC1	These columns store the starting coordinates (numeric or character).
	X2 or XC2 Y2 or YC2	These columns store the ending coordinates (numeric or character).
IMAGE	Image	This column stores the path to the image file (character).
LINE	X1 or XC1 Y1 or YC1	These columns store the starting coordinates (numeric or character).
	X2 or XC2 Y2 or YC2	These columns store the ending coordinates (numeric or character).
OVAL	Height Width	These columns store the oval dimensions (numeric).
	X1 or XC1	These columns store the oval anchor coordinates (numeric or character).

FUNCTION	Additional Columns Required[1]	Description
	Y1 or YC1	
POLYGON	X1 or XC1 Y1 or YC1	These columns store the polygon starting coordinates (numeric or character).
POLYLINE	X1 or XC1 Y1 or YC1	These columns store the polyline starting coordinates (numeric or character).
POLYCONT	X1 or XC1 Y1 or YC1	These columns store the ending coordinates of a polygon or polyline segment (numeric or character).
RECTANGLE	Height Width	These columns store the rectangle dimensions (numeric).
	X1 or XC1 Y1 or YC1	These columns store the rectangle anchor coordinates (numeric).
TEXT and TEXTCONT	Label	This column stores the annotation text (character).

1 See "About the Coordinate Columns" on page 1478.

For the remaining information such as LINECOLOR, TEXTFONT, and so on, default values are used. To change the default values, you can add the necessary columns to your instruction observations. For information about other columns that you can add for each function, see "SG Annotation Function Dictionary" in *SAS ODS Graphics: Procedures Guide*

Note: For polylines and polygons, the initial POLYLINE or POLYGON observation and all of the subsequent POLYCONT observations for the annotation must be contiguous. For text that is continued, the initial TEXT observation and all of the subsequent TEXTCONT observations for the annotation must also be contiguous.

About the Coordinate Columns

The annotation coordinates specify the location of the annotation as X and Y values. In some cases, such as for a line or arrow, two sets of coordinates are required in order to specify the beginning and ending locations of the annotation. You can specify numeric or character columns for each coordinate value. For numeric coordinate values, the location or starting location coordinates are stored in the X1 and Y1 columns in the annotation data set. When ending coordinates are

required, the numeric coordinates are stored in the X2 and Y2 columns. For character values, the coordinates are stored in the XC1 and YC1 columns, and when required, the XC2 and YC2 columns.

Note: If both the numeric and character columns are specified for a coordinate value, then the numeric column takes precedence and the character column is ignored.

About the Drawing Space

When you specify X and Y coordinates for an annotation, the coordinate values refer to a drawing space. By default, this space is a percentage of the graph area. Specifying X=50 and Y=50, for example, refers to a point in the center of the graph area. Here is a complete list of the drawing spaces that you can use.

DATAPERCENT	GRAPHPERCENT	LAYOUTPIXEL
DATAPIXEL	GRAPHPIXEL	WALLPERCENT
DATAVALUE	LAYOUTPERCENT	WALLPIXEL

For more information about these drawing spaces, see "About the Drawing Space and Drawing Units" on page 1398.

To change the default drawing space for your annotations, you can add the columns shown in the following table to your annotation observations.

Column Name	Description
DrawSpace	Specifies the drawing space for all coordinates. This value cannot be used with the POLYCONT function.
X1Space	Specifies the drawing space for the X1 coordinate. This value cannot be used with the TEXTCONT function.
X2Space	Specifies the drawing space for the ending X2 coordinate. This value can be used with the ARROW and LINE functions only.
Y1Space	Specifies the drawing space for the Y1 coordinate. This value cannot be used with the TEXTCONT function.
Y2Space	Specifies the drawing space for the ending Y2 coordinate. This value can be used with the ARROW and LINE functions only.

For information about these columns, see "SG Annotation Function Dictionary" in *SAS ODS Graphics: Procedures Guide*

Using the SGANNO Macros

Table 15.1 *SG Annotation Macros*

Macro Name[1]	Description
%SGANNO	Compiles the available macros and makes them available for you to use. **Note:** You must run the %SGANNO macro in your SAS session before you can use any of the other annotation macros that are listed in this table.
%SGANNO_HELP	Displays help information for a specified annotation macro.
%SGARROW	Creates an observation that draws an arrow.
%SGIMAGE	Creates an observation that displays an image.
%SGLINE	Creates an observation that draws a line.
%SGOVAL	Creates an observation that draws an oval.
%SGPOLYCONT	Creates an observation that draws a polygon or polyline segment.
%SGPOLYGON	Creates an observation that specifies the starting point of a polygon. **Note:** Use the %SGPOLYCONT macro to draw the segments.
%SGPOLYLINE	Creates an observation that specifies the starting point of a polyline. **Note:** Use the %SGPOLYCONT macro to draw the segments.
%SGRECTANGLE	Creates an observation that draws a rectangle.
%SGTEXT	Creates an observation that draws a single line of text or the first line of text in a multiline annotation. **Note:** For multiple lines of text, use the %SGTEXTCONT macro for the subsequent lines.

Macro Name[1]	Description
%SGTEXTCONT	Creates an observation that draws a continuing line of text in a multiline annotation.

1 The macros listed in this table are valid starting with SAS 9.4M1. You can run these macros in a DATA step to simplify the process of creating your SG annotation data sets.

For more information about these macros, see *SAS ODS Graphics: Procedures Guide*.

See Also

"Adding Observations for Polylines and Polygons" in *SAS Graph Template Language: User's Guide*

ANNOTATE Statement

To render the annotations in your annotation data set, you must include at least one ANNOTATE statement in the GTL template for your graph. You can place the ANNOTATE statement anywhere in the template to render your annotations. The annotations are drawn using the context in which the ANNOTATE statement is encountered. You can use the ANNOTATE statement with no options to render all of the annotations in your annotation data set. You can use the ID= option in the ANNOTATE statement to render only a subset of the annotations.

For more information about the ANNOTATE statement, see "ANNOTATE Statement" on page 1483.

SGRENDER Statement SGANNO Option

The SGRENDER statement SGANNO= option specifies the name of a SAS data set that contains annotation instructions. To render your graph with annotations, you must use the SGANNO= option in the SGRENDER statement to specify the name of your annotation data set. When the ANNOTATE statement is encountered in the template, the annotation instructions are read from the annotation data set and are rendered in the current context in the graph. If the template does not include the ANNOTATE statement, the annotations in the annotation data set are ignored. See "SGANNO=annotation-data-set" in *SAS ODS Graphics: Procedures Guide*.

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The ANNOTATE Statement

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Dictionary

ANNOTATE Statement

Draws annotations from annotation instructions that are stored in a SAS data set.

Requirements: The annotation instructions must be stored in a SAS data set.

The annotation data set must be specified by the SGANNO= option in the SGRENDER statement.

Tips: When the ANNOTATE statement is placed inside a LAYOUT container, the layout container is used as the context when DRAWSPACE for an annotation is specified as LAYOUT, WALL, or DATA.

When the DRAWSPACE for an annotation object is GRAPH, the context for drawing the object is the graph area regardless of where the ANNOTATE statement is located.

The LAYER option determines whether the annotations are drawn in front of the graph elements or behind them.

See: "Annotation Data Set" on page 1476

"SG Annotation Function Dictionary" in *SAS ODS Graphics: Procedures Guide*

SGRENDER statement SGANNO= option

"Adding Data-Driven Annotations to Your Graph" in *SAS Graph Template Language: User's Guide*

Syntax

ANNOTATE </ID="*annotation-ID*">

Optional Argument

ID="*annotation-identifier*"
specifies the ID column value of the annotations that are to be drawn. The ID column of the annotation data set contains a unique character value that identifies the subset to which each annotation belongs. All annotations in the annotation data set with an ID column value that matches the specified annotation identifier are drawn. If the annotation data set does not contain an ID column or if no ID column value matches the specified identifier, then no annotations are drawn.

Default All of the annotations in the annotation data set are drawn.

Requirement The annotation data set must contain an ID column, and at least one ID column value must match the specified identifier value.

Tips The ID= option can be used with the annotation data set ID column to subset the annotations that are stored in an annotation data set.

The identifier value matching is case sensitive.

See "Subsetting Annotations" in *SAS Graph Template Language: User's Guide*

Details

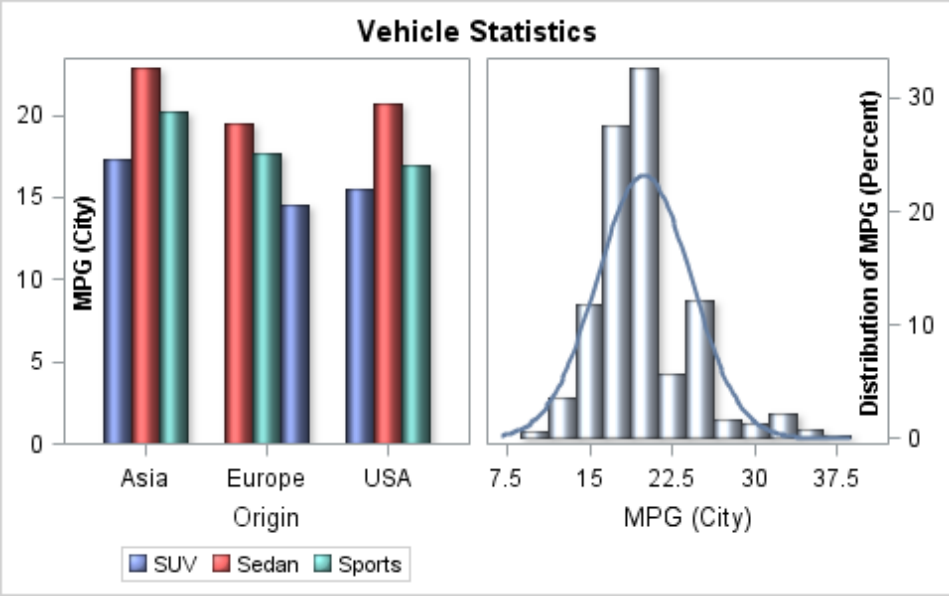
You can use the ANNOTATE statement anywhere in a GTL template to render annotation objects in the current context. The annotation objects are read from an annotation data set that is specified by the SGANNO= option in the SGRENDER statement. You must use at least one ANNOTATE statement in the template to draw the annotations. By default, all of the annotations in the annotation data set are drawn. You can use the ID column in the annotation data set with the ID= option in the ANNOTATE statement to draw only a subset of the annotations in the data set, if you want to. See "Subsetting Annotations" in *SAS Graph Template Language: User's Guide*.

Examples

Example 1: Adding Simple Text Annotations

Here is an example that uses the GTL annotation facility to place custom Y-axis labels inside the plot wall for each of two side-by-side plots. Each label is rotated 90 degrees and is placed on the inside edge of the plot wall near the plot's Y axis. The default Y-axis labels are suppressed.

Here is the output for this example.



Example Program

```
/* Create the annotation data set */
data anno;
   length label $30 id $5 anchor $12;
   drawspace="wallpercent";

   /* Create the bar chart Y-axis label. */
   id='BAR'; function='text'; x1=0;
   textweight='bold'; anchor='top'; rotate=90;
   width=1000; widthunit="pixel";
   label="MPG (City)";
   output;

   /* Create the histogram Y-axis label. */
   id='HIST'; anchor='bottom'; x1=100;
   label="Distribution of MPG (Percent)";
   output;
run;

/* Define the template */
proc template;
   define statgraph anno;
      begingraph;
         entrytitle "Vehicle Statistics";
         layout lattice / columns=2 columngutter=10;
            layout overlay /
               xaxisopts=(offsetmin=0.2 offsetmax=0.2)
               yaxisopts=(display=(ticks tickvalues));

               /* Draw the barchart of origin and MPG city */
                 barchart x=origin y=mpg_city / name="bar" stat=mean
```

```
                group=type groupdisplay=cluster clusterwidth=0.7
                dataskin=sheen;
             discretelegend "bar";
             annotate / id="BAR"; /* Draw the barchart label. */
          endlayout;
          layout overlay /
             y2axisopts=(display=(ticks tickvalues));

             /* Draw the histogram of MPG city */
             histogram mpg_city / dataskin=sheen yaxis=y2;
             densityplot mpg_city / yaxis=y2;
             annotate / id="HIST"; /* Draw the histogram label. */
          endlayout;
       endlayout;
    endgraph;
 end;
run;

/* Render the graph with the annotation */
proc sgrender data=sashelp.cars template=anno sganno=anno;
   where type in ("Sedan" "Sports" "SUV");
run;
```

Program Description

Create the annotation data set Anno. The annotation data set contains two observations, one for each label. The DRAWSPACE is set to WALLPERCENT for both labels. The ID column specifies an identifier for each label. The bar chart label is identified as BAR. It is rotated 90 degrees, anchored on TOP, and is placed at 0% of the wall space along the X axis. The default value 50% percent is used along the Y axis to center the label vertically. This places the label on inside left edge of the bar chart wall. This histogram label is identified as HIST. It is rotated 90 degrees, anchored on BOTTOM, and is placed at 100% of the wall space along the X axis. Like the bar chart label, the default 50% percent is used along the Y axis. This places the label on the right inside edge of the histogram plot wall.

```
/* Create the annotation data set */
data anno;
   length label $30 id $5 anchor $12;
   drawspace="wallpercent";

   /* Create the bar chart Y-axis label. */
   id='BAR'; function='text'; x1=0;
   textweight='bold'; anchor='top'; rotate=90;
   width=1000; widthunit="pixel";
   label="MPG (City)";
   output;

   /* Create the histogram Y-axis label. */
   id='HIST'; anchor='bottom'; x1=100;
   label="Distribution of MPG (Percent)";
   output;
run;
```

Define the graph template. The template defines a two-column, one-row lattice for the two plots. For both plots, the DISPLAY= Y-axis option suppresses the default axis label. For the bar chart, the OFFSETMIN= and OFFSETMAX= X-axis options reserve space for the Y-axis label. The ANNOTATE statement draws the axis label. The ID="BAR" option in the ANNOTATE statement draws the bar chart Y-axis label in the context of the bar chart's OVERLAY layout. For the histogram, the ANNOTATE statement draws the histogram Y-axis label (ID="HIST") in the context of the histogram's OVERLAY layout.

```
/* Define the template */
proc template;
   define statgraph anno;
      begingraph;
         entrytitle "Vehicle Statistics";
         layout lattice / columns=2 columngutter=10;
            layout overlay /
               xaxisopts=(offsetmin=0.2 offsetmax=0.2)
               yaxisopts=(display=(ticks tickvalues));

               /* Draw the barchart of origin and MPG city */
                 barchart x=origin y=mpg_city / name="bar" stat=mean
                  group=type groupdisplay=cluster clusterwidth=0.7
                  dataskin=sheen;
               discretelegend "bar";
               annotate / id="BAR"; /* Draw the barchart label. */
            endlayout;
            layout overlay /
               y2axisopts=(display=(ticks tickvalues));

               /* Draw the histogram of MPG city */
               histogram mpg_city / dataskin=sheen yaxis=y2;
               densityplot mpg_city / yaxis=y2;
               annotate / id="HIST"; /* Draw the histogram label. */
            endlayout;
         endlayout;
      endgraph;
   end;
run;
```

Render the graph with the annotations. The SGANNO=ANNO option is included in the SGRENDER statement to specify the name of the annotation data set. When the graph is rendered, the ANNOTATE statements in the graph template cause the annotations to be drawn.

```
/* Render the graph with the annotation */
proc sgrender data=sashelp.cars template=anno sganno=anno;
   where type in ("Sedan" "Sports" "SUV");
run;
```

Example 2: Using the SG Annotation Macros to Generate Your Annotation Data

In "Example 1: Adding Simple Text Annotations" on page 1484, standard SAS DATA step statements are used to create the observations for the text annotations. This example shows you how to use the SG annotation macros instead to create the same data set.

Example Program

```
/* Create the annotation data set */
data anno;
   /* Compile the annotation macros */
   %sganno;

   /* Create the bar chart Y-axis label. */
   %sgtext(
      reset=all,
      id=BAR,
      drawspace=wallpercent,
      x1=0,
      label="MPG (City)",
      textweight=bold,
      anchor=top,
      rotate=90,
      width=1000,
      widthunit=pixel);

   /* Create the histogram Y-axis label. */
   %sgtext(
      id=HIST,
      x1=100,
      label="Distribution of MPG (Percent)",
      anchor=bottom);
run;
```

Program Description

Here is the SAS code.

Open the DATA step and run the %SGANNO macro. After you open the DATA step, you must run the %SGANNO macro to compile the SG annotation macros and make them available for your use. You need to compile the macros only once during a SAS session.

```
/* Create the annotation data set */
data anno;
   /* Compile the annotation macros */
   %sganno;
```

Create the observation for the bar chart Y-axis label. Use the %SGTEXT macro to generate the observation for the bar chart Y-axis label.

```
   /* Create the bar chart Y-axis label. */
   %sgtext(
      reset=all,
      id=BAR,
      drawspace=wallpercent,
      x1=0,
      label="MPG (City)",
      textweight=bold,
      anchor=top,
      rotate=90,
      width=1000,
```

```
      widthunit=pixel);
```

Create the histogram Y-axis label, and close the DATA step. Specify the new values for the ID, X1, Label, and Anchor columns. To carry over the remaining column values from the previous macro call, do not specify RESET=ALL.

```
   /* Create the histogram Y-axis label. */
   %sgtext(
      id=HIST,
      x1=100,
      label="Distribution of MPG (Percent)",
      anchor=bottom);
run;
```

See Also

- Chapter 15, “About the GTL Annotation Facility,” on page 1475
- “Adding Data-Driven Annotations to Your Graph” in *SAS Graph Template Language: User’s Guide*

PART 11

Attribute Maps

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Key Concepts for Using Attribute Maps

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About Attribute Maps

By default, many of the graphical attributes of a plot vary with the plot data. For example, when plots display grouped values, by default, the graphical attributes for each group value are selected from the GraphData1–GraphDataN style elements in data order. Changes in the data order can significantly change the appearance of the plot. When plots display a color gradient, by default, the colors assigned to the classification variable are derived from a color ramp based on the actual range of the data. The color assigned to each value can vary with the range of the classification values. Attribute maps enable you to assign the same graphical properties to specific values or ranges of values regardless of data order or the data range. They are useful when you want your graphs to have consistent visual properties when the data varies.

GTL supports two types of attribute maps: discrete attribute maps and range attribute maps. A discrete attribute map maps discrete values to graphical properties. A range attribute map maps numeric values or ranges of numeric values to graphical properties.

Defining a Discrete Attribute Map

How to Define a Discrete Attribute Map

You define a discrete attribute map in the following way:

- Specify the attribute mapping information in a SAS data set or in a DISCRETEATTRMAP block in the template code. See "Specifying the Attribute Mapping Information in a DISCRETEATTRMAP Block" on page 1494 and "Specifying the Attribute Mapping Information in a SAS Data Set" on page 1495.

  Note: Defining a discrete attribute map in a SAS data set is valid in SAS 9.4M1 and later releases.

- Reference the attribute map in plot statements by using one of the following methods:
  - Include a DISCRETEATTRVAR statement in the template code to create an attribute map variable. The variable associates the attribute map with a classification column in the plot data. Then use the attribute map variable to reference the discrete attribute map in plot statements. This method applies to an attribute map that is defined in a SAS data set or in a DISCRETEATTRMAP block in the template code.
  - Specify the classification column, which is in the plot data, in the plot statements where needed. When the graph is rendered, the SGRENDER DATTRVAR statement is used to associate the attribute map that is defined in a SAS data set with the classification column in the plot data. This method applies only to an attribute map that is defined in a SAS data set.

    Note: The DATTRVAR statement is valid in SAS 9.4M1 and later releases. For information about the DATTRVAR statement, see *SAS ODS Graphics: Procedures Guide*.

Specifying the Attribute Mapping Information in a DISCRETEATTRMAP Block

Use a DISCRETEATTRMAP block to specify the attribute mapping information in the template code. Place the block in the global definition area of your template between the BEGINGRAPH statement and the first layout statement. The block

contains one or more VALUE statements that specify the attribute mapping information. Each VALUE statement specifies a single discrete value and one or more graphical properties that are assigned to that value. The NAME= option in the DISCRETEATTRMAP statement specifies the name of the attribute map. The DISCRETEATTRVAR statement creates the reference variable for the attribute map. The following options are in the DISCRETEATTRVAR statement:

- The ATTRVAR= option specifies a unique name for the attribute-map-to-data-set-column association.
- The ATTRMAP= option specifies the value of the NAME= option that is specified in the DISCRETEATTRMAP statement.
- The VAR= option specifies the name of the numeric or character column in the plot data set, an expression, or the name of a dynamic variable.

Use the attribute map variable to reference the attribute map in plot statements.

Note: Do not use the attribute variable in an expression. Doing so might produce unexpected results.

Note: The values and graphical attributes that are defined in a discrete attribute map cannot be displayed by a CONTINUOUSLEGEND statement.

For more information, see "Defining a Discrete Attribute Map in a DISCRETEATTRMAP Block" on page 1510.

Specifying the Attribute Mapping Information in a SAS Data Set

Starting with SAS 9.4M1, you can specify the attribute mapping information for a discrete attribute map in a SAS data set instead of in a DISCRETEATTRMAP block in the template. You must store the attribute mapping information in a SAS data set. Attribute mapping information stored in a Cloud Analytic Services (CAS) in-memory table is not supported. Each observation in the data set maps a discrete value to one or more specific graphical properties. The following table lists the columns that you must include in your data set for each observation.

Table 17.1 *Columns That Are Required in Each Observation*

Column Name	Type	Description
ID	Character	Specifies the name of the attribute map to which this observation is associated. The ID value must be a SAS name token and not a literal. A data set can define multiple attribute maps. All observations that are associated with a specific attribute map must have the same ID value. When

Column Name	Type	Description
		you are creating an attribute map variable for this attribute map, specify the name that you specified in the ID column in the DISCRETEATTRVAR statement ATTRMAP= argument. The ID column can also be specified in an SGRENDER DATTRVAR statement when the graph is rendered. The ID value is case sensitive.
Value	Character	Specifies the discrete classification value that is to be mapped to the graphical properties that are specified in this observation. The value is case sensitive.

The following table lists the columns that you can use to specify the graphical properties for each classification value. Properties that you do not specify default to the properties that are normally used when an attribute map is not specified.

Table 17.2 *Optional Columns That Specify Graphical Properties*

Column Name	Type	Description
FillColor	Character	Specifies the color for the filled areas for this classification value. When FillStyleElement is also specified, this column overrides the specified style element's Color attribute.
FillStyleElement	Character	Specifies the name of a style element, such as GraphData3, that is to provide the fill attributes.
FillTransparency	Numeric	Specifies the transparency of the fill color for this classification value. Values are in the range 0 (opaque) to 1 (completely transparent).
LineColor	Character	Specifies the line color for this classification value. When LineStyleElement is also specified, this column overrides the specified style element's ContrastColor attribute.
LinePattern	Character or Numeric	Specifies the line pattern for this classification value. You can specify the pattern name or number. See "Available Line Patterns" on page 1607.
LineStyleElement	Character	Specifies the name of a style element, such as GraphData3, that is to provide the line attributes.
LineThickness	Numeric	Specifies the line thickness, in pixels, for this classification value. The values must be integers.

Column Name	Type	Description
MarkerColor	Character	Specifies the color of the marker symbol for this classification value. When MarkerStyleElement is also specified, this column overrides the specified style element's ContrastColor attribute.
MarkerSize	Numeric	Specifies the size of the marker, in pixels, for this classification value. The values must be integers.
MarkerSyleElement	Character	Specifies the name of a style element, such as GraphData3, that is to provide the marker attributes.
MarkerSymbol	Character	Specifies the marker symbol to use for this classification value. See SYMBOL= in "Marker Options" on page 1604. When MarkerStyleElement is also specified, this column overrides the specified style element's MarkerSymbol attribute.
MarkerTransparency	Numeric	Specifies the transparency of the marker for this classification value. Values are in the range 0 (opaque) to 1 (completely transparent).
NoCase	Character	Specifies whether the attribute-map value comparisons are case-insensitive. Valid values are **TRUE** and **FALSE**. When **TRUE**, value comparisons are case insensitive. The default is **TRUE**. **Note:** This column is valid starting with SAS 9.4M3.
TextColor	Character	Specifies the text color for this classification value.
TextFont	Character	Specifies the text font by name for this classification value.
TextSize	Numeric	Specifies the text font size in points for this classification value. The values must be integers.
TextStyle	Character	Specifies the text style for this classification value. Valid values are **NORMAL** and **ITALIC**.
TextStyleElement	Character	Specifies the name of a style element, such as GraphLabelText, that is to provide the text attributes.

Column Name	Type	Description
TextWeight	Character	Specifies the text weight for this classification value. Valid values are **NORMAL** and **BOLD**.
Show	Character	Specifies whether the legend displays only the attribute map values that appear in the data or always displays all of the values in the attribute map. Valid values are **DATA** and **ATTRMAP**. The default is **DATA**. **Note:** This column is valid starting with SAS 9.4M3.

The ID column provides the name of the attribute map, which is specified in the ATTRMAP= option in the DISCRETEATTRVAR statement or in a DATTRVAR statement. When the graph is rendered, the name of the attribute map data set must be specified in the DATTRMAP= option in the SGRENDER statement. See "DATTRVAR Statement" in *SAS ODS Graphics: Procedures Guide*. For information about how to reference the attribute map in your plot statements, see "Referencing a Discrete Attribute Map in Plot Statements" on page 1499.

Defining a Range Attribute Map

A range attribute map is defined as follows:

- The attribute mapping information is specified in a RANGEATTRMAP block in the template code. It must be placed in the global definition area of your template between the BEGINGRAPH statement and the first layout statement. The NAME= option in the RANGEATTRMAP statement specifies the name of the attribute map. The block contains one or more RANGE statements that specify the attribute mapping information. Each RANGE statement specifies a numeric value or numeric value range, and one or more graphical properties that are assigned to that value or range. An ENDRANGEATTRMAP statement is used to close the block.

  Note: Range attribute maps do not support attribute map information that is stored in a SAS data set.

- The RANGEATTRVAR statement is used to create an attribute map variable that associates the attribute map with a column in the data that provides the classification values. In the RANGEATTRVAR statement:
  - The ATTRVAR= option specifies a unique name for range attribute map to data set column association.
  - The ATTRMAP= option specifies the value of the NAME= option that is specified in the RANGEATTRMAP statement.

- The VAR= option specifies the name of the numeric column in the plot data set with which the range attribute map is to be associated.

  Note: A RANGEATTRMAP can be used with a numeric column only.

- The attribute map variable is used to reference the discrete attribute map in plot statements.

  Note: The values and graphical attributes defined in a range attribute map cannot be displayed by a DISCRETELEGEND statement.

  For information about how to reference a range attribute map, see "Referencing a Discrete Attribute Map in Plot Statements" on page 1499.

The RANGE statements in the RANGEATTRMAP block can associate a range of values or a single value with a single color or a color ramp. The syntax of the RANGE statement is as follows:

RANGE *low-value*< < > – < < >*high-value* / *options*

The optional exclusion operator (<) can be placed after the low value or before the high value to exclude that value from the range endpoint. The low value and high value can be an unformatted numeric value or a range keyword. For the low value, keyword MIN, NEGMAX, or NEGMAXABS can be used instead of numeric value. For the high value, keyword MAX or MAXABS can be used. For information about the range keywords, see *SAS Graph Template Language: Reference*.

Note: If two ranges share a common endpoint, such as 10–20 and 20–30, and no exclusion operator (<) is used, then the common endpoint belongs to the lower range, which is 10–20 in this case.

For more information about how to create a range attribute map, see "Creating and Using a Range Attribute Map" on page 1527.

Referencing an Attribute Map in Your Plot Statements

Referencing a Discrete Attribute Map in Plot Statements

If you use a DISCRETEATTRVAR statement to create a variable for an attribute map, then reference the attribute map in a plot statement by specifying the name

that is assigned in the DISCRETEATTRVAR statement's ATTRVAR= argument. Each plot statement's documentation in this reference indicates which options support a reference to a discrete attribute map variable as the specified value.

Note: A reference to a discrete attribute variable must be a direct reference to the attribute variable. It cannot be set by a dynamic variable.

When you use a DATTRVAR statement in the SGRENDER statement, the attribute map is referenced implicitly when a column that is assigned to the attribute map ID in the DATTRVAR statement is referenced in a plot statement. The following table lists the statement options that support a reference to a discrete attribute map.

Table 17.3 *Statement Options That Support a Discrete Attribute Map*

Statement	Options
AXISTABLE	COLORGROUP= on page 222 TEXTGROUP= on page 231
BANDPLOT	GROUP= on page 248
BARCHART	GROUP= on page 276
BARCHARPARM	GROUP= on page 323
BOXPLOT	GROUP= on page 381
BOXPLOTPARM	GROUP= on page 421
BUBBLEPLOT	GROUP= on page 452
ELLIPSEPARM	GROUP= on page 519
FRINGEPLOT	GROUP= on page 528
HEATMAPPARM	COLORGROUP= on page 550
HIGHLOWPLOT	GROUP= on page 573
LINECHART	GROUP= on page 573
LINEPARM	GROUP= on page 654
LOESSPLOT	GROUP= on page 666
MOSAICPLOTPARM	COLORGROUP= on page 687
NEEDLEPLOT	GROUP= on page 708

Statement	Options
PBSPLINEPLOT	GROUP= on page 724
PIECHART	CATEGORY= on page 734
POLYGONPLOT	GROUP= on page 757
REGRESSIONPLOT	GROUP= on page 800
SCATTERPLOT	GROUP= on page 824
SCATTERPLOTMATRIX	GROUP= on page 864
SERIESPLOT	GROUP= on page 900
STEPPLOT	GROUP= on page 944
VECTORPLOT	GROUP= on page 1007
WATERFALLCHART	COLORGROUP= on page 1022

In a DISCRETELEGEND statement, reference the plot statement that uses the attribute map. The plot statement must have a NAME= option that assigns a name to the plot, because the DISCRETELEGEND statement references that name. Because the attribute map is referenced in the plot statement, the legend uses the attribute map to represent the group values that exist in the data.

TIP If the discrete attribute map is defined in a DISCRETEATTRMAP block, then you can use the DISCRETELEGENDENTRYPOLICY=ATTRMAP option in the DISCRETEATTRMAP statement to display all of the items that are defined in the attribute map regardless of whether the values appear in the data. See DISCRETELEGENDENTRYPOLICY= on page 1506.

For an example of how to reference an attribute map variable that is created with the DISCRETEATTRVAR statement, see "Example: DISCRETEATTRVAR Statement with an Attribute Map Data Set" on page 1517.

The following code shows you how to reference an attribute map.

```
data attrds;
   input ID $1-7 VALUE $8-14 FILLCOLOR $15-26 LINECOLOR $27-38;
datalines;
origin Asia   DodgerBlue  Black
origin Europe Chartreuse  Black
origin USA    SlateGray   Black
;
run;

proc sort data=sashelp.cars out=cars;
```

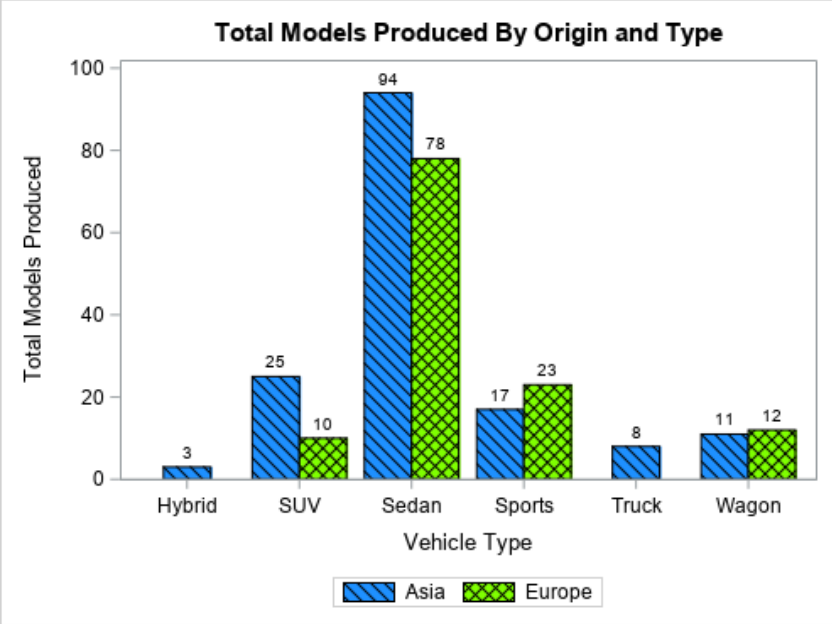
```
   by origin;
run;

proc summary data=cars;
  class type;
  ways 1;
  by origin;
  output out=counts(drop=_TYPE_ rename=(_FREQ_=Count));
run;

/* Define the template for this graph */
proc template;
   define statgraph barchart;
      begingraph / attrpriority=none;
         entrytitle "Total Models Produced By Origin and Type";
         layout overlay /
            xaxisopts=(label="Vehicle Type")
            yaxisopts=(label="Total Models Produced");
            barchart category=type response=count / name="bar"
               display=all barlabel=true
               group=origin groupdisplay=cluster;
            discretelegend "bar";
         endlayout;
       endgraph;
   end;
run;

proc sgrender data=counts dattrmap=attrds template=barchart;
   dattrvar origin="origin";
   where origin ne "USA";
run;
```

SAS data set Attrds is created to define attribute map ORIGIN. For each value of origin, attribute map ORIGIN specifies a fill color and a line color. The SUMMARY procedure is used to create data set Counts, which contains the counts of vehicle models by type and origin from table Sashelp.Cars. The TEMPLATE procedure defines a bar chart of columns Type and Count grouped by column Origin in table Counts. The SGRENDER procedure renders the graph.

In the SGRENDER procedure step, the DATTRMAP= option specifies the Attrds attribute map data set. The DATTRVAR statement associates discrete attribute map ORIGIN with classification column Origin in table Counts. A WHERE statement eliminates cars that are manufactured in the USA. The WHERE statement applies to the data in data set Counts only. It does not apply to the data in attribute map data set Attrds.

> **TIP** To subset data in your attribute map data set using a WHERE clause, use a WHERE statement in a DATA step to create a new attribute map data set or use the data set WHERE option in the SGRENDER procedure DATTRMAP= option. Here is an example of the latter:
>
> ```
> dattrmap=attrds(where=(value ne "USA"))
> ```

Here is the output for this example.



Referencing a Range Attribute Map in Plot Statements

In a plot statement, you reference a range attribute map by specifying the name that is assigned in the RANGEATTRVAR statement's ATTRVAR= argument. Each plot statement's documentation in this reference indicates which options support a reference to a range attribute map variable as the specified value.

Note: A reference to a range attribute variable must be a direct reference to the attribute variable. It cannot be set by a dynamic variable.

The following table lists the statement options that support a reference to a range attribute map variable.

Table 17.4 *Statement Options That Support a Range Attribute Map Variable Reference*

Statement	Options
BUBBLEPLOT	COLORRESPONSE=
HEATMAP	COLORRESPONSE=
MOSAICPLOTPARM	COLORRESPONSE=
POLYGONPLOT	COLORRESPONSE=

Statement	Options
SCATTERPLOT	COLORRESPONSE= or MARKERCOLORGRADIENT=
SCATTERPLOTMATRIX	COLORRESPONSE= or MARKERCOLORGRADIENT=
SURFACEPLOTPARM	COLORRESPONSE or SURFACECOLORGRADIENT=
WATERFALLCHART	COLORRESPONSE=

In a CONTINUOUSLEGEND statement, reference the plot statement that uses the attribute map. The plot statement must have a NAME= option that assigns a name to the plot, because the CONTINUOUSLEGEND statement references that name. Because the attribute map is referenced in the plot statement, the legend uses that attribute map to represent the numeric values that are present in the data.

For an example, see “Example 1: Using a Range Attribute Map to Control Marker Colors” on page 1528.

18

Discrete Attribute Map Statements

Dictionary 1505
DISCRETEATTRMAP Statement 1505
DISCRETEATTRVAR Statement 1516

Dictionary

DISCRETEATTRMAP Statement

Defines a set of graphical properties that can be associated with user-defined sets of values.

Requirements: You must place the DISCRETEATTRMAP block directly inside the BEGINGRAPH block between the BEGINGRAPH statement and the first LAYOUT statement. Do not embed it in any other GTL statement block.

The DISCRETEATTRMAP block must contain at lease one VALUE statement.

The DISCRETEATTRVAR statement must be used to associate the discrete attribute map with a data column.

Notes: The graphical properties for a discrete attribute map can also be defined in a SAS data set. See "Defining a Discrete Attribute Map" on page 1494.

Prior to the third release for SAS 9.4, when a discrete attribute map is used for group values in a plot that contributes to a discrete legend and attributes are overridden in the plot statement, the attributes of some plot features and their corresponding legend items might not match. Starting with SAS 9.4M3, the attributes of the legend items always match the attributes of the corresponding plot features.

See: "DISCRETEATTRVAR Statement" on page 1516

Syntax

DISCRETEATTRMAP NAME="*string*" </*options*>;

VALUE *value-spec* </*options*>;

<... *more VALUE statements* ...>

ENDDISCRETEATTRMAP;

Required Argument

NAME="*string*"

assigns a name to the attribute definition. The name can be referenced in a DISCRETEATTRVAR statement, which is used to associate the attribute map with an input data column. The name can also be referenced in a DISCRETELEGEND statement to map the specified graphical properties directly to a discrete legend.

Restrictions The *string* is case sensitive, must be enclosed in quotation marks, and must define a unique name within the template.

This option does not support variables that are created by the DYNAMIC, MVAR, and NMVAR template statements.

Optional Arguments

DISCRETELEGENDENTRYPOLICY=DATA | ATTRMAP

specifies whether the items that are contributed to a discrete legend by the plot associated with this attribute map are only items that appear in the data or only items that are defined in the attribute map.

Note: This option is valid starting in SAS 9.4M1.

DATA

the associated plot contributes to a discrete legend only items that appear in the data.

ATTRMAP

the associated plot contributes to a discrete legend only items that are defined in the discrete attribute map.

Interaction If this option is set to ATTRMAP, then data skins, overrides from the DATATRANSPARENCY= option, and overrides from the TRANSPARENCY= suboption in the FILLATTRS= and MARKERATTRS= options are displayed in the discrete legend. Overrides from other options such as the COLOR= suboption in the FILLATTRS= option are not displayed.

Default DATA

IGNORECASE=TRUE | FALSE
specifies whether case is ignored when comparing the values that are specified in the attribute map with values from an input data column.

Default FALSE. Value comparisons are case-sensitive.

Tip The effect of this option can be achieved by applying a function like UPCASE to the data column and using only uppercase strings in each VALUE statement.

See "boolean " on page xii for other Boolean values that you can use.

TRIMLEADING=TRUE | FALSE
specifies whether leading blanks are trimmed (removed) from both the attribute map values and the input data values before those values are compared. Trailing blanks are always trimmed.

Default TRUE. Leading blanks are trimmed.

See "boolean " on page xii for other Boolean values that you can use.

VALUE Statement Required Argument

value-spec
specifies one or more formatted strings or the keyword OTHER. Strings are always quoted. Multiple strings must be separated by blanks, and each of the strings must be enclosed in its own set of quotation marks. The formatted strings must be equal to the formatted values of the classification column that is used with the DISCRETEATTRVAR statement.

OTHER
creates a category for all other column values that are not explicitly assigned with VALUE statements. This keyword is not quoted. The default attributes for these values are derived from the GraphOther style element.

Note If OTHER is not specified, then data values that are not explicitly assigned with VALUE statements are mapped to attributes as if a discrete attribute map is not in effect.

The following examples elaborate on the *value-spec* strings:

"Hybrid"	By default, all string comparisons are case-sensitive. By default, the string *Hybrid* does not match the string *HYBRID*.
"HYBRID"	If IGNORECASE=TRUE in the DISCRETEATTRMAP statement, then you can specify an upper-, lower-, or mixed-cased string for the *value-spec* string. When IGNORECASE=TRUE, the string *Hybrid* matches the string *HYBRID*.
"15JAN2011"	If a numeric column is being mapped with a VALUE statement, then you must specify the formatted value of the column. This example shows how to specify the value

of a numeric SAS date column that has a DATE9. format associated with it.

"." If a numeric column has a missing value, then you should use the formatted value for missing, which is "." by default. If the MISSING= system option is used to change the default string, then you should match that value. For example, if OPTIONS MISSING="M" is specified in the SAS program, then you should use "M" in the VALUE statement to represent missing values.

" " If a character column has a missing value, then you should use the formatted value for missing, which is " " by default.

"Truck" "SUV" Multiple strings can be specified to indicate that each of the specified values matches to the same graphical properties. It does not mean that a single new category is formed. The list of strings is separated by blanks, and each string is enclosed in its own set of quotation marks.

Restrictions A dynamic variable reference or run-macro variable reference cannot be used in *value-spec*.

If a user-defined format is associated with the classification column, then you should specify the same formatted strings that appear in the format definition.

Note When the specified value strings are compared with the data values, leading blanks are honored and trailing blanks are ignored.

Tip In SAS 9.4M1 and earlier releases, if you create and use a format to display a special value for missing character values, in some cases, " " is returned instead of the formatted value. If your attribute map assigns attributes to the formatted missing value in that case, the attributes are not assigned to the missing values. To correct this problem, specify both " " and your formatted missing value in the VALUE statement for your missing-value attributes. This issue is resolved in SAS 9.4M2.

VALUE Statement Optional Arguments

The following options can be used in the VALUE statement.

FILLATTRS=*style-element* | *style-element* (*fill-options*) | (*fill-options*)
the fill attributes to be used when an attribute map is applied to filled areas in a graph.

Defaults When DISCRETELEGENDENTRYPOLICY=DATA, unspecified attributes receive the attributes that they would have if the attribute map were not defined.

When DISCRETELEGENDENTRYPOLICY=ATTRMAP, unspecified attributes derive attributes from the GraphDataDefault style element.

Restriction In SAS 9.4 and earlier releases, the TRANSPARENCY= fill option is ignored. Starting with SAS 9.4M2, the TRANSPARENCY= fill option is supported.

Requirement When you specify TRANSPARENCY, you must also specify COLOR. Otherwise, TRANSPARENCY is ignored.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Fill Color Options" on page 1600 for available *fill-options*.

LINEATTRS=*style-element* | *style-element* (*line-options*) | (*line-options*)
specifies the line attributes to be used when an attribute map is applied to lines in a graph.

Defaults When DISCRETELEGENDENTRYPOLICY=DATA, unspecified attributes receive the attributes that they would have if the attribute map were not defined.

When DISCRETELEGENDENTRYPOLICY=ATTRMAP, unspecified attributes derive attributes from the GraphDataDefault style element.

Restrictions In SAS 9.4 and earlier releases, the THICKNESS= line option is ignored. Starting with SAS 9.4M1, the THICKNESS= line option is supported.

Line option PATTERN= is ignored for the bar outlines in histograms.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Line Options" on page 1602 for available *line-options*.

MARKERATTRS=*style-element* | *style-element* (*marker-options*) | (*marker-options*)
specifies the marker attributes to be used when an attribute map is applied to marker symbols in a graph.

Defaults When DISCRETELEGENDENTRYPOLICY=DATA, unspecified attributes receive the attributes that they would have if the attribute map were not defined.

When DISCRETELEGENDENTRYPOLICY=ATTRMAP, unspecified attributes derive attributes from the GraphDataDefault style element.

Restrictions The WEIGHT= marker option is ignored.

In SAS 9.4 and earlier releases, the SIZE=, TRANSPARENCY=, and WEIGHT= marker options are ignored. Starting with SAS 9.4M1, the SIZE=, TRANSPARENCY=, and WEIGHT= marker options are supported.

For filled, outlined markers, COLOR and TRANSPARENCY are ignored.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a *style-element*.

"Marker Options" on page 1604 for available *marker-options*.

TEXTATTRS=*style-element* | *style-element* (*text-options*) | (*text-options*)
specifies the text attributes to use when an attribute map is applied to text in a graph.

Default The GraphDataText style element.

Restriction This option is honored only by the TEXTGROUP= option in the AXISTABLE statement and the GROUP= option in the TEXTPLOT statement.

See "General Syntax for Attribute Options" on page 1599 for the syntax on using a style element.

"Text Options" on page 1606 for available text options.

Details

About Discrete Attribute Maps

Attribute maps can be useful for ensuring that a particular value (a company name, for example) is always represented by the same visual characteristics in your graphs, regardless of the value's order in the input data. When specified directly in a discrete legend, an attribute map can be used to display legend entries for group values that are not in the data. (See "Displaying Legend Entries for Group Values That Are Not in the Data" on page 1512.)

If you do not want to manage the graphical properties that are associated with each unique discrete value, then you can simply specify an input column in the grouping option. In that case, each discrete value is represented by different graphical properties in the graph. The default properties are derived from options that are set in the plot statement or from the GraphData1–GraphDataN style elements that are defined in the ODS style that is in effect. However, to ensure that specific graphical properties are used to represent a discrete value in the graph, regardless of that value's order in the data, you can use an attribute map to create that association. Any values in the data that are not accounted for in the attribute map are assigned the graphical properties that they would receive if the attribute map is not defined.

Defining a Discrete Attribute Map in a DISCRETEATTRMAP Block

A DISCRETEATTRMAP block creates an attribute map that matches graphical properties to discrete values. The attribute map can be associated with a data input

column that is used as a classification variable in a graph. It can also be specified directly in a discrete legend.

To define a discrete attribute map in a DISCRETEATTRMAP block, do the following:

- Use the DISCRETEATTRMAP statement to start the attribute definition and assign a name to it. The DISCRETEATTRMAP statement must be located within the BEGINGRAPH block but outside of the outermost layout block. It cannot be nested in another DISCRETEATTRMAP statement or in a RANGEATTRMAP statement. The DISCRETEATTRMAP statement determines whether the data mapping is case-sensitive and whether leading blanks are trimmed from the data values during the mapping.
- Nest within the DISCRETEATTRMAP block at least one VALUE statement that specifies graphical properties to associate with a classification value. See "About the VALUE Statement" on page 1511. Use one VALUE statement for each classification value that you want to map. Values that are referenced in the attribute map can be character or numeric. Discrete values that are not accounted for in the attribute map are assigned the graphical properties that they would receive if the attribute map is not defined.
- Use the ENDDISCRETEATTRMAP statement to close the block.

For information about how to use the attribute map, see "Using a Discrete Attribute Map" on page 1512.

About the VALUE Statement

A VALUE statement within the DISCRETEATTRMAP block associates graphical properties with a discrete value in the attribute map. To associate graphical properties with multiple values, specify multiple VALUE statements in the attribute map using the following general syntax for each of the statements:

VALUE *value-spec* <*/options*>;

For a specific example, see the "Example Program" on page 1515.

If the discrete attribute map is referenced by a plot statement in the template, then the graphical properties that are defined in the VALUE statements are used in the plot. If a discrete legend is generated for the plot, then the graphical properties are represented in that legend.

If a discrete attribute map is referenced directly in a DISCRETELEGEND statement, then the graphical properties that are defined in the VALUE statement are mapped directly to the legend and are independent of the values in the data. For more information and an example, see the "Defining a Discrete Attribute Map in a DISCRETEATTRMAP Block" on page 1510 .

If two or more VALUE statements define attributes to associate with the same classification values, then the last VALUE statement's settings are used.

By default when comparing a column's value to a string that is specified for the VALUE statement's *value-spec*,

- the column value is formatted to a string, using the format that is defined for the column or the default format if no format is defined for the column

- leading spaces are trimmed from the string that is specified in the VALUE statement
- a case-sensitive comparison is performed between the column string and the VALUE string.

To change the default behavior for the comparison, you can use the DISCRETEATTRMAP statement's TRIMLEADING= and IGNORECASE= options.

Using a Discrete Attribute Map

To use a discrete attribute map that is defined in a DISCRETEATTRMAP block, do the following:

- Use the DISCRETEATTRVAR statement to create a named association between the defined attribute map and the input column that contains the classification values. The ATTRMAP= argument identifies the attribute map and the VAR= argument identifies the input column. Use the ATTRVAR= argument to assign a name that can be used to reference the named association in plot statements within the template.
- Reference the attribute map variable in the plot statements where needed. See "Referencing a Discrete Attribute Map in Plot Statements" on page 1499.

For an example, see "Example Program" on page 1515.

Displaying Legend Entries for Group Values That Are Not in the Data

To display legend entries for the values in a grouped plot, you typically use the plot statement's NAME= option to assign a name to the plot, and then reference that name in the DISCRETELEGEND statement. In this usage case, the legend displays entries for the group values that exist in the data.

To represent all of the group values in the legend, regardless of whether they exist in the data, you can specify DISCRETELEGENDENTRYPOLICY=ATTRMAP in the DISCRETEATTRMAP statement for the attribute map. When the DISCRETELEGENDENTRYPOLICY=ATTRMAP option is in effect, the associated plot contributes all of the items in the attribute map to the discrete legend regardless of whether they exist in the data.

Displaying all of the items in a discrete attribute map in the legend can be useful for flagging data in the graph. For example, assume you have weight and height values for all students in an analysis group and you want to create a scatter plot of the data. However, some of the observations are incomplete and do not record the student's sex. You want to include the incomplete observations in your plot, but you want to visually distinguish them from the others. In that case, you can do the following:

- Represent the unknown values in your data by entering the value U for sex.
- Define the discrete attribute map for the plot in a DISCRETEATTRMAP block. Include the DISCRETELEGENDENTRYPOLICY=ATTRMAP option in the DISCRETEATTRMAP statement. Include VALUE statements that specify the properties for the M, F, and U values.

- Use the DISCRETEATTRVAR statement to create a discrete attribute map variable that associates the attribute map with column Sex in the input data.
- In the SCATTERPLOT statement, specify the discrete attribute map variable name in the GROUP= option.
- In the DISCRETELEGEND statement, reference the scatter plot.

As a result, the legend displays the attribute-map definitions, and observations with the value U in column Sex are displayed as incomplete observations.

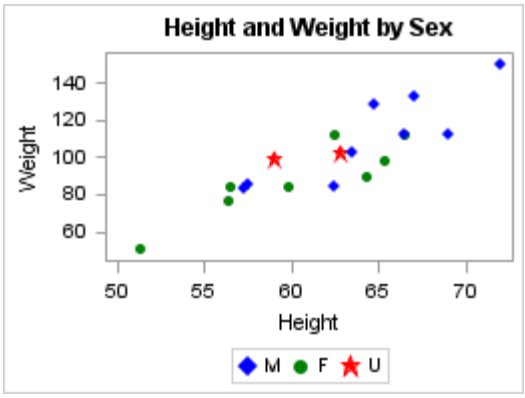
Here is an example of a template that uses a discrete attribute map to uniquely display observations with the value U in column Sex.

```
proc template;
  define statgraph discreteattrmapdatapresent;
    begingraph;
      entrytitle "Height and Weight by Sex";
      /* Define the attribute map and assign the name "symbols" */
      discreteattrmap name="symbols" / trimleading=true ignorecase=true
        discretelegendentrypolicy=attrmap;
        value "M" / markerattrs=(color=blue symbol=diamondfilled);
        value "F" / markerattrs=(color=green symbol=circlefilled);
        value "U" / markerattrs=(color=red symbol=starfilled);
      enddiscreteattrmap;

      /* Create attribute map variable GROUPMARKERS to associate
attribute
         map SYMBOLS with column Sex */
      discreteattrvar attrvar=groupmarkers var=sex attrmap="symbols";

      /* Use the attribute map by referencing GROUPMARKERS in a plot
         statement */
      layout overlay;
        scatterplot x=height y=weight / name="scatter"
          group=groupmarkers;
        discretelegend "scatter";
      endlayout;
    endgraph;
  end;
```

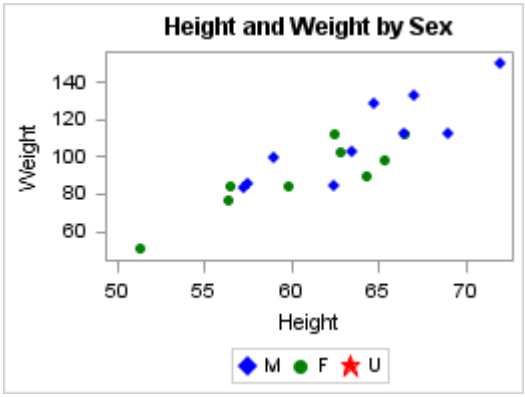
To test the template, you can generate test data set Testclass from Sashelp.Class by changing the value of column Sex to U for John and Carol as shown in the following code.

```
data testclass;
   set sashelp.class;
   if (name="John") then sex="U";
   if (name="Carol") then sex="U";
run;
```

The following figure shows the output of this template when it is run with the test data set Testclass.



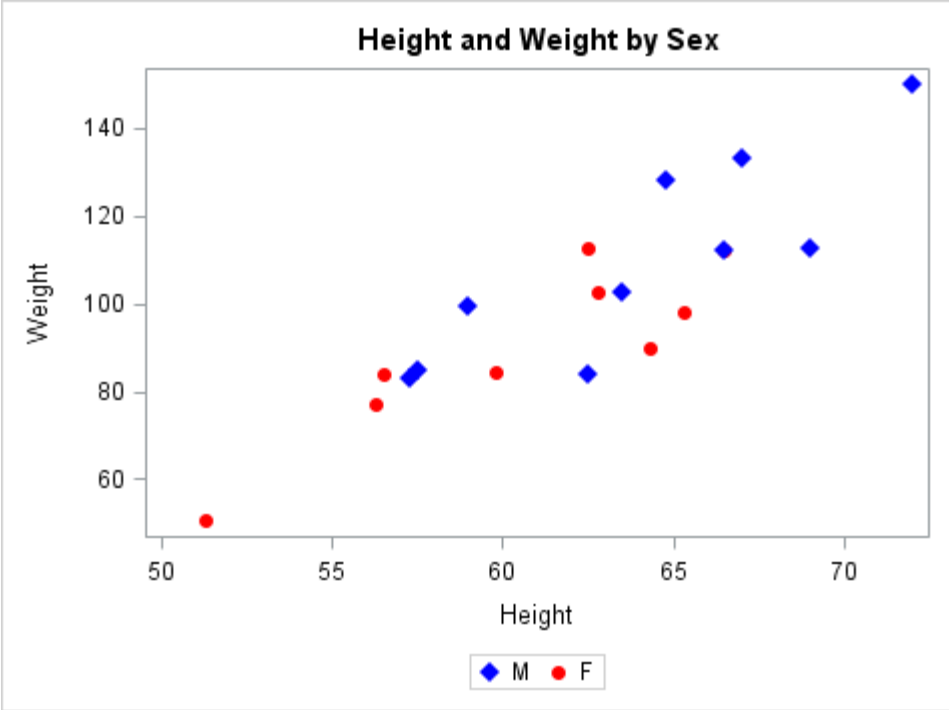
The two red stars in the plot indicate the observations with the value U in column Sex. The next figure shows the output of this template when it is run with the complete data in data set Sashelp.Class.



The absence of the red stars in the plot indicates that the value U is no longer present in the data. All of the observations are now complete. When DISCRETELEGENDENTRYPOLICY=ATTRMAP is specified for an attribute map, be aware that the legend entries that are contributed by an associated plot are defined entirely by the attribute map and are independent of the data.

Example: DISCRETEATTRMAP and DISCRETEATTRVAR Statements

The following graph was generated by the "Example Program" on page 1515. The example defines graphical properties to associate with classification values in an input column that is used in a scatter plot. The DISCRETEATTRMAP statement starts the attribute map definition, assigns a name to it, and ensures that the data mapping is not case sensitive. The VALUE statements define the colors and marker symbols to associate with the values M and F. The DISCRETEATTRVAR statement associates the attribute map with the data column Sex and assigns the name GROUPMARKERS to the association. The SCATTERPLOT statement references the named association in its GROUP= option.



Example Program

```
proc template;
  define statgraph scatterplot;
    begingraph;
      entrytitle "Height and Weight by Sex";

      /* define the attribute map and assign the name "symbols" */
      discreteattrmap name="symbols" / ignorecase=true ;
        value "m" / markerattrs=(color=blue symbol=diamondfilled) ;
        value "f" / markerattrs=(color=red  symbol=circlefilled) ;
      enddiscreteattrmap ;

      /* associate the attribute map with input data column Sex and
assign
       * the name GROUPMARKERS to the named association */
      discreteattrvar attrvar=groupmarkers var=sex attrmap="symbols" ;

      /* reference GROUPMARKERS in a plot statement */
      layout overlay;
        scatterplot x=height y=weight / name="scatter"
          group=groupmarkers ;
        discretelegend "scatter";
      endlayout;
    endgraph;
  end;

proc sgrender data=sashelp.class template=scatterplot;
run;
```

DISCRETEATTRVAR Statement

Creates a named association between a user-defined discrete attribute map and an input data column.

Requirements: You must place the DISCRETEATTRVAR statement directly inside the BEGINGRAPH block between the BEGINGRAPH statement and the first LAYOUT statement. Do not embed it in any other GTL statement block.

A discrete attribute map must be created using the DISCRETEATTRMAP statement.

See: "Example: DISCRETEATTRMAP and DISCRETEATTRVAR Statements" for an example.

Syntax

DISCRETEATTRVAR ATTRVAR=*attrvar-name*
VAR=*data-column* | *expression* | *dynamic*
ATTRMAP="*attrmap-name*";

Required Arguments

ATTRVAR=*attrvar-name*
specifies a SAS name for this association between the attribute map and the input column. This name must be unique within the template and can be referenced by other statements that can be associated with the attribute map. The attribute map variable name should not be used in an expression. If it is, then the results are unpredictable.

Restrictions The name that is assigned in this argument is used to associate an attribute map with the discrete values in an input data column. Thus, it is not the name to reference when you want to display legend entries that are independent of the data. For that special use, a DISCRETELEGEND statement can reference the attribute map directly by the name that is assigned in the DISCRETEATTRMAP statement. For more information, see the DISCRETEATTRMAP statement's "Defining a Discrete Attribute Map in a DISCRETEATTRMAP Block" on page 1510 .

Using an attribute variable in an expression is not supported.

Note The assigned SAS name can be the same as the name of the data input column, but it is not recommended. If an assigned *attrvar-name* matches the name of an input data column, then the *attrvar-name* takes precedence.

VAR=*data-column* | *expression* | *dynamic*
specifies an input data column to be associated with an attribute map at run time. If an *expression* is used, a new column of transformed values is created and then matched with the attribute map.

Interaction If the column is not found or the column is of the wrong type for the attribute map, then the DISCRETEATTRVAR statement is ignored.

Tip The input data column can be character or numeric, but the values must match the type of the values that are specified in the attribute map. For numeric columns, all values are treated as discrete values.

ATTRMAP="*attrmap-name*"
specifies the name of an existing discrete attribute map.

Restriction The *attrmap-name* is case sensitive, must be enclosed in quotation marks, and must be the name that was assigned to the attribute map in the DISCRETEATTRMAP statement's NAME= argument.

Details

The DISCRETEATTRVAR statement creates and names an association between graphical properties that are specified in a DISCRETEATTRMAP block and a classification column that is in the data. The name that is assigned to the association in the DISCRETEATTRVAR statement is the name that plot statements must reference to use the attribute map.

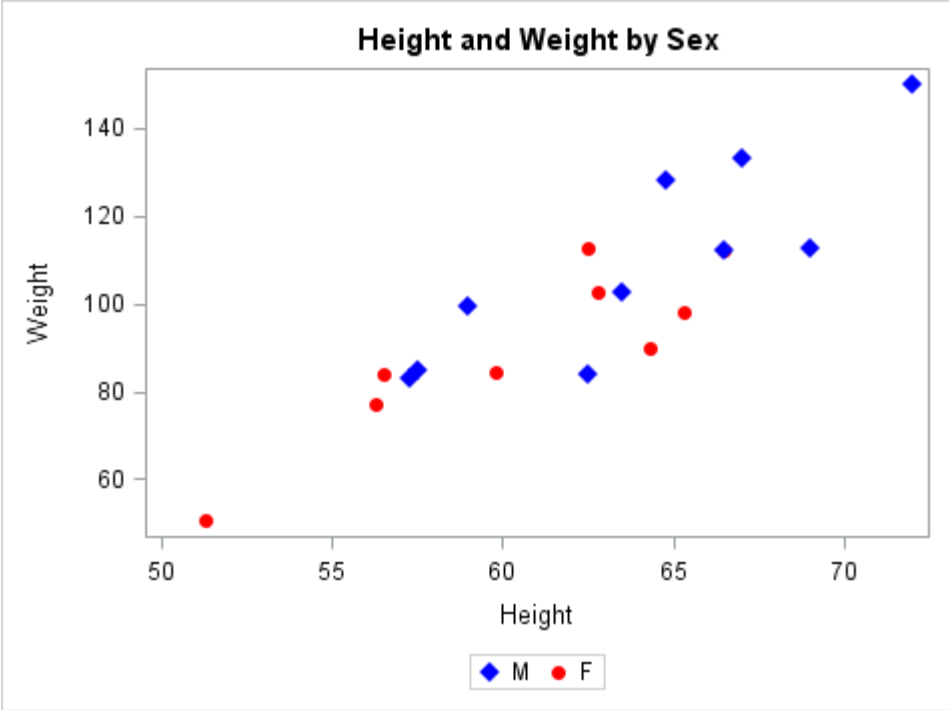
Defining and using a discrete attribute map requires you to coordinate settings on several statements. For more information, see the DISCRETEATTRMAP statement's "Defining a Discrete Attribute Map in a DISCRETEATTRMAP Block" on page 1510 .

The DISCRETEATTRVAR statement must be located within the BEGINGRAPH block but outside of the outermost layout block. It cannot be nested in a DISCRETEATTRMAP statement.

Example: DISCRETEATTRVAR Statement with an Attribute Map Data Set

Starting with SAS 9.4M1, you can define an attribute map in a SAS data set. This example shows you how to use the DISCRETEATTRVAR statement with an attribute map that is defined in a SAS data set. It is the example in "Example: DISCRETEATTRMAP and DISCRETEATTRVAR Statements" on page 1514 modified to use a SAS data set instead of a DISCRETEATTRMAP block.

Here is the output for this example.



Example Program

Here is the SAS code for this example.

```
/* Create the attribute map data set */
data attrds;
   input ID $1-7 VALUE $9 MARKERSYMBOL $11-23 MARKERCOLOR $25-30;
datalines;
symbols M diamondfilled blue
symbols F circlefilled  red
;
run;

/* Define the template for this graph */
proc template;
  define statgraph scatterplot;
    begingraph;
      entrytitle "Height and Weight by Sex";

      /* Associate the attribute map with input data column Sex and
assign
       * the name GROUPMARKERS to the named association */
      discreteattrvar attrvar=groupmarkers var=sex attrmap="symbols";

      /* Reference GROUPMARKERS in a plot statement */
      layout overlay;
        scatterplot x=height y=weight / name="scatter"
          group=groupmarkers;
        discretelegend "scatter";
      endlayout;
```

```
    endgraph;
  end;

  /* Generate the graph */
proc sgrender data=sashelp.class dattrmap=attrds template=scatterplot;
run;
```

Details

The attribute map is defined in data set Attrds. The data set includes the required columns ID and VALUE, which specify a name for this attribute map and the value of the classification variable that is to be mapped. The MarkerSymbol and MarkerColor columns specify the graphical properties that are mapped to each value. The values specified in the Value column are case-sensitive. Unlike the DISCRETEATTRMAP statement, when you define your attribute map in a data set, there is no option that you can specify to ignore case. You must ensure that the case of the values in your attribute map matches the case in the actual data.

The DISCRETEATTRVAR statement associates the attribute map with the data column Sex and assigns the name GROUPMARKERS to the attribute map variable. The ATTRMAP= option specifies the name in the ID column of the attribute map data set. The value is case-sensitive. The attribute map variable name is specified in the GROUP= option in the SCATTERPLOT statement.

Finally, in the SGRENDER statement, the DATTRMAP= option specifies the name of the attribute map data set. When your attribute map is defined in a SAS data set, you must specify the name of the data set in the DATTRMAP= option in the SGRENDER statement that renders the graph.

You can also use the DATTRVAR= statement with the SGRENDER statement to associate the attribute map with the data column Sex. See “Referencing an Attribute Map in Your Plot Statements” on page 1499.

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Range Attribute Map Statements

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Dictionary

RANGEATTRMAP Statement

Creates an attribute map that matches colors to numeric values or numeric ranges so that the colors can be associated with the values of an input data column.

Restriction: A RANGEATTRMAP cannot be directly referenced in a legend statement.

Requirements: You must place the RANGEATTRMAP block directly inside the BEGINGRAPH block between the BEGINGRAPH statement and the first LAYOUT statement. Do not embed it in any other GTL statement block.

The RANGEATTRMAP block must contain at lease one RANGE statement.

The RANGEATTRVAR statement must be used to associate the range attribute map with a data column.

Note: The RANGEATTRMAP statement defines a set of graphical properties for ranges of data values.

See: "RANGEATTRVAR Statement" on page 1531

Syntax

RANGEATTRMAP NAME="*string*";

RANGE *range-spec* < */options* >;

<... *more-RANGE statements* ...>

ENDRANGEATTRMAP;

Required Argument

NAME=*"string"*

assigns a name to the attribute definition for reference in a RANGEATTRVAR statement.

Restrictions The string is case sensitive, must be enclosed in quotation marks, and must define a name that is unique among RANGEATTRMAP names within the template.

This option does not support variables that are created by the DYNAMIC, MVAR, and NMVAR template statements.

RANGE Statement Required Argument

range-spec

specifies a range of numeric values or a keyword, such as OTHER or MISSING.

A range of numeric values is specified in the form *low-value - high-value*. Both the low value and the high value can be specified as an unformatted numeric value. A less-than symbol (<) can be placed after the low numeric value, before the high numeric value, or in both positions to exclude that value from the range endpoint (similar to the VALUE statement of PROC FORMAT). If you are excluding the first value in a range, then put the < after the low value. If you are excluding the last value in a range, then put the < before the high value. You can also exclude both the low and the high value.

For example, the following range does not include 0:

```
0 < - 100
```

Likewise, the following range does not include 100:

```
0 - < 100
```

If a value at the high end of one range also appears at the low end of another range and you do not use the < exclusion notation, then the value is assigned to the first range.

If two or more RANGE statements define colors to associate with the same numeric values or ranges, then the first RANGE statement's settings are used. If any RANGE statement's range overlaps another RANGE statement's range (for example, 10 - 20 and 15 - 25), then the entire attribute map is ignored and default coloring is used.

If two ranges share a common endpoint (for example, 10 - 20 and 20 - 30) and no exclusion operator is used, then the common endpoint belongs to the lower encountered range (10 - 20 in this case). The order of the specification does not matter.

To set a single numeric value, specify the same value for both the low value and the high value.

If the low value is not less than or equal to the high value, then the range specification is invalid, and the RANGE statement is ignored in the attribute map definition.

Note: If a range is not defined for keyword OTHER, then gaps within the attribute map ranges are assigned the default color that is defined by the GraphOther:ContrastColor style reference.

Rather than using a numeric value, you can specify one of the following keywords as the low value or the high value:

MIN	indicates the minimum data value for column values.
MAX	indicates the highest data value for the column values.
MAXABS	indicates max(abs(MIN) , abs(MAX))
NEGMAX	indicates -MAX
NEGMAXABS	indicates -max(abs(MIN) , abs(MAX))

Rather than specifying a low-value-to-high-value range, you can use one of the following keywords for the range specification:

MISSING
indicates a mapping for missing values. The visual attributes for this setting are obtained from the GraphMissing style element. If one RANGE statement specifies this value and another RANGE statement specifies keyword OTHER, then the OTHER range does not include missing values.

UNDER
creates a range for all data values between the lowest mapped value and the lowest actual data value. The visual attributes for this setting are obtained from the GraphUnderflow style element. If one RANGE statement specifies this value and another RANGE statement specifies keyword OTHER, then the OTHER range does not include underflow values.

OVER
creates a range for all data between the highest mapped value and the highest actual data value. The visual attributes for this setting are obtained from the GraphOverflow style element. If one RANGE statement specifies this value and another RANGE statement specifies keyword OTHER, then the OTHER range does not include overflow values.

OTHER
creates a category for all other column values not explicitly assigned to a range. The OTHER values can be composed of several non-contiguous ranges. The visual attributes for this setting are obtained from the GraphOther style element.

Restriction A dynamic variable reference or run-time macro variable reference cannot be used in *range-spec*.

RANGE Statement Optional Arguments

RANGEALTCOLOR=*style-reference* | *color* | GRADIENTSTEPPER(*color1,color2, num-steps, step*)

specifies a contrast color for lines, markers, and text to represent the defined value range.

GRADIENTSTEPPER (*color1,color2, num-steps, step*)

a gradient stepper that partitions a color range into equal-sized intervals and returns the color that is in the specified step position. The start and end colors for the range are specified in parameters *color1* and *color2*. The number of equal-sized intervals is specified in parameter *num-steps*, and the step position for the color to return is specified in parameter step.

Example:

```
rangeattrmap name="incomemap";
  range min - 13000    / rangealtcolor=gradientstepper(red,green,4,1);
  range 13000 < - 25000 / rangealtcolor=gradientstepper(red,green,4,2);
  range 25000 < - 50000 / rangealtcolor=gradientstepper(red,green,4,3);
  range 50000 < - max   / rangealtcolor=gradientstepper(red,green,4,4);
endrangeattrmap;
```

Default The GraphDataDefault:ContrastColor style reference.

Restriction A dynamic variable reference or run-time macro variable reference can be used to specify individual token values, but it cannot be used to replace the entire list of tokens.

Interaction If this option is specified, then the RANGEALTCOLORMODEL= option is ignored

Tips Because lines and markers have less surface area, choose a contrasting color in order to improve visibility.

Use RANGECOLOR= to control fill color.

RANGECOLOR=*style-reference* | *color* | GRADIENTSTEPPER(*color1,color2, num-steps, step*)

specifies a color for area fill to represent the defined value range.

GRADIENTSTEPPER (*color1,color2, num-steps, step*)

a gradient stepper that partitions a color range into equal-sized intervals and returns the color that is in the specified step position. The start and end colors for the range are specified in parameters *color1* and *color2*. The number of equal-sized intervals is specified in parameter *num-steps*, and the step position for the color to return is specified in parameter *step*. Example:

```
rangeattrmap name="incomemap";
  range min - 13000    / rangecolor=gradientstepper(red,blue,4,1);
  range 13000 < - 25000 / rangecolor=gradientstepper(red,blue,4,2);
  range 25000 < - 50000 / rangecolor=gradientstepper(red,blue,4,3);
  range 50000 < - max   / rangecolor=gradientstepper(red,blue,4,4);
endrangeattrmap;
```

Default The GraphDataDefault:ContrastColor style reference.

Restriction A dynamic variable reference or run-time macro variable reference can be used to specify individual token values, but it cannot be used to replace the entire list of tokens.

Interaction If this option is specified, then the RANGECOLORMODEL= option is ignored.

Tip Use RANGEALTCOLOR= to control line and marker color.

RANGEALTCOLORMODEL=*style-element* | (*list-of-colors*)
specifies either a style element or a list of one or more specific contrast colors for lines, markers, and text to represent the defined value range in this argument.

style-element
specifies the name of a style element. To display the range as a gradient ramp, choose a style element such as TwoColorRamp, TwoColorAltRamp, ThreeColorRamp, or ThreeColorAltRamp. The style element should contain the following style attributes:

STARTCOLOR	specifies a color for the smallest data value.
NEUTRALCOLOR	specifies a color for the midpoint of the data range. This attribute is not needed when defining a two-color ramp.
ENDCOLOR	specifies a color for the highest data value.

To display the range or single value contrast color as a color that is defined in a style, use a *style-reference* (for example, `GraphData1:color`) to refer to a Color attribute. The following style references correspond to the keywords that are available in this statement's *range-spec* argument:

***range-spec* Keyword**	**Corresponding Style Reference**
MISSING	GraphMissing:ContrastColor
OTHER	GraphOther:ContrastColor
UNDER	GraphUnderflow:ContrastColor
OVER	GraphOverflow:ContrastColor

(*list-of-colors*)
a space-separated list of two or more color keywords that is enclosed in parentheses.

Two colors create the endpoints of a ramp. The first color is assigned to the low value in the range specification, and the second color is assigned to the high value. Three or more colors partition the range specification into *n*-1 equal-sized intervals where each adjacent color pair defines a two-color ramp.

Interaction This option is ignored if the RANGEALTCOLOR= option is specified.

Tips Because lines and markers have less surface area, choose contrasting colors in order to improve visibility.

Use RANGECOLORMODEL= to control fill color.

RANGECOLORMODEL=*style-element* | (*list-of-colors*)
specifies either a style element or a list of one or more specific colors for area fills to represent the defined value range in this *range-spec* argument.

style-element
specifies the name of a style element. To display the range as a gradient ramp, choose a style element such as TwoColorRamp, TwoColorAltRamp, ThreeColorRamp, or ThreeColorAltRamp. The style element should contain the following style attributes:

STARTCOLOR	specifies a color for the smallest data value.
NEUTRALCOLOR	specifies a color for the midpoint of the data range. This attribute is not needed when defining a two-color ramp.
ENDCOLOR	specifies a color for the highest data value.

To display the range or single value as a color that is defined in a style, use a *style-reference* (for example, `GraphData1:color`) to refer to a color attribute. The following style references correspond to the keywords that are available in this statement's *range-spec* argument:

***range-spec* Keyword**	**Corresponding Style Reference**
MISSING	GraphMissing:ContrastColor
OTHER	GraphOther:ContrastColor
UNDER	GraphUnderflow:ContrastColor
OVER	GraphOverflow:ContrastColor

(*list-of-colors*)
a space-separated list of two or more color keywords that is enclosed in parentheses.

Two colors create the endpoints of a ramp. The first color is assigned to the low value in the range specification, and the second color is assigned to the high value. Three or more colors partition the range specification into *n*–1 equal-sized intervals, where each adjacent color pair defines a two-color ramp.

Interaction This option is ignored if the RANGECOLOR option is specified.

Tip Use RANGEALTCOLORMODEL= to control line and marker color.

Details

Creating and Using a Range Attribute Map

The RANGEATTRMAP statement creates an attribute map that matches colors to numeric values or value ranges. The attribute map can be associated with a data input column that uses color to represent response values in a graph. Attribute maps can be useful for controlling the application of gradient color in a graph. In addition, they enable you to map color to data values, independent of the actual data that is used in the graph. For example, for temperature data, you can set Blue for 0 and Red for 100, even if the values 0 and 100 are not in the data.

Defining and using the attribute map requires you to coordinate settings on several statements:

- Use the RANGEATTRMAP statement to start the attribute definition and assign a name to it.
- Nest within the RANGEATTRMAP block at least one RANGE statement that specifies a numeric value or numeric range and the color, contrast color, or both, to associate with that value or range. Use one RANGE statement for each value range that you want to map. You can use keywords like MIN and MAX in the range specification. For complete details about the range specifications, see the RANGE statement.
- Use the RANGEATTRVAR statement to create a named association between the defined attribute map and the input column that contains the numeric values. The ATTRMAP= argument identifies the attribute map and the VAR= argument identifies the input column. Use the ATTRVAR= argument to assign a name that can be used to reference the named association in plot statements within the template.
- Reference the attribute map where needed. See "Referencing a Range Attribute Map in Plot Statements" on page 1503.

The RANGEATTRMAP statement must be located within the BEGINGRAPH block but outside of the outermost layout block. It cannot be nested in another RANGEATTRMAP statement or in a RANGEATTRMAP statement. The RANGEATTRMAP block must contain at least one RANGE statement. All values that are referenced in the attribute map must be numeric. Data values that are not accounted for in the attribute map receive the default color from the GraphOther, GraphOverflow, or GraphUnderflow style element, depending on where the unassigned values are relative to the specified data ranges.

Note: Unlike a DISCRETEATTRMAP statement, a RANGEATTRMAP statement cannot be directly referenced in a legend. This is because the RANGE statements can specify keywords like MIN and MAX that require a data association for interpretation.

About the RANGE Statement

A RANGE statement within the RANGEATTRMAP block matches color to a numeric value, or a color ramp to a numeric range. To match colors to multiple

values or ranges, specify multiple RANGE statements using the following general syntax for each of the statements:

RANGE *range-spec* < */options* >;

For a specific example, see the "Example Program" on page 1529.

When defining multiple RANGE statements, be careful not to define conflicting ranges. A RANGE statement might be syntactically correct by itself while conflicting with settings in another RANGE statement.

Specifying Color in a RANGE Option

For specifying a color in one of the RANGE options, the color keywords can be any of the following:

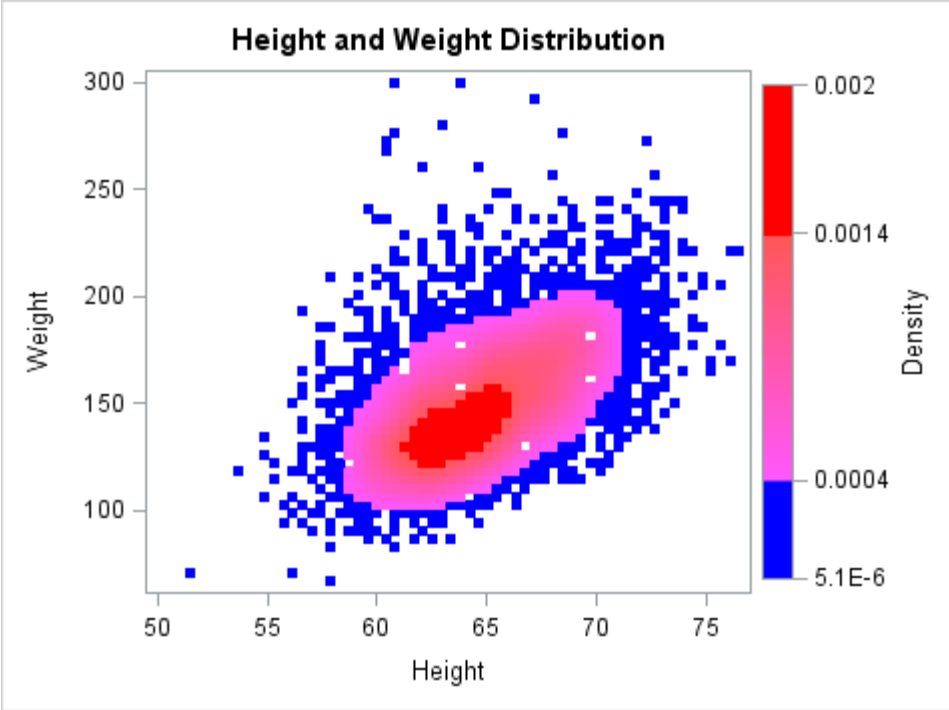
- a SAS color name (for example, blue)
- an RGB name (for example, CX0000FF or x0000FF)
- an HLS value (for example, H14E162D)
- a gray-scale color code (for example, GRAYBB)
- an HTML color name (for example, AZURE)
- a SAS session color (for example, DMSBLUE).

Examples

Example 1: Using a Range Attribute Map to Control Marker Colors

The following graph was generated by the "Example Program" on page 1529. The example defines colors to associate with data ranges in an input column that is used in a grouped scatter plot. The RANGEATTRMAP statement starts the attribute map definition and assigns a name to it. The RANGE statements define the value ranges and the colors to associate with those ranges. Because the SCATTERPLOT statement uses the ContrastColor style attribute for the marker colors in a grouped plot, the RANGEALTCOLOR= and RANGEALTCOLORMODEL= options are used in the RANGE statement to define the range colors. These options can also be used to define range colors for lines and some text elements.

The highest range value specified, which is 0.002 in this example, does not have to be an actual value in the data. The RANGEATTRVAR statement associates the attribute map with the data column Density and assigns the name RANGEVAR to the association. The SCATTERPLOT statement references the named association in its MARKERCOLORGRADIENT= option.



Example Program

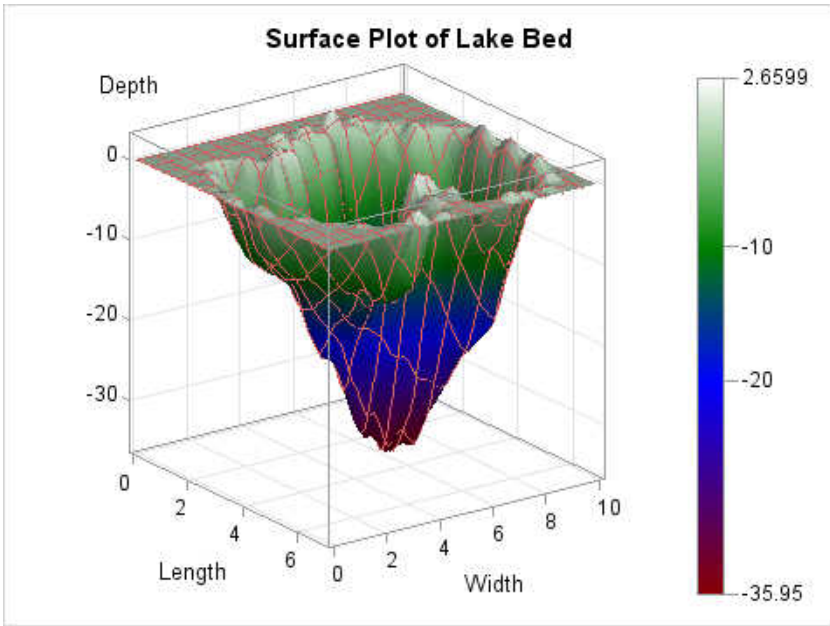
```
proc template;
define statgraph attrmap;
  begingraph;
    entrytitle "Height and Weight Distribution" ;

    /* Define the attribute map and assign the name "densityrange." */
    rangeattrmap name="densityrange" ;
      range MIN - 0.0004     / rangealtcolor=blue ;
      range 0.0004 < - 0.0014 / rangealtcolormodel=(lightpurple
lightred) ;
      range 0.0014 < - 0.002  / rangealtcolor=red ;
    endrangeattrmap ;

    /* Associate the attribute map with input data column Density and
       assign variable name RANGEVAR to the named association */
    rangeattrvar attrvar=rangevar var=density attrmap="densityrange" ;

    /* Reference RANGEVAR in the SCATTTERPLOT statement */
    layout overlay;
      scatterplot x=height y=weight / markercolorgradient=rangevar
        markerattrs=(symbol=squarefilled size=6px) name="scatter";
      continuouslegend "scatter" / orient=vertical
        halign=right title="Density";
    endlayout;
  endgraph;
end;

ods graphics / reset width=475px;
```

```
proc sgrender data=sashelp.gridded(where=(count>0)) template=attrmap;
run;
```

Example 2: Using a Range Attribute Map to Control Fill Colors

The following graph was generated by the "Example Program" on page 1530. The example defines colors to associate with data ranges in an input column that is used in a surface plot. The RANGEATTRMAP statement starts the attribute map definition and assigns a name to it. The RANGE statements define the value ranges and the colors to associate with those ranges. Because the SURFACEPLOTPARM statement uses the Color style attribute for fill colors, the RANGECOLORMODEL= option is used in the RANGE statement to define the range colors.

The RANGEATTRVAR statement associates the attribute map with the data column Depth and assigns the name DEPTHRANGE to the association. The SURFACEPLOTPARM statement references the named association in its COLORRESPONSE= option.



Example Program

```
proc template;
  define statgraph surfaceplot;
    dynamic type;
    begingraph;
      /* Define the attribute map and assign the name "depth." */
      rangeattrmap name='depth';
        range -10 - MAX / rangecolormodel=(green white);
        range -20 - -10 / rangecolormodel=(blue green);
        range MIN - -20 / rangecolormodel=(darkred blue);
      endrangeattrmap;

      /* Associate the attribute map with input data column Depth and
```

```
          assign variable name DEPTHRANGE to the named association. */
        rangeattrvar attrvar=depthrange var=Depth attrmap='depth';
        entrytitle "Surface Plot of Lake Bed";
        layout overlay3d /
          xaxisopts=(griddisplay=on)
          yaxisopts=(griddisplay=on)
          zaxisopts=(griddisplay=on);

          /* Reference DEPTHRANGE in the SURFACEPLOTPARM statement */
          surfaceplotparm x=length y=width z=depth / name="depth"
            reversecolormodel=true
            colorresponse=depthrange;
        continuouslegend "depth";
        endlayout;
      endgraph;
    end;

/* Use the SAS/GRAPH G3GRID procedure to create gridded data for
   the surface plot. */
proc g3grid data=sashelp.lake out=gridded;
   grid width*length = depth / naxis1=75 naxis2=75;
run;

proc sgrender data= gridded template=surfaceplot;
run;
```

RANGEATTRVAR Statement

Creates a named association between a range attribute map of numeric values or value ranges and an input data column.

Requirements: You must place the RANGEATTRVAR statement directly inside the BEGINGRAPH block between the BEGINGRAPH statement and the first LAYOUT statement. Do not embed it in any other GTL statement block.

A range attribute map must be created using the RANGEATTRMAP statement.

See: "Example 1: Using a Range Attribute Map to Control Marker Colors" on page 1528 for an example.

Syntax

RANGEATTRVAR ATTRVAR=*attrvar-name*
VAR=*data-column* | *expression* | *dynamic*
ATTRMAP="*attrmap-name*";

Required Arguments

ATTRVAR=*attrvar-name*
specifies a SAS name for the map. This name must be unique among the RANGEATTRVAR statements within the template. The assigned name can be

referenced by other statements that can be associated with the range attribute map.the *attrvar-name*

Restriction Using an attribute variable in an expression is not supported.

VAR=*data-column* | *expression* | *dynamic*
specifies a numeric input data column to be associated with an attribute map at run time. If an *expression* is used, then a new column of transformed values is created and then matched with the attribute map.

Interaction If the column is not found or the column is of the wrong type for the attribute map, then the RANGEATTRVAR statement is ignored.

ATTRMAP="*attrmap-name* "
specifies the name of an existing range attribute map.

Restriction The *attrmap-name* is case sensitive, must be enclosed in quotation marks, and must be the name that was assigned to the attribute map in the RANGEATTRMAP statement's NAME= argument.

Details

The RANGEATTRVAR statement creates and names an association between colors that are specified in a RANGEATTRMAP block and a numeric column that is in the data. Attribute maps can be useful for controlling the application of gradient color in a graph or specifying data values that are independent of the actual data. The name that is assigned to the association in the RANGEATTRVAR statement is the name that plot statements must reference to use the attribute map.

Defining and using a numeric-range attribute map requires you to coordinate settings on several statements. For more information, see the RANGEATTRMAP statement's "Creating and Using a Range Attribute Map" on page 1527 .

The RANGEATTRVAR statement must be located within the BEGINGRAPH block but outside of the outermost layout block. It cannot be nested in a RANGEATTRMAP statement.

PART 12

Run-Time Programming Features

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20

Dynamic Variables and Macro Variables

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Template Types on PROC TEMPLATE

PROC TEMPLATE supports different template types such as COLUMN, TABLE, HEADER, FOOTER, and STATGRAPH. All of these template types support run-time variable substitution via dynamic variables or macro variables. For STATGRAPH templates such variables should be declared within the scope of the template definition before the BEGINGRAPH block.

```
PROC TEMPLATE;
  DEFINE STATGRAPH template-name ;

   DYNAMIC variable-1<"text-1"> <... variable-n<"text-n">>;
   MVAR variable-1<"text-1"> <... variable-n<"text-n">>;
   NMVAR variable-1<"text-1"> <... variable-n<"text-n">>;
   NOTES "text";

   BEGINGRAPH;
     GTL statements;
   ENDGRAPH;
  END;
RUN;
```

DYNAMIC, MVAR, and NMVAR Statements

Each of the DYNAMIC, MVAR, and NMVAR statements can define multiple variables and an optional text-string denoting its purpose or usage. For example:

```
DYNAMIC YVAR "required" YLABEL "optional";
MVAR LOCATE "INSIDE or OUTSIDE" SYSDATE;
NMVAR TRANS "transparency factor";
```

Note: For template readability, it is helpful to adopt a naming convention for these variables to distinguish them from actual option values or column names. Common conventions include capitalization, or adding leading or trailing underscores to their names.

Dynamic variables and macro variables can be referenced within the template definition as

- argument or option values. For example:

```
seriesplot x=date y=YVAR / curvelabel=YLABEL
  curvelabellocation=LOCATE datatransparency=TRANS;
```

- parts of some text strings. For example:

```
entrytitle "Time Series for " YLABEL;
entryfootnote "Created on " SYSDATE;
```

Dynamic variables and run-time macro variable references cannot resolve to statement or option keywords.

Note that macro variable references should not be prefaced with an ampersand (&) if you want them to resolve at run time.

Macro variables defined by MVAR are strings when they resolve, as with SYMGET() in the DATA step.

Macro variables defined by NMVAR are converted to numeric tokens when they resolve, as with SYMGETN() in the DATA step.

The values for a dynamic variable do not have to be provided by the data source. Rather, you can provide the values in the DYNAMIC statement in PROC SGRENDER, specifying the values as a space delimited list, enclosed in quotation marks. Do not use parentheses in the specification.

In the following example, the graph template specifies a dynamic variable named TICKS, which is referenced on the XAXISOPTS= option in LAYOUT OVERLAY. The DYNAMIC statement in PROC SGRENDER provides values for TICKS:

```
proc template;
  define statgraph regress;
    dynamic TICKS ;
    begingraph;
      layout overlay /xaxisopts=(linearopts=(tickvaluelist=TICKS));
        scatterplot x=age y=weight;
      endlayout;
    endgraph;
  end;
run;

proc sgrender data=sashelp.class template=regress;
  dynamic TICKS="11 13 16" ;
run;
```

If your template uses a dynamic variable to specify a required attribute, such as a variable name, and the name is misspelled or is not provided in the SGRENDER procedure, then a warning is issued and the respective plot statement drops out of the final graph. A graph is produced, but it might be a blank graph, or it might show the results of all statements except those that are in error.

For more information about using dynamic variables and macro variables in your templates, see *SAS Graph Template Language: User's Guide*.

Dynamic Variables Compared to Macro Variables

The main difference between dynamic variables and macro variables is how they are initialized.

For dynamic variables, use the DYNAMIC statement with PROC SGRENDER. For example,

```
proc sgrender data=sashelp.class template=timeseries;
  dynamic yvar="inflation" ylabel="Inflation Rate";
run;
```

Values for dynamic variables that resolve to column names or strings should be quoted. Numeric values should not be quoted.

For macro variables, use the current symbol table (local or global) to look up the macro variable values at run time. For example,

```
%let locate=inside;
%let trans=0.3;
```

```
proc sgrender data=sashelp.class template=timeseries;
  dynamic yvar="inflation" ylabel="Inflation Rate";
run;
```

No initialization is needed for system macro variables like SYSDATE.

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Expressions

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Overview

In Graph Template Language (GTL), as in Base SAS, an expression is an arithmetic or logical expression that consists of a sequence of operators, operands, and functions. An operand is a dynamic, a macro variable, a column, a function, or a constant. An operator is a symbol that requests a comparison, logical operation, or arithmetic calculation. In GTL, the expression must be enclosed in an EVAL function.

Expressions can be used to set the following types of option values:

- a constant
- a column
- part of the text for ENTRYTITLE, ENTRYFOOTNOTE, and ENTRY statements

Here is an example of computing constants:

```
/* create reference lines at computed positions */
referenceline y=eval(mean(height)+2*std(height)) /
  curvelabel="+2 STD";
referenceline y=eval(mean(height));
referenceline y=eval(mean(height)-2*std(height)) /
  curvelabel="-2 STD";
```

Here is an example of creating a new column:

```
/* create a new column as a log transformation */
scatterplot x=date y=eval(log10(amount));
```

Here is an example of building a footnote text string:

```
/* create a date and time stamp as a footnote */
entryfootnote  eval(put(today(),date9.)||" : "||
  put(time(),timeampm8.));
```

When you are building a text string, you can use the || operator to concatenate the substrings if none of the substrings are a numeric character value. If one or more of the substrings are a numeric character value such as “1.5”, then the || operator might produce unexpected results. In that case, use the CATS function to concatenate the strings instead. Here is an example of using the CATS function to build a footnote text string that includes the value of dynamic variable maxWeight, which stores a numeric character value:

```
/* indicate the maximum weight in a footnote */
entryfootnote eval(cats("Maximum weight: ", maxWeight," lbs"));
```

GTL Expressions Compared to WHERE Expressions

Valid GTL expressions are identical to valid WHERE expressions. See the WHERE statement documentation in Base SAS for a comprehensive list of operators and operands. However, GTL expressions do not perform subset operations as WHERE expressions do. The major difference in the result of a logical GTL expression on a column is that a Boolean value is returned for each observation without changing the number of observations.

For example, in the following line of code, the expression for the Y= argument does not reduce the number of observations plotted.

```
scatterplot x=name y=eval(height between 40 and 60);
```

Instead, the computed numeric column for the Y= argument consists of 0s and 1s, based on whether each observation’s Height column value is between 40 and 60. Whenever expressions are used to create new columns, a new column name is internally manufactured so that it does not collide with other columns in use.

An Expression in Statement Syntax

Throughout GTL documentation, you see *expression* used in statement documentation:

BOXPLOT X=*column* | *expression*

Y=*numeric-column* | *expression* < /*options*>;

For the X= argument, *expression* means any EVAL(*expression*) that results in either a numeric or character column. An expression that yields a constant is not valid because the X= argument does not accept constants.

Similarly, for the Y= argument, expression means any EVAL(*expression*) that results in a numeric column. The expression cannot result in a character column or any constant because the Y= argument accepts only a numeric column.

On the following REFERENCELINE statement, the X= argument can be a constant (single line) or a column (multiple lines) that has the same data type as the axis. This means that EVAL(*expression*) can result in a numeric or character column or constant that agrees with the axis type.

REFERENCELINE X= *x-axis-value* | *column* | *expression* </*options*>;

Automatic Type Conversion. Although expressions that are used in a DATA step perform automatic type conversion, GTL expression evaluation does not. Thus, you must use function(s) to perform required type conversions in an expression. Otherwise, the expression generates an error condition without warning when the template is executed.

For example, consider the following GTL expression:

```
if(substr(value, 1, 2) = "11")
```

This expression uses the SUBSTR function to determine whether the first two characters from VALUE evaluate to the string value "11". If VALUE is a string, then the expression works properly. However, if VALUE is numeric, then the expression generates an error condition. For a numeric, you must convert the value to a string before passing it to the SUBSTR function. The following modification uses the CATS function to perform the type conversion when necessary:

```
if(substr(cats(value, 1, 2)) = "11")
```

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Functions

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Overview

GTL supports a large number of functions, including:

- SAS functions that can be used in the context of a WHERE expression
- functions that are defined only in GTL
- summary statistic functions

SAS Functions

SAS Functions That Can Be Used in a GTL Template

Most of the SAS functions that are available in WHERE expressions can be used in a GTL template. These SAS functions include:

- character-handling functions
- date and time functions
- mathematical and statistical functions

Not all SAS functions are available in WHERE expressions. Call routines and other DATA-step-only functions (for example, LAG, VNAME, OPEN) are some examples of functions that cannot be used. Not all functions that are available in WHERE expressions are supported in GTL templates in all cases. The following form of the PUT function is an example:

```
markercharacter = eval(put(amount, dollar7.2 -L))
```

This form results in an error when the template is compiled. However, the following form is supported.

```
markercharacter = eval(put(amount, dollar7.2))
```

If you want to justify a string that is generated by the PUT function, use the LEFT or RIGHT function with the PUT function as shown in the following example:

```
markercharacter = eval(left(put(amount, dollar7.2)))
```

Functions that accept null parameter values also might not be supported when you specify a null parameter value.

For more information about SAS functions, see "Dictionary of Functions and CALL Routines" in *SAS Functions and CALL Routines: Reference*.

SAS Functions That Can Be Used to Create Flexible Templates

The following table shows some of the SAS functions can be used to increase the flexibility of your template code.

SAS Function Name	Description
IFC(*logical-expression*, "*true-value*", "*false-value*" <,"*missing-value*">)	Returns the character value *true-value* if *logical-expression* resolves to TRUE, *false-value* if it resolves to FALSE, or *missing-value* if it resolves to a missing value. The TRUE, FALSE, and MISSING values must be enclosed in quotation marks.
IFN(*logical-expression*, *true-value*, *false-value* <,*missing-value*>)	Returns the numeric value *true-value* if *logical-expression* resolves to TRUE, *false-value* if it resolves to FALSE, or *missing-value* if it resolves to a missing value.

Examples of Using the IFC and IFN SAS Functions

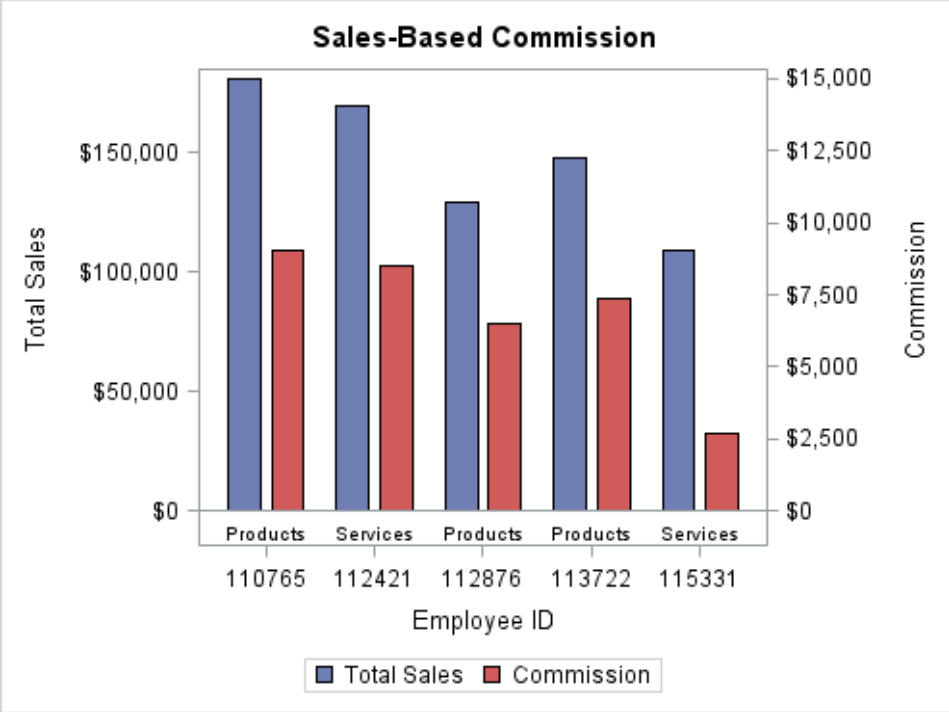
The IFC and IFN functions return one of two character or numeric values based on whether a conditional expression resolves to TRUE or FALSE. They can also return an optional third value if the conditional expression resolves to a missing value. These functions enable you to specify a value based on a conditional expression, effectively creating a new data column. In some cases, these functions can be used in place of IF-THEN-ELSE statements in your template code. As with other functions, you must enclose the IFC and IFN functions in the EVAL function.

Here is an example that uses both the IFN and IFC functions for creating a sales-based commission chart for employees in a sales group. Each employee in the group works in one of two sales units: Products and Services. The data for this example includes the employee ID, total sales, and sales unit code for each member of the sales group. Here is the data.

```
data sales;
  input empID totalSales salesUnit $18;
  format totalSales dollar9.;
datalines;
112876 129489.44 P
112421 169842.97 S
115331 108763.51 S
110765 181009.22 P
113722 147688.78 P
;
```

The TotalSales column contains the total sales for each employee. The SalesUnit column contains a code that identifies the sales unit in which each employee works. The codes are P for the Products unit and S for the Services unit.

Here is the output for this example.



The two bar charts show the total sales and earned commission for each employee. The IFN function is used to compute commission for each employee based on his or her total sales. Employees that achieved a sales total of $120,000 or more earn a commission of 5% of their total sales. All other employees earn a commission of 2.5% of their total sales.

An axis table along the X axis shows the sales unit for each employee. The IFC function is used to convert the P and S SalesUnit codes into more descriptive values in the axis table. Because only two sales unit codes are used in this case, the IFC function can be used for this purpose. This eliminates the need to add a new column to the data in a DATA step or to create and apply a custom format to the SalesUnit column.

Here is the SAS code that defines the template and generates the graph.

```
proc template;
  define statgraph commission;
    begingraph;
      entrytitle "Sales-Based Commission";
      layout overlay /
        xaxisopts=(label="Employee ID")
        yaxisopts=(label="Total Sales")
        y2axisopts=(label="Commission"
          linearopts=(viewmax=15000 tickvalueformat=dollar9.));
        /* Generate the sales bar chart. */
        barchart category=empID response=totalSales /
          name="Sales" legendlabel="Total Sales" barwidth=0.3
          discreteoffset=-0.2 fillattrs=graphData1;

        /* Generate the commission bar chart. */
        barchart category=empID
          /* Use IFN to compute the commission. */
          response=eval(ifn(totalSales >= 120000,
```

```
        totalSales * 0.05,      /* 5% if TRUE */
        totalSales * 0.025)) /   /* 2.5% if FALSE */
      name="Commission"  legendlabel="Commission"
      barwidth=0.3 yaxis=y2 discreteoffset=0.2
      fillattrs=graphData2;

    /* Add an axis table that shows the sales unit for each
      employee. */
    innermargin / align=bottom;
      axistable x=empID
        /* Use IFC to convert the codes to meaningful
           values. */
        value=eval(ifc(salesUnit = 'P',"Products",
          "Services")) / display=(values);
    endinnermargin;
    discretelegend "Sales" "Commission";
  endlayout;
 endgraph;
end;
run;

proc sgrender data=sales template=commission;
run;
```

Functions Defined Only in GTL

GTL Functions Used with the EVAL Function

The following table shows some functions that are used only in GTL. As with other functions, these must be enclosed within an EVAL. In all these functions, *column* can be either the name of a column in the input data set or a dynamic / macro variable that resolves to such a column.

Function Name	Description
COLC("*string-1*", "*string-1*"<, "*string-n*" … >)	Converts a list of comma-separated string values into a temporary character column. Starting with SAS 9.4M2, you can use this function to specify values in options that accept a character column.
COLN(*n-1*, *n-1*<, *n-N*… >)	Converts a list of comma-separated numeric values into a temporary numeric column. You can use this function to specify values in options that accept a numeric column.
COLNAME(*column*)	Returns the case-sensitive name of the *column*.

Function Name	Description
COLLABEL(*column*)	Returns the case-sensitive label of the *column*. If no label is defined for the *column*, then the case-sensitive name of the *column* is returned.
EXISTS(*item*)	Returns 1 if specified *item* exists, 0 otherwise. If *item* is a column, then it tests for the presence of the column in the input data set. If *item* is a dynamic / macro variable, then it tests whether there has been a run-time initialization of the variable.
EXPAND(*numeric-column*, *freq-column*)	Creates a new column as (*numeric-column* * *frequency-column*) .
ASORT(*column*, RETAIN=ALL)	Sorts all columns of the data object by the values of *column* in ascending order. SORT is an alias for ASORT. **Warning:** if the RETAIN=ALL argument is not included, *column* alone is sorted, not the other columns, causing rowwise information to be lost. **Limitation:** only one sort operation (whether an ASORT() or DSORT() function) can be used within a single template definition.
DSORT(*column*, RETAIN=ALL)	Sorts all columns of the data object by the values of *column* in descending order. **Warning:** if the RETAIN=ALL argument is not included, *column* alone is sorted, not the other columns, causing rowwise information to be lost. **Limitation:** only one sort operation (whether an ASORT() or DSORT() function) can be used within a single template definition.
NUMERATE(*column*)	Returns a *column* that contains the ordinal position of each observation in the input data set (similar to an Obs column).

Examples

```
/* arrange bars in descending order of response values */
barchartparm category=region response=eval(dsort(amount,retain=all));

/* label outliers with their position in the data set */
/* it does not matter which column is used for NUMERATE() */
```

```
boxplot x=age y=weight / datalabel=eval(numerate(age));

/* add information about the column being processed,
   which is passed by a dynamic */
entrytitle "Distribution for " eval(colname(DYNVAR));
```

Using the TYPEOF SAS Function

The TYPEOF function returns the type of a specified column at run time.

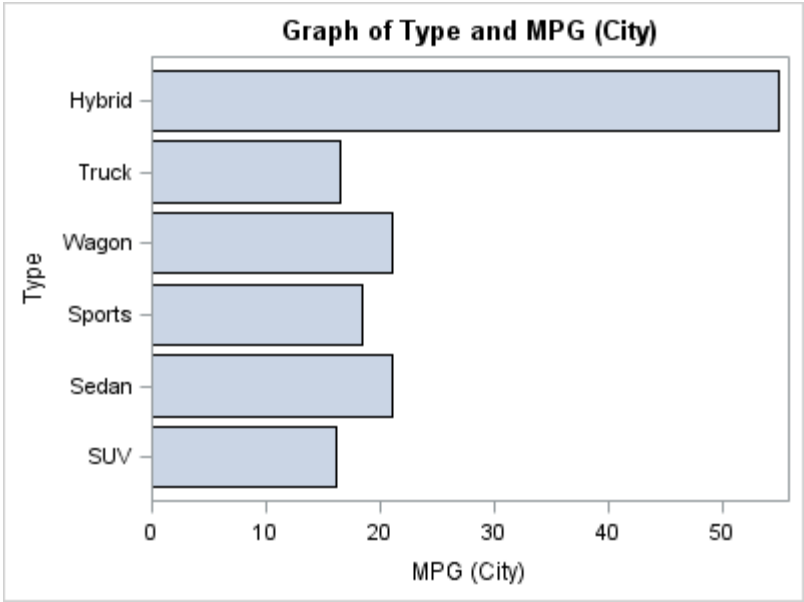
TYPEOF(*column*)

This function returns the character 'C' if the specified column is a character column or 'N' if it is a numeric column.

You can use the TYPEOF function to take specific actions in your template at run time based on the input data type. Here is an example that creates a graph of two columns and uses the TYPEOF function to select a graph type that is appropriate for the column types. The result returned by the TYPEOF function determines the graph type as follows:

- If both columns are numeric, then it creates a scatter plot.
- If the X column is character and the Y column is numeric, then it creates a vertical bar chart.
- If the X column is numeric and the Y column is character, then it swaps the category and response columns in the BARCHART statement and orients the chart horizontally.

Here is the output for the third case, a numeric X column and a character Y column.



Here is the SAS code.

```
   /* Define the graph template. */
```

```
proc template;
  define statgraph plot;
    dynamic cat resp; /* Category and response columns. */
    begingraph;
      entrytitle "Graph of " eval(collabel(resp)) " and "
        eval(collabel(cat));
      layout overlay;
        /* If cat and resp are numeric, then generate a scatter plot.
          Otherwise, generate a bar chart.  */
        if (typeof(cat) = "N" and typeof(resp) = "N")
          scatterplot x=cat y=resp;
        else
          /* If cat is a character column, then generate a vertical bar
            chart. Otherwise, generate a horizontal bar chart. */
          if (typeof(cat) = "C")
            barchart category=cat response=resp / stat=mean;
          else
            barchart category=resp response=cat /
              stat=mean orient=horizontal;
          endif;
        endif;
      endlayout;
    endgraph;
  end;
run;

proc sgrender data=sashelp.cars template=plot;
  dynamic cat="MPG_CITY" resp="TYPE";
run;
```

Note: See "Functions Defined Only in GTL" on page 1547 for information about the COLLABEL function.

GTL Summary Statistic Functions

Commonly Used Summary Statistic Functions

Several GTL summary statistic functions are available that return a numeric constant, based on a summary operation on a numeric column. The results are the same as if the corresponding statistics were requested with PROC SUMMARY. These functions take a single argument that resolves to the name of a numeric column. Here is an example.

```
number = EVAL(function-name(numeric-column))
```

The GTL summary statistic functions take precedence over similar multi-argument DATA step functions. The following table lists the GTL summary statistic functions that you can use.

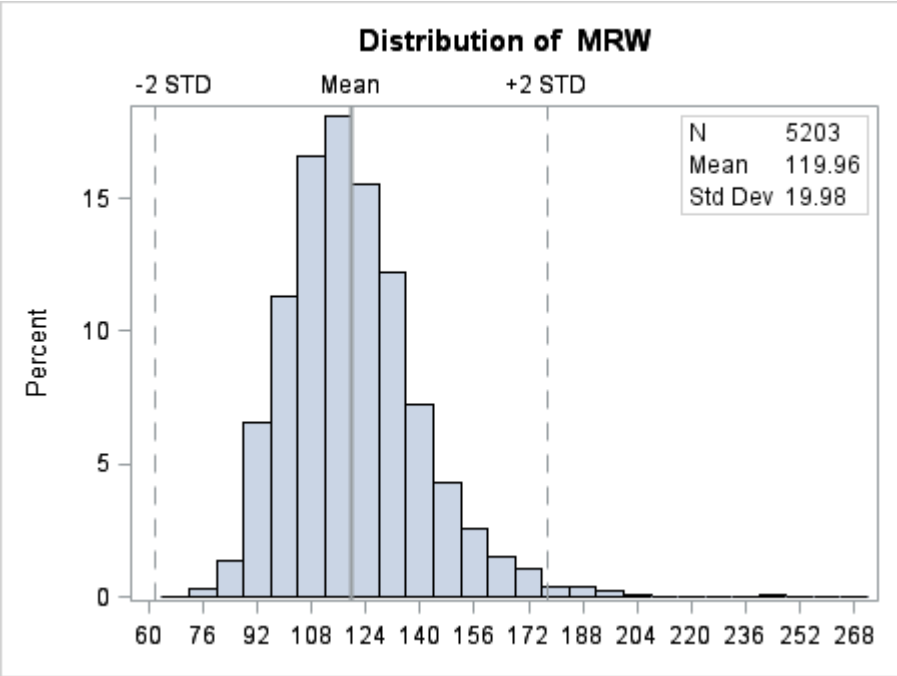
Function Name	Description
CSS	Corrected sum of squares
CV	Coefficient of variation
KURTOSIS	Kurtosis
LCLM	One-sided confidence limit below the mean
MAX	Largest (maximum) value
MEAN	Mean
MEDIAN	Median (50th percentile)
MIN	Smallest (minimum) value
N	Number of nonmissing values
NMISS	Number of missing values
P1	1st percentile
P5	5th percentile
P25	25th percentile
P50	50th percentile
P75	75th percentile
P90	90th percentile
P95	95th percentile
P99	99th percentile
PROBT	p-value for Student's t statistic
Q1	First quartile
Q3	Third quartile
QRANGE	Interquartile range

Function Name	Description
RANGE	Range
SKEWNESS	Skewness
STDDEV	Standard deviation
STDERR	Standard error of the mean
SUM	Sum
SUMWGT	Sum of weights
T	Student's t statistic
UCLM	One-sided confidence limit above the mean
USS	Uncorrected sum of squares
VAR	Variance

Example

The following example uses GTL summary statistic functions to dynamically construct reference lines and a table of statistics for a numeric variable, which is supplied at run time.

Here is the graph for this example.



Here is the SAS code.

```
proc template;
  define statgraph expression;
    dynamic NUMVAR "required";
    begingraph;
      entrytitle "Distribution of  " eval(colname(NUMVAR));
      layout overlay / xaxisopts=(display=(ticks tickvalues line));
        histogram NUMVAR;

        /* create reference lines at computed positions */
        referenceline x=eval(mean(NUMVAR)+2*std(NUMVAR)) /
          lineattrs=(pattern=dash) curvelabel="+2 STD";
        referenceline x=eval(mean(NUMVAR)) /
          lineattrs=(thickness=2px) curvelabel="Mean";
        referenceline x=eval(mean(NUMVAR)-2*std(NUMVAR)) /
          lineattrs=(pattern=dash) curvelabel="-2 STD";

        /* create inset */
        layout gridded / columns=2 order=rowmajor
          autoalign=(topleft topright) border=true;
          entry halign=left "N";
          entry halign=left eval(strip(put(n(NUMVAR),12.0)));
          entry halign=left "Mean";
          entry halign=left eval(strip(put(mean(NUMVAR),12.2)));
          entry halign=left "Std Dev";
          entry halign=left eval(strip(put(stddev(NUMVAR),12.2)));
        endlayout;
      endlayout;
    endgraph;
  end;
run;

proc sgrender data=sashelp.heart template=expression;
  dynamic numvar="MRW";
```

```
run;
```

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Conditional Logic

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Overview

GTL supports conditional logic that enables you to include or exclude one or more GTL statements at run time:

IF (*condition*)

    GTL-statement(s);

ELSE

    GTL-statement(s);

ENDIF;

The IF statement requires an ENDIF statement. The IF block can be placed anywhere within the BEGINGRAPH / ENDGRAPH block.

The *condition* is an expression that evaluates to a numeric constant, where all numeric constants other than 0 and MISSING are true. There is an implied EVAL(*condition*), so it is not necessary to include an EVAL as part of the condition.

Examples:

```
/* test a computed value */
if (weekday(today()) in (1 7))
   entrytitle "Run during the work week";
else
   entrytitle "Run during the weekend";
endif;

/* test for the value a numeric dynamic */
if (ADDREF > 0)
   referenceline y=1;
```

```
   referenceline y=0;
   referenceline y=-1;
endif;

/* test for the value a character dynamic */
if (upcase(ADDREF) =: "Y")
   referenceline y=1;
   referenceline y=0;
   referenceline y=-1;
endif;

/* test whether a dynamic is initialized */
if (exists(ADDREF))
   referenceline y=1;
   referenceline y=0;
   referenceline y=-1;
endif;
```

Conditional Logic Determines Statement Rendering

The GTL conditional logic is used only to determine which statements are rendered, not to control what is in the data object. In the following example, the data object contains columns for Date, Amount, and LOG(AMOUNT), but only one scatter plot is created.

```
if (LOGFLAG)
  scatterplot x=date y=amount;
else
  scatterplot x=date y=log(amount);
endif;
```

Also, it is seldom necessary to test for the existence of option values set by columns or dynamic variables. Consider the following statement:

```
scatterplot x=date y=amount / group=GROUPVAR;
```

This SCATTERPLOT statement is equivalent to the following code because option values that are set by columns that do not exist or dynamic variables that are uninitialized simply “drop out” at run time and do not produce errors or warnings:

```
if (exists(GROUPVAR))
  scatterplot x=date y=amount / group=GROUPVAR;
else
  scatterplot x=date y=amount;
endif;
```

The GTL code that is conditional must be complete statements, or complete blocks of statements, or both. The following IF block produces a compile error because there are more LAYOUT statements than ENDLAYOUT statements:

```
/* this IF block produces a compile error */
if (exists(SQUAREPLOT))
  layout overlayequated / equatetype=square;
else
  layout overlay;
endif;

    scatterplot x=XVAR y=YVAR;
endlayout;
```

This is the correct conditional construct:

```
if (exists(SQUAREPLOT))
  layout overlayequated / equatetype=square;
    scatterplot x=XVAR y=YVAR;
  endlayout;
else
  layout overlay;
    scatterplot x=XVAR y=YVAR;
  endlayout;
endif;
```

GTL Does Not Provide ELSE IF Syntax

GTL does not provide ELSE IF syntax, but you can create a nested IF/ELSE block as follows:

IF (*condition-1*)
    GTL-statement(s);
ELSE
    IF (*condition-2*)
        GTL-statement(s);
    ELSE
        GTL-statement(s);
    ENDIF;
ENDIF;

PART 13

Appendixes

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ODS GRAPHICS Statement

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ODS GRAPHICS Statement 1561

Dictionary

ODS GRAPHICS Statement

Enables or disables ODS Graphics processing and sets graphics environment options. This statement affects ODS template-based (ODS Graphics) graphics only. The ODS GRAPHICS statement does not affect device-based graphics (SAS/GRAPH).

Valid in: Anywhere

Category: ODS: Output Control

Default: ON. Beginning in SAS 9.4, ODS Graphics is enabled by default on all platforms except z/OS. When running SAS in batch mode, the default is OFF.

Interaction: SAS/GRAPH device-based global statements such as GOPTIONS, SYMBOL, PATTERN, AXIS, and LEGEND do not affect template-based graphics. The ODS GRAPHICS statement does not affect device-based graphics.

Syntax

ODS GRAPHICS <OFF | ON> </ *options*> ;

Summary of Optional Arguments

ANTIALIAS | NOANTIALIAS | ANTIALIAS= ON | OFF
: specifies whether anti-aliasing is applied to the rendering of the line and markers in any graph.

ANTIALIASMAX= *n*
: specifies the maximum number of graphics elements before anti-aliasing is disabled.

ATTRPRIORITY=COLOR | NONE
: specifies a priority for cycling of the group attributes.

BORDER | NOBORDER | BORDER=ON | OFF
: specifies whether to draw a border around each graph.

BYLINE=NOBYLINE | TITLE | FOOTNOTE
: specifies how the BY line is displayed in graphs.

DATASKINMAX=*n*
: specifies the maximum number of graphical elements allowed per plot when a data skin is applied.

DISCRETEMAX=*n*
: specifies the maximum number of discrete values to be shown in any graph.

DRILLTARGET="_blank" | "_self" | "_parent" | "_top" | "frame-name"
: specifies the window that displays the drill-down output.

GROUPMAX=*n*
: specifies the maximum number of group values to be shown in any graph.

HEIGHT=*dimension*
: specifies the height of a graph.

IMAGEMAP | NOIMAGEMAP | IMAGEMAP=ON | OFF
: specifies whether data tips are generated.

IMAGENAME="*filename*"
: specifies the base image filename.

LABELMAX=*n*
: specifies the maximum number of labeled areas before data label collision avoidance is disabled.

LABELPLACEMENT= GREEDY | SA
: specifies the label-placement algorithm to use for positioning labels in the graphs.

LEGENDAREAMAX=*n*
: specifies an integer that is interpreted as the maximum percentage of the overall graphics area that a legend can occupy.

LINEPATTERNOBSMAX=*n*
: specifies the maximum the number of vertices for a patterned line.

LOESSOBSMAX=*n*
: specifies an upper limit for the number of observations that can be used with a loess plot.

NBINSMAX=*n*
: specifies the maximum number of bins that are processed for histograms.

NXYBINSMAX=*n*

specifies the maximum number of bins that are processed for heat maps.

OBSMAX=*n*
specifies the maximum number of observations that are processed.

OUTPUTFMT=*file-type* | STATIC
specifies the output format used to generate image or vector graphic files.

PANELCELLMAX=*n*
specifies the maximum number of cells in a graph panel where the number of cells is determined dynamically by classification variables.

PUSH

POP
pushes and pops ODS GRAPHICS settings in a stack.

RESET | RESET= *option*
Reset one or more ODS GRAPHICS options to its default.

SCALE | NOSCALE | SCALE=ON | OFF
specifies whether the content of a graph is scaled proportionally.

SCALEMARKERS | NOSCALEMARKERS | SCALEMARKERS=ON | OFF
specifies whether the plot markers are to be scaled with the graph size.

SHOW
writes the current ODS Graphics settings to the SAS log.

STACKDEPTHMAX=*n*
specifies the maximum stack depth for PUSH and POP requests.

SUBPIXEL | NOSUBPIXEL | SUBPIXEL=ON | OFF
specifies whether subpixel rendering should be used for rendering ODS Graphics.

TIPMAX=*n*
specifies the maximum number of distinct data tip areas allowed before data tips are disabled.

TOTALCELLMAX=*n*
specifies the maximum number of total cells in a graph where the number of cells is determined dynamically by classification variables.

WIDTH=*dimension*
specifies the width of any graph.

Without Arguments

If ODS Graphics is currently disabled, then specifying the ODS GRAPHICS statement without options enables it. If ODS Graphics is currently enabled, then specifying the ODS GRAPHICS statement leaves it enabled.

Required Arguments

ON
enables ODS Graphics processing. This is the default if no argument is used.

Note: Beginning in SAS 9.4, ODS Graphics is enabled by default on all platforms except z/OS.

Alias YES

OFF
disables ODS Graphics processing.

Alias NO

Optional Arguments

ANTIALIAS | NOANTIALIAS | ANTIALIAS= ON | OFF
specifies whether anti-aliasing is applied to the rendering of the line and markers in any graph. Anti-aliasing smooths the appearance of lines and some markers. Text displayed in the graph is always anti-aliased. For graphical displays that plot large numbers of points it is recommended that ANTIALIAS=OFF be specified for performance considerations.

ANTIALIAS
smooths jagged edges of all components in the graph.

NOANTIALIAS
does not smooth jagged edges of components other than text in the graph.

ANTIALIAS=ON | OFF
specifies whether anti-aliasing is applied to the rendering of the line and markers in the graph.

ON
smooths jagged edges of all components in the graph.

Alias YES

OFF
does not smooth jagged edges of components other than text in the graph.

Alias NO

Default ANTIALIAS or ANTIALIAS=ON | YES

Restrictions If the number of markers or lines in the plot exceeds the number specified by the ANTIALIASMAX= option, then the ANTIALIAS option is disabled. This is true even if you specify the option ANTIALIAS=ON or ANTIALIAS.

This option is ignored by the SGPIE and SGMAP procedures.

ANTIALIASMAX= *n*
specifies the maximum number of graphics elements before anti-aliasing is disabled. For example, if there are more than 400 scatter point markers to be anti-aliased and ANTIALIASMAX=400, then no markers are anti-aliased. The default value is 4000.

Note: Prior to SAS 9.4M3, the ANTIALIASMAX= option specifies the maximum number of observations in the graph data to be anti-aliased before anti-aliasing

is disabled. The default is 4000. When the graph data contains more than 4000 observations, anti-aliasing is disabled for the entire graph. Starting with SAS 9.4M3, the ANTIALIASMAX= option specifies the maximum number of graphics elements to be anti-aliased in each plot on a per-plot basis. The default remains at 4000. If any plot in a graph contains more than 4000 elements, anti-aliasing is disabled for that plot. Anti-aliasing is enabled for the rest of the graph in that case.

n
specifies a positive integer.

Default 4000

Restriction This option is ignored by the SGPIE and SGMAP procedures.

ATTRPRIORITY=COLOR | NONE
specifies a priority for cycling of the group attributes.

COLOR
assigns priority to the color attribute rotation by cycling through the list of colors while holding the marker symbol and line pattern constant. When all of the colors are exhausted, the marker symbol and line style attributes increment to the next element, and then the colors in the list are repeated. This pattern repeats as needed.

NONE
does not use an attribute priority in the rotation pattern, even if one is set in the active style's AttrPriority attribute. The rotation pattern cycles progressively through the attribute lists.

Default The AttrPriority attribute of the graph style element, or NONE if the current style does not define the AttrPriority style attribute.

Interaction The default lists of data colors, contrast colors, marker symbols, and line patterns are set in the active style's GraphData1–GraphData*N* elements.

Tip Use the ATTRPRIORITY=NONE option if you want groups to be distinguished by color, marker, and line changes for all styles that use color.

BORDER | NOBORDER | BORDER=ON | OFF
specifies whether to draw a border around each graph.

BORDER
draws a border around the graph.

NOBORDER
does not draw a border around the graph.

BORDER=ON | OFF
specifies whether to draw the graph with a border on the outermost layout.

ON
draws a border around the graph.

Alias YES

OFF
does not draw a border around the graph.

Alias NO

Default BORDER or BORDER=ON | YES

BYLINE=NOBYLINE | TITLE | FOOTNOTE
specifies how the BY line is displayed in graphs. The option specifies how the BY line is displayed when an analysis is run with a BY statement. By default, no BY line is displayed.

The following code is an example of how the placement of the BY line is controlled in most graph templates:

```
if (_BYTITLE_)
   entrytitle _BYLINE_ / textattrs=GraphValueText;
else
   if (_BYFOOTNOTE_)
      entryfootnote halign=left _BYLINE_;
   endif;
endif;
```

You can modify the graph template if you want to change how the BY line is displayed. Because most graphs have titles and few graphs have footnotes, the BY line looks better when it is displayed as a footnote. For complete documentation about the Graph Template Language, see *SAS Graph Template Language: User's Guide*.

When the BYLINE= option is specified, and there are BY groups, ODS creates a BY line and sets the appropriate special dynamic variables. The following table lists the special dynamic variables for BY lines. For complete documentation about special dynamic variables, see "Special Dynamic Variables" in *SAS Graph Template Language: User's Guide*.

Table A12.1 *Special Dynamic Variables for BY Lines*

BYFOOTNOTE	This variable is set to 1 when you specify a BY statement and the ODS GRAPHICS BYLINE= option is set to FOOTNOTE. Otherwise, the variable is set to 0 or is NULL.
BYTITLE	This variable is set to 1 when you specify a BY statement and the ODS GRAPHICS BYLINE= option is set to TITLE. Otherwise, the variable is set to 0 or is NULL.
BYLINE	This variable contains the text string that can be displayed as a title or footnote.

The variables in the table are set automatically only for analytical procedures that support ODS Graphics. For all other procedures, the variables are not set

automatically (NULL). To determine whether the procedure that you are using supports ODS Graphics, refer to the procedure documentation.

NOBYLINE
specifies that no BY line is displayed. NOBYLINE is the default.

FOOTNOTE
specifies that the BY line is displayed as a left-justified graph footnote. This is the recommended setting.

TITLE
specifies that the BY line is displayed as a centered graph title. Specifying TITLE is not recommended because graphs are not designed to have additional title lines.

Default NOBYLINE

Restriction This option does not work with the ODS Graphics procedures such as SGPLOT and SGPANEL. To remove BY lines in those procedures, use the NOBYLINE SAS system option. Example: `options nobyline;`

DATASKINMAX=*n*
specifies the maximum number of graphical elements allowed per plot when a data skin is applied.

Note: This feature applies to SAS 9.4M1 and later releases.

n
specifies a positive integer.

Default 200

DISCRETEMAX=*n*
specifies the maximum number of discrete values to be shown in any graph. Bar charts and box plots are examples of affected plot types. Scatter plots and other plot types can be affected if the data to be plotted is discrete or the axis is discrete.

n
specifies a positive integer.

Default 1000

Tips Some plot layers might be unaffected by the DISCRETEMAX= option, and those layers are rendered. If all layers are affected, a blank graph is rendered.

If the value specified by the DISCRETEMAX= option is exceeded by any plot layer in the graph, that layer is not drawn and a warning message is issued. In that case, use the DISCRETEMAX= option to increase the maximum number of discrete values that are allowed. Starting with SAS 9.4M5, the log message includes a suggested value for DISCRETEMAX=.

DRILLTARGET="_blank" | "_self" | "_parent" | "_top" | "frame-name"
specifies the window that displays the drill-down output.

Note: This option is supported only for HTML.

"_blank"
opens a new browser window to display the drilldown output.

Default _blank is the default.

Requirements You must enclose *_blank* in quotation marks.

You must specify *_blank* in lowercase.

"_self"
opens the drill-down output in the same window.

Requirements You must enclose *_self* in quotation marks.

You must specify *_self* in lowercase.

"_parent"
opens the drill-down output in the parent frame.

Requirements You must enclose *_parent* in quotation marks.

You must specify *_parent* in lowercase.

"_top"
opens the drill-down output in the full body of the window.

Requirements You must enclose *_top* in quotation marks.

You must specify *_top* in lowercase.

"frame-name"
opens the drill down output in the named frame in the current window. If the name does not exist, the output is opened in a new window.

Requirement You must enclose *frame–name* in quotation marks.

GROUPMAX=*n*
specifies the maximum number of group values to be shown in any graph. Any graph that supports the GROUP= option is affected.

n
specifies a positive integer.

Default 1000

Note This option is ignored by the SGMAP procedure.

Tip If the value specified by the GROUPMAX= option is exceeded by any plot layer in the graph, that layer is rendered. The system ignores the GROUP= option and issues a warning message. In that case, use the

GROUPMAX= option to increase the maximum number of group values that are allowed. Starting with SAS 9.4M5, the log message includes a suggested value for GROUPMAX=.

HEIGHT=*dimension*
specifies the height of a graph.

dimension
is a nonnegative number followed by one of these units of measure:

Table A12.2 *Units of Measure for Dimension*

cm	Centimeters
in	Inches
mm	Millimeters
pct or %	Percentage
pt	Point size (72 points = 1 inch)
px	Pixels

Defaults The value of the SAS registry entry "ODS > ODS GRAPHICS > Design Height" or the value of the DesignHeight= option in a STATGRAPH template. Typically, the value is 480px.

For the PRINTER destination, units of 1/150 of an inch are used by default.

Tips If only the HEIGHT= option is specified, then the default aspect ratio of the graph is maintained.

When you change the size of a graph, by default graph elements such as markers, lines, text, and titles are scaled proportionally. This scaling takes effect even when you specify dimensions for the graph elements. To disable the scaling, specify the NOSCALE option.

IMAGEMAP | NOIMAGEMAP | IMAGEMAP=ON | OFF
controls data tips and drill down generation. Data tips are pieces of explanatory text that appear when you hold the mouse pointer over the data portions of a graph contained in an HTML page.

IMAGEMAP
specifies to generate data tips.

NOIMAGEMAP
specifies not to generate data tips.

IMAGEMAP= ON | OFF
controls data tips generation.

ON
specifies to generate data tips.

Alias YES

OFF
specifies not to generate data tips.

Alias NO

Default NOIMAGEMAP or IMAGEMAP=OFF | NO

Restrictions This option applies only when one of the ODS HTML* destinations is used.

Prior to SAS 9.4M5, an image map is not generated using SVG with ODS Graphics. The image map data that is used to produce tooltips and links is written directly in the SVG and is not part of the HTML. Using HTML5 with the inline SVG mode (the default value), the tooltips and links are written in the SVG portion of the document. (If you are using SAS 9.4M5, see the following Note.)

Interaction When IMAGEMAP | IMAGEMAP=ON is specified and the ODS HTML destination is used, the IMAGE_DPI option in the ODS HTML destination is ignored, if specified, and the default image resolution of 96 DPI is used.

Note Starting with SAS 9.4M5, image maps are supported with SVG output using HTML5. However, image maps are supported only when the HTML5 SVG mode is INLINE (the default value).

IMAGENAME="*filename*"
specifies the base image filename. If more than one image is generated, each is assigned a filename that consists of a base name followed by a number in order to create unique names. This numbering can be reset with the RESET=INDEX option. Path information (if needed) can be set with the GPATH= option on the ODS destination statement. The default path is the current output directory. A file extension for filename is automatically generated based on the OUTPUTFMT= option.

Note: Starting with SAS 9.4M5, if a BY statement is in effect, you can uniquely name image files based on BY groups. To do this, insert #BY text into the image name. For more information, see "Substituting BY Values in the Image Name" on page 1585.

Default The name of the output object.

Restrictions *filename* must be a single name. It must not include any path specification or image-format name extension.

filename can contain only the following types of characters: letter, digit, underscore, and space.

Requirement You must enclose *filename* in quotation marks.

See "Specifying and Resetting the Image Name" on page 1585

LABELMAX=*n*
specifies the maximum number of labeled areas before data label collision avoidance is disabled. For example, if there are more than 50 points to be labeled and LABELMAX=50, then collision avoidance is turned off and the labels are all displayed at the top right of the data points.

n
specifies a positive integer.

Default 200

Restriction Data label collision avoidance is turned off under the following conditions:

- The number of observations with nonmissing labels exceeds the value specified by LABELMAX=.
- The number of observations exceeds five times the value specified by LABELMAX=.

A message is then sent to the SAS log.

Tip To turn off collision avoidance, specify LABELMAX=0.

LABELPLACEMENT= GREEDY | SA
specifies the label-placement algorithm to use for positioning labels in the graphs. The following labels are affected:

- data labels for needle plots, scatter plots, series plots, step plots, and vector plots
- vertex labels for line charts
- curve labels when the curve label is positioned at the start or end of the curve

GREEDY
specifies the Greedy method for managing label collision. The Greedy method tries different placement combinations in order to find an optimal approximation that avoids collisions. Label placement using this method is often less optimal than label placement using the Simulated Annealing (SA) method. However, depending on the number of data points and the potential for label collisions, the Greedy process can be significantly faster.

SA
specifies the Simulated Annealing method for managing label collision. The SA method attempts to determine the global minimization-of-cost function, which is based on a simulated annealing algorithm. The resulting label placement is usually better than placement using the Greedy method. However, depending on the number of data points and the potential for label collisions, the SA method can be significantly slower.

Restriction For BANDPLOT and LINECHART, the SA method has no effect on the curve labels when the CURVELABELPOSITION= option specifies START or END.

Default GREEDY

LEGENDAREAMAX=*n*
specifies an integer that is interpreted as the maximum percentage of the overall graphics area that a legend can occupy.

Note: This feature applies to SAS 9.4M3 and later releases. LEGENDAREAMAX= replaces MAXLEGENDAREA=. However, MAXLEGENDAREA= is supported as an alias. It is recommended that you use LEGENDAREAMAX=.

n
specifies a positive integer.

Alias MAXLEGENDAREA=

Default 20

Range 0–100

Tip To turn off the legend, specify LEGENDAREAMAX=0. No warning is issued when the legend is turned off in this way.

LINEPATTERNOBSMAX=*n*
specifies the maximum the number of vertices for a patterned line. If the number of vertices exceeds the specified limit, the plot is not drawn.

n
specifies a positive integer.

Note: This feature applies to SAS 9.4M5 and later releases.

Default 10000

Restriction This option is ignored by the SGMAP and SGPIE procedures.

Note If the number of vertices exceeds the specified limit, the plot is not drawn and a note is written to the SAS log. In that case, increase LINEPATTERNOBSMAX= to the value suggested in the log message, or change the line pattern to SOLID.

LOESSOBSMAX=*n*
specifies an upper limit for the number of observations that can be used with a loess plot.

Note: This feature applies to SAS 9.4M3 and later releases. LOESSOBSMAX= replaces LOESSMAXOBS=. However, LOESSMAXOBS= is supported as an alias. It is recommended that you use LOESSOBSMAX=.

If the number of observations of the loess plot exceeds the specified limit, the loess plot is not drawn.

For example, the following specifies that the most observations a loess plot can have is 1000.

```
LOESSOBSMAX=1000
```

Alias LOESSMAXOBS=

Default 5000

NBINSMAX=*n*
specifies the maximum number of bins that are processed for histograms. This option affects both computed and parameterized histograms, when available.

Note: This feature applies to SAS 9.4M4 and later releases.

n
specifies a positive integer.

Default 10000

Requirement The NBINSMAX= value must be greater than or equal to the default number of bins in the histogram. If the NBINXMAX= value is less than the default number of bins, an error occurs and the histogram is not drawn. In that case, an error message is written to the SAS log, which provides a minimum NBINSMAX= value that you can use.

Interaction If you specify the number of bins in the histogram plot statement NBINS= option, that option is honored if the NBINS= value specified is less than or equal to the NBINXMAX= value. If the NBINS= value specified exceeds the NBINSMAX= value, an error occurs, and the histogram is not drawn.

NXYBINSMAX=*n*
specifies the maximum number of bins that are processed for heat maps. This option affects both computed and parameterized heat maps. The option applies to the product of the X and Y bins.

Note: This feature applies to SAS 9.4M4 and later releases.

n
specifies a positive integer.

Default 100000

Interaction If you specify the number of bins in the heat map statement, that option is honored regardless of the NXYBINSMAX= option.

OBSMAX=*n*
specifies the maximum number of observations that are processed. If the number of observations in the data set exceeds the value specified for OBSMAX=, the procedure step terminates with a log message.

Note: This feature applies to SAS 9.4M5 and later releases.

n
specifies a positive integer.

Alias MAXOBS=

Default 2 million observations

Interaction There are other ways to control the number of observations: CASDATALIMIT= system option, DATALIMIT= option in the CAS LIBNAME statement, and DATALIMIT= data set option. If the CAS data transfer limit is set lower than OBSMAX=, then OBSMAX= has no effect.

OUTPUTFMT=*file-type* | STATIC
specifies the output format used to generate image or vector graphic files. If the image or vector graphic format is not valid for the active output destination, the format is automatically changed to the default format for that destination.

file-type
is the image or vector graphic format to be generated. See "Supported File Types for Output Destinations" on page 1590.

STATIC
uses the best quality static image format for the active output destination. This is the default output format.

> **TIP** The STATIC keyword can be used to reset the output format to its default state.

Default STATIC

See "Specifying the Image Format" on page 1587

PANELCELLMAX=*n*
specifies the maximum number of cells in a graph panel where the number of cells is determined dynamically by classification variables. If the number of cells in the panel exceeds the specified limit, the panel is not drawn.

n
specifies a positive integer.

Default 1000

Note Graphs with DataPanel or DataLattice templates layouts are affected. In the ODS Graphics procedures, this option affects graphs that are created with the SGPANEL procedure. If the value specified by the PANELCELLMAX= option is exceeded by any of these layouts, an empty graph is rendered and a warning message is issued.

Tip You can use the TOTALCELLMAX= option to control the total maximum number of cells in the graph.

PUSH | POP
pushes and pops ODS GRAPHICS settings in a stack. This feature enables you to temporarily save your custom settings in a stack and later restore those settings.

Note: This feature applies to SAS 9.4M3 and later releases.

PUSH
pushes the current ODS GRAPHICS settings to a stack.

POP
restores the most recently pushed settings from the stack. For each PUSH action, you can specify a POP request. ODS issues a warning if you specify POP without a corresponding PUSH. In that case, nothing is popped because nothing has been pushed.

The pushed settings remain in the stack in the current SAS session until they are popped or the stack is emptied.

Interaction You can specify PUSH as many times as you like up to the limit that is defined by the STACKDEPTHMAX= option. You can also use STACKDEPTHMAX= to empty the stack. For more information, see "Managing the Stack Depth" on page 1594.

Note Order of specification is important when using the PUSH and POP options. For more information, see "About PUSH and POP" on page 1593.

Tip Use the SHOW option to show the current ODS GRAPHICS settings.

See "Temporarily Saving and Restoring ODS GRAPHICS Settings" on page 1593

RESET | RESET= *option*
Reset one or more ODS GRAPHICS options to its default.

RESET
resets all *options* to their defaults.

RESET=
resets one of the following to its default:

ALL
resets all *reset-options* to their defaults.

ANTIALIAS
resets the ANTIALIAS= option to its default.

See ANTIALIAS= on page 1564

ANTIALIASMAX
resets the ANTIALIASMAX= option to its default.

See ANTIALIASMAX= on page 1564

ATTRPRIORITY
resets the ATTRPRIORITY= option to its default.

See ATTRPRIORITY= on page 1565

BORDER
resets the BORDER= option to its default.

See BORDER= on page 1565

BYLINE
resets the BYLINE= option to its default.

See BYLINE= on page 1566

DATASKINMAX
resets the DATASKINMAX= option to its default.

See DATASKINMAX= on page 1567

DISCRETEMAX
resets the DISCRETEMAX= option to its default.

See DISCRETEMAX= on page 1567

DRILLTARGET
resets the DRILLTARGET= option to its default.

See DRILLTARGET= on page 1568

GROUPMAX
resets the GROUPMAX= option to its default.

See GROUPMAX= on page 1568

HEIGHT
resets the HEIGHT= option to its default.

See HEIGHT= on page 1569

IMAGEMAP
resets the IMAGEMAP= option to its default.

Note Not all output destinations support this feature.

See IMAGEMAP= on page 1569

IMAGENAME
resets the IMAGENAME= option to its default.

Note: This feature applies to SAS 9.4M3 and later releases.

See IMAGENAME= on page 1570

INDEX <(*positive-integer*)>
resets the index counter that is appended to static image files.

Note: This feature applies to SAS 9.4M3 and later releases.

When specifying this option, you can also specify the value for the index counter. The number that you specify must be enclosed in parentheses. *positive-integer* determines the suffix for the next subsequent image, and increments with each new image.

See "Resetting the Image Name" on page 1585

LABELMAX
resets the LABELMAX= option to its default.

See LABELMAX= on page 1571

LABELPLACEMENT
specifies the label-placement algorithm to use for positioning labels in the graphs.

See LABELPLACEMENT= on page 1571

LEGENDAREAMAX
resets the LEGENDAREAMAX= option to its default.

See LEGENDAREAMAX= on page 1572

LOESSOBSMAX
resets the LOESSOBSMAX= option to its default.

See LOESSOBSMAX= on page 1572

NBINSMAX
resets the NBINSMAX= option to its default.

See NBINSMAX= on page 1573

NXYBINSMAX
resets the NXYBINSMAX= option to its default.

See NXYBINSMAX= on page 1573

OUTPUTFMT
resets the OUTPUTFMT= option to its default.

Note: This feature applies to SAS 9.4M3 and later releases.

See OUTPUTFMT= on page 1574

PANELCELLMAX
resets the PANELCELLMAX= option to its default.

See PANELCELLMAX= on page 1574

SCALE
resets the SCALE= option to its default.

See SCALE= on page 1578

SCALEMARKERS
resets the SCALEMARKERS= option to its default.

See SCALEMARKERS= on page 1579

STACKDEPTHMAX
resets the STACKDEPTHMAX= option to its default.

Note: This feature applies to SAS 9.4M3 and later releases.

See STACKDEPTHMAX= on page 1581

SUBPIXEL
resets the SUBPIXEL option to its default.

Note: This feature applies to SAS 9.4M3 and later releases.

See SUBPIXEL on page 1581

TIPMAX
resets the TIPMAX= option to its default.

See TIPMAX = on page 1582

WIDTH
resets the WIDTH= option to its default.

See WIDTH= on page 1583

SCALE | NOSCALE | SCALE=ON | OFF
specifies whether the content of a graph is scaled proportionally.

SCALE
scales the components of a graph proportionally.

NOSCALE
does not scale the components of a graph proportionally.

SCALE=ON | OFF
specifies whether the content of a graph is scaled proportionally.

ON
scales the components of a graph proportionally.

Alias YES

OFF
does not scale the components of a graph proportionally.

Aliases NOSCALE

NO

Default SCALE or SCALE=ON | YES

SCALEMARKERS | NOSCALEMARKERS | SCALEMARKERS=ON | OFF
specifies whether the plot markers are to be scaled with the graph size. The scaling factor is based on the height of the graph cells and the height of the graph.

SCALEMARKERS
scales the markers with the graph size.

NOSCALE
does not scale the markers with the graph size.

SCALEMARKERS=ON | OFF
specifies whether the plot markers are to be scaled with the graph size.

ON
scales the markers with the graph size.

Alias YES

OFF
does not scale the markers with the graph size.

Aliases NOSCALE

NO

Default SCALEMARKERS or SCALEMARKERS=ON | YES

Restriction Scaling is done only if the graph contains multiple cells or single nested cells.

SHOW
writes the current ODS Graphics settings to the SAS log. This option enables you to verify which settings are in effect. The option is especially useful when you use the PUSH and POP options to restore settings. For more information, see "Temporarily Saving and Restoring ODS GRAPHICS Settings" on page 1593.

Note: This feature applies to SAS 9.4M3 and later releases.

If no options have been specified, then SHOW lists those options for which ODS currently knows the default values.

The following statement resets all settings and shows the default values.

```
ods graphics / reset=all show;
```

Here are the default values displayed in the SAS log:

```
ODS Graphics Settings
---------------------
Output format:                    STATIC
By line:                          NOBYLINE
Antialias:                        ON
Maximum Loess observations:       5000
Maximum stack depth:              1024
Stack depth:                      0
MaxObs:                           2000000
Maximum Histogram Bins:           10000
Maximum Heatmap Bins:             100000
Maximum Obs for Patterned Lines:  10000
Maximum Total Cells per BY-group: 2000
```

If you have specified the settings for one or more options, then SHOW includes those settings along with the defaults.

Order of specification is important when using the SHOW option. For example, the following statement shows the current settings and then sets the NOBORDER option.

```
ods graphics / show noborder;
```

However, the following statement sets the NOBORDER option and then shows the settings. The NOBORDER setting is shown in the log along with the other settings that are in effect.

```
ods graphics / noborder show;
```

The following statement resets all settings. It then sets the image width and shows the default settings along with the specified width.

```
ods graphics / reset=all width=5in show;
```

Here are the default values plus the image width, as displayed in the SAS log:

```
ODS Graphics Settings
---------------------
Output format:                    STATIC
By line:                          NOBYLINE
Antialias:                        ON
Maximum Loess observations:       5000
Image width:                      5in
Maximum stack depth:              1024
Stack depth:                      0
MaxObs:                           2000000
Maximum Histogram Bins:           10000
Maximum Heatmap Bins:             100000
```

```
Maximum Total Cells per BY-group:  2000
```

Tip If you have specified the settings for some options but want to see the default values without losing your specified settings, issue the following two statements. The first statement pushes your specified settings, resets all settings, and then lists options for which ODS currently knows the default values. The second statement restores your previous settings.

```
ods graphics / push reset=all show;
ods graphics / pop;
```

STACKDEPTHMAX=*n*

specifies the maximum stack depth for PUSH and POP requests. The stack is used to temporarily store ODS GRAPHICS settings when you issue PUSH requests. PUSH saves the current settings to the stack and increments the stack depth. POP restores the most recently saved settings from the stack and decrements the stack depth.

Note: This feature applies to SAS 9.4M3 and later releases.

n

specifies a positive integer.

If *n* is less than the current stack depth, then the stack is popped until its depth equals *n*. Popping the stack does not affect other option settings.

Defaults 1024 is the default maximum depth

0 is the default depth

Tips To empty the stack and then reset it to the default maximum depth, issue the following statement:

```
ods graphics / stackdepthmax=0 reset=stackdepthmax;
```

You can use any of the following commands to reset the stack to its default maximum depth:

```
reset=stackdepthmax
reset=all
reset
stackdepthmax=1024
```

See “Managing the Stack Depth” on page 1594

SUBPIXEL | NOSUBPIXEL | SUBPIXEL=ON | OFF

specifies whether subpixel rendering should be used for rendering ODS Graphics. Subpixel rendering produces smoother curves and more precise bar spacing.

Note: This feature applies to SAS 9.4M3 and later releases.

SUBPIXEL

always uses subpixel rendering, when applicable, for rendering lines and bars.

NOSUBPIXEL
never uses subpixel rendering.

SUBPIXEL=ON | OFF
specifies whether subpixel rendering should be used.

ON
always uses subpixel rendering, when applicable, for rendering lines and bars.

Alias YES

OFF
never uses subpixel rendering.

Alias NO

Default Subpixel rendering is always enabled for vector-graphics output. It is enabled by default for image output, unless the graph contains a scatter plot or a scatter-plot matrix. In those cases, subpixel rendering is disabled by default.

Restriction This option is ignored by the SGPIE and SGMAP procedures.

Requirement Antialiasing must be enabled for this option to have any effect. Antialiasing is enabled by default. To re-enable antialiasing, use the ANTIALIAS=ON option in the ODS GRAPHICS statement.

Tip For a large amount of data, antialiasing is disabled when the number of observations exceeds the default maximum of 4000 observations. In that case, subpixel rendering is also disabled. To increase the maximum, use the ANTIALIASMAX= option in the ODS GRAPHICS statement.

See "Subpixel Rendering" in *SAS ODS Graphics: Procedures Guide*

TIPMAX=*n*
specifies the maximum number of distinct data tip areas allowed before data tips are disabled. For example, if there are more than 400 points in a scatterplot, and TIPMAX=400, then no data tips appear. The default maximum value is 500.

Note: Prior to SAS 9.4M3, the TIPMAX= option specifies the maximum number of observations in the graph data to be allowed before data tips are disabled. The default is 500. When the graph data contains more than 500 observations, data tips are disabled for the entire graph. Starting with SAS 9.4M3, the TIPMAX= option specifies the maximum number of data-tip areas allowed before data tips are disabled. This threshold is applied separately for each plot. The default remains at 500. If any plot in a graph contains more than 500 data-tip areas, data tips are disabled for that plot. Data tips are enabled for the remaining plots in the graph.

n
specifies a positive integer.

Default 500

TOTALCELLMAX=*n*
specifies the maximum number of total cells in a graph where the number of cells is determined dynamically by classification variables.

Note: This feature applies to SAS 9.4M5 and later releases.

If the number of cells exceeds the specified limit, the graph is not drawn. This option is useful when multiple classification variables or large amounts of data result in a large number of cells.

n
specifies a positive integer.

Default 2000

Notes If the number of cells exceeds the limit specified for TOTALCELLMAX=, the graph is not drawn and an error message is written to the SAS log. The error message includes a suggested value for TOTALCELLMAX=. You can use the TOTALCELLMAX= option to increase the maximum number of cells. Note, however, that the processing time to render the graph increases with an increase in the maximum number of cells.

Graphs with DataPanel or DataLattice templates layouts are affected. In the ODS Graphics procedures, this option affects graphs that are created with the SGPANEL procedure.

Tip You can use the PANELCELLMAX= option to control the maximum number of cells in a graph panel.

WIDTH=*dimension*
specifies the width of any graph.

dimension
is a nonnegative number followed by one of these units of measure:

Table A12.3 *Units of Measure for Dimension*

cm	Centimeters
in	Inches
mm	Millimeters
pct or %	Percentage
pt	Point size (72 points = 1 inch)
px	Pixels

Defaults The value of the SAS registry entry "ODS > ODS GRAPHICS > Design Width" or the value of the DesignWidth= option in a STATGRAPH template. Typically, this value is 640px.

For the PRINTER destination, units of 1/150 of an inch

Tips If only the WIDTH= option is specified, then the default aspect of the graph is maintained.

When you change the size of a graph, by default graph elements such as markers, lines, text, and titles are scaled proportionally. This scaling takes effect even when you specify dimensions for the graph elements. To disable the scaling, specify the NOSCALE option.

Details

Using the ODS GRAPHICS Statement

You can enable ODS Graphics by using one of the following equivalent statements:

```
ods graphics on;
ods graphics;
```

When you specify one of these statements before your procedure invocation, Base, SAS/STAT, SAS/ETS, and SAS/QC procedures support ODS Graphics, either by default, or when you specify procedure options for requesting particular graphs.

To disable ODS Graphics, specify the following statement:

```
ods graphics off;
```

Note: ODS Graphics is ON by default for these procedures: SGDESIGN, SGMAP, SGPANEL, SGPIE, SGPLOT, SGRENDER, and SGSCATTER. For other products, the initial state of ODS Graphics is determined by a SAS Registry setting.

Using the ODS GRAPHICS Statement for Batch Jobs

To generate ODS Graphics output in UNIX batch jobs, you must set the DISPLAY system option before creating the output. To set the display, enter the following command:

```
export DISPLAY=<ip_address>:0
```

The *ip_address* is the TCP/IP address, or the name of a UNIX terminal. Usually, the IP address of the UNIX system where SAS is running would be used. If you do not set the DISPLAY variable, then you get an error message in the SAS log.

Specifying and Resetting the Image Name

Specifying the Image Name

For ODS Graphics output, by default, the ODS object name is used as the “root” name for the image output file. The following example creates a GIF image named REGPLOT:

```
ods graphics / imagename="regplot" outputfmt=gif;
```

The assigned name REGPLOT is treated as a "root" name and the first output created is named REGPLOT. Subsequent graphs are named REGPLOT1, REGPLOT2, and so on, with an increasing index counter. This numbering can be reset with the RESET=INDEX option.

Resetting the Image Name

The RESET=INDEX option enables you to reset the file name numbering sequence. This feature applies to SAS 9.4M3 and later releases.

For a usage example, suppose that you are developing a paper or a presentation and it takes several submissions to get the desired output. You can use the RESET or RESET=INDEX option to force each output to replace itself:

```
ods graphics / reset=index ... ;
```

This specification causes all subsequent images to be created with the default or current image name.

When specifying this option, you can also specify the value for the index counter. The value that you specify determines the suffix for the next subsequent image. For example:

```
ods graphics / reset=index(100) imagename="MyName";
```

The next graph that you produce is named MYNAME100.

This feature is useful for creating animated graphics. For example, for a sequence of 100 images, you might begin with the following statement:

```
ods graphics / reset=index(1) imagename="MyName";
```

In the example, your program produces 100 images named MYNAME1, MYNAME2, ..., MYNAME100. If you later add more images to the animation, you might submit the following:

```
ods graphics / reset=index(101) imagename="MyName";
```

The next generated image is named MYNAME101.

Substituting BY Values in the Image Name

Note: This feature applies to SAS 9.4M5 and later releases.

If a BY statement is in effect for the data, then you can uniquely name image files based on BY groups. You do this by inserting any of the #BY* substitution items into the image file name. You can specify BY variable values or BY variable names

for IMAGENAME=. You can combine the #BY* substitution item with other text. To do this, insert the #BY* item in the specified text string at the position where you want the substitution text to appear.

As explained in the IMAGENAME= description, the file extension is automatically generated based on the OUTPUTFMT= option.

Here are descriptions of the #BY* substitution items:

#BYVAL*n* | #BYVAL(*BY-variable-name*)
substitutes the current value of the specified BY variable for #BYVAL in the file name string. Specify the variable with one of these:

n
specifies a variable by its position in the BY statement. You must provide the position even if your BY statement contains only one variable. Otherwise, no substitution occurs.

BY-variable-name
specifies a variable from the BY statement by its name. *BY-variable-name* is not case sensitive.

Examples The following example specifies the first variable in the BY statement. The value of that variable is used for the image file name.

```
imagename="#byval1"
```

The following example specifies the second variable in the BY statement preceded by the text *sales_*:

```
imagename="sales_#byval2"
```

The following example specifies the YEAR variable in the BY statement. The value of that variable is used for the image file name:

```
imagename="#byval(year)"
```

The following example specifies the YEAR variable in the BY statement followed with the text *_sales*:

```
imagename="#byval(year)_sales"
```

#BYVAR*n* | #BYVAR(*BY-variable-name*)
substitutes the name of the BY variable or the label associated with the variable (whatever the BY line would normally display) for #BYVAR in the file name string. Specify the variable with one of these:

n
specifies a variable by its position in the BY statement. You must provide the position even if your BY statement contains only one variable. Otherwise, no substitution occurs.

BY-variable-name
specifies a variable from the BY statement by its name. *BY-variable-name* is not case sensitive.

Examples The following example specifies the first variable in the BY statement. The name of that variable is used for the image file name.

```
imagename="#byvar1"
```

The following example specifies the second variable in the BY statement preceded by the text *sales_*:

```
imagename="sales_#byvar2"
```

The following example specifies the YEAR variable in the BY statement. The name of that variable is used for the image file name:

```
imagename="#byvar(year)"
```

The following example specifies the YEAR variable in the BY statement followed with the text *_sales*:

```
imagename="#byvar(year)_sales"
```

Note: When using this feature, consider any file name length restrictions that might apply to your platform host. The file name length can vary greatly depending on the input data.

Specifying the Image Format

Each ODS destination uses a default format for its output. You can use the OUTPUTFMT= option in the ODS GRAPHICS statement to change the output format.

Note: Unless you have a special requirement for changing the image format, we recommend that you not change it. The default PNG or vector graphic format is far superior to other formats, such as GIF, in support for transparency and a large number of colors. Also, PNG and vector graphics images require much less disk storage space than JPEG or TIFF formats.

If you want to generate vector graphics images, you can use the following OUTPUTFMT= values for each destination:

Table A12.4 *Generating Vector Graphics Output with ODS*

ODS Destination	OUTPUTFMT=value
ODS EPUB	OUTPUTFMT=SVG
ODS destination for Excel	OUTPUTFMT=EMF
ODS HTML	OUTPUTFMT=SVG
ODS HTML5	Vector graphics images are generated by default
ODS LISTING	OUTPUTFMT=EMF OUTPUTFMT=PDF OUTPUTFMT=PS | EPS | EPSI OUTPUTFMT=SVG

ODS Destination	OUTPUTFMT=value
	OUTPUTFMT=PCL
ODS PDF	Vector graphics images are generated by default
ODS PCL	OUTPUTFMT=PCL (for PCL output)
ODS PS	OUTPUTFMT=PS (for PostScript output)
ODS destination for PowerPoint	OUTPUTFMT=EMF
ODS PRINTER	OUTPUTFMT=PCL (for PCL output) OUTPUTFMT=PDF (for PDF output) OUTPUTFMT=PS | EPS | EPSI (for PostScript output) OUTPUTFMT=SVG
ODS RTF	OUTPUTFMT=EMF
ODS Measured RTF	OUTPUTFMT=EMF

Note: For information about SVG and SAS Universal Printing, see "Creating SVG Documents Using Universal Printing" in *SAS 9.4 Universal Printing*.

When a vector graphics image cannot be generated for the format that you specify, a PNG image is generated instead and is embedded in the specified output file. The output file format and extension are not changed in that case. In the following cases, a vector graphics image cannot be generated:

- surface plots
- bivariate histograms
- graphs that use smooth gradient contours
- graphs that include continuous legends
- graphs that use data skins
- graphs that use transparency (EMF and PS ODS destinations only)
- graphs that contain one or more rotated images
- graphs that have a broken axis
- graphs that contain outline marker characters

Starting with SAS 9.4M2, additional cases for which vector graphics output cannot be generated for graphs are as follows:

- graphs that use gradient fill for bars in a bar chart, histogram, or waterfall chart
- graphs that use the back-light effect on text

- graphs that include a text plot that displays text with an outlined bounding box or text with a filled bounding-box background
- graphs that include images (PostScript output only)

Starting with SAS 9.4M3, vector graphics output can be generated in the EMF, PDF, and SVG output formats for the following cases:

- graphs that use data skins

  Note: For the EMF, PDF, and SVG formats, vector graphics output is not supported for graphs that use transparency and data skins. An image is generated in that case.

- graphs that include one or more rotated images
- graphs that use gradient fills (except PDF)
- graphs that use a continuous legend

  Note: For the PDF output format, vector graphics output is not supported for graphs that use a continuous legend and data transparency. An image is generated in that case.

Starting with SAS 9.4M5, vector graphics output can or cannot be generated in the output formats as indicated in the following table:

Table A12.5 *Support for Vector Graphics*

Case	EMF	PCL	PDF	PS	SVG
Surface plots	No	No	No	No	No
Gradient fill contour plots	No	No	No	No	No
3-D bivariate histograms	No	No	No	No	No
Continuous legends without data or fill transparency	Yes	No	Yes	No	Yes
Continuous legends with data transparency	Yes	No	No	No	Yes
Data skins	Yes	No	Yes	No	Yes
Data skins with transparency	No	No	No	No	Yes
Data transparency, without images	Yes	Yes	Yes	No	Yes
Transparent images[1]	Yes	No	Yes	No	Yes
Images with data transparency	No	No	No	No	Yes
Rotated images	Yes	No	Yes	No	Yes

Case	EMF	PCL	PDF	PS	SVG
Text plots with backlight	Yes	No	Yes	No	Yes
Text plots with fill and outline	Yes	No	Yes	Yes	Yes
Scatter plots with an outlined marker character	Yes	No	Yes	No	Yes
Broken axis	Yes	No	Yes	No	Yes
Fill patterns	Yes	No	No	No	Yes
Fill pattern legend chiclets	No	No	No	No	No

1 Starting with SAS 9.4M7, vector graphics are supported for transparent images in EMF, PDF, and SVG output. The image itself must be transparent. If you make an image transparent by specifying transparency in your program, a vector graphic is not created.

Note: The SGMAP procedure, which is new in SAS 9.4M5, does not support vector-based output.

Supported File Types for Output Destinations

The following table lists all of the supported file types for some ODS output destinations.

Table A12.6 *Supported File Types for Output Destinations*

Output Destination	Supported File Types
EPUB, EPUB2	PNG (default), GIF, JPG, SVG
EPUB3	SVG (default), PNG, GIF, JPG **Note:** EPUB3 was added in SAS 9.4M1. **Note:** Starting with SAS 9.4M3, EPUB3 is an alias for EPUB, and the EPUB3 supported file types supersede the EPUB supported file types.
ODS destination for Excel	PNG (default), JPEG, JPG, EMF
HTML	PNG (default), GIF, JPEG, JPG, SVG
HTML5	SVG (default), PNG, GIF, JPEG, JPG
LISTING	PNG (default), BMP, EMF, EPSI, GIF, JFIF, JPEG, JPG, PDF, PS, SASEMF, STATIC, TIFF, WMF, PSL, SVG
PDF	Native PDF (default), JPEG, JPG, GIF, PNG

Output Destination	Supported File Types
ODS destination for PowerPoint	PNG (default), JPEG, JPG, GIF, EMF, TIFF, BMP
PS	PNG (default), JPEG, JPG, GIF, EPS, PDF, PCL, PS
RTF and Measured RTF	EMF (default), PNG, JPEG, JPG, JFIF

Description of Supported File Types

The following table provides descriptions of the supported file types for ODS output destinations.

Table A12.7 *Description of Supported File Types*

File Type	Description
BMP (Microsoft Windows Device Independent Bitmap)	Supports color-mapped and true color images that are stored as uncompressed or run-length encoded data. BMP was developed by Microsoft Corporation.
CGM (Computer Graphics Metafile)	A free and open international standard file format for 2-D vector graphics, raster graphics, and text. This format is defined by ISO/IEC 8632.
DIB (Microsoft Windows Device Independent Bitmap)	See the description of BMP.
EMF (Enhanced Metafile Format)	Supports standard Enhanced Metafile Format.
EMF Plus (Enhanced Metafile Format Plus Extensions)	Supports Enhanced Metafile Plus Extensions that provides additional functionality, such as support of RGBA colors.
EMF Dual (Enhanced Metafile Format and Enhanced Metafile Format Plus Extensions)	Produces both EMF and EMF Plus formats simultaneously in the same output.
EPS	Encapsulated PostScript
EPSI (Microsoft NT Enhanced Metafile)	An extended version of the standard PostScript (PS) format. Files that use this format can be printed on PostScript printers and can also be imported into

File Type	Description
	other applications. Notice that EPSI files can be read, but PS files cannot be read.
GIF (Graphics Interchange Format)	Supports only color-mapped images. GIF is owned by CompuServe, Inc.
JFIF (JPEG File Interchange Format)	Supports JPEG image compression. JFIF software is developed by the Independent JPEG Group.
JPEG or JPG (Joint Photographic Experts Group)	A file format that is used for storing noninteractive images.
PBM (Portable Bitmap Utilities)	Supports gray-scale, color, RGB, and bitmap files. The Portable Bitmap Utilities are a set of free utility programs that were developed primarily by Jef Poskanzer.
PCL	Printer Control Language
PDF (Portable Document Format)	A file format for electronic distribution and exchange of documents.
PNG (Portable Network Graphic)	Supports true color, gray-scale, and 8-bit images.
PS (PostScript Image File Format)	The Image classes use only PostScript image operators. A level II PS printer is required for color images. PostScript was developed by Adobe Systems, Inc.
PSL (PostScript)	PostScript
STATIC	Chooses the best image format for the current ODS destination.
SVG (Scalable Vector Graphics)	Is an XML language for describing two-dimensional vector graphics.
TIFF (Tagged Image File Format)	Internally supports a number of compression types and image types, including bitmapped, color-mapped, gray-scaled, and true color. TIFF was developed by Aldus Corporation and Microsoft Corporation and is used by a wide variety of applications (available if licensed).

File Type	Description
XBM	X Window Bitmap
XPM	X Window Pixmap

Temporarily Saving and Restoring ODS GRAPHICS Settings

About PUSH and POP

Note: This feature applies to SAS 9.4M3 and later releases.

Although you can use the RESET option to restore the default ODS GRAPHICS settings, there might be times when you want to save your current custom settings and later restore them. ODS enables you to temporarily store your custom settings in a stack created for this purpose, perform some other task with different settings, and then restore the previous settings.

The PUSH option saves the current ODS GRAPHICS settings to the stack and increments the stack depth. The POP option restores the most recently stored settings from the stack and decrements the stack depth.

This feature is useful when you write macros. Within a macro you can PUSH at the start of the macro and POP at the end. This enables your macro to have custom ODS GRAPHICS behaviors without affecting the calling environment.

You can specify PUSH as many times as you like up to the limit that is defined by the STACKDEPTHMAX= option. The pushed settings remain in the stack in the current SAS session until they are popped or the stack is emptied. For more information, see “Managing the Stack Depth” on page 1594. For each PUSH option, you can specify a POP option. ODS issues a warning if you specify POP without a corresponding PUSH. In that case, nothing is popped because nothing has been pushed to the stack.

Order of specification is important when using the PUSH option. For example, the following statement pushes the NOBORDER option to the stack along with any other custom settings that are in effect.

```
ods graphics / noborder push;
```

A subsequent POP option restores the pushed settings including NOBORDER.

However, the following statement pushes the current custom settings and then sets the NOBORDER option.

```
ods graphics / push noborder;
```

Here, the subsequent POP option restores whatever border setting was in effect when the PUSH option was specified.

TIP Use the SHOW option to show the ODS GRAPHICS settings that are currently in effect.

Settings That Can Be Pushed

The PUSH and POP options apply to all ODS GRAPHICS options except the following: PUSH, POP, RESET=INDEX, and SHOW.

How Code Errors Affect the PUSH Operation

If the ODS GRAPHICS statement contains a syntax error, then the PUSH option is ignored.

For example, the PUSH option is ignored in the following statement:

```
ods graphics / antialias=bogus push;
```

A syntax error (BOGUS) in ANTIALIAS causes the parser to ignore the remaining options. However, a simple semantics error does not prevent the remaining options from being handled. In the following statement, the PUSH option is honored.

```
ods graphics / antialiasmax=-1 push;
```

In this statement, ANTIALIASMAX= –1 is invalid. The option expects a zero or a positive integer. In this case, a warning is issued to the log, but the PUSH occurs.

Note: Syntax errors in your code can have other unexpected results that are not described here.

Managing the Stack Depth

By default, the stack supports up to 1024 pushes. You can change the default by using the STACKDEPTHMAX= option.

If the specified STACKDEPTHMAX= value is less than the current stack depth, then the stack is popped until its depth equals the specified value. Popping the stack does not affect other option settings.

If you want to empty the stack, issue the following statement:

```
ods graphics / stackdepthmax=0 reset=stackdepthmax;
```

This statement first empties the stack of all PUSH requests and then restores the stack size to 1024.

Appendix 2

Reserved Keywords and Unicode Values

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Reserved Keywords and Unicode Values

Overview

The tables in this section show some of the reserved keywords and Unicode values that can be used with the UNICODE text command. For information about rendering Unicode characters, see "Managing the String on Text Statements" in *SAS Graph Template Language: User's Guide*.

Note the following:

- Keywords and Unicode values are not case-sensitive: "03B1"x is the same code point as "03b1"x.
- The word `blank` is the keyword for a blank space.

Lowercase Greek Letters

Keyword	Glyph	Unicode	Description
alpha	α	03B1	lowercase alpha
beta	β	03B2	lowercase beta
gamma	γ	03B3	lowercase gamma
delta	δ	03B4	lowercase delta
epsilon	ε	03B5	lowercase epsilon
zeta	ζ	03B6	lowercase zeta
eta	η	03B7	lowercase eta
theta	θ	03B8	lowercase theta
iota	ι	03B9	lowercase iota
kappa	κ	03BA	lowercase kappa
lambda	λ	03BB	lowercase lambda
mu	μ	03BC	lowercase mu
nu	ν	03BD	lowercase nu
xi	ξ	03BE	lowercase xi
omicron	ο	03BF	lowercase omicron
pi	π	03C0	lowercase pi
rho	ρ	03C1	lowercase rho
sigma	σ	03C3	lowercase sigma
tau	τ	03C4	lowercase tau
upsilon	υ	03C5	lowercase upsilon
phi	φ	03C6	lowercase phi

Keyword	Glyph	Unicode	Description
chi	χ	03C7	lowercase chi
psi	ψ	03C8	lowercase psi
omega	ω	03C9	lowercase omega

Uppercase Greek Letters

Keyword	Glyph	Unicode	Description
alpha_u	Α	0391	uppercase alpha
beta_u	Β	0392	uppercase beta
gamma_u	Γ	0393	uppercase gamma
delta_u	Δ	0394	uppercase delta
epsilon_u	Ε	0395	uppercase epsilon
zeta_u	Ζ	0396	uppercase zeta
eta_u	Η	0397	uppercase eta
theta_u	Θ	0398	uppercase theta
iota_u	Ι	0399	uppercase iota
kappa_u	Κ	039A	uppercase kappa
lambda_u	Λ	039B	uppercase lambda
mu_u	Μ	039C	uppercase mu
nu_u	Ν	039D	uppercase nu
xi_u	Ξ	039E	uppercase xi
omicron_u	Ο	039F	uppercase omicron
pi_u	Π	03A0	uppercase pi

Keyword	Glyph	Unicode	Description
rho_u	Ρ	03A1	uppercase rho
sigma_u	Σ	03A3	uppercase sigma
tau_u	Τ	03A4	uppercase theta
upsilon_u	Υ	03A5	uppercase upsilon
phi_u	Φ	03A6	uppercase phi
chi_u	Χ	03A7	uppercase chi
psi_u	Ψ	03A8	uppercase psi
omega_u	Ω	03A9	uppercase omega

Special Characters

Keyword	Glyph	Unicode	Description
prime	′	00B4	single prime sign
bar	¯	0305	combining overline[1]
bar2	‾	033F	combining double overline[1]
tilde	˜	0303	combining tilde[1]
hat	ˆ	0302	combining circumflex accent[1]

1 This is an overstriking character that requires a Unicode font to render properly.

Appendix 3

Display Attributes

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General Syntax for Attribute Options

Most statements provide options that enable you to specify attributes for the fills, lines, data markers, or text that is used in the display. For example, many plots provide a DATALABELATTRS= option that specifies the attributes of the data labels. This appendix discusses the general syntax for those options and the valid values for they accept.

A statement's attribute options use the following general syntax:

attribute-option-name **=** *style-element* | *style-element (options)* | *(options)*

style-element
specifies the name of a style element. Only style attributes that are relevant for rendering the fill, line, data marker, or text are used.

```
Example  fillattrs = graphdata1
```

style-element (options)
specifies the name of a style element, plus individual options to be used as style overrides. *Options* is a space-delimited list of *option* = *value* pairs. Any options that are not specified are derived from the specified style element.

```
Example  fillattrs = graphdata1(color = blue)
```

(options)
specifies individual options as a space-delimited list of *option* = *value* pairs. Any options that are not specified are derived from the default style element.

```
Example  datalabelattrs = (family = "Arial" size = 10pt)
         datalabelattrs = (family = graphvaluetext:fontfamily)
```

Depending on the attribute option used, the options might be fill options , line options , marker options , or text options .

In general, any relevant attribute that is not specified defaults to an internal value, which is typically derived from the style element that you specify for the attributes. When choosing a style element, you should use an element of the correct type. See "Graph Style Elements Used by ODS Graphics" in *SAS Graph Template Language: User's Guide* for a list of style elements and their types.

Attributes Available for the Attribute Options

Depending on the attribute option used on a statement, the available attributes might be fill-color options on page 1600, fill-pattern options on page 1601, line options on page 1602, marker options on page 1604, or text options on page 1606.

Fill Color Options

Use one or more of the following options to specify fill-color attributes. The options must be enclosed in parentheses and specified as a space-delimited list of *name* = *value* pairs.

COLOR=*style-reference* | *color*
specifies the fill color. *Style-reference* must specify a valid style attribute such as Color, ContrastColor, StartColor, NeutralColor, or EndColor in the form

style-element-name:*attribute-name*. If *style-reference* is not defined in the active ODS style, the COLOR= option is ignored and the default color is used.

Color must be a valid color name, such as RED, or a color code, such as CXFF0000 or #FF0000. The color name must not exceed 64 characters. A color code must be a valid code for a SAS color-naming scheme, such as RGB, CMYK, HLS, or HSV (HSB). See "Color-Naming Schemes" on page 1609.

TRANSPARENCY=*number*
specifies the degree of the transparency of the filled area. This setting enables you to set the transparency for the filled elements of some graph types. You can set just this fill transparency, or set the fill independently of the other transparent elements in the graph. For example, you can use this setting to set the transparency level for the filled bars of a bar chart, and use the bar chart's DATATRANSPARENCY= option to set a different transparency level for the bar outlines.

Default The same as the setting of the statement's DATATRANSPARENCY= option.

Range 0–1, where 0 is opaque and 1 is entirely transparent

Interaction This setting overrides the statement's DATATRANSPARENCY= setting for the fills but not for the outlines.

Example
```
fillattrs = (transparency = 0.5)
```

Fill Pattern Options

Use one or more of the following options to specify fill-pattern attributes. The options must be enclosed in parentheses and specified as a space-delimited list of *name* = *value* pairs.

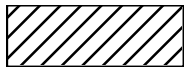
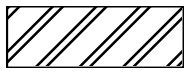
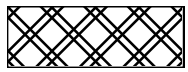
COLOR=*style-reference* | *color*
specifies the fill color.*Style-reference* must specify a valid style attribute such as Color, ContrastColor, StartColor, NeutralColor, or EndColor in the form *style-element-name*:*attribute-name*. If *style-reference* is not defined in the active ODS style, the COLOR= option is ignored and the default color is used.

Color must be a valid color name, such as RED, or a color code, such as CXFF0000 or #FF0000. The color name must not exceed 64 characters. A color code must be a valid code for a SAS color-naming scheme, such as RGB, CMYK, HLS, or HSV (HSB). See "Color-Naming Schemes" on page 1609.

PATTERN=*style-reference* | *fill-pattern*
specifies the fill pattern. *Style-reference* is valid starting with SAS 9.4M5. It must specify a FILLPATTERN attribute in the form *style-element-name*:FILLPATTERN. If *style-reference* is not defined in the active ODS style, the PATTERN= option is ignored and the default fill pattern is used, if one is specified by the active ODS style.

Fill-pattern is a two-character specification that consists of a line-direction prefix (R for right, L for left, and X for cross hatch) and a line-identification number, 1–5. The following table shows the patterns for each of the possible combinations.

Table A14.1 *Fill Patterns*

Pattern Name	Example	Pattern Name	Example	Pattern Name	Example
L1		R1		X1	
L2		R2		X2	
L3		R3		X3	
L4		R4		X4	
L5		R5		X5	

Line Options

Use one or more of the following options to specify line attributes. The options must be enclosed in parentheses and specified as a space-delimited list of *name* = *value* pairs.

COLOR=*style-reference* | *color*
specifies the line color. *Style-reference* must specify a valid style attribute such as Color, ContrastColor, StartColor, NeutralColor, or EndColor in the form `style-element-name:attribute-name`. If *style-reference* is not defined in the active ODS style, the COLOR= option is ignored and the default color is used.

Color must be a valid color name, such as RED, or a color code, such as CXFF0000 or #FF0000. The color name must not exceed 64 characters. A color code must be a valid code for a SAS color-naming scheme, such as RGB, CMYK, HLS, or HSV (HSB). See "Color-Naming Schemes" on page 1609.

PATTERN=*style-reference* | *line-pattern-name* | *line-pattern-number*
specifies the line pattern. *Style-reference* must specify a LineStyle attribute in the form `style-element-name:LINESTYLE`. Line patterns can be specified as a pattern name or pattern number. The following table lists commonly used line patterns.

Table A14.2 *Commonly Used Line Patterns*

Pattern Number	Pattern Name	Example
1	Solid	
2	ShortDash	
4	MediumDash	
5	LongDash	
8	MediumDashShortDash	
14	DashDashDot	
15	DashDotDot	
20	Dash	
26	LongDashShortDash	
34	Dot	
35	ThinDot	
41	ShortDashDot	
42	MediumDashDotDot	

Valid line-pattern numbers range from 1 to 46. Not all line-pattern numbers have names. See "Available Line Patterns" on page 1607 for a list of all possible line patterns. We recommend that you use the named patterns because they have been optimized to provide good discriminability when used in the same plot.

Note Anti-aliasing might alter the appearance of some line patterns that have fine detail such as line patterns 33 through 46. For example, if you specify the color black and the pattern 33 for a line, and anti-aliasing is enabled, then the line might appear gray. In that case, you can use the ODS GRAPHICS statement to disable anti-aliasing as shown in the following example:

```
ods graphics / antialias = off;
```

THICKNESS=*style-reference* | *dimension*
specifies the line thickness. *Style-reference* must specify a LINETHICKNESS attribute in the form *style-element-name*:LINETHICKNESS.

See “dimension” on page xiii

Marker Options

Use one or more of the following options to specify data-marker attributes. You must enclose the options in parentheses and specify the options as a space-delimited list of *name* = *value* pairs.

COLOR=*style-reference* | *color*
specifies the line color. *Style-reference* must specify a valid style attribute such as Color, ContrastColor, StartColor, NeutralColor, or EndColor in the form *style-element-name*:*attribute-name*. If *style-reference* is not defined in the active ODS style, the COLOR= option is ignored and the default color is used.

Color must be a valid color name, such as RED, or a color code, such as CXFF0000 or #FF0000. The color name must not exceed 64 characters. A color code must be a valid code for a SAS color-naming scheme, such as RGB, CMYK, HLS, or HSV (HSB). See “Color-Naming Schemes” on page 1609.

Restriction This option has no effect on marker symbols that are created with the SYMBOLIMAGE statement.

See “SYMBOLIMAGE Statement” on page 1384

SIZE=*style-reference* | *dimension*
specifies the marker size (both width and height). *Style-reference* must specify a MARKERSIZE attribute in the form *style-element-name*:MARKERSIZE.

See “dimension” on page xiii

SYMBOL=*style-reference* | *marker-name*
specifies the name of the marker. *Style-reference* must specify a MARKERSYMBOL attribute in the form *style-element-name*:MARKERSYMBOL.The following table lists the SAS symbols that are supported.

Table A14.3 *Supported Marker Symbols*

Symbol Name	Plot Symbol	Symbol Name	Plot Symbol
ArrowDown	↓	StarFilled	★
Asterisk	✳	Tack	⊤
Circle	○	Tilde	∿
CircleFilled	●	Triangle	△

Symbol Name	Plot Symbol	Symbol Name	Plot Symbol
Diamond		TriangleFilled	
DiamondFilled		TriangleDown	
GreaterThan		TriangleDownFilled	
Hash		TriangleLeft	
HomeDown		TriangleLeftFilled	
HomeDownFilled		TriangleRight	
IBeam		TriangleRightFilled	
LessThan		Union	
Plus		X	
Square		Y	
SquareFilled		Z	
Star			

You can also specify the names of symbols that are created by the SYMBOLCHAR and SYMBOLIMAGE statements.

See "SYMBOLCHAR Statement" on page 1377

"SYMBOLIMAGE Statement" on page 1384

TRANSPARENCY=*number*
specifies the degree of transparency for the plot markers.

Default The transparency that is specified by the DATATRANSPARENCY= option, which is 0 by default.

Range 0–1, where 0 is opaque and 1 is entirely transparent

Interaction This suboption overrides the DATATRANSPARENCY= option for the plot markers only.

WEIGHT=NORMAL | BOLD
specifies the marker weight.

Restriction This option has no effect on marker symbols that are created with the SYMBOLCHAR and SYMBOLIMAGE statements.

See "SYMBOLCHAR Statement" on page 1377

"SYMBOLIMAGE Statement" on page 1384

Text Options

Use one or more of the following options to specify text attributes. The options must be enclosed in parentheses and specified as a space-delimited list of *name = value* pairs.

COLOR=*style-reference* | *color*
specifies the line color. *Style-reference* must specify a valid style attribute such as Color, ContrastColor, StartColor, NeutralColor, or EndColor in the form *style-element-name*:*attribute-name*. If *style-reference* is not defined in the active ODS style, the COLOR= option is ignored and the default color is used.

Color must be a valid color name, such as RED, or a color code, such as CXFF0000 or #FF0000. The color name must not exceed 64 characters. A color code must be a valid code for a SAS color-naming scheme, such as RGB, CMYK, HLS, or HSV (HSB). See "Color-Naming Schemes" on page 1609.

FAMILY=*style-reference* | *"string"*
specifies the font family of the text. *Style-reference* must specify a FONTFAMILY attribute in the form *style-element-name*:FONTFAMILY.

SIZE=*style-reference* | *dimension*
specifies the font size of the text. *Style-reference* must specify a FONTSIZE attribute in the form *style-element-name*:FONTSIZE.

Restriction The font size cannot be less than the minimum font size in SAS, which is determined by the SAS system. If you specify a font size that is less than the minimum font size, the minimum size is used.

See "dimension" on page xiii

STYLE=*style-reference* | NORMAL | ITALIC
specifies the font style of the text. *Style-reference* must specify a FONTSTYLE attribute in the form *style-element-name*:FONTSTYLE.

WEIGHT=*style-reference* | NORMAL | BOLD
specifies the font weight of the text. *Style-reference* must specify a FONTWEIGHT attribute in the form *style-element-name*:FONTWEIGHT.

Available Line Patterns

The following line patterns can be used with the Graphics Template Language. A line pattern can be specified by its number or name. Not all patterns have names. We recommend that you use the named patterns because they have been optimized to provide good discriminability when used in the same plot.

Table A14.4 *Full List of Line Patterns*

Pattern Number	Pattern Name	Example
1	Solid	
2	ShortDash	
3		
4	MediumDash	
5	LongDash	
6		
7		
8	MediumDashShortDash	
9		
10		
11		
12		
13		
14	DashDashDot	
15	DashDotDot	
16		

Pattern Number	Pattern Name	Example
17		
18		
19		
20	Dash	
21		
22		
23		
24		
25		
26	LongDashShortDash	
27		
28		
29		
30		
31		
32		
33		
34	Dot	
35	ThinDot	
36		
37		
38		
39		

Pattern Number	Pattern Name	Example
40		
41	ShortDashDot	
42	MediumDashDotDot	
43		
44		
45		
46		

Color-Naming Schemes

Overview of Color-Naming Schemes

The valid color-naming schemes in SAS are as follows:

- RGB (red green blue)
- CMYK (cyan magenta yellow black)
- HLS (hue lightness saturation)
- HSV (hue saturation brightness), also called HSB
- Gray scale
- SAS color names (from the SAS Registry)
- SAS Color Naming System (CNS)

Table A3.5 on page 1609 shows examples of each color-naming scheme.

Table A14.5 *Examples of SAS Color-Naming Schemes*

Color-Naming Scheme	Example
RGB	`COLOR=(CX98FB98)`

Color-Naming Scheme	Example
CMYK	`COLOR=(FF00FF00)` `COLOR=(CMYK00FFFF00)`
HLS	`COLOR=(H14055FF)`
HSV	`COLOR=(V0F055FF)`
Gray Scale	`COLOR=(GRAY4F)`
SAS Registry Colors	`COLOR=(palegreen)`
CNS Color Names	`COLOR=(VeryLightPurplishBlue)` `COLOR=(Very_Light_Purplish_Blue)`

You can also mix color-naming schemes in the same statement. For example:

```
DATACOLORS=(CXEE0044 vivid_blue darkgreen);
```

Each of the color-naming schemes has its advantages and disadvantages based on how the output is used. For example, if you are creating a report that will be viewed only online, then specifying colors using the RGB naming scheme or the SAS color names defined in the registry might produce better results. If you are creating a report for publishing in printed form, you might want to use the CMYK color-naming scheme.

Note: If you specify an invalid color name, the default color is used instead.

For additional information about color-naming schemes, see *Effective Color Displays: Theory and Practice* by David Travis, *Computer Graphics: Principles and Practice* by Foley, van Dam, Feiner, and Hughes, and http://colorbrewer2.org.

RGB Color Codes

The RGB color-naming scheme is usually used to define colors for a display screen. This color-naming scheme is based on the properties of light. An RGB color code defines a color by combining red, green, and blue colors in different ratios. All the colors combined together create white. The absence of all color creates black.

Color names are in the form CX*rrggbb*, where the following is true:

- CX indicates to SAS that this is an RGB color specification.
- *rr* is the red component.
- *gg* is the green component.
- *bb* is the blue component.

The components are hexadecimal numbers in the range 00–FF (0% to 100%). Each hexadecimal number indicates how much of the red, green, or blue is included in the color. Lower percentage values are darker and higher values are lighter. This scheme allows for up to 256 levels of each color component (more than 16 million different colors).

Table A14.6 *Examples of RGB Color Values*

Color	RGB Value
Red	CXFF0000
Green	CX00FF00
Blue	CX0000FF
White	CXFFFFFF
Black	CX000000

Any combination of the color components is valid. Some combinations match the colors produced by predefined SAS color names. See "Predefined Colors" in *SAS Graph Template Language: User's Guide*.

CMYK Color Codes

The CMYK color-naming scheme is used in four-color printing. CMYK is based on the principles of objects reflecting light. Combining equal values of cyan, magenta, and yellow produces process black, which might not appear as pure black. The black component (K) of CMYK can be used to specify the level of blackness in the output. A lack of all colors produces white when the output is printed on white paper.

To specify the colors from a printer's Pantone Color Lookup Table, you can use the CMYK color-naming scheme. Specify colors in terms of their cyan, magenta, yellow, and black components. Color names are in the form CMYK*ccmmyykk* or K*ccmmyykk*, where the following is true:

- CMYK or K is an optional prefix that indicates to SAS that this is a CMYK color specification.
- *cc* is the cyan component.
- *mm* is the magenta component.
- *yy* is the yellow component.
- *kk* is the black component.

The color-value components are hexadecimal numbers in the range 00–FF, where higher values are darker and lower values are brighter. This scheme allows for up to

256 levels of each color component. When the color value begins with a letter (A–F), you can omit the CMYK or K prefix. When the color value begins with a number (0–9), you must use the CMYK or K prefix.

Table A14.7 *Examples of CMYK Color Values*

Color	CMYK Value
Red	CMYK00FFFF00
Green	FF00FF00
Blue	CMYKFFFF0000
White	K00000000
Process black (using cyan, magenta, and yellow ink)	FFFFFF00
Pure black (using only black ink)	K000000FF

Note: You can specify a CMY value by specifying zero (00) for *kk*, the color's black component.

CMYK color specifications are for output devices that support four colors. If you specify CMYK colors on an output device that supports three colors such as RGB, the CMYK colors are converted to colors in the three-color space. Because the four-color space supports many more colors than a three-color space, the CMYK colors might map to different colors in the three-color space. To preserve your CMYK colors in that case, specify a device that supports the CMYK color space. See "Color Support for Universal Printers" in *SAS 9.4 Universal Printing*.

HLS Color Codes

The HLS color scheme specifies colors in terms of hue, lightness, and saturation levels. It is based on the Tektronix Color Standard. HLS color names are of the form H*hhhlss*, where the following is true:

- H indicates to SAS that this is an HLS color specification.
- *hhh* is the hue component, which is expressed as an angle.
- *ll* is the lightness component.
- *ss* is the saturation component.

The components are hexadecimal numbers. The hue component is in the range 000–168 hexadecimal, which represents an angular value in the range 0–360 decimal. Hue starts with the primary color blue at 0 degrees, and then progresses

to red at 120 degrees, to green at 240 degrees, and back to blue at 360 degrees. Both the lightness and saturation components are in the range 00–FF hexadecimal (0–255 decimal), which provides 256 levels that represent 0% to 100% for each component.

Table A14.8 *Examples of HLS Color Codes*

Color	HLS Color Code
Red	H07880FF
Green	H0F080FF
Blue	H00080FF
Light gray	H000BB00
White[1]	H*xxx*FF00, such as H000FF00
Black[1]	H*xxx*0000 such as H0000000

1 When the saturation is set to 00, the color is a shade of gray that is determined by the lightness value. Therefore, white is defined as H*xxx*FF00 and black as H*xxx*0000, where *xxx* can be any hue.

HSV (or HSB) Color Codes

The HSV color-naming scheme specifies colors in terms of hue, saturation, and value (or brightness) components. HSV color names are of the form V*hhhssvv*, where the following is true:

- V indicates to SAS that this is an HSV color specification.
- *hhh* is the hue component, which is expressed as an angle.
- *ss* is the saturation component.
- *vv* is the value or brightness component.

The components are hexadecimal numbers. The hue component is in the range 000–168 hexadecimal, which represents an angular value in the range 0–360 decimal. Hue starts with the primary color red at 0 degrees, and then progresses to green at 120 degrees, to blue at 240 degrees, and back to red at 360 degrees. Both the saturation and value (brightness) components are in the range 00–FF hexadecimal (0–255 decimal), which provides 256 levels for each component.

Table A14.9 *Examples of HSV (or HSB) Color Codes*

Color	HSV Color Code
Red	V000FFFF

Color	HSV Color Code
Green	V078FFFF
Blue	V0F0FFFF
Light gray[1]	V*xxx*00BB such as V07900BB
White[1]	V*xxx*00FF such as V07900FF
Black[1]	V*xxx*00000 such as V0790000

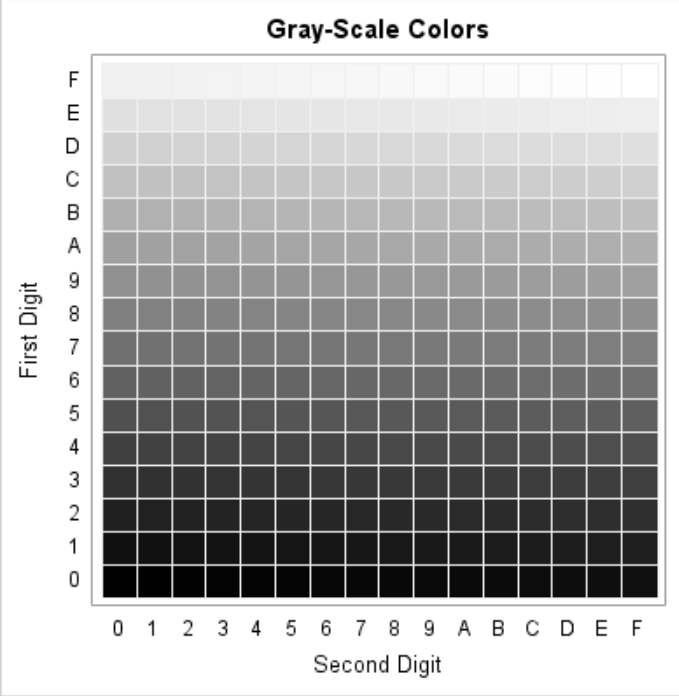
1 When the saturation is set to 00, the color is a shade of gray. The value component determines the intensity of gray level. The *xxx* value can be any hue.

Gray-Scale Color Codes

Gray-scale colors are specified using the word GRAY and a lightness value in the form GRAY*hh*. The value *hh* is the lightness of the gray and is a hexadecimal number in the range 00–FF, which provides 256 levels on the gray scale.

Note: GRAY, without a lightness value, is a SAS color name defined in the SAS registry. (See "SAS Color Names and RGB Values in the SAS Registry" on page 1616.) Its value is CX808080. Invalid color specifications are mapped to GRAY.

The following figure shows the gray-scale color for each hexadecimal value.



Color Naming System (CNS) Values

For CNS, you specify a color value by specifying lightness, saturation, and hue, in that order, using the terms shown in the following table.

Table A14.10 *Color Naming System Values*

Lightness	Saturation	Hue
Black	Gray	Blue
Very Dark	Grayish	Purple
Dark	Moderate	Red
Medium	Strong	Orange/Brown
Light	Vivid	Yellow
Very Light		Green
White		

Follow these rules when you are determining the CNS color name:

- You should not use the lightness values Black and White with saturation or hue values.
- If you do not specify default values, medium is the default lightness value and vivid is the default saturation value.
- Gray is the only saturation value that can be used without a hue.
- Unless the color that you want is black, white, or some form of gray, you must specify at least one hue.

You can use one or two hue values in the CNS color name. When you use two hue values, the hues must be adjacent to each other in the following list: blue, purple, red, orange/brown, yellow, green, and then returning to blue. Two hue values result in a color that is a combination of both colors. Use the suffix “ish” to reduce the effect of a hue when two hues are combined. Reddish purple is less red than red purple. The color specified with the “ish” suffix must precede the color without the “ish” suffix.

You can write color names in the following ways:

- without space separators between words
- with an underscore to separate words

Do not enclose color names in quotation marks in GTL. For example, the following color specifications are valid:

- verylightmoderatepurplishblue
- very_light_moderate_purplish_blue

Note: If a CNS color name is also a color name in the SAS Registry, the SAS Registry color value takes precedence. Some CNS color names and color names in the SAS Registry have different color values. Dark blue is an example. To use a CNS color value when the color name is also in the SAS Registry, include an underscore to separate the words. Here is an example.

```
color=dark_blue
```

SAS Color Names and RGB Values in the SAS Registry

The SAS Registry provides a set of color names and RGB values that you can use to specify colors. These color names and RGB values are common to most web browsers. You can specify the name itself or the RGB value associated with that color name. To view the color names as associated RGB values that are defined in the registry, submit the following code:

```
proc registry list
 startat="COLORNAMES";
run;
```

SAS prints the output in the SAS log. Here is a partial listing.

```
NOTE: Contents of SASHELP REGISTRY starting at subkey [COLORNAMES]
[  COLORNAMES]
  Active="HTML"
[    HTML]
    AliceBlue=hex: F0,F8,FF
    AntiqueWhite=hex: FA,EB,D7
    Aqua=hex: 00,FF,FF
    Aquamarine=hex: 7F,FD,D4
    Azure=hex: F0,FF,FF
    Beige=hex: F5,F5,DC
    ...
```

For a list of the color names that are defined in the SAS Registry, see "Predefined Colors" in *SAS Graph Template Language: User's Guide*.

You can also create your own color values by adding them to the SAS registry. For information about viewing and modifying the list of color names, see "The SAS Registry" in *SAS Programmer's Guide: Essentials*.

Converting Color Values between Color-Naming Schemes

If the SAS/GRAPH software is included in your SAS installation, several macros are provided with SAS/GRAPH that enable you to perform selected conversions between color-naming schemes. The following table shows the conversions that are possible using these macros.

From Color Value	To Color Value	Conversion Macro
CMY	RGB	%CMY
CNS	HLS	%CNS
RGB	HLS	%RGB2HLS
HLS	RGB	%HLS2RGB

For information about these macros, see *SAS/GRAPH: Reference*.

Converting Numeric Color Component Values to Color Names

If the SAS/GRAPH software is included in your SAS installation, several macros are provided with SAS/GRAPH that enable you to convert numeric color component values to color names. The following table shows the macros that you can use for this purpose.

From Numeric Color Component Values	To Color Name	Conversion Macro
cyan, magenta, yellow, black	CMYK	%CMYK
hue, lightness, saturation	HLS	%HLS
hue, saturation, value	HSV	%HSV
red, green, blue	RGB	%RGB

Converting Color Values from Other Applications

Many software programs enable you to change or customize various colors. A dialog box typically provides a means of selecting a different color or modifying the attributes of an existing color. In the SAS ODS Graphics Editor, for example, the More Colors dialog box shown in the following figure serves this purpose.

Figure A14.1 *More Colors Dialog Box*

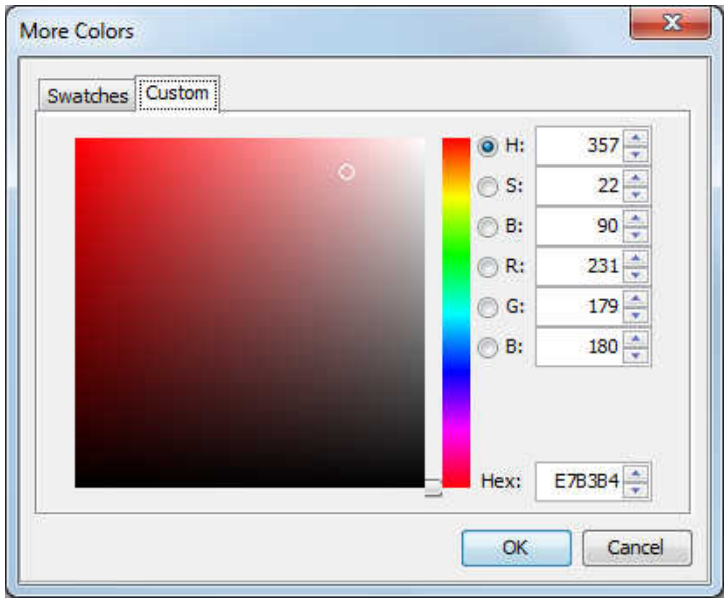


Figure A3.1 on page 1618 shows the HSB and RGB numeric color component values for the currently selected color. It also shows the RGB values in hexadecimal. To use the RGB specification for this color in a SAS program, add the CX prefix to the **Hex** value E7B3B4. If the application provides only the numeric component values, you must convert the decimal component values to hexadecimal. In Figure A3.1 on page 1618, the **H** value is in the range 0–360 degrees, and the **S** and **B** values are each in the range 0–100 percent. The **R**, **G**, and **B** values are in the range 0–255 each. You can convert the component values manually. (See "Understanding Hexadecimal Values" in *SAS Graph Template Language: User's Guide*.) Be aware that you must first convert the **S** and **B** values from percentages to 255-based values by rounding the result of the following computation to the nearest integer:

$$\left(\frac{Value}{100}\right) \times 255$$

If the SAS/GRAPH software is included in your SAS installation, you can also use the SAS/GRAPH color utility macros to convert the values. The %HSV color utility macro converts HSV (HSB) numeric color component values to an HSV color name. Likewise, the %RGB macro converts RGB numeric color component values to an RGB color name. The following example shows how to use the %HSV color utility macro to convert the **H**, **S**, and **B** color component values in Figure A3.1 on page 1618 to an HSV color name.

```
%COLORMAC;
data _null_;
  put "%HSV(357,22,90)";
run;
```

Note: The %COLORMAC macro compiles all of the SAS/GRAPH color utility macros. You need to run it only once during a SAS session.

Because the %HSV macro accepts values in the range 0–100 as a percentage of 255 for saturation and value, use the **S** and **B** values as shown. The result is V16538E6.

The following example shows how to use the %RGB color utility macro to convert the **R**, **G**, and **B** numeric color component values in Figure A3.1 on page 1618 to an RGB color name.

```
/* Compute the RGB percentages */
data _null_;
  r = 231;
  g = 179;
  b = 180;
  call symputx("r", round((r/255)*100));
  call symputx("g", round((g/255)*100));
  call symputx("b", round((b/255)*100));
run;

/* Convert to RGB color name */
%COLORMAC;
data _null_;
  put "%RGB(&r,&g,&b)";
run;
```

Because the %RGB color utility macro accepts integer values in the range 0–100 as a percentage of 255, you must convert the 255-based values to integer percentages in order to use them in the %RGB macro call. The result is CXE8B3B5. The result from the %RGB macro is not exact due to rounding. If you want more exact results, use the following program.

```
data _null_;
  r = 231;
  g = 179;
  b = 180;
  rgb="CX" || put(r,hex2.) || put(g,hex2.) || put(b,hex2.);
  put rgb;
run;
```

The result is CXE7B3B4.

To convert the RGB color name to an HLS color name, use the %RGB2HLS macro as shown in the following program.

```
%COLORMAC;
data _null_;
  put "%RGB2HLS(CXE7B3B4)";
run;
```

The result is H077CD84.

For more information about the SAS/GRAPH color utility macros, see *SAS/GRAPH: Reference*.

Appendix 4

Format Support in ODS Graphics

Assigning Formats 1621
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Assigning Formats

SAS formats and user-defined formats can be assigned to input data columns with the FORMAT statement of the SGRENDER procedure. Also, several GTL statement options accept a format as an option value. Examples include the TICKVALUEFORMAT= option for formatting axis tick values, and the TIPFORMAT= option for formatting data tips. For information about SAS formats, see *SAS Formats and Informats: Reference*. For information about user-defined formats, see "FORMAT Procedure" in *Base SAS Procedures Guide*.

Not all SAS formats and user-defined formats are supported in GTL or with the SGPLOT, SGSCATTER, SGPANEL, and SGRENDER procedures. See "SAS Formats That Are Not Supported" on page 1622. When an unsupported format is encountered, a note similar to the following is written to the SAS log:

```
TICKVALUEFORMAT=bestx. is invalid. The format is invalid or unsupported.
 The default will be used.
```

Using Locale-Sensitive Decimal Separators with Numeric Formats

System option NLDECSEPARATOR= is not supported by ODS Graphics. When system option NLDECSEPARATOR is in effect, syntax errors or null debug errors might result when using an ODS Graphics enabled procedure. For locale-sensitive decimal separators in your graph's numeric values, specify system option NONLDECSEPARATOR, and then use appropriate NL formats to format your numeric variables. See "Dictionary of Formats for NLS" in *SAS National Language Support (NLS): Reference Guide*.

SAS Formats That Are Not Supported

Unsupported Numeric Formats

The following numeric formats are not supported in ODS Graphics:

BESTD	BESTX	D	FLOAT	FRACT
FREE	IB	IBR	IEEE	IEEER
ODDSR	PCPIB	PD	PIB	PIBR
PK	RB	SSN	WORDF	WORDS
Z	ZD			

Unsupported Date and Time Formats Related to ISO 8601

The following date and time formats are not supported in ODS Graphics:

$N8601B	$N8601BA	$N8601E	$N8601EA	$N8601EH
$N8601EX	$N8601H	$N8601X	B8601DA	B8601DN
B8601DT	B8601DZ	B8601LZ	B8601TM	B8601TZ
E8601DA	E8601DN	E8601DT	E8601DZ	E8601LZ
E8601TM	E8601TZ	IS8601DA	IS8601DN	IS8601DT
IS8601DZ	IS8601LZ	IS8601TM	IS8601TZ	

Other Unsupported Date and Time Formats

The following date and time formats are not supported in ODS Graphics:

HDATE	HEBDATE	JDATEMDW	JDATEMNW	JDATEWK
JDATEYDW	JDATEYM	JDATEYMD	JDATEYMW	JDATEYT
JDATEYTW	JNENGO	JNENGOT	JNENGOTW	JNENGOW
JTIMEH	JTIMEHM	JTIMEHMS	JTIMEHW	JTIMEMW
JTIMESW	MDYAMPM	MINGUO	NENGO	NLDATEYQ
NLDATEYR	NLDATEYW	NLDATMYQ	NLDATMYR	NLDATMYW
NLSTRMON	NLSTRQTR	NLSTRWK	PDJULG	PDJULI
TWMDY	XYYMMDD	YYQZ		

Unsupported Currency Formats

The following currency formats are not supported in ODS Graphics:

EURFRATS	EURFRBEF	EURFRCHF	EURFRCZK	EURFRDEM
EURFRDKK	EURFRESP	EURFRFIM	EURFRFRF	EURFRGBP
EURFRGRD	EURFRHUF	EURFRIEP	EURFRITL	EURFRLUF
EURFRNLG	EURFRNOK	EURFRPLZ	EURFRPTE	EURFRROL

EURFRRUR	EURFRSEK	EURFRSIT	EURFRTRL	EURFRYUD
EURTOATS	EURTOBEF	EURTOCHF	EURTOCZK	EURTODEM
EURTODKK	EURTOESP	EURTOFIM	EURTOFRF	EURTOGBP
EURTOGRD	EURTOHUF	EURTOIEP	EURTOITL	EURTOLUF
EURTONLG	EURTONOK	EURTOPLZ	EURTOPTE	EURTOROL
EURTORUR	EURTOSEK	EURTOSIT	EURTOTRL	EURTOYUD

User-Defined Formats That Are Not Supported

Picture Formats with Date, Time, or Datetime Directives

ODS Graphics does not support user-defined picture formats that specify date, time, or datetime directives such as %a, %W, %H, and so on. Using a picture format with directives produces unexpected results in ODS Graphics. To work around this limitation, apply the picture format to a new column in your data, and then plot the new preformatted column instead. Here is an example that creates column NewDate by formatting the Date column as MM/YYYY.

```
/* Create picture format MonYear for MM/YYYY date */
proc format;
  picture monyear (min=7)
    low-high='%0m/%Y' (datatype=date);
run;

/* Add preformatted date column NewDate to the data */
data stocks;
  set sashelp.stocks
    (where=(year(date) eq 2001 and stock eq "IBM"));
  newdate = put(date, monyear.);
  label newdate="Date: MM/YYYY";
run;
```

The NewDate column can be used in ODS Graphics plot statements instead of the Date column.

For information about the PICTURE statement in the FORMAT procedure, see *Base SAS Procedures Guide*.

Unicode Values with a User-Defined ODS Escape Character

ODS Graphics supports Unicode values in user-defined formats only if they are preceded by the (*ESC*) escape sequence as shown in the following example.

```
"(*ESC*){unicode beta}"
```

ODS Graphics does not support the use of a user-defined ODS escape character to escape Unicode values in user-defined formats.

For an example of how to use Unicode values in user-defined formats with ODS Graphics, see "Formatting the Tick Values on a Discrete Axis" in *SAS Graph Template Language: User's Guide*.

Appendix 5

Generalized Macro for BOXPLOTPARM Data

Generalized Macro for BOXPLOTPARM Data 1627

Generalized Macro for BOXPLOTPARM Data

The following SAS code is a generalized macro for computing input data for BOXPLOTPARM.

```
%macro boxcompute(indsn=,x=,y=,outdsn=boxdata,datalabel=,
                  qntldef=5,table=no);
/* NOTE: INDSN, X and Y are required parameters, where
   INDSN = input SAS data set
   X = categorical variable (num or char)
   Y = response variable (num)
   OUTDSN = output dataset. It contains these variables:
      STAT: Statistic names for BOXPLOTPARM
      VALUE: values for STAT type
      X: X variable values
      DATALABEL: outlier labels from the DATALABEL= variable
      N, Mean, Median, Std if TABLE=YES
   DATALABEL= variable used to label outliers (num or char)
   QNTLDEF = 1|2|3|4|5
     (how to compute quantiles - see PROC SUMMARY)
   TABLE = YES | NO
     (add additional data to build table of statistics)
 */
  %macro varinfo(dsid,varname,role,rc);
   /* utility macro for obtaining variable info */
```

```
    %local varnum;
    %if %length(&varname)=0 %then %do;
      %let &rc=0;  %return;
    %end;
    %let varnum=%sysfunc(varnum(&dsid,&varname));
    %if &varnum > 0 %then %do;
      %let &role.label=%sysfunc(varlabel(&dsid,&varnum));
      %if  %length(&&&role.label)=0 %then
         %let &role.label=%sysfunc(varname(&dsid,&varnum));
      %let &role.fmt=%sysfunc(varfmt(&dsid,&varnum));
      %let &rc=0;
    %end;
    %else %do;
      %put ERROR: %upcase(&role) variable &varname not found.;
      %let &rc=1;
    %end;
  %mend varinfo;

/* validate dataset and variables */
%local dsid ylabel xlabel datalabellabel
       yfmt xfmt datalabelfmt rc_y rc_x rc_d;
%let dsid=%sysfunc(open(&indsn));
%if &dsid %then %do;
   %varinfo(&dsid,&y,Y,rc_y)
   %varinfo(&dsid,&x,X,rc_x)
   %if %length(&datalabel) %then
      %varinfo(&dsid,&datalabel,DATALABEL,rc_d);
   %else %let rc_d=0;
   %let dsid=%sysfunc(close(&dsid));
   %if &rc_y or &rc_x or &rc_d %then %return;
%end;
%else %do;
   %put ERROR: Input dataset &indsn not found.;
   %return;
%end;

/* compute basic summary statistics */
proc summary data=&indsn(rename=(&y=VALUE &x=X))
             nway qntldef=&qntldef;
  class x;
  var value;
  output out=summary(drop=_type_ _freq_) n=N mean=Mean
             median=Median q1=Q1 q3=Q3 std=STD / noinherit;
run;
proc sort data=&indsn(keep=&x &y &datalabel)
  %if %length(&datalabel) %then
    out=sorted(rename=(&x=X &y=VALUE &datalabel=DATALABEL));
  %else out=sorted(rename=(&x=X &y=VALUE));
;  by &x;
run;
/* compute fences, MIN, MAX and any outliers for X values */
data outliers;
  length STAT $10;
  %if %length(&datalabel) %then
   %do;
    keep STAT X VALUE DATALABEL;
```

```
    label VALUE="&ylabel" X="&xlabel"
          DATALABEL="&datalabellabel";
    format VALUE &yfmt X &xfmt DATALABEL &datalabelfmt;
   %end;
  %else
   %do;
    keep STAT X VALUE;
    label VALUE="&ylabel" X="&xlabel";
    format VALUE &yfmt X &xfmt;
   %end;
  retain lowerFence upperFence farLowerFence farUpperFence
         tempmin tempmax;
  merge sorted summary; by x;

  /* perform computations for each X value */
  if first.X then do;
     lowerFence=q1-((q3-q1)*1.5);
     upperFence=q3+((q3-q1)*1.5);
     farLowerFence=q1-((q3-q1)*3);
     farUpperFence=q3+((q3-q1)*3);
     /* these computations for MIN and MAX result
        in the same values produced by the BOXPLOT
        statement, however they can be modified to
        satify other statistical definitions */
     if value <= upperFence then tempmax=value;
     else tempmax=.;
     if value => lowerFence then tempmin=value;
     else tempmin=.;
  end;
  /* recompute MAX and MIN for each obs */
  if 0 <= sum(upperFence,-value) then
     tempmax=max(tempmax,value);
  if 0 <= sum(value,-lowerFence) then
     tempmin=min(tempmin,value);
  /* write out both types of outliers */
  if value < farLowerFence or value > farUpperFence then do;
     stat="FAROUTLIER"; output;
  end;
  else if value < LowerFence or value > UpperFence then do;
     stat="OUTLIER"; output;
  end;
  /* write out MIN and MAX for each X value */
  if last.X then do;
    value=tempmin; stat="MIN"; output;
    value=tempmax; stat="MAX"; output;
  end;
run;
/* transpose the stats into the columns
   required by BOXPLOTPARM */
data transpose(keep=x stat value);
  length STAT $10;
  set summary;
  array stats{*} n--std;
  do i=1 to dim(stats);
    stat=upcase(vname(stats{i}));
    VALUE=stats{i};
```

```
    output;
  end;
run;
/* interleave the obs by the X variable */
data &outdsn;
  set transpose outliers; by X;
run;
/* merge the output stats for building a stat table */
%if %upcase(&table)=YES %then %do;
  data &outdsn;
    merge &outdsn summary; by X;
  run;
%end;
%mend boxcompute;
```

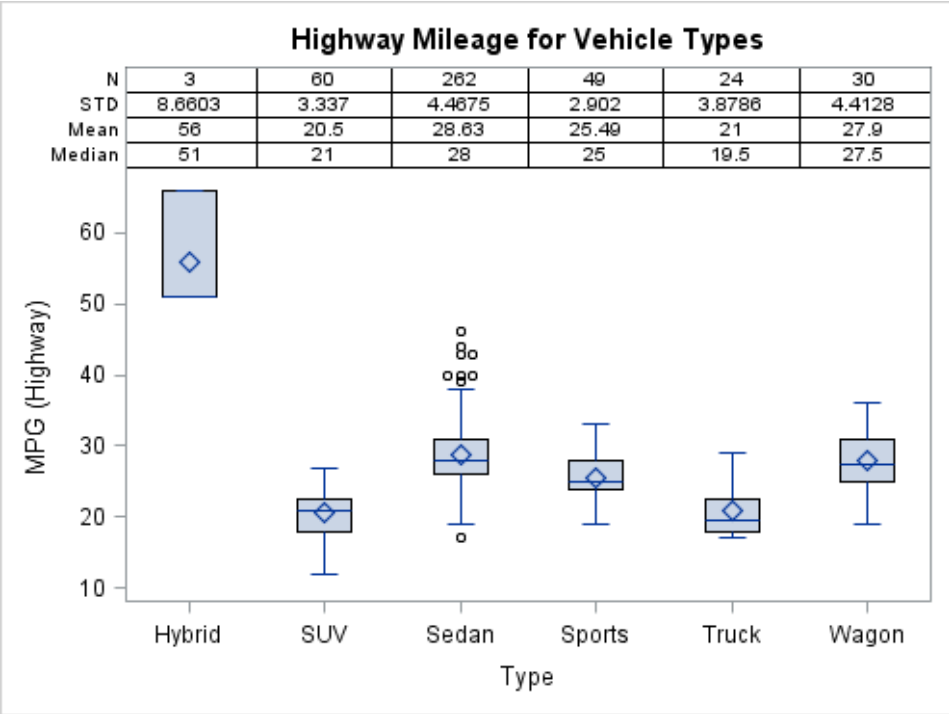
Here is the macro invocation to produce the data for the graph shown in the section "Example: BOXPLOTPARM Statement" on page 439 .

```
%boxcompute(indsn=sashelp.cars,x=type,y=mpg_city,
            datalabel=make);

proc template;
  define statgraph boxplotparm1;
    begingraph;
      entrytitle "City Mileage for Vehicle Types";
      layout overlay;
        boxplotparm y=value x=x stat=stat /
         datalabel=datalabel spread=true ;
      endlayout;
    endgraph;
  end;
run;

proc sgrender data=boxdata template=boxplotparm1;
run;
```

The following figure and code show an example of a "table" of statistics with BLOCKPLOT statements.




```
%boxcompute(indsn=sashelp.cars,x=type,y=mpg_highway,
            outdsn=boxdata2,table=yes);

proc template;
  define statgraph boxplotparm2;
    begingraph;
      entrytitle "Highway Mileage for Vehicle Types";
      layout overlay / xaxisOpts=(offsetMin=0.08 offsetMax=0.08);
        innerMargin / align=top;
          blockplot x=x block=n /
            display=(values label outline) valuehalign=center
            labelattrs=graphdatatext valueattrs=graphdatatext;
          blockplot x=x block=std /
            display=(values label outline) valuehalign=center
            labelattrs=graphdatatext valueattrs=graphdatatext;
          blockplot x=x block=mean /
            display=(values label outline) valuehalign=center
            labelattrs=graphdatatext valueattrs=graphdatatext;
          blockplot x=x block=median /
            display=(values label outline) valuehalign=center
            labelattrs=graphdatatext valueattrs=graphdatatext;
        endInnerMargin;
        boxplotparm y=value x=x stat=stat /
          datalabel=datalabel spread=true;
      endlayout;
    endgraph;
  end;
run;

proc sgrender data=boxdata2 template=boxplotparm2;
run;
```

Appendix 6

Memory Management for ODS Graphics

SAS Options Affecting Memory 1633
Managing a Java Out of Memory Error 1634

SAS Options Affecting Memory

ODS Graphics uses Java technology to produce its graphs. Most of the time this fact is transparent to you because the required Java Runtime Environment (JRE) and JAR files are included with SAS software installation. Also, the Java environment is automatically started and stopped for you. When Java is started, it allocates a fixed amount of memory. The memory can grow up to the value set for the -Xmx suboption in the JREOPTIONS option (discussed in a moment). This memory is independent of the memory limit that SAS sets for the SAS session with its MEMSIZE= option.

Normally, the memory limit for Java is sufficient for most ODS Graphics applications. However, some tasks are very memory intensive and might exhaust all available Java memory, resulting in an OutOfMemoryError condition. You might encounter Java memory limitations in the following cases:

- the product of the output size and the DPI setting results in very large output
- a classification panel has a very large number of classifier crossings
- a scatter plot matrix has a large number of variables
- creating 3-D plots and 2-D contours, which are memory intensive to generate
- a plot has a very large number of marker labels
- a plot uses many character variables or has a large number of GROUP values
- using the SG Editor to edit a graph with a large amount of data

Managing a Java Out of Memory Error

If you encounter a Java OutOfMemoryError, then you can try executing your program again by restarting SAS and specifying a larger amount of memory for Java at SAS invocation.

To determine what the current Java memory settings are, you can submit a PROC OPTIONS statement that shows the value of the JREOPTIONS option:

```
proc options option=jreoptions;
run;
```

After you submit this procedure code, a list of JREOPTIONS settings is written to the SAS log. The JREOPTIONS option has many suboptions that configure the SAS Java environment. Many of the suboptions are installation and host specific and should not be modified, especially the ones that provide installed file locations. For managing memory, look for the -Xmx and -Xms suboptions:

```
JREOPTIONS=(/* other Java suboptions */ -Xmx128m -Xms128m)
```

-Xms
: Use this option to set the minimum Java memory (heap) size, in bytes. Set this value to a multiple of 1024 greater than 1MB. Append the letter k or K to indicate kilobytes, or m or M to indicate megabytes. The default is 2MB. Examples:

```
-Xms6291456
-Xms6144k
-Xms6m
```

-Xmx
: Use this option to set the maximum size, in bytes, of the memory allocation pool. Set this value to a multiple of 1024 greater than 2MB. Append the letter k or K to indicate kilobytes, or m or M to indicate megabytes. The default is 64MB. Examples:

```
-Xmx83886080
-Xmx81920k
-Xmx80m
```

As a general rule, you should set the minimum heap size (-Xms) equal to the maximum heap size (-Xmx) to minimize garbage collections.

Typically, SAS sets both -Xms and -Xmx to be about 1/4 of the total available memory or a maximum of 128M. However, you can set a more aggressive maximum memory (heap) size, but it should never be more than 1/2 of physical memory.

You should be aware of the maximum amount of physical memory your computer has available. Let us assume that doubling the Java memory allocation is feasible. So when you start SAS from a system prompt, you can add the following option:

```
-jreoptions (-Xmx256m -Xms256m)
```

Alternatively, you might need to specify the setting in quotation marks:

```
-jreoptions '(-Xmx256m -Xms256m)'
```

The exact syntax varies for specifying Java options, depending on your operating system, and the amount of memory that you can allocate varies from system to system. The set of JRE options must be enclosed in parentheses. If you specify multiple JREOPTIONS system options, then SAS appends JRE options to JRE options that are currently defined. Incorrect JRE options are ignored.

If you choose to create a custom configuration file, then you would simply replace the existing -Xms and -Xmx suboption values in the JREOPTIONS=(*all Java options*) portion of the configuration file.

For more information, see the SAS Companion for your operating system.