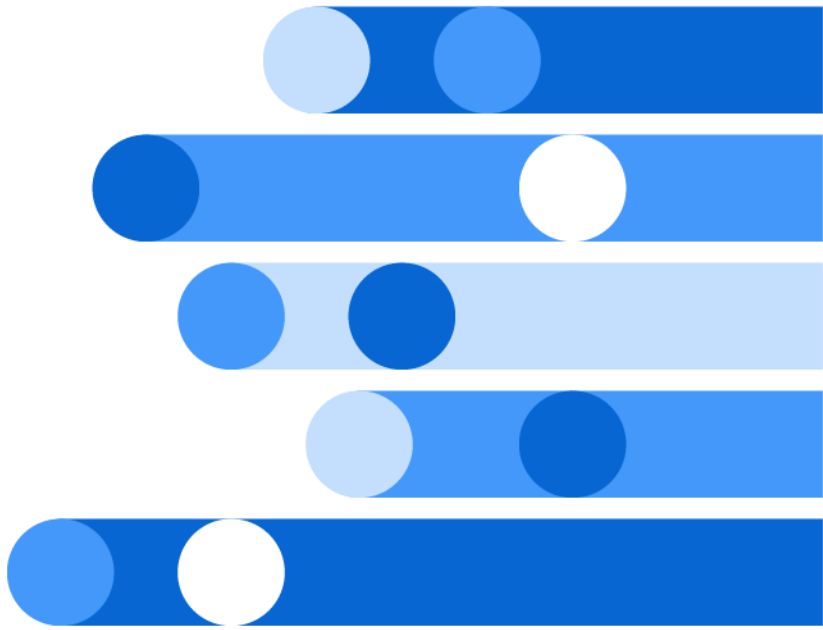
# SAS® 9.4 Companion for z/OS, Sixth Edition



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**SAS® 9.4 Companion for z/OS, Sixth Edition**



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# Contents

# 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';
```

# What's New in SAS 9.4 Companion for z/OS

## Overview

SAS for z/OS has added the following new and enhanced features:

User exit for SASRX

SAS for z/OS has enhanced the following language elements:

- Statements

  FILE INFILE
  FILENAME LIBNAME

- System Options

  CARDIMAGE MVARSIZE
  CONFIG VALIDMEMNAME
  LRECL

SAS for z/OS has added the following language elements:

- Function

  ZDSLIST

- SASRX Switch Option

  WORKLARGE

- System Options

  ALIGNSASIOFILES HOSTINFOLONG
  DLLBI SORTBLKREC
  FILEBUFNO SORTCUT
  HELPTOC

- Threaded Kernel Option

  set TKOPT_TKIOP_DIAG_SPACE

# SAS Software Enhancements

The following software enhancements have been made to SAS for z/OS:

Support for Pervasive Encryption
: Starting in SAS 9.4M8, support for pervasive encryption is available for SAS direct access bound libraries in z/OS through the Execute Channel Program (EXCP). For more information, see "IBM z/OS Pervasive Encryption for Data Sets with SAS 9.4M8" in *Encryption in SAS*.

Support for LE COBOL Routines
: SAS 9.4M3 adds support for LE COBOL routines to the ROUTINE statement of the SASCBTBL attribute table. For more information, see "ROUTINE Statement" on page 408.

Support for Longer TSO User IDs
: SAS 9.4M5 adds support for 8-character TSO user IDs on z/OS V2R3. For more information, see "Support for Longer TSO User IDs" on page 8.

Support for CSSMTP
: SAS 9.4M5 adds support for the CSSMTP email server on z/OS V2R3.

IBM z/OS V2R2 GDG
: SAS 9.4M4 adds support for the IBM z/OS V2R2 Extended Format Generation Data Groups (GDG), which allow up to 999 generation data sets to be associated with the GDG.

zHPF Support
: SAS 9.4M3 added support to automatically generate zHPF channel programs when reading or writing direct access bound libraries that reside in DSORG=PS data sets if the appropriate level of zHPF is available and enabled on the processor, the disk controller, and the channels that connect them. Otherwise, SAS generates CCW channel programs to process these libraries, as was done in prior releases. zHPF channel programs perform I/O in less elapsed time than the CCW channel programs, and they also use less channel capacity, which might avoid delays for other I/O being processed on the same channel.

Large Block Size Support for SAS Libraries on Tape Devices
: SAS 9.4M2 added support for the block size for a sequential access bound library on a tape device to exceed 32760. Block size values greater than 32760 reduce elapsed time for tape devices and can also improve tape utilization. For more information, see the DLLBI option of the "LIBNAME Statement: z/OS" on page 656 and "DLLBI System Option: z/OS" on page 729.

LOCKDOWN for Foundation Servers
: SAS 9.4M2 for z/OS supports the LOCKDOWN feature. LOCKDOWN enables the server administrator to specify a restricted set of z/OS data sets and UFS paths that are available to clients of the server. When SAS is in the locked-down state, access to certain system interfaces is also disabled. For more information,

see Chapter 10, “SAS Processing Restrictions for Servers in a Locked-Down State,” on page 219.

SAS/CONNECT Spawner
The SAS/CONNECT spawner for UNIX and z/OS has been replaced with a new cross-platform spawner. The new spawner is named CNTSPAWN. For more information, see the “Administration” topic in *SAS/CONNECT User’s Guide*.

SASRX User Exit
The SASRX -USEREXIT option specifies the name of an exec that the SASRX exec calls as a user exit instead of executing SASCP.

# Enhanced SAS Procedures

RELEASE
SAS 9.4M5 does not support using PROC RELEASE to release unused space in a PDSE. SAS writes a note to the log if you issue PROC RELEASE against a PDSE. SAS writes an error to the log if you issue PROC RELEASE against any other type of unsupported data set.

# Enhanced SAS Functions

The following function has been enhanced:

ZDSLIST
supports the specification of up to thirty path components in a UFS directory path.

# New SAS Functions

The following function is new:

ZDSRATT
returns RACF security attributes for a z/OS data set name, or UNIX security attributes (including ACL definitions) for a UFS file or directory.

# Enhanced SAS Statements

The following SAS statements have been enhanced:

FILE statement
: In the May 2019 release of SAS 9.4M6, the FILE statement cannot modify or override the device type that was set by an earlier FILENAME statement.

  SAS 9.4M3 adds support for the PERMISSION option. This option specifies permissions to set for the specified fileref.

FILENAME statement
: SAS 9.4M7 adds PRESERVELRECL that retains spaces at the end of fixed-length records of email attachments.

  SAS 9.4M5 supports the CSSMTP Access Method.

  SAS 9.4M3 has the following changes and enhancements:

  PERMISSION
  : specifies the permissions to set for the specified fileref.

  The FILENAME statement supports the following device types:

  DATAURL
  : specifies the access method that enables you to read data from the *data-url-spec*.

  EMAIL
  : enables you to send electronic mail programmatically from SAS.

  WebDAV
  : specifies the access method that enables you to use WebDAV (Web Distributed Authoring and Versioning) to read from or write to a file from any host machine that you can connect to on a network with a WebDAV server running.

  ZIP
  : specifies the access method that enables you to use ZIP files.

    **Note:** The ZIP access method supports only UFS files.

INFILE statement
: In the May 2019 release of SAS 9.4M6, the INFILE statement cannot modify or override the device type that was set by an earlier FILENAME statement.

LIBNAME statement
: SAS 9.4M8 adds support for the DSKEYLBL= option, which specifies the encryption key label to access a library that uses pervasive encryption.

SAS 9.4M2 adds support for the DLLBI option. This option specifies whether SAS is to use the device optimum block size, or 32760 as the BLKSIZE default when creating new sequential access bound libraries.

# Enhanced SAS System Options

The following SAS system options have been enhanced or changed:

CARDIMAGE
: has a default value of NOCARDIMAGE.

CONFIG
: can have a value that is a ddname, a data set name, a UNIX filename, or a list of any combination of these that is enclosed in parentheses. Multiple instances of the CONFIG option are supported on the command line.

LRECL
: has a default value of 256 if you are using RECFM=F to specify fixed length records. Otherwise, it is 32,767.

MSYMTABMAX
: SAS 9.4M6 has a default value of 2,097,152 bytes (2MB) for the MSYMTABMAX option.

MVARSIZE
: SAS 9.4M3 has a default value of 65,534 bytes for the MVARSIZE option.

VALIDMEMNAME
: requires that you include the full extension delimiter of a member name when the EXTEND value is specified.

# New SAS System Options

The following SAS system options are new:

DLDSKEYLBL
: SAS 9.4M8 adds the DLDSKEYLBL option, which specifies a default data set pervasive encryption key label for accessing SAS libraries.

FILEBUFNO
: SAS 9.4M5 adds the FILEBUFNO option, which specifies how many memory buffers to allocate for reading and writing.

SORTBLKREC
: SAS 9.4M3 adds the SORTBLKREC option, which is used to control the size of the SORTBLKMODE buffers used for DFSORT host sort utility.

DLLBI
SAS 9.4M2 adds the DLLIBI option, which specifies whether SAS can create a sequential access bound library on tape with block sizes larger than 32760.

ALIGNSASIOFILES
aligns output data on a page boundary for SAS data sets written to UFS libraries.

HELPTOC
specifies the table of contents files for the online SAS Help and Documentation.

HOSTINFOLONG
specifies to print additional operating environment information in the SAS log when SAS starts.

SORTCUT
specifies that SAS uses the host sort utility if the number of observations is greater than or equal to the value of SORTCUT.

# Deprecated SAS System Options

The following SAS system options have been deprecated:

- AUTHENCR
- HELPCASE
- PRIMARYPROVIDERDOMAIN

# New SASRX Switch Option

WORKLARGE SASRX
SAS 9.4M3 adds support for the WORKLARGE SASRX switch option, which enables you to allocate the WORK library with DSNTYPE(LARGE).

# New Threaded Kernel Option

The following threaded kernel option is new:

set TKOPT_TKIOP_DIAG_SPACE
This option results in the production of diagnostic messages when an output utility file is closed. These messages detail the space allocation that is associated with the utility file allocation and the amount of space that the utility file actually used.

# Documentation Enhancements

The following enhancements have been made to *SAS Companion for z/OS*:

- SAS 9.4M3 has the following changes and enhancements:
  - *SAS Companion for z/OS* is reorganized to enhance faster retrieval of information. "Initializing and Configuring SAS Software," the first chapter of previous versions of the documentation, has been separated into several smaller chapters. These new chapters now appear with other chapters that contain related information. "Initializing and Configuring SAS Software" is now the title of Part 1 of the documentation. Other chapters have been moved to appear in Parts of the documentation that contain similar information. For more information about the documentation reorganization, see the Table of Contents.
  - Appendix 2, "Using EBCDIC Data on ASCII Systems," on page 923 has been added to the *SAS Companion for z/OS*. The appendix contains information about moving data from EBCDIC to ASCII systems, and from ASCII to EBCDIC systems.
- "Solving Problems with Scroll Bars, Borders, Buttons, and Text" on page 241 has a new section about solving problems with scroll bars, borders, buttons, and text on SAS windows.
- "Using SAS to Read a PDS or PDSE Directory Sequentially" on page 122 describes how SAS simplifies the process for reading the directory contents for a PDS or PDSE when you do not supply a member name.
- "Using the LENGTH Statement to Save Storage Space" on page 400 has a new table that contains variable lengths and largest exact integer values for IEEE.
- Chapter 23, "The SASCBTBL Attribute Table and SAS MODULEx CALL Routines," on page 405 contains information about load libraries and the SASCBTBL attribute table for SAS on z/OS.
- Documentation has been added about "CALL MODULE Routine: z/OS" on page 456 for SAS on z/OS.
- The "Summary Table of System Options" has been deleted from the *SAS Companion for z/OS*. For information about SAS system options that are supported on z/OS, see "System Options under z/OS" on page 685 and *SAS System Options: Reference*.

- "SAS System Options for z/OS by Category" on page 690 lists all of the system options by their specified category.
- The descriptions of the TKMVSENV options are now in "TKMVSENV Options under z/OS" on page 895.
- The information about optimizing performance is now in Appendix 1, "Optimizing Performance," on page 903.
- Appendix 3, "Encoding for z/OS Resource Names," on page 939 describes z/OS resource names and the contexts in which they might be specified or displayed by SAS.

PART 1

# Initializing and Configuring SAS Software

# 1

# Invoking SAS in the z/OS Environment



## Invocation Methods

You can invoke SAS with any of the following methods:

- in interactive mode under TSO using the SAS CLIST
- in interactive mode under TSO using the SASRX exec
- in batch mode with the SAS cataloged JCL procedure
- by using the SIGNON command with SAS/CONNECT software

**Note:** Additional configuration steps are necessary before you can run SAS in interactive mode. For more information, see the *Configuration Guide for SAS Foundation for z/OS*.

# Invoking SAS under TSO: the SAS CLIST

To invoke SAS under TSO, you execute the SAS CLIST by entering a command (usually `SAS`) at the READY prompt. The SAS CLIST is an external file that contains TSO commands and control instructions.

You can execute a CLIST explicitly by specifying the full data set name. Or, your support personnel might have put the SAS CLIST in a common library so that you can execute it by using a simple command such as SAS. Ask your support personnel for site-specific information about the CLIST.

Depending on the defaults that have been specified in the CLIST, it starts one of the following sessions:

- a SAS windowing environment session
- an interactive line mode session
- a noninteractive session.

To override the mode of running SAS that is specified in the CLIST, you use commands similar to those shown in Table 1.1 on page 5. The exact commands that you use might be site-specific.

# Invoking SAS under TSO: the SASRX exec

SASRX is a REXX program that you can use to invoke SAS. It is provided as an alternative to the SAS CLIST. SASRX supports the same command-line syntax as the SAS CLIST. It also supports these additional features:

- mixed-case option values
- additional options
- option specifications that have a UNIX style
- direct specification of SAS system options
- UFS file and directory names as option values

You can execute a SASRX exec explicitly by specifying the full data set name. Or, your support personnel might have put the SASRX exec in a common library so that you can execute it by using a simple command such as SAS. Ask your support personnel for site-specific information about the SASRX exec. For details about the SASRX exec, see “Invoking SAS under TSO: the SASRX exec” on page 4.

Throughout this document, references to the SAS CLIST apply equally to the SASRX exec.

# Commands for Invoking SAS

Commands for invoking SAS are issued from a command line, not by submitting code. The following table contains examples of commands that you can use to invoke SAS:

***Table 1.1*** *Commands for Invoking SAS*

| Mode | To Invoke | To Terminate | Description |
|---|---|---|---|
| SAS windowing environment | `sas options('dms')` or `sasrx -dms` | `bye` or `endsas` | enables you to write and execute SAS programs and to view the SAS log and SAS procedure output in an interactive windowing environment. If this is the default at your site, then you can invoke it by entering **`sas`** (or **`sasrx`**) with no options. |
| Explorer | `sas options('explorer')` or `sasrx -explorer` | `bye` or `endsas` | enables you to manipulate SAS data and files visually, launch SAS applications, and access SAS windowing environment windows and Output Delivery System hierarchies. |
| interactive line mode | `sas options('nodms')` or `sasrx -nodms` | `/*` starting in first column of submitted code or `endsas;` statement | prompts you to enter SAS statements at your terminal, one line at a time. |
| noninteractive mode | `sas input('''my.sas.program''')` or `sasrx -input 'my.sas.program'` | not applicable | executes interactively, but it is called noninteractive because the program runs with no intervention from the terminal. |

# Invoking SAS in Batch Mode: the SAS Cataloged Procedure

To invoke SAS during a batch job, use a JCL EXEC statement that executes the SAS cataloged procedure that invokes SAS, such as

```
//MYJOB EXEC SAS
```

By specifying parameters in the JCL EXEC statement, you can change how SAS is invoked.

At each site, the JCL EXEC statement that you use and the cataloged procedure itself might have been modified by your on-site SAS support personnel. Ask your support personnel for site-specific information.

# What If SAS Does Not Start?

If SAS does not start, the SAS log might contain error messages that explain the failure. Any error messages that SAS issues before the SAS log is initialized are written to the SAS Console Log, which is the SASCLOG ddname destination. Under TSO, the SASCLOG ddname destination is normally the terminal. However, the destination might be changed by the on-site SAS support personnel by changing the CLIST or SASRX exec that invoked SAS. Similarly, a batch job or started task normally assigns the SASCLOG ddname to a spooled SYSOUT class. However, the destination might have been changed by the on-site SAS support personnel by changing the catalog procedure used to invoke SAS. Spooled SYSOUT data can be printed or viewed online with a JES spool viewer such as SDSF, IOF, or EJES.

**Note:** If SAS does not run in batch mode, check the messages in the JES job log.

# Connecting to SAS under z/OS

Under z/OS, you can access or connect to a SAS session in any of the following ways:

3270 terminals
: You can use devices that support extended data streams as well as those that do not. For more information about terminal support, see "Terminal Support in the z/OS Environment" on page 257.

terminal emulators
: SAS best supports the terminal emulators that closely conform to the original IBM specifications for the 3270 terminal. If you have problems with the SAS vector graphics in your emulator session, make sure that the settings for your emulator match these specifications as closely as possible.

SAS/CONNECT software
: SAS/CONNECT supports cooperative and distributed processing between z/OS and Windows, and between z/OS and UNIX. It supports the TCP/IP (Transmission Control Protocol/Internet Protocol) and XMS (Cross-Memory Services) communications access methods. TCP/IP and XMS enable local clients who are running SAS to communicate with one or more SAS applications or programs that are running in remote environments. For more information, see the "Administration" topic in *SAS/CONNECT User's Guide*.

SAS/SHARE software
: SAS/SHARE enables local and remote clients in a heterogeneous network to update SAS data concurrently. It also provides a low-overhead method for multiple remote clients to read local SAS data. For more information, see the "Administration" topic in *SAS/CONNECT User's Guide*.

SAS/SESSION software
: SAS/SESSION enables terminal users who are connected to the Customer Information Control System (CICS) to communicate with SAS software in a z/OS environment. It uses the LU6.2 (APPC/MVS) protocol. Your on-site SAS support personnel can find more information about SAS/SESSION in the installation instructions for SAS software in the z/OS environment.

  **Note:** Starting with SAS 9.4M8, SAS/Session is not available from SAS. If you have an existing installation of SAS/Session in your environment and plan to upgrade or migrate to SAS 9.4M8 or later, SAS recommends that you first uninstall SAS/Session. For more information, see Unconfiguring and Uninstalling Retired Products.

SAS Intelligence Platform
: SAS creates and delivers enterprise intelligence through the SAS Intelligence Platform. This cohesive platform is based on an architecture that fully integrates SAS technologies in data extraction, transformation, and loading; data storage; business intelligence; and analytics. These capabilities provide the end-to-end infrastructure necessary for exploring, analyzing, optimizing, reporting, and understanding your data. For more information, see *SAS Intelligence Platform: System Administration Guide* at **`support.sas.com`**.

# HFS, UFS, and zFS Terminology

Historically, the term HFS was used to refer to UNIX file systems in general on z/OS as well as to a particular physical file system implementation. However, since IBM has introduced zFS as a functional replacement for the HFS physical file system, the term HFS can be misleading. Therefore, SAS documentation now uses the term UFS to refer to UNIX file systems in general. The terms HFS, zFS, and NFS designate three different physical file system implementations. Except in rare cases, SAS processing for UFS files and directories is identical, regardless of the physical file system implementation.

Your systems administrator, not SAS, controls whether the HFS or zFS implementation is used for a particular file system.

Most occurrences of HFS in the documentation have been changed to UFS. HFS is still used in feature names and in syntax statements and prefixes where it is the correct term. UFS cannot be substituted for HFS in these contexts.

The following table lists the terminology changes that have been made:

***Table 1.2*** *Terminology Changes*

| Old Term | New Term |
|---|---|
| HFS file system | UFS file system |
| HFS file | UFS file |
| HFS library | UFS library |

For more information about the UFS file system, UFS libraries, and UFS files, see "UFS Libraries" on page 63.

# Support for Longer TSO User IDs

Prior to z/OS 2.3, TSO user IDs could be from 1 to 7 characters in length. Beginning with z/OS 2.3, TSO user IDs can be from 1 to 8 characters in length.

SAS 9.4M5 adds support for 8-character TSO user IDs on z/OS 2.3. If you want to use SAS with an 8-character TSO user ID, you must use SAS 9.4M5 with z/OS 2.3.

# 2

# Customizing Your SAS Session

# Overview of Customizing Your SAS Session

Whether you are using interactive processing under TSO or batch processing, you might want to customize certain aspects of your SAS session. For example, you might want to change the line size or page size for your output, or you might want to see performance statistics for your SAS programs.

You can customize your SAS sessions by setting SAS system options that control SAS behavior. For more information about SAS system options, see "System Options in the z/OS Environment" on page 689.

# Customizing Your SAS Session at Start Up

You can customize your SAS session in five ways:

- Under TSO, pass operands into the SAS CLIST or SASRX exec that your site uses to invoke SAS. This method is usually used for one-time overrides of CLIST or SASRX exec operands. For more information about passing operands at SAS invocation, see "Invoking SAS under TSO: the SAS CLIST" on page 4. Here are three examples:
  - `sas options('nocenter linesize=80')`
  - `sasrx -options (nocenter linesize=80)`
  - `sasrx -nocenter -linesize 80`
- In batch mode, pass parameters into the SAS cataloged procedure that your site uses to invoke SAS. This method is usually used for one-time overrides of parameters in the cataloged procedure. Here is an example:

  ```
  //MYJOB  EXEC SAS,
  //   OPTIONS='NOCENTER, LINESIZE=80'
  ```

  **Note:** The length limit of the parameter string is 100 characters. If the procedure uses any of the parameter string, then that amount is deducted from the number of characters that you can use.
- Specify SAS system options in a user configuration file. This method is useful if you, as an individual user, always want to override the values of system options

that are specified in your site's system configuration file. For more information about specifying SAS system options in a configuration file, see "Configuration Files" on page 11. The following examples use a TSO command to specify a user configuration file:

```
sas  config('''my.config.file''')
```

or

```
sasrx  -config 'my.config.file'
```

The following example specifies a user configuration file with JCL:

```
//MYJOB  EXEC SAS,
//      CONFIG='MY.CONFIG.FILE'
```

- Execute SAS statements (such as OPTIONS, LIBNAME, and FILENAME statements) in an AUTOEXEC file. For more information, see "Autoexec Files" on page 14. This method is most useful for specifying options and allocating files that pertain to a particular SAS application.
- In interactive mode, specify a Sasuser library that contains a user Profile catalog. For more information, see "Sasuser Library" on page 16.

For information about the order of precedence for options specified using these methods, "Precedence for Option Specifications" on page 23.

# Configuration Files

## Overview of Configuration Files

A configuration file contains SAS system options that are set automatically when you invoke SAS. SAS uses two types of configuration files:

- the system configuration file, which is used by all users at your site by default. Your on-site SAS support personnel maintain the system configuration file for your site.
- a user configuration file, which is generally used by an individual user or department.

## Creating a User Configuration File

To create a user configuration file, use any text editor to write SAS system options into a physical file. The configuration file can be a sequential data set member, a partitioned data set, or a UFS file. It can have any record length, and either fixed length or variable length records.

# Format of a Configuration File's Contents

Each line of a configuration file can contain one or more system options or comments. If you specify more than one system option on a line, use either a blank space or a comma to separate the options. If the file has the legacy configuration file format of LRECL=80 and RECFM=FB, then only columns 1-72 are used. The contents of columns 73-80 are ignored. If the file has any other format, then the entire line is used.

Two different types of comments are supported. If a line contains an asterisk in column one, then the entire line is a comment. If a comment of this type requires multiple lines, each line must begin with an asterisk. Comments beginning with /* and ending with */ can appear anywhere between option specifications, but cannot be embedded within an option specification. Comments of this type can continue across line boundaries.

**Note:** An */ that ends a comment cannot be in column one. If it is in column one, it starts a separate comment for the entire line.

Some options can be on (enabled) or off (disabled). Specifying only the keyword enables the option, and specifying the keyword prefixed with NO disables the option. For example, a configuration file might contain the following option specifications to disable the options:

```
NOCENTER
NOSTIMER
NOSTATS
```

Options that take a value must be specified in the following way:

```
option-name=value
```

For example, a configuration file might contain the following lines:

```
LINESIZE=80
PAGESIZE=60
```

**Note:** When you specify SAS system options in a configuration file, blank spaces are not permitted before or after an equal sign.

A configuration file can contain the CONFIG= option. A CONFIG= option in a configuration file can name a single ddname, a data set name, or a UFS filename. It can also be a list that is contained in parentheses of any combination of ddnames, data set names, or UFS filenames. The contents of the named configuration file or files are logically inserted in place of the CONFIG= specification. If a CONFIG= option specifies a file that has already been read as a configuration file, a warning message is written to the log and the file is not read again during this session.

The configuration file is processed as if all of the lines (other than comments) were concatenated into a single string with one blank space separating the lines. Options whose value can contain blank spaces can be continued across line boundaries. For

example, the specification of the option in the following example is on five separate lines, but it would be processed as if it is on one line:

```
jreoptions=(
   -jreoption1
   -jreoption2
   -jreoption3
  )
```

In cases where separating concatenated lines with a blank space is not suitable, two alternative methods of explicit concatenation are provided.

- If the file has the legacy format, and there is a non-blank character in column 72, then the next line is concatenated without an intervening blank space. The character in column 72 is not ignored, it is included in the concatenated value.
- If the legacy method of explicit concatenation does not apply, and the last non-blank character of the line (or of columns 1-71 in a legacy format file) is a hyphen (-) or a plus sign (+), then that character is deleted. The next uncommented line is concatenated without an added blank space. If the character is a hyphen, then the line is concatenated as is. If the character is a plus sign, then any leading blank spaces of the next line are removed.

For example, the following option specification is invalid because a blank space is inserted between the equal sign and the value.

```
YEARCUTOFF=
1950
```

The following option specification is valid because the value is concatenated immediately following the equal sign, and a blank space is not inserted.

```
YEARCUTOFF=+
1950
```

Option values in SAS configuration files can contain symbolic references. The values of these symbolic references are resolved from a variable that is set in the TKMVSENV file. For example, the localized member of the default configuration file concatenation contains a statement similar to the following:

```
SASHELP='MVS:&HLQ..ENW0.SASHELP'
```

In this option value, `&HLQ.` is a variable symbol. The variable HLQ is assigned a value in the TKMVSENV file, in a statement similar to the following:

```
set HLQ=<high-level-qualifier>
```

where "*<high-level-qualifier>*" is your actual high-level-qualifier for SAS that is set at install time. Therefore, the final value of the SASHELP option is resolved as the following:

```
SASHELP='<high-level-qualifier>.ENW0.SASHELP'
```

# Specifying a User Configuration File

To tell SAS where to find your user configuration file, do the following:

- If you use the SAS CLIST or SASRX exec to invoke SAS under TSO, use the CONFIG operand - for example:

  ```
  sas config('''my.config.file''')
  ```

  or

  ```
  sasrx -config 'my.config.file'
  ```

- If you use the SAS cataloged procedure to invoke SAS in batch mode, use the CONFIG= parameter - for example:

  ```
  //S1  EXEC SAS,CONFIG='MY.CONFIG.FILE'
  ```

The user configuration file that you specify is executed along with the system configuration file that your installation uses. This happens because the SAS CLIST, the SASRX exec, or the SAS cataloged procedure concatenates the file that you specified to the system configuration file.

During initialization, the specified value of the CONFIG= option is replaced with the list of all configuration files that are actually processed. PROC OPTIONS displays this new value.

**Note:** SAS system options that you specify in the user configuration file override system options that are specified in the system configuration file.

Normally, CONFIG is specified as a PROC option or REXX or CLIST option, and not as a SAS command line system option. However, it can be specified as a SAS command line option. Unlike most such options, if there are multiple instances of CONFIG= on the command line, all instances are processed instead of just the last one. You can take advantage of this to mix types of configuration files that cannot be concatenated. For example, to append a private UNIX configuration file named ~/sas.cfg in batch JCL, use one of the following statements:

```
//         OPTIONS='CONFIG=CONFIG CONFIG="~/sas.cfg"'
```

or

```
//         OPTIONS='CONFIG=(CONFIG "~/sas.cfg")'
```

Explicitly specifying the default of CONFIG=CONFIG allows the second CONFIG= value to be appended to the default instead of superseding it.

# Autoexec Files

## Overview of Autoexec Files

Under z/OS, an autoexec file can be a sequential data set, a member of a partitioned data set, or a UFS file. Unlike configuration files, which contain SAS system options, an autoexec file contains SAS statements. These statements are

executed immediately after SAS has been fully initialized and before any SAS input source statements have been processed. For example, an autoexec file could contain the following lines:

```
options fullstats pagesize=60 linesize=80;
libname mylib 'userid.my.lib';
dm 'clock';
```

The OPTIONS statement sets some SAS system options, the LIBNAME statement assigns a library, and the DM statement executes a command.

**Note:** Some SAS system options can be specified only when you invoke SAS. These system options cannot be specified in an OPTIONS statement. Therefore, they cannot be specified in an autoexec file. For information about SAS system options and where they can be specified, see "System Options under z/OS" on page 685 and *SAS System Options: Reference*

# Displaying Autoexec Statements in the SAS Log

SAS statements that are submitted from an autoexec file usually are not displayed in the SAS log. However, if you specify the ECHOAUTO system option when you invoke SAS, then SAS writes (or "echoes") the autoexec statements to the SAS log as they are executed.

# Using an Autoexec File under TSO

Under TSO, use the AUTOEXEC operand when you invoke SAS to tell SAS where to find your autoexec file. For example, the following commands invoke SAS and tell SAS to use an autoexec file that is named MY.EXEC.FILE:

```
sas autoexec('''my.exec.file''')

sasrx -autoexec 'my.exec.file'
```

# Using an Autoexec File in Batch Mode

To specify an autoexec file in a batch job, use a JCL DD statement to assign the ddname SASEXEC to your autoexec file. This DD statement must follow the JCL EXEC statement that invokes the SAS cataloged procedure. For example, the following two lines of JCL can be used to accomplish the same results in a batch job as the previous example did under TSO:

```
//MYJOB    EXEC SAS
//SASEXEC  DD DSN=MY.EXEC.FILE,DISP=SHR
```

## Concatenating Autoexec Files

You can concatenate multiple AUTOEXEC files in the ddname that is the value of the AUTOEXEC system option. Under TSO, you can list multiple AUTOEXEC files on the REXX or CLIST AUTOEXEC command-line option:

```
autoexec("autoexec1.sas autoexec2.sas")
```

The REXX or CLIST then allocates these data sets to the SASEXEC ddname.

You can also concatenate AUTOEXEC files with the APPEND on page 705 and INSERT on page 783 system options if all of the files are UFS files:

```
autoexec='~/autoexec2.sas' insert=(autoexec='~/autoexec1.sas')
```

If you use the INSERT option, the file is prepended to the existing autoexec file.

If any file in a concatenated autoexec list does not exist or cannot be opened (for example, if you are not authorized for Read access), then SAS issues error messages to the log that indicate system start-up failure. SAS terminates without executing any of the files in the autoexec concatenation list.

# Sasuser Library

## Overview of the Sasuser Library

SAS enables you to customize certain features while your SAS session is running and to save these changes. The Sasuser library contains various SAS files in which SAS records these settings. For example, in Base SAS software, any changes that you make to function key settings or to window attributes are stored in a catalog named SASUSER.PROFILE. The Sasuser library can also contain personal catalogs for other SAS software products. You can also store SAS data files, SAS data views, SAS programs, SAS/ACCESS descriptor files, and additional SAS catalogs in your Sasuser library. In addition to storing function key settings and window attributes, the SASUSER.PROFILE catalog is used to store your DEFAULT.FORM. The DEFAULT.FORM is created by the FORM subsystem. It is used to control the default destination of all output that is generated by the PRINT command. For information about the FORM subsystem, see "Using the PRINT Command and the FORM Subsystem" on page 154 and the *SAS System Options: Reference*.

Use these methods to set up your Sasuser library:

- Establish a permanent Sasuser library with Read and Update access. You must use this method to set up Sasuser if you want settings that are modified in the current SAS session to be in effect for a subsequent SAS session. This situation

is the typical arrangement when you run SAS interactively. Creating a permanent Sasuser library is also necessary if you intend to save other application files in the Sasuser library for use in a later session. When accessing a permanent Sasuser library for Read and Update, only one SAS session at a time can use the Sasuser library. To access a personal Sasuser library for Read and Update, leave the Sasuser option unspecified and allocate the ddname Sasuser to the Sasuser library. The SAS CLIST and SASRX exec that are supplied by SAS to invoke SAS under TSO work this way by default. They also create the Sasuser library data set if it does not exist. The default data set name that they use is **<prefix>.SAS9.SASUSER**, where **<prefix>** is the system prefix that is defined in your user profile, or with your user ID if no prefix is defined.

- Establish a permanent Sasuser library with Read access but not Update access. This method enables you to create a single Sasuser library that is shared by multiple SAS sessions that are running simultaneously. This method also enables you to provide other users with a Sasuser library that contains a set of pre-configured settings that are protected from Write access with system authorization facilities (for a bound library) or with UFS permissions (for a UFS library). To access a Sasuser library in either a shared or read-only manner, you must specify the RSASUSER option. For more information about RSASUSER, see “RSASUSER System Option” in the *SAS System Options: Reference*.
- Establish a temporary Sasuser library that exists only for the lifetime of the current session. This method is appropriate for applications that can use the default settings and that do not need to save settings. If you do not specify the SASUSER option and do not allocate the SASUSER ddname, then SAS uses this method in the batch environment by default. You can also run interactive sessions in this manner by specifying the SASRX option NOSASUSER. When you do not specify a Sasuser library, SAS creates a new PROFILE catalog that is used to store profile information for use during the current SAS session. This catalog is placed in the Work library, and a note to this effect is written to the SAS log. The Work library is typically deleted at the end of your session, which means that any changes made to the PROFILE catalog are not available in a subsequent SAS session.

If you are running SAS under TSO and you want to specify SASUSER in your SAS configuration file, then you need to specify the SASRX option NOSASUSER to prevent SASRX from allocating the Sasuser library before the configuration file is processed. This specification is available only if you are using SASRX. It is not available if you are using the CLIST because the CLIST does not have the NOSASUSER option.

# Creating Your Own Sasuser Libraries

By creating your own Sasuser libraries, you can customize SAS software to meet the requirements of a number of different types of jobs. For example, suppose you want to create a user profile for a particular type of task that requires a unique set of key definitions.

To create this user profile, you must first create a SAS library that can be used as the Sasuser library. The easiest way to create this library is to start a SAS session

and then use a LIBNAME statement to create the library, as explained in "Assigning SAS Libraries Internally" on page 74. For example, to create a SAS library with a physical filename of ABC.MY.SASUSER, submit the following LIBNAME statement:

```
libname newlib 'abc.my.sasuser' disp=(new,catlg);
```

**Note:** A NEWLIB libref of was used in this example because SASUSER is a reserved libref and cannot be reassigned during a SAS session.

To use the new SAS library as the Sasuser library, you must end your SAS session and start a second session. When you start a second session, you can use the SASUSER option of the SAS CLIST or SASRX exec to specify ABC.MY.SASUSER as the Sasuser library.

# Specifying Your Own Sasuser Library

After creating your own permanent SAS library, designate that library as your Sasuser library. You can do this in either of the following ways:

- Use the SASUSER option of the SAS CLIST or SASRX exec to specify the physical filename of your SAS library. For example, if you create a library with a name of ABC.MY.SASUSER, then you use the following CLIST command to invoke SAS:

  ```
  sas sasuser('''abc.my.sasuser''')
  ```

  Or, you would use the following SASRX command to invoke SAS:

  ```
  sasrx -sasuser 'abc.my.sasuser'
  ```

  When you enter this command, the libref SASUSER is associated with the SAS library whose physical filename is ABC.MY.SASUSER. Any profile changes that you make during your session are saved in the SAS catalog SASUSER.PROFILE, which is a member of the Sasuser library. These changes are retained when you end your SAS session.

- Use the SASUSER= system option to specify the ddname that identifies your SAS library. For more information, see "SASUSER= System Option: z/OS" on page 838.

Both of these methods require that you identify the SAS library when you invoke SAS; you cannot change the Sasuser library during a SAS session.

# SAS System Options

## Overview of SAS System Options

SAS system options control many aspects of your SAS session, including output destinations, the efficiency of program execution, and the attributes of SAS files and libraries.

After a system option is set, it affects all subsequent DATA and PROC steps in a process until it is specified again with a different value. For example, the CENTER|NOCENTER option affects all output in the SAS session or program, regardless of the number of steps in the process.

## Specifying or Changing System Option Settings

The default values for SAS system options are appropriate for many of your SAS programs. If you need to specify or change the value of a system option, you can do so in the following ways:

- Create a user configuration file to specify values for the SAS system options whose default values you want to override. For more information, see "Creating a User Configuration File" on page 11.
- Under TSO, specify any SAS system options following the OPTIONS parameter in the SAS CLIST command:

  ```
  sas options('option-list')
  ```

  On the SASRX command line, specify any SAS system options with this command:

  ```
  sasrx option-list
  ```

  For options that can be on or off, just list the keyword that corresponds to the appropriate setting. For options that take a value, list the keyword identifying the option followed by an equal sign and the option value, as in the following example:

  ```
  sas options('nodate config=myconfig')
  ```

  For detailed information about the SASRX exec, see Appendix 4, "Starting SAS with SASRX," on page 943.
- In batch mode, specify any SAS system option in the EXEC SAS statement:

  ```
  // EXEC SAS,OPTIONS='option-list'
  ```

  For example:

```
// EXEC SAS,OPTIONS='OPLIST LS=80 NOSTATS'
```

- Specify SAS system options in an OPTIONS statement in an autoexec file. This file is executed when you invoke SAS, or in an OPTIONS statement at any point during a SAS session. Options specified in an OPTIONS statement apply to the process in which they are specified. They are reset for the duration of the SAS session or until you change them with another OPTIONS statement.

  For example:

  ```
  options nodate linesize=72;
  ```

  To find out whether a particular option can be specified in the OPTIONS statement, see "System Options under z/OS" on page 685 and *SAS System Options: Reference*. For more information about autoexec files, see "Autoexec Files" on page 14. For more information about the OPTIONS statement, see *SAS System Options: Reference* and *Step-by-Step Programming with Base SAS Software*.

- Change SAS system options from within the OPTIONS window. On a command line, enter the keyword OPTIONS. The OPTIONS window appears. Place the cursor on any option setting and type over the existing value. The value is saved for the duration of the SAS session only. Not all options are listed in the OPTIONS window. For more information, see "OPTIONS Window" on page 22.

- Specify PROC OPTLOAD or the DMOPTLOAD command to load a set of options that you have saved in a file or data set by using PROC OPTSAVE or the DMOPTSAVE command. For example, specifying

  ```
  proc optload data=options1;
  run;
  ```

  loads the set of options that you have saved in a file that is named **options1**. You can save multiple sets of options, and then use the OPTLOAD procedure to load any of your sets of options at any time during a SAS session. The ability to load the options at any time during a SAS session provides advantages over using a configuration file, which you can use only when you invoke SAS. However, not all options are saved by PROC OPTSAVE. For information about which options cannot be saved with PROC OPTSAVE, see "The OPTSAVE Procedure" in *Base SAS Procedures Guide*.

# Determining How an Option Was Set

Because of the relationship between some SAS system options, SAS might modify an option's value. This modification might change your results.

To determine how an option was set, enter the following code in the SAS Program Editor:

```
proc options option=option value; run;
```

After you submit this code, the SAS log displays the value that was set for the option, and how the value was set. For example, the following log message is displayed when you enter

```
proc options option=CATCACHE value; run;
```

***Output 2.1*** *Results of the OPTIONS Procedure for the CATCACHE Option*

```
Option Value Information for SAS Option CATCACHE
      Value:  0
      Scope:  Default
      How option value set:  Shipped Default
```

Contact your on-site SAS support personnel for more information.

# Default Options Table and Restricted Options Table

Your on-site SAS support personnel might have created a default options table or a restricted options table. Information about creating and maintaining these tables is provided in the *Configuration Guide for SAS Foundation for z/OS*.

The default options table is created by your site administrator and provides a global set of defaults that are specific to your site. It reduces the need to duplicate options in every system configuration file at your site.

The restricted options table is created by your site administrator. It specifies option values that are established at start-up and cannot be overridden. If an option is listed in the restricted options table, any attempt to set it is ignored. An attempt to set it with the options statement causes a warning message to be written to the log, for example:

```
1    options vsamload;
             --------
             36
WARNING 36-12: SAS option VSAMLOAD is restricted by your Site Administrator and
cannot be updated.
```

To find out which options are in the restricted options table, submit this statement:

```
PROC OPTIONS RESTRICT;
RUN;
```

For a list of restricted options, see “Restricted Options” in *SAS System Options: Reference*.

Some SAS system options cannot be added to a restricted options table. To find out whether an option can be restricted, run PROC OPTIONS with the DEFINE option. For example:

```
PROC OPTIONS OPTION=option-name DEFINE;
RUN;
```

The output that is returned by the preceding statement includes either of the following messages:

```
Your Site Administrator can restrict modification of this option.
```

or

```
Your Site Administrator cannot restrict modification of this option.
```

If an ineligible option has been placed in the restricted options table, the following message is issued:

```
SAS option option-name cannot be restricted by your Systems Administrator.
```

SAS terminates with an abend. If you receive such an error, you should immediately notify your site administrator.

# Displaying System Option Settings

To display the current settings of SAS system options, use the OPTIONS procedure or the OPTIONS window.

Some options might seem to have default values even though the default value listed in "System Options under z/OS" on page 685 and *SAS System Options: Reference* is none. This situation happens when the option is set in a system configuration file, in the default options table, or in the restricted options table.

You can use the VALUE parameter of the OPTIONS procedure to see when an option's value was set.

# OPTIONS Procedure

The OPTIONS procedure writes system options that are available under z/OS to the SAS log. By default, the procedure lists one option per line with a brief explanation of what the option does. To list the options with no explanation, use the SHORT option:

```
proc options short;
run;
```

To list all the options in a certain category, use the GROUP= option:

```
proc options group=sort;
run;
```

Some options, such as system options that are specific to SAS/ACCESS interfaces or to the SAS interface to ISPF, are listed only if you specify the GROUP= option. For more information, see "OPTIONS Procedure Statement: z/OS" on page 552.

# OPTIONS Window

To display the OPTIONS window, enter `OPTIONS` on a command line. The OPTIONS window displays the settings of many SAS system options.

## Precedence for Option Specifications

When the same option is set in more than one place, the order of precedence is as follows:

1. restricted options table, if there is one
2. OPTIONS statement or OPTIONS window
3. SAS invocation, including invocation by way of an EXEC SAS JCL statement (in batch) or by way of the SAS CLIST or SASRX exec commands (under TSO)
4. user configuration file, if there is one
5. system configuration file (as SAS software is initialized)
6. default options table, if there is one

For example, options that you specify during your SAS session (using the OPTIONS statement or OPTIONS window) take precedence over options that you specified when you invoked SAS. Options that you specify with the SAS CLIST or SASRX exec commands take precedence over settings in the configuration file. The settings in the user configuration file take precedence over settings in the system configuration file and in the default options table.

**Note:** Options that are specified in the restricted options table can be updated only by your SAS administrator.

# The SAS Registry File

For information about using the SAS Registry file to customize your SAS session, see the information about the REGEDIT command and the SAS Registry Editor window in the SAS online Help.

# 3

# SAS Software Files



## Overview of SAS Software Files

Configuration files (described in "Configuration Files" on page 11) and Sasuser files (described in "Sasuser Library" on page 16) are only two of several SAS software files that are automatically identified to your session by either the SAS CLIST or

SASRX exec (under TSO) or the SAS cataloged procedure (in batch). This section describes several other SAS software files that are significant to SAS users under z/OS.

For brief descriptions of all the SAS software files that are frequently used by the SAS CLIST, the SASRX exec, or by the SAS cataloged procedure, see "Summary Table of SAS Software Files" on page 36.

# Work Library and Other Utility Files

## Overview of the Work Library

The Work library is a special-purpose SAS library that contains temporary files, including certain types of utility files that are created by SAS as part of processing the current SAS session or job. The Work library is also the default location for one-level member names and user settings. One-level member names are member names that are specified without a libref. They reside in the Work library unless a User library has been identified. For more information about User libraries, see "User Library" on page 30. In a single-user SAS session or job, if the Sasuser library is not assigned, then the Work library also houses temporary user settings in files, such as the PROFILE catalog and the SAS registry item store.

In a single-user SAS session or job, the Work library is typically created at the beginning of a SAS session or job and deleted at the end. Multi-user SAS servers also create a Work library (referred to as a *client Work library*) for each client that connects to the server. Client Work libraries contain the temporary files created as part of the processing done by the server on behalf of the client. The server creates a distinct client Work library for each client so that files used by one client are not commingled with files belonging to another client. These libraries are created when the client establishes a connection with the server, and they exist until the client disconnects. Each client Work library has the same library implementation type as the Work library for the server.

The Work library is always processed by the BASE engine, which requires that you use one of the following library implementation types for Work:

- "Direct Access Bound Library (DSORG=PS)" on page 27
- "UFS Library" on page 28
- "Hiperspace Library" on page 29

The advantages of each of these library implementation types for use with the Work library are detailed in the following topics, along with usage notes. For information about each type of library, see "Library Implementation Types for Base and Sequential Engines" on page 51.

# Direct Access Bound Library (DSORG=PS)

Assigning a direct access bound library in a physical sequential (DSORG=PS) data set for the Work library is generally the best choice for single-user SAS sessions or jobs. Follow these steps to set up the Work library:

1. Accept the default value, WORK, for the WORK option.
2. Ensure that the DDNAME WORK is allocated to a physical sequential data set that has an unspecified record format, or has a record format that is set to RECFM=FS. The SASRX exec sets this format automatically unless a WORK SASRX option specifies a data set name or a UFS directory path. The DDNAME WORK is also allocated by the SAS CLIST or SAS JCL procedure in most cases.

**Note:** At SAS invocation, do not specify the SAS system options HSWORK or FILESYSTEM=HFS.

For SAS processing to complete successfully, the Work library data set must be large enough to accommodate the maximum number of library blocks that are in use at any one time during the SAS session. Otherwise, it must be possible to add enough additional disk space to the library data set to satisfy the requirements of SAS processing. If the Work library becomes full and cannot be expanded, an attempt to create or extend a member fails. Such a failure usually results in a message similar to this one:

```
ERROR: Write to WORK <member>.<type> failed. File is full and might be damaged.
```

In most cases, SAS processing cannot succeed if the Work library data set has insufficient space and cannot be expanded. There are two possible causes for situations in which the library data set cannot be expanded:

- The system did not have enough disk space available to satisfy the secondary allocation request when SAS needed to expand the library.
- The combination of the primary and secondary allocation amounts did not specify sufficient space to accommodate the number of library blocks that SAS required.

For information about how the primary and secondary allocation amounts influence the amount of space available for the library data set, see “z/OS Disk Space Allocation” on page 84.

If you specified sufficient space for the Work library but the space was not available, contact your z/OS systems administrator for assistance. Otherwise, increase the primary and secondary allocation amounts. If you are starting a single-user SAS session with the SASRX exec, you can increase these allocation amounts by specifying the appropriate values for the SASRX option WORK. Otherwise, if you are using a SAS CLIST or SAS JCL procedure to start a single-user SAS session or job, specify the appropriate parameters or modify the allocation statement directly.

If a client work library that resides in a direct access bound library (DSORG=PS) becomes full, then contact the SAS administrator who is responsible for the SAS server to which you were connected. The amount of disk space available to each client Work library can be increased by modifying the CLIENTWORK system option. For more information, see "CLIENTWORK System Option: z/OS" on page 719.

Allocating an excessive amount of space for the Work library reserves disk space that could be used by other jobs. To avoid wasting system resources by allocating more space to the Work library than is required, it might be necessary to run the SAS job or session to perform a typical processing job, and then measure the amount of Work library space that the job uses. To measure the amount of library space, include the following statement at the end of your job:

```
proc datasets lib=work; quit; run;
```

In the information that is listed for the library directory, the statistic "Highest Formatted Block" represents the largest number of blocks in simultaneous use at any time during the SAS session. Divide this statistic by the "Blocks per Track" statistic to convert it to the maximum number of disk tracks required for the Work library during this session. Using this information, you can derive the primary and secondary space allocation for the Work library data set with the following method:

1. Select a primary allocation that is approximately equivalent to the minimum expected space utilization.
2. Select a secondary allocation that enables sufficient growth up to the maximum expected space utilization.

Some SAS procedures write utility files to the Work library only if the NOTHREADS system option has been specified. Therefore, a smaller amount of Work library space might be required if you specify THREADS.

For processing performed by a multi-user SAS server, the libref Work refers to the client Work library only in certain contexts, such as in SAS code submitted for execution by the server. See the documentation for the specific SAS server to determine how to access the client Work library.

Allocating the Work library data set to virtual I/O (VIO) can avoid physical I/O and thus decrease the elapsed time required for a SAS job to run. Therefore, VIO is often preferable to actual disc devices, especially for jobs with modest workspace requirements. To use VIO, a particular UNIT name typically must be specified with the SASRX exec, SAS CLIST, or JCL procedure. For assistance, contact your z/OS systems administrator. If you are using a SAS CLIST, a SASRX exec, or JCL procedure to invoke SAS, contact your SAS systems administrator for information about how to control the allocation of the DDNAME Work.

# UFS Library

Placing the Work library in a UFS directory eliminates the need to specify the amount of space that is allocated to the Work library (including client Work libraries). This feature is particularly valuable for multi-user SAS servers because the space requirements for individual client Work libraries might vary widely and be difficult to predict. When you place your Work library in a UFS directory, each Work

library uses only the space it actually needs for the files that are created. This space is drawn from a large pool. A pool consists of the free space available in the UFS file system in which the directory is located.

**Note:** Contact your system administrator if you have questions about the space available in the UFS file system in which you have placed the Work library.

To use UFS libraries, follow these guidelines:

- Specify the path to the directory in which the Work library (or libraries) are to reside with the SAS system option WORK, as shown in the following example:

  ```
  WORK="/mydir"
  ```

  Each Work library (or client Work library) resides in a subdirectory within the UFS directory that you specify with the WORK option. These subdirectories are created automatically as they are needed.

  If SAS jobs or sessions that run under different user accounts are to specify the same directory path for the WORK option, then SAS recommends that the specified UFS path correspond to a directory with its sticky bit turned on. When the sticky bit is on for a directory, directories that are contained within that directory can be removed only by one of the following users:

  - the owner of the directory
  - the owner of the directory that is being deleted
  - a superuser

  This setting enables multiple SAS users to place temporary directories in the same location without the risk of accidentally deleting each other's files.

- If necessary, specify the SAS system option WORKTERM to remove the Work library subdirectories and their contents when they are no longer needed. For more information about using WORKTERM, see "WORKTERM System Option: z/OS" on page 888.

- Avoid allocating the DDNAME WORK (if possible), or allocate the minimum amount of space. The data set allocated to the DDNAME WORK is not used when a UFS path is specified for the WORK option.

For more information about UFS, see "HFS, UFS, and zFS Terminology" on page 8.

# Hiperspace Library

A hiperspace library is a temporary direct access bound library in which each library block resides in a 4K block in a z/OS hiperspace. Specifying the SAS system option HSWORK causes the Work library to be a hiperspace library. Hiperspaces reside in memory, and specifying HSWORK can reduce the elapsed time that is required for SAS processing because I/O operations to disk are not required for Work library processing. When HSWORK is specified at the invocation of a SAS server, any client Work libraries that are created are hiperspace libraries. For more information, see "Hiperspace Libraries" on page 66.

**Note:** Some installations might place limits on hiperspace use. Consequently, using hiperspace for Work might be more appropriate for SAS jobs or servers with modest Work space requirements. Contact your systems administrator for information about hiperspace limitations.

Follow these guidelines to specify that the Work library and any client Work libraries are hiperspace libraries:

- Specify the SAS system option "HSWORK System Option: z/OS" on page 782.
- Avoid allocating the DDNAME WORK (if possible), or allocate the minimum amount of space, because the data set allocated to the DDNAME WORK is not used when HSWORK is specified.
- Specify values that provide sufficient total space for the entire SAS job or server for the following SAS system options:
  - HSLXTNTS
  - HSMAXPGS
  - HSMAXSPC

For more information, see "HSLXTNTS= System Option: z/OS" on page 779, "HSMAXPGS= System Option: z/OS" on page 780, and "HSMAXSPC= System Option: z/OS" on page 781.

# User Library

You can identify a permanent library in which SAS stores members specified with one-level names (that is, without a libref). This feature can be useful for applications that require a default location for SAS files that is permanent or that exists beyond the end of the current SAS session. You might also find that it is useful to allocate a larger amount of temporary space when you have already started SAS and cannot increase the size of WORK. More temporary workspace is also useful when you do not want to increase the size of WORK for every user who is connecting to a specific server.

To use a User library, follow these guidelines:

- Assign a libref to the User library data set.
- Specify the libref as a value of the "USER= System Option: z/OS" on page 877.

# Utility Files That Do Not Reside in Work

In SAS®9, some SAS procedures create a new type of utility file that does not reside in Work but rather in a location specified via the UTILLOC system option. In some cases, these utility files are created only if the THREADS system option is set to a

nonzero value. These utility files, which provide certain performance benefits, can reside in one of two different types of locations on z/OS:

temporary z/OS data set
: Each utility file resides in a separate, temporary, sequential data set on disk (or VIO) that has a system-generated name that is allocated by a system-generated DDNAME. The amount of disk space available to each utility file is specified by an ALLOC command, which is specified as the value of the UTILLOC option. Specify the UCOUNT keyword to allow these files to reside in multi-volume data sets.

UFS file
: Each utility file is a UFS file residing in a temporary directory subordinate to the UFS path specified for the UTILLOC option.

For more information about the UTILLOC system option and the UCOUNT keyword, see "UTILLOC= System Option: z/OS" on page 877.

# SAS Log File

## Overview of the SAS Log File

The SAS log file is a temporary physical file that has a ddname of SASLOG in the SAS cataloged procedure, the SAS CLIST, and the SASRX exec. In batch mode, the SAS cataloged procedure assigns default data control block (DCB) characteristics to this file as follows:

**BLKSIZE**=141

**LRECL**=137

**RECFM**=VBA

Under TSO, either interactively or noninteractively, the SASLOG file is routed to the terminal by default. In the windowing environment, the SAS log is directed to the Log window.

For more information about the SAS log and about how to route output in a batch job, see "Types of SAS Output" on page 142.

## Changing the Contents of the SAS Log

The particular information that appears in the SAS log depends on the settings of several SAS system options. For more information, see "Collecting Performance Statistics" on page 904.

In addition, the following portable system options affect the contents of the SAS log:

CPUID
: controls whether CPU information is printed at the beginning of the SAS log.

DETAILS
: specifies whether to include additional information when files are listed in a SAS library.

ECHOAUTO
: controls whether the SAS source statements in the autoexec file are written (echoed) to the SAS log.

MLOGIC
: controls whether macro trace information is written to the SAS log when macros are executed.

MPRINT
: controls whether SAS statements that are generated by macros are displayed.

MSGLEVEL=
: controls the type of messages that are displayed.

NEWS=
: specifies an external file that contains messages to be written to the SAS log when SAS software is initialized. Typically, the file contains information such as news items about the system.

NOTES
: controls whether NOTES are printed in the log. NOTES is the default setting for all methods of running SAS. Do not specify NONOTES unless your SAS program is completely debugged.

OPLIST
: specifies whether options given at SAS invocation are written to the SAS log.

PAGESIZE=
: specifies the number of lines that compose a page of SAS output.

PRINTMSGLIST
: controls whether extended lists of messages are printed.

SOURCE
: controls whether SAS source statements are written to the log. NOSOURCE is the default setting for SAS interactive line mode. Otherwise, SOURCE is the default.

SOURCE2
: controls whether secondary source statements from files that are included by %INCLUDE statements are written to the SAS log.

SYMBOLGEN
: controls whether the macro processor displays the results of resolving macro references.

## Changing the Appearance of the SAS Log

The following portable system options are used to change the appearance of the SAS log:

DATE
: controls whether the date and time, based on when the SAS job or session began, are written at the top of each page of the SAS log and of any print file that SAS software creates. Use NODATE to suppress printing of the date and time.

LINESIZE=
: specifies the line size (printer line width) for the SAS log and the SAS procedure output file. LS= is an alias for this option. LINESIZE= values can range from 64 through 256.

NUMBER
: controls whether the log pages are numbered. NUMBER is the default. Use the NONUMBER option to suppress page numbers.

OVP
: controls whether lines in SAS output are overprinted.

# SAS Procedure Output File

## Overview of the SAS Procedure Output File

Whenever a SAS program executes a PROC step that produces printed output, SAS sends the output to the procedure output file. Under TSO, either interactively or noninteractively, the procedure output file is routed to the terminal by default. In the windowing environment, output is directed to the Output window.

In batch mode, the SAS procedure output file is identified in the cataloged procedure by the ddname SASLIST. Unless you specify otherwise, SAS writes most procedure output to this file. (A few procedures, such as the OPTIONS procedure, route output directly to the SAS log by default.) PUT statement output might also be directed to this file by a FILE statement that uses the fileref PRINT. (PRINT is a special fileref that can be specified in the FILE statement.) A DATA step can also send output to this file by using the PUT statement when a FILE PRINT; statement is the active FILE statement.

The following DCB characteristics of the procedure output file are controlled by the cataloged procedure, typically with the following values:

**BLKSIZE**=264

**LRECL**=260

**RECFM**=VBA

The SAS procedure output file is often called the *print file*. However, any data set that contains carriage-control information (identified by a trailing A as part of the RECFM= specification) can be called a print file.

# Changing the Appearance of Procedure Output

The following portable system options are used to change the appearance of procedure output:

CENTER
: controls whether the printed results are centered or left-aligned on the procedure output page. CENTER is the default; NOCENTER specifies left alignment.

DATE
: controls whether the date and time, based on when the SAS job or session began, are written at the top of each page of the SAS log and of any print file that SAS software creates. Use NODATE to suppress printing of the date and time.

LINESIZE=
: specifies the line size (printer line width) for the SAS log and the SAS procedure output file. LS= is an alias for this option. LINESIZE= values can range from 64 through 256.

NUMBER
: controls whether the page number is printed on the first title line of each SAS printed output page. NUMBER is the default. Use the NONUMBER option to suppress page numbers.

PAGENO=
: specifies a beginning page number for the next page of output that SAS software produces.

PAGESIZE=
: specifies how many lines to be printed on each page of SAS output. PS= is an alias for this option. In the windowing environment or in an interactive line mode session, the PAGESIZE= option defaults to the terminal screen size, if this information is available from the operating environment. PAGESIZE= values can range from 15 through 500.

# Console Log File

The SAS console log file is a physical file that is automatically allocated at the start of SAS initialization. The console log file records log messages generated when the regular SAS log is either unavailable or is not yet initialized. The SAS CLIST, the SASRX exec, and cataloged procedures allocate this file using the ddname SASCLOG.

# Parmcards File

The parmcards file is a temporary physical file that is identified by the ddname SASPARM. It is created automatically by the SAS cataloged procedure and by the SAS CLIST or SASRX exec. SAS uses the parmcards file for internal processing. Lines that follow a PARMCARDS statement in a PROC step are first written to the parmcards file. Then they are read into the procedure.

# TKMVSENV File

A TKMVSENV file is created during installation. You can use the ddname TKMVSENV with the SAS cataloged procedure, the SASRX exec, and CLISTs to point to the file. The file must be a sequential file or a member of a PDS with a record format of fixed blocked.

The TKMVSENV file is used to create pseudo-environment variables. Environment variables are supported for customizing applications. Some environment variables are used at the request of SAS Technical Support to investigate problems that are reported by users.

Each record in the TKMVSENV file must contain a single command: SET or RESET. The RESET command clears all previously set environment variables. The SET name=*value* command enables you to create the variable *name* and assign it the value *value*.

Each command must begin in column 1 of the record. No blank spaces are permitted in the name=*value* specification on the SET command, except when the value is enclosed in quotation marks. Some variables have a Boolean effect. These variables are turned on when they are defined and turned off when they are not

defined. Such variables do not need to have a value and can be defined by using the SET name= command without a value.

You can include comments after the command specification by adding one or more blank spaces between the command specification and the comment. Any record that has an asterisk in column 1 is ignored, and the entire record is treated as a comment.

For more information, see "TKMVSENV Options under z/OS" on page 895.

# Summary Table of SAS Software Files

Table 3.1 on page 36 lists all of the SAS software files that are frequently used in the SAS CLIST, the SASRX exec, or in the SAS cataloged procedure. In the CLIST, SASRX, and cataloged procedure, logical names are associated with physical files. The logical names listed in the table are those that are used by the standard SAS CLIST, SASRX, or cataloged procedure. Your installation might have changed these names.

The system option column in the table lists the SAS system options that you can pass into the SAS CLIST or SASRX (using the OPTIONS operand) or into the SAS cataloged procedure (using the OPTIONS parameter) when you invoke SAS. You can use these system options to change the defaults that were established by the CLIST, SASRX, or by the cataloged procedure. For more information, see "Specifying or Changing System Option Settings" on page 19.

**Note:** If a system option exists for a particular logical name, such as CONFIG or TKMVSENV, you should not provide a DD statement or TSO ALLOC statement for your own file. You should use only the system option that is shown to make overrides of the default value.

Some of these logical names have related options that are more complex than can be summarized in this table. For more information, see "System Options under z/OS" on page 685.

***Table 3.1*** *SAS Software Files*

| Default Logical Name | Purpose | System Option | CLIST Operands | Type of OS Data Set |
|---|---|---|---|---|
| CONFIG | system configuration file | CONFIG= *ddname* | not applicable | sequential data set or PDS member |
| *Description*: contains system options that are processed automatically when you invoke SAS. The system configuration file is usually maintained by your data center. | | | | |

| Default Logical Name | Purpose | System Option | CLIST Operands | Type of OS Data Set |
|---|---|---|---|---|
| CONFIG | user configuration file | CONFIG= *ddname* | CONFIG(*dsn*) | sequential data set or PDS member |
| *Description*: also contains system options that are processed automatically when you invoke SAS. Your user configuration file is concatenated to the system configuration file. | | | | |
| LIBRARY | format library | not applicable | not applicable | SAS library |
| *Description*: contains formats and informats. | | | | |
| SAMPSIO | sample SAS library | not applicable | not applicable | SAS library |
| *Description*: is the SAS library that is accessed by SAS programs in the sample library provided by SAS Institute. | | | | |
| SAS*nnnnn* | command processor file | not applicable | not applicable | sequential data set or PDS member |
| *Description*: is used by the SASCP command in the SAS CLIST or the SASRX exec. | | | | |
| SASAUTOS | system autocall library | not applicable | MAUTS(*dsn*) | PDS |
| *Description*: contains source for SAS macros that were written by your data center or provided by SAS Institute. | | | | |
| SASAUTOS | user autocall library | SASAUTOS= *specification*[1] | SASAUTOS(*dsn*) | PDS |
| *Description*: contains a user-defined autocall library to which the system autocall library is concatenated. | | | | |
| SASCLOG | console log | not applicable | CLOG(*dsn*) | sequential data set or PDS member |
| *Description*: SAS console log file. | | | | |
| SASEXEC | autoexec file | AUTOEXEC= *ddname* | AUTOEXEC(*dsn*) | sequential data set or PDS member |
| *Description*: contains statements that are executed automatically when you invoke SAS. | | | | |
| SASHELP | HELP library | SASHELP= *ddname* | SASHELP(*dsn*) | SAS library |
| *Description*: contains system default catalogs and Help system information. | | | | |

| Default Logical Name | Purpose | System Option | CLIST Operands | Type of OS Data Set |
|---|---|---|---|---|
| SASLIB | format library (V5) | SASLIB= *ddname* | not applicable | load library |
| *Description*: a load library that contains user-written procedures and functions or Version 5 formats and informats. It is searched before the SAS software load library. | | | | |
| SASLIST | procedure output file | PRINT= *ddname* | PRINT(*dsn*) | sequential data set or PDS member |
| *Description*: contains SAS procedure output. | | | | |
| SASLOG | log file | LOG= *ddname* | LOG(*dsn*) | sequential data set or PDS member |
| *Description*: SAS log file. | | | | |
| SASMSG | system message file | SASMSG= *ddname* | SASMSG(*dsn*) | PDS |
| *Description*: contains SAS software messages. | | | | |
| SASPARM | parmcards file | PARMCARD= *ddname* | PARMCARD(*size*) | sequential data set or PDS member |
| *Description*: a temporary data set that is used by some procedures. The PARMCARD= system option assigns a ddname to the parmcards file; the PARMCARD CLIST or SASRX operand specifies the file size. You can use the DDPARMCD operand to specify an alternate name for the parmcards file via the CLIST or SASRX. | | | | |
| SASSNAP | SNAP dump file | not applicable | not applicable | sequential data set or PDS member |
| *Description*: SNAP output from dump taken during abend recovery. | | | | |
| SASSWK*nn* | sort work files | DYNALLOC SORTWKDD= SORTWKNO= | not applicable | sequential |
| *Description*: temporary files that are used by the host sort utility when sorting large amounts of data. | | | | |
| SASUSER | Sasuser library | SASUSER= *ddname* | SASUSER(*dsn*) | SAS library |
| *Description*: contains the user profile catalog and other personal catalogs. | | | | |
| STEPLIB | STEPLIB library | not applicable | LOAD(*dsn*) SASLOAD(*dsn*) | load library |

| Default Logical Name | Purpose | System Option | CLIST Operands | Type of OS Data Set |
|---|---|---|---|---|
| *Description*: a load library that contains SAS procedure and user-written load modules. (Allocate with a STEPLIB DD statement in a batch job.) | | | | |
| SYSIN | primary input file | SYSIN= *ddname* | INPUT(*dsn*) | sequential data set or PDS member |
| *Description*: contains SAS statements. The primary input file can be specified with the INPUT operand under TSO, or allocated with a DD statement in a batch job. | | | | |
| TKMVSENV | TKMVSENV file | not applicable | TKMVSENV(*dsn*) | sequential data set or PDS member |
| *Description*: contains a list of pseudo-environment variables that are available to threaded kernel applications. | | | | |
| USER | User library | USER= *ddname* \| *dsn* | not applicable | SAS library |
| *Description*: specifies a SAS library in which to store SAS data sets that have one-level names (instead of storing them in the Work library). | | | | |
| WORK | Work library | WORK= *ddname* | WORK(*parms*) | SAS library |
| *Description*: contains temporary SAS files that are created by SAS software during your session. | | | | |

1 SASAUTOS: *specification* can be a fileref, a partitioned data set name enclosed in quotation marks, or a series of file specifications enclosed in parentheses.

# Transporting SAS Data Sets between Operating Environments

SAS supports three ways of transporting SAS data sets between z/OS and other SAS operating environments: the XPORT engine, the CPORT and CIMPORT procedures, and SAS/CONNECT software, which is licensed separately. The process of moving a SAS file to or from z/OS with the XPORT engine or with the CPORT and CIMPORT procedures involves three general steps:

1. Convert the SAS file to the intermediate form known as *transport format*.
2. Physically move the transport format file to the other operating environment.
3. Convert the transport format file into a normal, fully functional SAS file, in the format required by the other operating environment.

For further information about the XPORT engine and on the CPORT and CIMPORT procedures, including limited restrictions, see *Moving and Accessing SAS Files*.

SAS/CONNECT software enables you to move files between operating environments without using the intermediate transport format. For further information about SAS/CONNECT, including limited restrictions, see *SAS/CONNECT User's Guide*.

# Accessing SAS Files in Other Operating Environments

SAS supports read-only cross-environment data access (CEDA) for certain types of SAS files created in the format of SAS Version 7 or later. CEDA enables you to read files in other operating environments as if those files were stored under z/OS. For more information about CEDA, see *Moving and Accessing SAS Files* and the information about the Migration focus area at **`support.sas.com/migration`**.

# Using Input/Output Features

SAS 5 and SAS 6 data sets generally need to be migrated to SAS 9 to enable you to use the I/O features introduced in SAS 9 and SAS 8. For example, to add integrity constraints to a SAS 6 data set, you must first migrate that data set to SAS 9. For information about migrating your data sets, see the Migration focus area at **`support.sas.com/migration`**.

# Reserved z/OS Ddnames

In addition to the logical names shown in Table 3.1 on page 36, which have a special meaning to SAS, you should be aware of the following reserved ddnames. These ddnames have a special meaning to the operating environment:

JOBCAT
: specifies a private catalog that the operating environment is to use instead of the system catalog for the duration of the job (including jobs with more than one job step).

JOBLIB
: performs the same function as STEPLIB except that it can be used in a job that has more than one job step. For more information, see Table 3.1 on page 36.

SORTLIB
: is used by some host sort utilities.

SORTMSG
: is used by some host sort utilities to print messages.

SORTWK*nn*
: specifies sort work data sets for the host sort utility. If allocated, this ddname is used instead of the SASSWK*nn* data sets.

STEPCAT
: specifies a private catalog that the operating environment is to use instead of the system catalog for the current job step.

SYSABEND
: in the event of an abnormal job termination, SYSABEND specifies a data set that receives a medium-sized dump that consists of the following information:

  - user-allocated storage and modules
  - system storage related to current tasks and open files
  - system and programs related to the terminated job

  For more information, see the following information about SYSMDUMP and SYSUDUMP.

SYSHELP
: is used by TSO HELP libraries (not the SAS HELP facility).

SYSLIB
: is used by some IBM system utility programs.

SYSMDUMP
: in the event of an abnormal job termination, SYSMDUMP specifies a data set that receives a system dump in IPCS format. The contents of the dump are determined by z/OS installation options. SYSMDUMP generally includes all user-allocated storage, all system-allocated storage used to control job execution, and all program modules (system modules and user programs) that were in use when the dump was taken.

SYSOUT
: is used by some utility programs to identify an output data set.

SYSPRINT
: is used by some utility programs to identify a data set for listings and messages that might be sent to the printer.

SYSUADS
: is used by some TSO commands that might be invoked under SAS software.

SYSUDUMP
: in the event of an abnormal job termination, SYSUDUMP specifies a data set that receives a “short” system dump. This dump consists of user-allocated storage and modules and system storage related to current tasks and open files. For more information, see the previous discussions about SYSABEND and SYSMDUMP.

SYS*nnnnn*
: is reserved for internal use (for dynamic allocation) by the operating environment.

PART 2

# Running SAS Software under z/OS

# 4

# Using SAS Libraries



## Introduction

The following information explains how to create, identify, and manage SAS libraries that reside in MVS data sets or UNIX file system directories on z/OS. For example, creating certain types of SAS libraries on z/OS requires the specification of physical characteristics such as block size. It can also require the identification

of system resources such as disk space. In addition, z/OS provides robust facilities, such as MVS JCL, for identifying the MVS data sets in which some SAS libraries reside. The MVS ddname associated with an MVS data set can be used to assign a library within SAS. The following information describes how to control the physical characteristics of SAS libraries to optimize performance and take full advantage of the z/OS environment. For more information, see "SAS Libraries" in *SAS Language Reference: Concepts* and "SAS Engines" in *SAS Programmer's Guide: Essentials*.

The topics in the following list discuss the use of library engines and SAS libraries:

SAS Library Engines
: describes how to use various types of engines under z/OS to access SAS libraries. For the base, sequential, and certain compatibility engines, the SAS libraries can exist in various formats. For more information, see "SAS Library Engines" on page 46.

Library Implementation Types for Base and Sequential Engines
: describes the purpose for each of the various library formats as well as how to select the format that is most appropriate for your application. For more information, see "Library Implementation Types for Base and Sequential Engines" on page 51.

Assigning SAS Libraries
: describes the various means for specifying that a particular library be used within a SAS session. For more information, see "Assigning SAS Libraries" on page 72.

# SAS Library Engines

## Overview of SAS Library Engines

SAS provides different engines that enable you to access and, in most cases, to update files of different types and different formats.

## The V9 Engine

The default Base SAS engine for SAS libraries is V9. The V9 engine creates libraries in the V9 format, and it can also read and write libraries created using the V7 and V8 engines.

The V9 engine is the appropriate choice for most applications because it supports the full SAS data set functionality. The V9 engine also exploits the random access capabilities of disk devices to achieve greater performance than is possible with sequential engines.

The V9 engine is the default engine in most cases, but you can change the specified default engine with the ENGINE system option. The V9 engine can be used only for the types of devices that support it.

**Note:** Use BASE as the engine name if you write programs that create new SAS libraries and you want to create the libraries in the latest available format. In SAS®9, BASE is an alias for V9, and it will be an alias for newer engines in subsequent releases of SAS.

# The V9TAPE Engine

The sequential engine for SAS libraries is V9TAPE. The V9TAPE engine creates sequential libraries in the V9TAPE format, and it can also read and write libraries created using the V7TAPE and V8TAPE engines.

The V9TAPE engine provides a way to store files on devices such as tape that do not support random access. Some of the uses of the V9TAPE engine on z/OS include

- archiving SAS files to tape for long-term storage.
- transporting SAS files between your z/OS system and another z/OS system via tape.
- sending SAS data, via a pipe connection, for immediate consumption by another job running in parallel.

In contrast to the V9 engine, V9TAPE has the following limitations:

- does not support indexing, compression of observations, or audit trail capabilities
- does not support direct access to individual observations (using the POINT= or KEY= options in the SET or MODIFY statements)
- provides limited support for the following types of SAS library members: ACCESS, CATALOG, PROGRAM, and VIEW. You can move or transport these member types, but you cannot use the V9TAPE engine to access the information within these members.

**Note:** Use TAPE as the engine name if you write programs that create new SAS libraries and you want to create the libraries in the latest available format. TAPE is an alias for V9TAPE, and it will be an alias for any sequential engines that can be made available in subsequent releases of SAS.

# Compatibility Engines

## Overview of Compatibility Engines

SAS provides compatibility engines for processing libraries that were created by previous versions of SAS. The engine that should be used depends on the engine format of the library. In most cases, SAS can detect the engine format and automatically select the appropriate engine to use. However, if you are using SAS to create a new library, or members in a library, that you want to access using an earlier version of SAS, then you should specify the appropriate engine as described in the following text. For more information about cross-release compatibility and migration, see **`support.sas.com/migration`**.

The following Base SAS engine library formats can be read and written by SAS:

V9 library
: Libraries created by the default Base SAS engine in V8 or V7 are identified by SAS as being in V9 format.

V6 library
: These libraries were created using the default Base SAS engine in V6 or using the V6 compatibility engine under a later version of SAS.

Specifying one of the following compatibility engines has the indicated effect:

V8
: creates a V9 library but does not allow creation of members with format names longer than 8 bytes.

V7
: has the same effect as V8.

V6
: creates a V6 format library.

The following sequential engine library formats can be read and written by SAS 9:

V9TAPE library
: Libraries created by the default sequential engine in V8 or V7 are identified by SAS 9.4 as being in V9TAPE format.

V6TAPE library
: These libraries were created using the default sequential engine in V6 or using the V6TAPE compatibility engine under a later version of SAS.

Specifying one of the following compatibility engines has the indicated effect:

V8TAPE
: creates a V9TAPE library but does not allow creation of members with format names longer than 8 bytes.

V7TAPE
: has the same effect as V8TAPE.

V6TAPE
creates a V6TAPE format library.

## Long Format Names

The V9 and V9TAPE engines support long format names in data sets. These long format names can have a maximum length of 32 bytes. SAS 8 and SAS 7 can process V9 and V9TAPE format libraries, including new data sets that were created using SAS 9.2. However, the data sets cannot have format names longer than 8 bytes. If you are using SAS 9.2 to create data sets that you intend to process using SAS 8 or SAS 7, specify the V8 or V8TAPE engine, as appropriate, to ensure that the format names do not exceed eight characters.

## SAS 6.06 Format Data Sets

Data sets that were created under SAS 6.06 cannot be read or written by SAS 9.2 because their storage format differs from that used in subsequent releases of SAS 6. To make a SAS 6.06 data set available for processing in SAS 9.2, first use a later release of SAS 6 (6.07, 6.08, or 6.09) to copy the SAS 6.06 data set to a new SAS data set, either in the same library or in a new library. (Beginning with SAS 9.2, SAS can process libraries that were originally created by SAS 6.06, if the library members have been converted to the engine format associated with a later release of SAS, such as SAS 6.09.) The newly copied data set automatically receives the new SAS 6 format, which allows the new data set to be processed by the V6 or V6TAPE engine in SAS 9.2.

## V5 and V5TAPE Engines

SAS 9.2 can read, but not update, libraries that were created in the V5 and V5TAPE formats. Libraries that were created in the V5 format cannot reside in Extended Addressing Space on Extended Address Volumes.

## Other SAS Engines

In addition to the engines described in the preceding sections, SAS provides other LIBNAME engines to support a wide variety of different types of libraries. The following engines can be used on z/OS to access libraries of these engines that reside in native z/OS data sets:

XPORT
The XPORT engine converts SAS files to a format suitable for transporting the file from one operating environment to another. For general information about how to use this engine, see *Moving and Accessing SAS Files*. For information

about the LIBNAME syntax to use with this engine, see "LIBNAME Statement: z/OS" on page 656.

Interface Engines
: The BMDP, OSIRIS, and SPSS engines provide Read-Only access to BMDP, OSIRIS, and SPSS (including SPSS-X) files, respectively. For more information about the LIBNAME syntax to use with these engines, see "Host Options for the XPORT, BMDP, OSIRIS, and SPSS Engines" on page 671 and Appendix 6, "Accessing BMDP, SPSS, and OSIRIS Files," on page 967.

# SAS View Engines

SAS view engines enable SAS software to read SAS data views and DATA step views that are described by the DATA step, SQL procedure, or by SAS/ACCESS software. Under z/OS, the following view engines are supported. These engines support the SAS data set model only and are not specified in the LIBNAME statement or LIBNAME function.

ADB
: accesses ADABAS database files.

DDB
: accesses CA-DATACOM/DB database files.

IDMS
: accesses CA-IDMS database files.

IMS
: accesses IMS-DL/I database files.

DATASTEP
: accesses data sets that are described by a SAS DATA step.

These engines support the SAS data view and are also specified in the LIBNAME statement and the LIBNAME function:

DB2
: accesses DB2 database files.

ORACLE
: accesses Oracle database files.

SQL
: accesses data sets that are described by the SQL procedure.

For more information about the SQL view engine, see *SAS SQL Procedure User's Guide*. For information about the other view engines, see the appropriate SAS/ACCESS software documentation.

# Library Implementation Types for Base and Sequential Engines

## Overview of Library Implementation Types

For a given engine, a SAS library can be implemented in a variety of forms that have different usability and performance characteristics. These implementation types and the engines with which they can be used are listed in the following table. A complete description of each library can be found in the sections that follow.

***Table 4.1*** *Types of Libraries and Supported Engines*

| Implementation Type | Engines Supported |
|---|---|
| Direct Access Bound Library | V9, V8, V7, V6 |
| Sequential Access Bound Library | V9TAPE, V8TAPE, V7TAPE, V6TAPE |
| UFS Library | V9, SPD Engine, V8, V7, V9TAPE, V8TAPE, V7TAPE |
| Hiperspace Library | V9, V8, V7, V6 |
| Pipe Library | V9TAPE, V8TAPE, V7TAPE, V6TAPE |

## Direct Access Bound Libraries

### Overview of Direct Access Bound Libraries

A direct access bound library is a single z/OS data set, accessed on disk or hiperspace. It logically contains one or more SAS files in a manner similar to that of a z/OS partitioned data set (PDS). However, unlike a PDS, the members of a direct access bound library can be read, written, or managed only by SAS. Direct access bound libraries support the requirements of the Base SAS engines, particularly the need to randomly access SAS files and to have open more than one SAS file

simultaneously. Direct access bound libraries can extend to as many as 59 physical direct access storage device (DASD) volumes. As with a PDSE, SAS can reuse space in these libraries when a member is deleted or shortened. SAS performs most of its I/O asynchronously to direct access bound libraries. This process enables SAS servers that are accessing these libraries to perform other work while I/O operations to these libraries are in progress. For more information, see "Allocating Disk Space for SAS Libraries" on page 84 and "CONTENTS Procedure Statement: z/OS" on page 527.

## Creating Direct Access Bound Libraries

There are many ways to create a direct access bound library, but all methods have two points in common: First, the library physical name must correspond to a new or empty z/OS data set on DASD. Second, the library data set must have the DCB attribute DSORG=PS, and RECFM, if specified, must be FS. The second requirement is met if a Base SAS engine is explicitly specified in the LIBNAME statement that is used to identify the library.

The first time a new direct access bound library is used, it is initialized with the control structures that are necessary to manage library space and maintain the directory of library members.

The following example uses the LIBNAME statement with the default library options:

```
libname study '.study1.saslib' disp=(new,catlg);
data study.run1;
 ...
run;
```

These SAS statements use the V9 engine to create a library named *prefix*.STUDY1.SASLIB where *prefix* is the value of the SYSPREF system option. The amount of space allocated to the library is derived from the value of the FILEUNIT, FILESPPRI, and FILESPSEC system options. SAS automatically sets the appropriate DCB attributes. In an interactive session, it is possible to omit the DISP option; in this case, SAS assumes a status of NEW and prompts for the value of the normal disposition.

The following example creates an external assignment using JCL:

```
//jobname JOB ...
//   EXEC SAS
//STUDY DD DSN-USER489.STUDY1.SASLIB,DISP=(NEW,CATLG),
//      UNIT=DISK,SPACE=(CYL,(200,50)),DCB=DSORG=PS
data study.run1;
  ...
run;
```

Assuming that the ENGINE system option uses the default of V9, these SAS statements create a library named USER489.STUDY1.SASLIB.

As in the previous example, SAS automatically sets the appropriate DCB attributes. Note that it is not necessary to specify the LIBNAME statement.

The following example explicitly specifies the V6 compatibility engine:

```
//jobname JOB ...
//   EXEC SAS
//HIST DD DSN=USER489.HISTORY1.SASLIB,DISP=(NEW,CATLG),
//       UNIT=3390,SPACE=(CYL,(10,10)),
//       DCB=(DSORG=PS,BLKSIZE=27648)
libname hist V6;
data hist.analysis;
        ...
run;
```

Like the previous JCL example, this example uses external assignment. However, the V6 compatibility engine is explicitly specified in the LIBNAME statement. This library can now be processed by SAS Version 6. In addition, the DD statement in the JCL explicitly specifies the library block size.

## General Usage Notes

- Only one SAS session can open a direct access bound library for update at a given time. It is necessary to specify a disposition status of NEW, OLD, or MOD in order to update a SAS library. However, multiple SAS sessions can share a SAS library for Read-Only access using DISP=SHR. Except for a special case of relevance only during the installation of the SAS product, SAS does not allow updates of a library that is allocated DISP=SHR.
- The mode in which SAS opens the library data set is governed by the disposition status with which the library data set is allocated. The RACF authorization the user has to the library data set also governs the mode in which SAS opens the library data set. If the disposition is SHR, then SAS treats the library as read-only. Otherwise, SAS assumes that the user has read-write access. SAS then issues a RACROUTE call to verify that the SAS job step is authorized to open the library data set in the requested manner (read-only or read-write). If read-write access is requested but not authorized, then SAS checks to determine whether Read-Only access is authorized. If permitted, SAS treats the library as read-only even though DISP=OLD is specified. After that series of checks, SAS then opens the library in the authorized manner: INPUT mode is used for read-only libraries. For read-write libraries, OUTPUT mode is used to open the data set on the last (or only) volume; UPDATE mode is used for volumes that are not the last one. Of course, if SAS is not authorized to access the library at all, it does not attempt to open the library. Note, however, that the RACF authorization check is not performed if the system option FILEAUTHDEFER has been specified.
- The data set in which a direct access library resides is itself a simple physical sequential data set. Therefore, the library data set can be copied or backed up (subject to the following restrictions) to disk or to tape by using any z/OS utilities such as IEBGENER, ISPF 3.3, DF/HSM, or DFDSS that honors the requirements of RECFM=FS. The library data can be copied to a different disk device type (with a different track size) than the original, and SAS can then successfully process the copy. The library data set can also be copied by using FTP if the FTP mode is set to binary and the copy of the data set has the same

DSORG, RECFM, BLKSIZE, and LRECL attributes as the original. However, even though the library data set can be copied to tape (such as for the purposes of transport or archive), SAS cannot open the data set unless it resides on DASD.

- The library data set for a direct access bound library must not be copied or backed up while SAS has the library open for update. Failure to respect this restriction can lead to loss of data. Utility programs that respect the DISP=OLD allocation, and that run in an address space separate from the SAS session, comply with this restriction.
- Multivolume direct access bound libraries that were last processed by SAS 9 (or SAS 8) can be successfully copied by standard utilities, regardless of the engine format. However, multivolume direct access bound libraries that were last processed by earlier versions of SAS could have the DS1IND80 bit (last volume flag) turned on for each volume. Utilities that honor the DS1IND80 flag terminate the copy operation at the first volume for which the flag is on. Libraries for which the DS1IND80 flag is on for all volumes (or any volume except the last volume with data) cannot be copied in their entirety by such utilities. This problem exists for any library that was last processed by SAS 6. The problem might also exist for any library last processed by SAS 8 but only if the SAS session abended. For this reason, SAS recommends using the COPY procedure for libraries that are processed by those older versions of SAS.
- When rewriting a SAS file in a direct access bound library, SAS does not delete the old copy of the file until the entire SAS file has been completely rewritten. The library grows large enough to contain both the old and new version of the file.
- SAS reclaims free space in a direct access bound library for its own use. It does not release free space back to the operating system as part of normal processing. To make free space available for other z/OS data sets, use the COPY procedure to copy all of the members of the library to another smaller library, and then delete the original copy. Unformatted free space at the end of the library data set (that is, the difference between “Total Library Blocks” and “Highest Formatted Block” in the CONTENTS procedure output) can be released by specifying the RLSE subparameter of the SPACE parameter when accessing a library for update. The RELEASE procedure can release both formatted and unformatted free space at the end of a library (that is, space that follows “Highest Used Block” as indicated by the CONTENTS procedure or the DATASETS procedure), but it can be used only for libraries that reside on a single volume. Neither the RLSE subparameter nor PROC RELEASE can be used to release embedded free space in a direct access bound library, that is, free blocks below the “Highest Used Block.”
- PROC CONTENTS, PROC DATASETS, and LIBNAME LIST do not report the existence of allocated space on disk volumes beyond the last used volume in the library data set. In other words, any volumes beyond the volume that contains the "Highest Formatted Block" are disregarded in the list of volumes ("Volume" statistic) and the total allocated space ("Total Library Blocks"). The library data set might actually be cataloged and have allocated space on subsequent volumes. However, SAS does not recognize that space until it is necessary to extend the library to one of those subsequent volumes.
- The COPY procedure can also be used to re-organize a direct access bound library so that all the blocks of each SAS file reside in contiguous library blocks.

This re-organization could improve the efficiency of frequently processed libraries.

- Because SAS uses EXCP to process direct access bound libraries, the direct access bound libraries cannot reside in extended format sequential data sets. However, direct access bound libraries can reside in DSNTYPE=LARGE data sets. In that case, more than 64K tracks can be used on each volume.
- For direct access bound libraries that reside in DSNTYPE=BASIC data sets, a maximum of 64K tracks can be used on any single volume. Because a single data set cannot reside on more than 59 volumes, the maximum size for a such a library is approximately 199 G bytes (assuming optimal half-track blocking on a 3390 device).
- For direct access bound libraries that reside in DSNTYPE=LARGE data sets, a maximum of $2^{24}$–1 (about 16 million) tracks can be used on any single volume. In addition, the total number of blocks for the entire library on all volumes cannot exceed $2^{31}$–1 (about 2 billion). To avoid encountering the block limitation for multi–volume data sets that reside on EAV volumes, use half-track blocking (27648 on a 3390 device).
- A direct access bound library that is externally allocated with DISP=MOD cannot be assigned if the library has been extended to more than one volume. This restriction also applies when re-assigning a library using an external allocation that was previously used in the current SAS session or a previous SAS session. (Libraries can be re-assigned by issuing a LIBNAME statement that names the libref with which the library is currently assigned. Certain SAS procedures, the DOWNLOAD procedure in particular, also re-assign libraries.) Moreover, a direct access bound library that is externally allocated with DISP=NEW cannot be re-assigned once the library has been extended to more than one volume, and the library is temporary, not cataloged, or resides in a generation data group (GDG). (However, a library that is allocated with DISP=(NEW,CATLG) can be re-assigned even after it has been extended to multiple volumes.) The previously stated restrictions can be circumvented by establishing a DISP=OLD or DISP=SHR allocation to continue processing the library. Under TSO, the restrictions can be circumvented by deassigning the library, freeing the external allocation, and using the SAS LIBNAME statement or TSO ALLOCATE command to establish a new allocation. In batch, the restrictions can be circumvented by passing the library to a subsequent job step for further processing.
- Leading blanks on member names are ignored.
- SAS does not support multi-volume direct access bound libraries with zero DASD extents on the first volume. To avoid this situation, always specify a nonzero primary allocation value when you assign a new direct access bound library that can extend to multiple volumes.
- Values that are specified for the BUFNO option of the DD statement are ignored. Use the SAS system option BUFNO to tune SAS I/O processing. For more information, see Appendix 1, “Optimizing Performance,” on page 903 and “BUFNO= Data Set Option” in *SAS Data Set Options: Reference*.

## Controlling Library Block Size

The block size of a direct access bound library affects performance because it is the minimum value for the page size for all SAS files in the library. Moreover, the page size of any SAS file in the library must be an integral multiple of the library block size. For more information, see "Optimizing SAS I/O" on page 905.

The block size of a direct access bound library is set at initialization time, and it does not change for the duration of the library data set. SAS begins the process of determining the library block size by selecting the first applicable value from the following hierarchy of sources:

- for a preallocated but uninitialized data set, the block size value specified for the first or only volume of the data set.
- for a data set allocated using DISP=NEW, the block size value specified on allocation, either in the LIBNAME statement or, for external allocation, in the DD statement or TSO ALLOCATE command. For a description of how and when SAS dynamically allocates the library data set, see "Allocating the Library Data Set" on page 73.
- value of the BLKSIZE= system option, if nonzero.
- value of the BLKSIZE(*device-type*) system option for the device type on which the library resides, provided the value is nonzero.
- 6144.

SAS then adjusts the block size value selected from the previous list as necessary to meet the unique requirements of direct access bound libraries. The following procedure is used to adjust the value:

- If the value is greater than the maximum for the device, it is decreased to the maximum for the device.
- If the value is less than 4096, it is increased to 4096.
- After the previous two calculations are completed, if the value is not a multiple of 512, it is rounded down to the nearest multiple of 512.

**Note:** For example, suppose that a block size of 27,998 (optimum half-track blocking for an IBM 3390) was specified for a given library by one or more of the means listed in this section, and it was specified that the library would reside on a 3390 device. SAS would not use the specified block size. Instead, SAS would set the library block size to 27,648, because that is the largest multiple of 512 that is less than or equal to 27,998.

# Sequential Access Bound Libraries

## Overview of Sequential Access Bound Libraries

A sequential access bound library is a single z/OS data set that resides on disk or tape and logically contains one or more SAS files, each file written sequentially one after another. The primary purpose of this library implementation, like the sequential engines that it supports, is for storing SAS data sets on sequential devices such as tapes. Sequential access bound libraries can extend to multiple volumes, subject only to the limitations of the device type.

For more information about the contents of a sequential access bound library, see "CONTENTS Procedure Statement: z/OS" on page 527.

## Definitions

SASIO
: refers to datasets that are created and updated by one of the SAS library engines via SAS proprietary input/output. These datasets can reside on HFS/ZFS or in z/OS Native datasets.

EXTIO
: refers to z/OS Native datasets. BSAM and BPAM are two examples that are supported through the SAS statements LIBNAME, FILENAME, FILE, INFILE, and so on. For more information see DFSMS Using Data Sets.

## Creating Sequential Access Bound Libraries

The following example shows how to create a new multivolume tape library that resides on more than five volumes. As the sample JCL DD statement shows, the library can be assigned externally.

```
//MYTAPE   DD DSN=USER489.TAPE.SASLIB,DISP=(NEW,CATLG,DELETE),
//         UNIT=CART,LABEL=(1,SL),VOLUME=(PRIVATE,,,7)
```

The library data set can also be assigned internal to SAS using the SAS LIBNAME statement, as is shown in the following example, which is equivalent to the previous DD statement:

```
libname mytape tape 'user489.tape.saslib' disp=(new,catlg,delete)
   unit=cart label=(1,sl) volcount=7;
```

Regardless of how the library data set was assigned (either with a DD statement or with a LIBNAME), specify the libref, or externally assigned ddname, as the library in which a new member is to be created, as is shown in the following example:

```
data mytape.member1; /* new member */
...
```

**Note:**

- The engine ID must be specified when you internally assign a new library on tape. However, when you externally assign a new library on tape, the value of the SEQENGINE system option determines the engine that is used to create the library, unless it is overridden by a LIBNAME statement.
- The volume count must be specified for a tape library that extends to more than five volumes. Refer to the documentation for the VOLUME parameter of **DD statement** in *IBM MVS JCL Reference* for details.

The following example shows how to create a new, multivolume sequential access bound library on disk that uses as many as three volumes. As this sample JCL DD statement shows, the library can be assigned externally:

```
//SEQDISK  DD   DSN=USER489.SEQDISK.SASLIB,DISP=(NEW,CATLG),
//         UNIT=(3390,3),SPACE=(CYL,(200,200)),BLKSIZE=27998
...
  LIBNAME SEQDISK TAPE; /* use TAPE engine */
  DATA SEQDISK.MEMB01;
  ...
```

The library data set can also be assigned internal to SAS using the SAS LIBNAME statement, as shown in the following example, which is equivalent to the previous DD statement:

```
libname seqdisk tape 'user489.seqdisk.saslib' disp=(new,catlg)
   unit=(3390,3) space=(cyl,(200,200)) blksize=27998;
data seqdisk.memb01;
...
```

**Note:**

- To ensure the most complete use of the DASD track, specify the optimum half-track BLKSIZE for the type of disk device used. For sequential access bound libraries, this value must be specified in the DD or LIBNAME statement. The SAS BLKSIZE system options are not used for sequential access bound libraries.
- The maximum number of disk volumes to which the library data set can extend is governed by the unit count in the previous examples.
- Sequential access bound libraries can reside in extended format sequential data sets. Extended format sequential data sets can be defined as compressed by SMS, and they can also occupy more than 64K tracks per volume.

## General Usage Notes

- Due to the nature of sequential devices, SAS allows only two types of operations with members of a sequential bound library: reading an existing

member and writing a new copy of a member to the library. The following types of operations are not supported for sequential access bound libraries:

- having multiple members in the library open at the same time
- updating the contents or attributes of a member of the library
- renaming or deleting a member of the library.
- An abend that is handled by SAS results if both of the following conditions are met:
  - you attempt to access a tape library that has a BLKSIZE greater than 32760 with SAS 9.4M1 or earlier
  - that version of SAS does not contain LBI support or support for large-block SAS libraries

  Here is an example of the messages that are produced in the SAS log when SAS version 9.4 attempts to access a library with large block sizes:

```
1            libname mytape tape '.saslib.lbi';
NOTE: Libref MYTAPE was successfully assigned as follows:
      Engine:        TAPE
      Physical Name: SASJOB.SASLIB.LBI
ERROR: OPEN failed for library data set SASJOB.SASLIB.LBI.
Abend code 013. Return code E1.
ERROR: An I/O error has occurred on file MYTAPE.ALL..
ERROR: OPEN failed for library data set SASJOB.SASLIB.LBI.
Abend code 013. Return code E1.
ERROR: An I/O error has occurred on file MYTAPE.
NOTE: The SAS System stopped processing this step because of errors.
```

  For information about the IBM log message that is also issued, see *MVS System Messages Volume 7 (IEB - IEE)*.

**CAUTION**

**SAS deletes all members of a sequential bound library that are subsequent to the library member that you replace.**

- By default, when writing a member of a sequential bound library, SAS scans the entire library from the beginning to determine whether a member having the specified name already exists in the library. If such a member already exists in the library, then the new copy of the member is written starting at the position in the library data set where the old copy of the member began, and all subsequent members of the library are deleted. If the specified member does not already exist in the library, it is appended to the end of the library. This behavior is not influenced by the REPLACE system option because NOREPLACE is not supported by the TAPE engine.
- When the FILEDISP=NEW data set option is specified for a member to be written to a sequential access bound library, SAS replaces all of the members that previously existed in the library, even if they were protected by an ALTER password. The ALTER password is not checked even for the member being replaced.
- When the COPY procedure is used to write members to a sequential access bound library, the rules regarding member replacement (discussed in the

previous topic) apply only to the first member being processed by a COPY statement or PROC COPY invocation. All other members involved in the COPY operation are appended to the end of the library data even if they already exist in the library. Therefore, it is possible to cause a library to contain two copies of the member, only the first of which is recognized. You should plan all COPY operations carefully so that you avoid this outcome.

- Some specialized SAS procedures repeatedly process a group of observations that have the same value for a specific variable. This situation requires SAS to interrupt its sequential access pattern and reposition to a previous location in the library data set. However, SAS does not support repositioning to a location on a previous volume of a multi-volume tape data set. When this situation occurs, SAS issues the following error message:

```
ERROR: A POINT operation was attempted on sequential library SEQLIB.
   A volume switch has occurred on this library since the last NOTE
   operation, making the POINT results unpredictable.
```

  Should this situation occur, you can avoid the limitation by copying the member to a library on disk.

- When using the LIBNAME statement to dynamically allocate SAS libraries on tape, it is not possible to simultaneously allocate multiple MVS data sets on the same tape volume. Therefore, it is necessary to use the SAS LIBNAME CLEAR statement to deassign the library before you attempt to assign another MVS data set on the tape.

- The mode in which SAS opens the library data set is primarily governed by the type of access that is being performed. When reading a member, listing the members in the library, or retrieving information about the library, the library data set is opened for INPUT. When writing a member, the library data set is opened for INOUT (unless DISP=NEW and the data set has not been previously opened. In that case, OUTIN is used). SAS does not write to a library that is allocated with DISP=SHR or LABEL=(,,,IN), issuing an ERROR message instead. Before opening the library data set, SAS first checks the RACF authorization, but only for libraries that reside on disk, and only if NOFILEAUTHDEFER is in effect.

## Optimizing Performance

- Specify the DLLBI SAS system option or the DLLBI=YES LIBNAME statement option when you create sequential access bound libraries on tape that do not need to be processed by SAS 9.4M1 or earlier. DLLBI=YES allows for block size (BLKSIZE) values to exceed 32760. Unless overridden on the allocation, SAS selects the optimum block size for the device, typically 224K-256K. Setting the optimum BLKSIZE results in significant improvements in the I/O rate (bytes per elapsed second) relative to BLKSIZE=32760, and can also improve tape utilization.

- For sequential access bound libraries that reside in data sets on disk, avoid specifying BLKSIZE when you allocate the library data set. SAS uses the

optimum BLKSIZE, typically half-track blocking, regardless of how the DLLBI LIBNAME option or DLLBI system option has been specified.

- To release the library data set before the end of the SAS session, specify the SAS TAPECLOSE=FREE system option before the SAS DATA step or procedure that writes the members of the library. For tape libraries, this step is necessary to make the tape device and volumes available for other jobs before the end of the SAS session.
- In some cases, it is convenient to create multiple tape libraries on the same tape volume. To avoid having the operating system unmount and re-mount the tape volume for each library data set, allocate the libraries with JCL DD statements that specify UNIT=AFF and VOLUME=(,RETAIN,REF=<ddname>), as the following example shows:

```
//jobname JOB job-accounting-info
//* ------------------------------------------------------------------
//* create multiple sequential libs stacked on single tape volume
//* ------------------------------------------------------------------
//SAS      EXEC SAS
//SASLOG   DD   SYSOUT=*
//SASLIST  DD   SYSOUT=*
//TAPLIB01 DD   DSN=USERA.TAPELIB1,DISP=(NEW,CATLG,DELETE),
//         UNIT=(CART,,DEFER),
//         LABEL=(1,SL),VOLUME=(PRIVATE,RETAIN)
//TAPLIB02 DD   DSN=USERA,TAPLIB2,DISP=(NEW,CATLG,DELETE),
//         UNIT=AFF=TAPLIB01,
//         LABEL=(2,SL),VOLUME=(PRIVATE,RETAIN,REF=*.TAPLIB01)
//TAPLIB03 DD   DSN=USERA.TAPLIB,DISP=(NEW,CATLG,DELETE),
//         UNIT=AFF=TAPLIB01,
//         LABEL=(3,SL),VOLUME=(PRIVATE,RATAIN,REF=*.TAPLIB01)
//SYSIN    DD *
  data taplib01.memb01;
  ...
  run;

  data taplib02.memb02;
  ...
  run;

  data taplib03.memb03;
  ...
  run;
/*
//
```

- When attempting to read multiple SAS libraries that reside on the same tape volume, specifying the SAS system option TAPECLOSE=LEAVE can significantly reduce the elapsed time required for the job. TAPECLOSE=LEAVE causes the operating system to leave the tape volume positioned at the end of the library data set when it is closed. Otherwise, the operating system rewinds to the beginning of the library data set and then advances to the next library data set. Those two redundant operations could require significant elapsed time. The following sample job reads the three data libraries that are created by the preceding example.

```
//jobname JOB job-accounting-info
```

```
//*
//SAS      EXEC SAS
//SASLOG   DD   SYSOUT=*
//SASLIST  DD   SYSOUT=*
//TAPLIB01 DD   DSN=USERA.TAPELIB1,DISP=SHR
//TAPLIB02 DD   DSN=USERA.TAPELIB2,DISP=SHR
//TAPLIB03 DD   DSN=USERA.TAPELIB3,DISP=SHR
//SYSIN    DD *
  options tapeclose=leave;
  data _null_;
     set taplib01.memb01;
  run;

  data _null_;
     set taplib02.memb02;
  run;

  data _null_;
     set taplib03.memb03;
  run;

/*
//
```

## Controlling Library Block Size

Because sequential access bound libraries use RECFM=U, the block size value is an upper limit for the maximum size of a block. The value that SAS uses for any given session, for either a new or existing library, is specified by the user from the following hierarchy of sources:

- the block size value specified on allocation, either in the LIBNAME statement or, for external allocation, in the DD statement or TSO ALLOCATE command.
- the block size value specified in the data set label (that is, the value in effect when the library data set was created).
- the block size value specified for tape devices:
  - If DLLBI=YES is in effect for the assignment, the optimum block size for the device is used. DLLBI=YES is in effect if either DLLBI=YES is specified in the LIBNAME statement, or if DLLBI is omitted from the LIBNAME statement and the SAS system option DLLIB is in effect.
  - If DLLBI=NO is in effect, 32760 is used as the library block size.
- the optimum block size specified for disk devices (typically half-track blocking) is used regardless of the DLLBI LIBNAME option or DLLBI system option.

# UFS Libraries

## Overview of UFS Libraries

A UNIX file system (UFS) library is a collection of SAS files of the same engine type that is stored in a single directory of the z/OS UNIX System Services (USS) file system. Each SAS library member resides in a separate UFS file. UFS is a default component of z/OS, and its availability is limited only by the extent to which it has been implemented at a particular installation.

**Note:** In addition to the original UFS implementation, z/OS also provides another UNIX file system known as zFS. zFS, which provides certain performance and manageability benefits, is functionally equivalent to UFS from the perspective of a SAS user. All information about UFS libraries applies equally to SAS files that reside in a zFS file system. Your system administrator, not SAS, controls whether the UFS or zFS implementation is used for a particular file system.

UFS libraries provide many important capabilities that are not available in other types of library implementations:

- SAS data sets (that is, SAS files of member type DATA) in UFS libraries can be processed by versions of SAS running in other operating environments via the SAS cross-environment data access (CEDA) facility. The individual SAS files can be copied (via a utility such as FTP) to other operating environments and can be directly read by the versions for the target operating environment. Conversely, SAS files created in most other operating environments can be copied to a UFS directory and read directly by the z/OS version of SAS via CEDA. This technique can be further extended by using the network file system (NFS) capability of z/OS to either mount directories that exist on remote hosts (NFS client) or to share a UFS directory with other hosts (NFS server).
- UFS directory names can contain mixed case, and they can also be longer than a z/OS data set name. The directory hierarchy provides more flexibility for organizing files.
- Multiple SAS jobs can simultaneously update different members of the same library. This capability provides more flexibility than that of direct access and sequential access bound libraries, which permit only one SAS job to have Update access to a library at a given time.
- Allocating and assigning a UFS library is very straightforward. The LIBNAME statement merely needs to specify the libref, the USS directory path, and perhaps the engine. The various options for reserving space and specifying DCB attributes are not required, nor do they apply to UFS libraries.

For more information about the contents of a library in a UFS directory, see "CONTENTS Procedure Statement: z/OS" on page 527.

## Creating UFS Libraries

Creating a UFS library is as simple as creating a SAS file in a particular library directory, as shown in the following example:

```
libname myproj '/u/user905/MyProject';
data myproj.member1;
   ...
run;
```

If the library directory does not exist, SAS automatically creates the directory if possible. In the previous example, the directory node MyProject would have been created if it did not already exist, provided the SAS session had adequate authority to do so. However, the other directories in the directory path must exist before you attempt to create the library.

## General Usage Notes

- The fully qualified name of a SAS file in a UFS library is:

*<fully-qualified-path>/<member-name>.<SAS-extension>*

  The member name in this construction is formed by converting to lowercase the member name that is specified in the SAS session. The file extension for a SAS file is automatically supplied by SAS and indicates the member type and the engine that was used to create the file. For a list of extensions that are used, see Table 4.2 on page 65. Do not change the file extension of a SAS file because that could cause unpredictable results. The total length of the fully qualified name must not exceed 254 characters. This value is more restrictive than the IBM limits on UFS filenames.

- When SAS creates or updates a member of a UFS library, it places an exclusive lock on the individual file (but not on the library). The lock prevents other jobs, processes, or SAS sessions from reading, writing, or updating that file until SAS finishes using the file, at which time the lock is removed. It is still possible for other SAS sessions to access other SAS files in the library, provided they are unlocked. The write lock is analogous to the SYSDSN enqueue that is issued when a data set is allocated with DISP=OLD.

- When SAS reads an existing member of a UFS library, it places a read (or shared) lock on the individual file. This lock prevents other jobs, processes, or SAS sessions from updating the file, although it is still possible for others to read the file. The read lock is analogous to the SYSDSN enqueue that is issued when a data set is allocated with DISP=SHR.

- If another SAS session or UNIX process has a lock on a UFS file, then a message in the SAS log contains the Process ID (PID) number associated with the session or process in decimal format. You can issue the following command to find the user's ID:

  ```
  ps -f -s <PID>
  ```

- In performance testing at SAS, native UFS libraries have demonstrated I/O throughput rates that, for a variety of access patterns, generally match or exceed the rates demonstrated for direct access bound libraries.
- Although it is possible to externally allocate a UFS library via JCL or the TSO ALLOCATE command, doing so does not lock or reserve the library in any way. The main benefit of external allocation is to provide a convenient way to specify a different library for a particular job.
- When using NFS client capability to access SAS files in other operating environments, specify the **`xlat(n)`** option for the NFS mount point on z/OS. Similar options might need to be specified in other operating environments when you are accessing SAS files shared by an NFS server running on z/OS. For information about the **`xlat`** option, see the IBM documentation for the z/OS Network File System (NFS).
- If a user wants to run a SHARE server with a UMASK of 077, and the user wants to allow clients of that server to be able to access the library members that they replace through the server, then the user might need to define the RACF profile for the CHOWN.UNRESTRICTED resource. Otherwise, the group ID (GID) of the replaced files is set according to the normal rules. That is, they are set to either the GID of the server account or to the GID of the library directory (if the SET-GROUP-ID flag is set for the directory and a FILE.GROUPOWNER.SETGID profile is defined). These normal rules might cause the GID for the replacement file to differ from the GID of the original file. To prevent this difference in the GIDs from occurring, define CHOWN.UNRESTRICTED to allow SAS to set the GID of the new file to match that of the original copy.

***Table 4.2*** *File Extensions for SAS Files in UFS Libraries*

| Random Access Files | Sequential Access Files | SAS Member Type | Description |
|---|---|---|---|
| .sas7bdat | .sas7sdat | DATA | SAS data file |
| .sas7bndx | .sas7sndx | INDEX | data file index; not treated by SAS software as a separate file |
| .sas7bcat | .sas7scat | CATALOG | SAS catalog |
| .sas7bpgm | .sas7spgm | PROGRAM | stored program (DATA step) |
| .sas7bvew | .sas7svew | VIEW | SAS data view |
| .sas7bacs | .sas7sacs | ACCESS | access descriptor file |
| .sas7baud | .sas7saud | AUDIT | audit file |
| .sas7bfdb | .sas7sfdb | FDB | consolidation database |
| .sas7bmdb | .sas7smdb | MDDB | multidimensional database |

| Random Access Files | Sequential Access Files | SAS Member Type | Description |
|---|---|---|---|
| .sas7bods | .sas7sods | SASODS | output delivery system file |
| .sas7bdmd | .sas7sdmd | DMDB | data mining database |
| .sas7bitm | .sas7ssitm | ITEMSTOR | item store file |
| .sas7butl | .sas7sutl | UTILITY | utility file |
| .sas7bput | .sas7sput | PUTILITY | permanent utility file |
| .sas7bbak | .sas7sbak | BACKUP | backup file |
| .spds9 | .saspds9 | multiple | used by the SPD Engine and the SPD Engine server |

# Hiperspace Libraries

## Overview of Hiperspace Libraries

A hiperspace library is a temporary library in which each library block resides in a 4K block in a z/OS hiperspace, a form of electronic storage internal to the processor. Hiperspace libraries have the same internal format as that of a direct access bound library, but a hiperspace library has no associated data set or file in which it resides.

Placing small to moderately sized SAS data sets in a hiperspace can dramatically decrease the elapsed time required for SAS to process such data sets. The performance increase is usually at least as great as for direct access bound libraries allocated to VIO and can be even greater for data sets that are accessed randomly. However, the actual performance benefit depends on various factors, including the aggregate system demand for central storage frames.

Hiperspace libraries are created when they are assigned. A hiperspace library exists until the libref with which it was originally assigned is freed, which happens automatically at the end of the SAS session or when the libref is re-assigned.

## Creating Hiperspace Libraries

These sample statements demonstrate how to create a hiperspace library by specifying the HIPERSPACE option of the LIBNAME statement:

```
libname hiperlib ' ' hiperspace;
data hiperlib.memb01;
   ...
run;
```

SAS generates a simulated physical name for the hiperspace library to use in messages. This information is also displayed when you issue the CONTENTS procedure, or you issue a LIBNAME statement with a LIST argument.

**Note:** The simulated name cannot be used in any context to assign the library.

When the HSWORK system option is specified, and you issue a `libname work list` statement, the statement returns the following note in the SAS log.

***Output 4.1*** *Output from the LIBNAME WORK LIST Statement*

```
      LIBNAME WORK LIST;

NOTE: Libref=   WORK
      Scope=    CONFIG
      Engine=   V9
      Access=   TEMP
      Physical Name= In-Memory Library Number 0000000001
      Disposition= (temporary)
      Device= (hiperspace)
      Blocksize= 4096
      Total Library Blocks= 1500
      Total Used Blocks= 24
      Percent Used Blocks= 1.5%
      Total Free Blocks= 1476
      Highest Used Block= 32
      Highest Formatted Block= 24
      Members= 3
      Data Representation= MVS_32
```

See the following system options for information about controlling how SAS processes hiperspace libraries:

- “HSLXTNTS= System Option: z/OS” on page 779
- “HSMAXPGS= System Option: z/OS” on page 780
- “HSMAXSPC= System Option: z/OS” on page 781
- “HSWORK System Option: z/OS” on page 782

## General Usage Notes

- The syntax of the LIBNAME statement requires the specification of some library physical name in quotation marks or double quotation marks, but the library physical name is disregarded for hiperspace libraries. Therefore, to avoid confusion, specify a null or blank string for the library physical name.
- SAS generates a simulated physical name for the hiperspace library for use in messages and the information that is displayed by LIBNAME LIST and PROC CONTENTS, but that name cannot be used in any context to assign the library.
- The number of hiperspace pages used for hiperspace libraries is governed by the HSLXTNTS, HSMAXPGS, and HSMAXSPC SAS system options. When a hiperspace library is created, a hiperspace with HSLXTNTS pages is created. When the library needs to be extended, another hiperspace is established with that same number of pages. This process can continue until a total hiperspace in use by SAS in the current session for all hiperspace libraries exceeds HSMAXSPC, or the total number of hiperspace pages in use by SAS the current session for all hiperspace libraries exceeds HSMAXPGS.

# Pipe Libraries

## Overview of Pipe Libraries

The IBM product BatchPipes on z/OS provides a way to reduce the elapsed time for processes in which one job creates a data set that is read by a second job in the process. Piping can also be done with SAS/CONNECT. For example code, see the last example in "Sample JCL" on page 70. SAS supports the use of BatchPipes with SAS data sets that were created with the TAPE and V6TAPE engines. With BatchPipes, each page of a SAS data set written to a pipe can be read immediately by a second SAS session. Because the second session does not have to wait for the entire data set to be written, the two SAS sessions can run largely in parallel, subject to available system resources. The resulting increase in throughput can be particularly important for sequences of batch jobs that must complete within a certain time frame.

In order to use BatchPipes on z/OS, verify that the BatchPipes product is installed and that at least one instance of the BatchPipes subsystem is started. Second, consult the IBM documentation, particularly the IBM *BatchPipes z/OS Users Guide and Reference*, for general background on how to use the product.

Using SAS with BatchPipes requires two jobs, one that writes a SAS data set into the pipe and a second that reads the data set from the pipe. Both sending to, and receiving from, a pipe are inherently sequential operations, so only the V9TAPE engine or the V6TAPE engine can be used. SAS generally treats the pipe as a

special type of sequential access bound library. Additional exceptions and restrictions are noted in the following text.

You can also use the MP CONNECT facility of SAS/CONNECT to pipe data to a second SAS session. For more information, see "MP CONNECT" in *SAS/CONNECT User's Guide*. For example code, see the last example in "Sample JCL" on page 70.

## General Usage Notes

- The pipe library must be allocated externally to SAS either for output (meaning that SAS is sending member contents to another job) or for input (meaning that SAS is receiving member contents from another job). It is not possible to dynamically allocate a pipe library (via the LIBNAME statement), so it is not possible during a SAS session to change the manner (that is, sending or receiving) in which the pipe library is being used. For information about how to allocate pipe libraries, see "Allocating a SAS Library to a Pipe" on page 70.
- Only one member can be written to a pipe library by a single DATA step or SAS procedure. Likewise, one pipe library member can be read by a single DATA step or SAS procedure. It is possible, however, to transfer multiple members between jobs by pairing each sending step or procedure in one job with a receiving step or procedure in a second job. A single member is transferred by each pair with this process.
- Only output SAS operations can be attempted on the sending side of a pipe, which is consistent with the nature of pipes. Therefore, the job that has allocated a pipe library format should not attempt to use PROC CONTENTS to list the library directory. Likewise, only input SAS operations should be attempted on the receiving side of a pipe library. Moreover, since the pages in the pipe are transient (that is, they exist only until they are read by the receiving job), it is not possible to re-read a previously read member or to list the directory after the library has already been read.
- SAS does not support a mode of operation in which there are multiple readers or multiple writers for a pipe library. For example, using two different jobs to simultaneously write to a pipe that is being read by another SAS job would lead to errors, incorrect results, or both.
- It is important to monitor and verify that pipe-related jobs are running as expected. Under normal circumstances, the receiving SAS DATA step or procedure reads all of the member pages sent by the sending SAS DATA step or procedure. After sending the last member page, the sending step or procedure closes the pipe library, The receiving step or procedure then receives an end-of-file indication after reading the last member page. However, if the receiving step or procedure encounters an error condition (such as out-of-space on a library or external file to which it is copying the member data), then the receiving step or procedure closes the pipe library before it has read all of the member pages that the sending step or procedure has sent (or will send). To avoid the sending job suspending indefinitely in this case, specify the option ERC=DUMMY on the SUBSYS parameter of the DD statement for the sending job. If the receiving step or procedure closes the pipe library prematurely, the ERC=DUMMY option

causes the sending step or procedure to continue processing. In this case, the member pages are discarded instead of being sent to the receiving job.

- If you receive a message that the PIPE command was stopped, contact your systems administrator. You might need to update your profile. For information about determining the minimum requirements that are needed to use the pipe engine, see the *Configuration Guide for SAS Foundation for z/OS*.

## Allocating a SAS Library to a Pipe

- Externally assign the pipe library using a JCL DD statement. In this DD statement, use the SUBSYS parameter to specify the name of the BatchPipes subsystem that manages the pipe. Within the SAS job, refer to this pipe library using the ddname specified as the libref. Specify the DSN parameter in the DD statement using a data set name that conforms to the standards for your installation.
- Distinguish between the sending and receiving sides of the pipe library using the LABEL parameter of the DD statement. In the DD statement for the pipe library, specify **`LABEL=(,,,OUT)`** to indicate that SAS sends SAS data sets to the pipe library. Specify **`LABEL=(,,,IN)`** to indicate that SAS reads SAS data sets from the pipe library.
- The DCB attributes for a pipe library vary from the DCB attributes used for other sequential access bound libraries. Specify **`DSORG=PS, RECFM=F`** for both the sending and receiving sides of the pipe library. Specify an LRECL between 1024 and 32760 for the pipe library. The values specified for LRECL in the sending and receiving sides of the pipe library must match exactly.
- Identify, if necessary, the engine to be used for processing the pipe library. By default, SAS uses the value of the SEQENGINE option to determine the engine to use for processing the pipe library. If this value is appropriate and set identically for both the sending and receiving jobs, it is not necessary to identify the engine. To use another engine, specify a LIBNAME statement with the libref and engine and no other parameters.
- No other DD statement parameters other than those described in this section should be specified unless they are described in the IBM documentation.

## Sample JCL

The following code example illustrates how to write a SAS library to a pipe:

```
//jobname JOB
    // EXEC SAS
    //*-------------------------------------------------
    //* This job writes a SAS data set to a pipe.
    //*-------------------------------------------------
    //PIPESND DD DSN=TEST.SAS.BATCHPIPES,
    // LRECL=6144,RECFM=F,DSORG=PS,
    // SUBSYS=(BP01,CLOSESYNC,ERC=DUMMY),
```

```
    // LABEL=(,,,OUT)
    //*
    //SYSIN DD *
      data pipesnd.member1;
         ...
         output;
      run;
    /*
    //
```

The following code example illustrates how to read a SAS library from a pipe:

```
//jobname JOB
    // EXEC SAS
    //*-----------------------------------------
    //* This job reads a SAS data set from a pipe.
    //*-----------------------------------------
    //PIPERCV DD DSN=TEST.SAS.BATCHPIPES,
    // LRECL=6144,RECFM=F,DSORG=PS,
    // SUBSYS=(BP01,CLOSESYNC,EOFREQUIRED=NO),
    // LABEL=(,,,IN)
    //*
    //SYSIN DD *
      data ...;
         set pipercv.member1;
         ...
      run;
    /*
    //
```

The following code examples demonstrate how to use multiple SAS DATA step or procedure pairs in a single pair of jobs. Note that only one member can be written to a pipe library in a SAS step, and that there is a one-to-one correspondence of steps and procedures between receiving and sending pipe jobs.

Sending job:

```
DATA PIPEOUT.MEMBER1; X=1; RUN;

DATA PIPEOUT.MEMBER2; Y=2; RUN;
```

Receiving job:

```
/* receives MEMBER1 from sending job */
DATA X; SET PIPEIN.MEMBER1; RUN;

/* will copy MEMBER2 to WORK library: */
PROC COPY IN=PIPEIN OUT=WORK; RUN;
```

The following code example demonstrates how to use the piping facility of SAS/CONNECT MP Connect to pipe data to a second SAS session:

```
signon TASK1;
signon TASK2;

RSUBMIT task1 cwait=no;
libname pipe1 sasesock ":9003" timeout=200;
data PIPE1._symbol ;
  do i=1 to 10000000;
    r=ranuni(3003);
```

```
   output;
  end;
run;
ENDRSUBMIT;

RSUBMIT task2 cwait=no;
libname pipe1 sasesock ":9003" timeout=200;
proc univariate data=pipe1._symbol;;
run;
ENDRSUBMIT;

waitfor _all_ task1 task2;

rget task1 ;
rget task2;
signoff task1;
signoff task2;
```

# Assigning SAS Libraries

## Overview of Assigning SAS Libraries

To use a particular SAS library within a SAS program, the library must be identified to SAS. This process, termed assigning a library, has the following aspects:

- specifying a logical name, or libref, by which such items as SAS statements and procedures can refer to the library.
- determining which engine is used to process the library. In some cases, you must specify the engine when you assign the library. In most cases, however, SAS can select the appropriate engine automatically.
- identifying and reserving the z/OS resources required to process the library, which is described in detail in "Allocating the Library Data Set" on page 73.
- specifying options that govern SAS processing for the library during the lifetime that it is assigned under this libref. These options can be specified in the LIBNAME statement or LIBNAME function. For information about LIBNAME statement options that are common to all SAS host platforms, see *SAS DATA Step Statements: Reference*. For information about the LIBNAME statement options that are specific to z/OS, see "LIBNAME Statement: z/OS" on page 656.

Under z/OS, you can assign a new or existing SAS library in the following ways:

internally (within a SAS session)
: using a LIBNAME statement, LIBNAME function, SAS Explorer New Library Assignment dialog box, or a reference that is explicitly assigned to members using quoted name syntax. For more information, see "Accessing SAS Data Sets

without a Libref Using Quoted References" on page 76 and "Assigning SAS Libraries Internally" on page 74.

externally
using a JCL DD statement or a TSO ALLOCATE command. For more information, see "Assigning SAS Libraries Externally" on page 77.

In addition to describing how to assign a SAS library internally and externally, this section also discusses the following topics:

- "How SAS Assigns an Engine" on page 81
- "Assigning Multiple Librefs to a Single SAS Library" on page 82
- "Listing Your Current Librefs" on page 82
- "Deassigning SAS Libraries" on page 83
- "Allocating Disk Space for SAS Libraries" on page 84
- "Allocating a Multivolume Generation Data Group" on page 88

# Allocating the Library Data Set

Assigning a direct or sequential access bound library involves allocating the z/OS data set in which the library resides. This z/OS process includes the following actions:

- Identifying a logical name (ddname) by which the data set is accessed by the operating system.
- Creating the data set and reserving an initial allocation of disk space if it is a new data set on disk.
- Identifying, either directly or indirectly, the volumes on which the data set resides for a new or existing data set.
- Establishing a disposition status (also known as a data set enqueue) to prevent other jobs or users on the z/OS system from accessing the data set in a manner inconsistent with your SAS job.
  - Specifying a disposition status of OLD, NEW, or MOD requests exclusive access to the library data set. The allocation does not succeed unless no other jobs or users have the library allocated, and z/OS prevents any other jobs or users from allocating the library until you deallocate the library. In order to update any member of a library, you must request exclusive access to the library data set.
  - Specifying a disposition status of SHR requests shared access to the library. The allocation succeeds if no other job or users have allocated the library for exclusive access, and z/OS prevents other jobs or users from allocating the library for exclusive access until you deallocate the library. However, other SHR allocations can exist concurrent with yours.

You can allocate the z/OS data set externally to SAS using z/OS facilities such as JCL or the TSO ALLOCATE command. In most cases, SAS uses the external allocation to process the library. SAS always uses the external allocation if the

ddname of the allocation is specified as the libref. However, if SAS does not find an external allocation of the library data set, it dynamically allocates the library data set when assigning a library internally. When this dynamic allocation is necessary, SAS allocates a library with a disposition status of OLD, unless a different status has been specified. The ddname used for this allocation is the same as the libref unless the libref is not a valid ddname or is a ddname that matches another libref that is already allocated. In those cases, SAS must let the operating system generate a unique ddname, which would be in the format **SYSnnnnn**.

After SAS has allocated a library data set, it uses that allocation to process the library, regardless of how many librefs are assigned to the library and provided that the same disposition status is specified (or implied) on all the assignments. For more information, see "Assigning Multiple Librefs to a Single SAS Library" on page 82. However, if a library is assigned with a disposition status of SHR and later, an additional assignment is made with a status of OLD, SAS attempts to dynamically allocate the library data set a second time using a disposition status of OLD and a system-generated ddname. If successful, this second allocation is used for all subsequent processing of the library until all librefs associated with the library have been deassigned. Note that in this case SAS does not (and cannot) release exclusive access to the library even when you release the assignment that specified a status of OLD.

# Assigning SAS Libraries Internally

## Overview of Assigning SAS Libraries Internally

SAS provides two methods for assigning SAS libraries internally, that is, via SAS statements without relying on operating environment facilities such as JCL:

- The LIBNAME statement or LIBNAME function can be used to assign a SAS library.

  In the following example, the library USER934.MYLIB.SASLIB has been assigned to the libref MYLIB. The z/OS allocation parameter DISP=SHR requests shared access to the library data set. Since no engine was specified, SAS examines the format of the library data set to determine which engine to use.

  ```
  libname mylib 'user934.mylib.saslib' disp=shr;
  ```

  In the following DATA step, the libref MYLIB is used to refer to the library. MYLIB can be used for the remainder of the SAS session until it is cleared by a LIBNAME CLEAR statement.

  ```
  data mylib.member1;
  ...
  run;
  ```

  Except for a few special cases, the LIBNAME statement or function can perform all of the assignment functions that are required for SAS libraries. The LIBNAME statement or function supports the options that are necessary to create a new direct or sequential access bound library, and it also provides a way to specify

the engine that is used to create the library. For more information and examples, see "LIBNAME Statement: z/OS" on page 656 and "LIBNAME Function" in *SAS Functions and CALL Routines: Reference* in the *SAS Functions and CALL Routines: Reference*.

In most cases, the engine does not need to be specified when assigning existing SAS libraries. SAS also uses a default engine if no engine was specified for a new library. For a description of how SAS determines which engine to use when no engine has been specified, see "How SAS Assigns an Engine" on page 81.

- In certain contexts in which the name of a SAS file is specified in *libref.member* syntax, it is possible to directly specify the full library name and member name, as shown in the following example:

```
data 'user934.mylib.saslib(member1)';
...
run;
```

The previous statement has the same effect in most cases as the previous LIBNAME statement example. This syntax can be used only if neither the engine name nor LIBNAME options are required to assign the library. For more information, see "Accessing SAS Data Sets without a Libref Using Quoted References" on page 76.

## Advantages of Allocating SAS Libraries Internally

Although you can use a JCL DD statement or a TSO ALLOCATE command to allocate SAS libraries externally, the LIBNAME statement or LIBNAME function can do much more. Here are several reasons why it is better to allocate SAS libraries internally with the LIBNAME statement or function.

- If you use the LIBNAME statement or function, you can allocate your library for only as long as you need it, and then deassign and deallocate it. By contrast, ddnames that are allocated externally remain allocated for the duration of the SAS session or job. The LIBNAME CLEAR statement deassigns an externally allocated libref, but it does not deallocate the file unless FREE=CLOSE is specified on the external allocation and the library is a direct access bound library. Similarly, by conditionally executing a LIBNAME statement or function within macro statements, you can allocate a library data set only if it is required for execution of your particular job.
- The LIBNAME statement or function provides an easy way to do dynamic allocation in the batch environment. SAS programs that have LIBNAME statements or functions instead of external allocations can be executed either in the TSO environment or in the batch environment without requiring additional supporting allocation statements in JCL or TSO CLISTs.
- The JCL DD statement and the TSO ALLOCATE command are not portable to operating environments other than to another z/OS environment. The LIBNAME statement or function is portable with minor changes to the *physical-filename* and options parameters.

- ddnames that are allocated externally cannot be reassigned later by a LIBNAME statement or a LIBNAME function. You would receive an error message in the SAS log stating that the ddname is currently assigned.
- Using a LIBNAME statement or a LIBNAME function enables you to specify an engine. Also, the following SAS engines must be specified in a LIBNAME statement or function because they are not assigned by default: XPORT, BMDP, SPSS, and OSIRIS.
- ddnames that are allocated externally are not included in the list that is produced by the LIBNAME LIST statement nor in the SAS Explorer window until after they have been used as librefs in your SAS session. For more information, see "Listing Your Current Librefs" on page 82.

## Accessing SAS Data Sets without a Libref Using Quoted References

As an alternative to the *libref.member* syntax, it is possible to refer to some SAS files directly by merely specifying the library and member name. This alternative is supported even in cases in which the library has not yet been assigned (such as via external allocation or a LIBNAME statement). SAS automatically assigns the library, if necessary, when the first reference to the library is made. The engine is determined by default according to the rules described in "How SAS Assigns an Engine" on page 81.

**Note:** This method of identifying SAS files should be used only for SAS files that are residing in libraries that can be allocated internally via a LIBNAME statement or function and for which no LIBNAME options need to be specified. SAS determines which engine to use by following the rules described in Chapter 10, "SAS Processing Restrictions for Servers in a Locked-Down State," on page 219. However, for SAS files in UFS libraries, it is possible also to specify the file extension and thus control which engine should be used. This technique is described in the following text. When a SAS server is in a locked-down state, SAS data sets or views cannot be accessed unless they reside in a library directory named in the lockdown list that is maintained by the server administrator. For more information, see Chapter 10, "SAS Processing Restrictions for Servers in a Locked-Down State," on page 219.

## Members of Direct Access and Sequential Access Bound Libraries

Members of existing direct access bound libraries and sequential access bound libraries can be identified without a libref using the following syntax:

'*<z/OS-data-set-name>*(*member*)'

For example:

```
data 'user489.test.saslib(member1)'; x=1; run;
proc print data='user489.test.saslib(member1)'; run;
```

If the value of the SYSPREF= system option was USER489, the following equivalent syntax could have been used:

```
data '.test.saslib(member1)'; x=1; run;
proc print data='.test.saslib(member1)'; run;
```

Although the syntax is similar to the notation used for partitioned data set (PDS) members, a SAS library is not a PDS. Only SAS files can be accessed in this manner.

## Members of UFS Libraries

Members of new or existing UFS libraries can be identified without a libref using the following syntax:

*'<directory-path>'/member*

If the library directory (that is, the lowest level directory in the specified path) does not exist, SAS creates it automatically, if possible.

The directory path can be fully qualified, as in the following example:

```
data '/u/user905/MyProject/Member1'; x=51; run;
proc print data='/u/user905/MyProject/Member1'; run;
```

A partially qualified directory path can also be specified, in which the path specified is relative to the current working directory. For example, if the current working directory is **/u/user905**, the following example would be equivalent to the previous example:

```
data 'MyProject/Member1'; x=51; run;
proc print data='MyProject/Member1'; run;
```

It is not necessary to specify the SAS file extension to a member if the member type is implied by the context, and if the default engine is the desired engine. However, if you wanted to access TAPE engine files that exist in the same directory as BASE engine files, you would need to specify the extension as shown here:

```
proc print data='NewProject/member1.sas7sdat'; run;
```

# Assigning SAS Libraries Externally

## Overview of Assigning SAS Libraries Externally

SAS libraries can be assigned externally by first allocating a ddname to the library via JCL or a TSO command. Assignment of the library is then completed by specifying the ddname as a libref within SAS. At that point, SAS selects an engine for the library according to the rules detailed in the section "How SAS Assigns an Engine" on page 81. However, if the reference to the libref is in a LIBNAME

statement that explicitly specifies which engine should be used, SAS uses the rules described in "Specifying an Engine for Externally Allocated SAS Libraries" on page 81.

Despite the advantages of assigning SAS libraries internally, assigning SAS libraries externally also has advantages, which might be important in some cases.

- You might not want to allow a SAS job running in batch to start until the libraries that it needs to access are available. If you allocate the libraries using DD statements in JCL, the z/OS job scheduler automatically ensures that the libraries are accessible:
  - by granting the job exclusive access to the library if DISP=OLD is specified
  - by granting the job shared access to the library if DISP=SHR is specified.
- The syntax of the JCL DD statement and the TSO ALLOCATE command is more comprehensive than that of the LIBNAME statement. For example, in order to specify a list of more than 30 volumes, it is necessary to use external allocation.
- If a particular SAS program uses an externally assigned SAS library, it is possible to change the library that the program acts upon merely by changing the JCL or TSO CLIST that invokes SAS, as opposed to changing the program. This capability might prove to be convenient in some circumstances.

**Note:**

- Because direct bound libraries are not partitioned data sets (PDS or PDSE), they cannot be concatenated via external allocation. An attempt to concatenate library data sets in this way is ignored with a warning, and only the first library in the concatenation is recognized. However, sequential access bound libraries can be concatenated if they are allocated with DISP=SHR.
- SAS does not attempt to deallocate a library data set that was allocated externally to SAS. Therefore, externally assigned bound libraries remain allocated until the end of the job step or until a TSO FREE command is issued. However, if FREE=CLOSE is specified on the external allocation for a direct access bound library, the library is deallocated by the system when the last libref assigned to the library is cleared. This exception does not apply to sequential access bound libraries; they would not be freed at deassign time even if FREE=CLOSE was specified.

  When a SAS server is in a locked-down state, SAS does not complete the assignment for an externally allocated SAS library unless the server administrator has enabled access to the library through the lockdown list. For more information, see Chapter 10, "SAS Processing Restrictions for Servers in a Locked-Down State," on page 219.

## JCL DD Statement Examples

- Allocating an existing SAS library

The following JCL DD statement allocates the cataloged data set LIBRARY.CATALOG.DATA and assigns the ddname BOOKS to it:

```
//BOOKS DD DSN=LIBRARY.CATALOG.DATA,
//         DISP=OLD
```

The following JCL DD statement allocates an existing SAS library, which is stored in a UFS directory:

```
//UFSLIB DD PATH='/corp/dev/test1'
```

Note that UNIX System Services recognizes and distinguishes between uppercase and lowercase letters in pathnames. Also, in contrast to bound libraries, allocating UFS libraries merely provides a convenient way to establish an external logical name (ddname) for a UFS library. It does not place any enqueue that would prevent the library from being accessed by other jobs on the z/OS system.

- Allocating a new SAS library

  This example allocates a new SAS library on tape:

  ```
  //INTAPE DD DSN=USERID.V9.SEQDATA,
  //  UNIT=TAPE,LABEL=(1,SL),

  //  DCB=(RECFM=U,BLKSIZE=32760),

  //  DISP=(NEW,KEEP),VOL=SER=XXXXXX
  ```

  Notice that DCB attributes are specified. When you allocate a new SAS library externally, you must either specify DCB attributes or accept the default DCB attributes that SAS supplies.

- Specifying additional options for a previously allocated SAS library

  For more information, see “Specifying an Engine for Externally Allocated SAS Libraries” on page 81.

## Using Environment Variables to Externally Assign a SAS Library

You can use an environment variable that was defined with the SET system option to externally assign a libref to a SAS library. For example, if you specify the following SAS option

```
SET='MYLIB ("USERID.MYLIB.SASLIB")'
```

then the following SAS statement

```
libname mylib list;
```

assigns the libref MYLIB to the SAS library USERID.MYLIB.SASLIB. Libraries that are assigned in this way are allocated as DISP=OLD unless they are already internally assigned DISP=SHR or externally allocated.

## TSO ALLOCATE Command Examples

- Allocating an existing SAS library

  The following TSO ALLOCATE command allocates the cataloged data set LIBRARY.CATALOG.DATA and assigns the ddname BOOKS to it:

  ```
  alloc dd(books) da('lib.cat.data') old
  ```

  The following command performs the same allocation, this time using the SAS X statement to submit the TSO ALLOC command.

  ```
  x alloc dd(books) da('lib.cat.data') old;
  ```

  For more information, see "X Statement: z/OS" on page 681.

  The following command allocates a directory as a SAS library with the ddname RESULT2:

  ```
  x alloc dd(result2) path('/corp/dev/test2');
  ```

  Note that allocating UFS libraries in this way provides a convenient way to establish an external logical name (ddname) for a UFS library. No enqueue is placed on the library.

- Allocating a new SAS library

  The following TSO command allocates a new sequential SAS library on disk:

  ```
  alloc fi(intape) da(V9.seqdata) dsorg(ps) recfm(u) new
  ```

  Notice that DCB attributes are specified. When you allocate a new SAS library externally, you must either specify DCB attributes or accept the default DCB attributes that SAS supplies.

- Specifying additional options for a previously allocated SAS library

  For more information, see "Specifying an Engine for Externally Allocated SAS Libraries" on page 81.

## Using a Ddname as a Libref

Even though a library has been allocated to a ddname externally to SAS, the assignment process is not complete until the library has been referred to within a SAS program or feature that specifies the ddname as a libref. At that point SAS completes the assignment process and adds the ddname to its table of active librefs. For example:

```
proc contents data=books._all_; run;
```

The first time the ddname *BOOKS* is used in this manner, SAS assigns it as a libref for the SAS library.

When a ddname is allocated externally, it is not listed by the LIBNAME LIST statement or in the SAS Explorer until after you have used it as a libref in your SAS session. For more information, see "Listing Your Current Librefs" on page 82.

## Specifying an Engine for Externally Allocated SAS Libraries

In most cases, SAS can identify the proper engine to use for existing libraries. However, when creating new libraries that were allocated externally, you might need to use the LIBNAME statement or LIBNAME function to override the engine that SAS would use by default. For example, suppose you used an X statement to submit the following TSO ALLOCATE command, which allocates the SAS library QUARTER1.MAILING.LIST:

```
x alloc f(mail) da('quarter1.mailing.list') new
   dsorg(ps) space(10 1) cyl;
```

You could instruct SAS to use the V9TAPE engine for this new library with the following statement:

```
libname mail tape;
```

This LIBNAME statement does not need to specify the name of library data set or any other options, because that information was supplied on the external allocation referenced by the ddname *mail*.

# How SAS Assigns an Engine

In some cases, you might choose not to specify an engine name in the LIBNAME statement or LIBNAME function, or you might choose not to issue a LIBNAME statement or function for a library that was allocated externally. The following information describes how SAS determines which engine to use when you do not specify one. The engine that SAS selects depends on which type of library you are accessing. For more information about libraries, see "Library Implementation Types for Base and Sequential Engines" on page 51.

If the library that you specify corresponds to a new or empty z/OS data set, SAS assigns the default engine specified by the ENGINE= system option unless a sequential engine must be used. Sequential engines are used for the following situations:

- The library data set is on a tape device, or it is a subsystem data set managed by BatchPipes.
- The DCB characteristics DSORG=PS and RECFM=U are specified for the data set.

If a sequential engine is used, SAS assigns the engine specified by the SEQENGINE= system option. For empty UFS libraries, SAS assigns the engine specified by the ENGINE= system option.

If the library data set has already been initialized, or, for UFS, if the library directory already contains members, SAS generally assigns the engine that has been used to process the library in the past. The following list contains details about how SAS assigns engines for the different types of libraries:

direct access bound library
: SAS automatically assigns the V5 engine if the library data set has the DCB characteristic DSORG=DA. Otherwise, SAS reads the library header and assigns the engine that was originally used to initialize the library.

sequential access bound library
: SAS reads the first member header record and assigns the engine that was used to write the first member of the library.

UFS library
: SAS examines the extension of each SAS file in the library directory, because the extension indicates the engine with which the library member was created. If all of the SAS files in the directory were created with the same engine, that engine is assigned to the library. If the SAS files were created using a mix of different engines, SAS assigns the engine specified by the ENGINE= system option.

hiperspace library
: SAS automatically assigns the V9 engine when assigning hiperspace libraries.

**Note:** Identifying the engine with the LIBNAME statement or function saves system resources.

# Assigning Multiple Librefs to a Single SAS Library

You can assign more than one libref to the same SAS library.

For example, suppose that in two different programs, you used different librefs for the same libraries. Later you develop a new program from parts of the two old programs, or you include two different programs with the %INCLUDE statement. In the new program, you could simply assign the two original librefs to each library and proceed.

Any assigned libref can be used to access the library with the following exception: if ACCESS=READONLY was specified or implied (by DISP=SHR) for one assignment, then that libref can be used only to read the library, even though Update access is available to the library through another libref.

# Listing Your Current Librefs

You can use either the LIBNAME command or a form of the LIBNAME statement to list your currently assigned librefs.

- When you issue the LIBNAME command, the SAS Explorer window is displayed. The SAS Explorer window lists all of the librefs that are currently assigned for your session.

  The SAS Explorer window displays the full z/OS data set name of the SAS library, and displays the engine that is used to access the library.

- The following form of the LIBNAME statement writes to the SAS log the attributes of all the librefs that are currently assigned for your session:

**LIBNAME** _ALL_ LIST;

# Deassigning SAS Libraries

Once a libref has been assigned to a library, it remains assigned until it is cleared by using the LIBNAME libref CLEAR statement. As noted in "Assigning Multiple Librefs to a Single SAS Library" on page 82, more than one libref can be assigned to a given library. A library remains assigned to SAS as long as at least one libref is currently assigned to the library. However, when the last libref assigned to a library is cleared, SAS releases the resources used to process this library. For bound libraries, the following actions are taken:

- The library data set is physically closed (if it is not already closed). If FREE=CLOSE was specified on the external allocation for a direct access bound library, the system automatically deallocates the library data set at this point. However, FREE=CLOSE is not honored for a sequential access bound library.
- If SAS allocated the library data set (as opposed to using an allocation that had been established externally to SAS), SAS releases the allocation. However, SAS does not release allocations that were established externally. These allocations are released at the end of the job step or, in the TSO environment, when a TSO FREE command is issued for the allocation. When an allocation is released, the enqueue on the library is released, making the library available for use by other jobs. Normal disposition processing, such as cataloging or deleting the library data (as specified by the DISP parameter), is also performed at deallocation time.

**Note:** All libraries assigned during a SAS session are automatically deassigned at the end of the session.

The method that you use to deallocate a SAS library depends on how the library was allocated.

- To deassign and deallocate a SAS library that was allocated with a LIBNAME statement or LIBNAME function, issue a LIBNAME statement or function in one of the following forms, using the libref for the library that you want to deallocate:

  LIBNAME statement: LIBNAME *libref* <CLEAR>;

  LIBNAME function: LIBNAME (*libref*, ' ');

This statement deassigns the libref. All libraries assigned during a SAS session are automatically deassigned at the end of the session.

- To deassign and deallocate a library that was allocated with a TSO command, first issue a LIBNAME statement or LIBNAME function to deassign the libref. Then issue a TSO FREE command to deallocate the data set.

  For example, suppose that a SAS library with the libref MYLIB is stored in the z/OS data set MYID.RECENT.DATA. The following two statements would clear the libref and deallocate the library data set:

  ```
  libname mylib clear;
  x free da('myid.recent.data');
  ```

  **CAUTION**
  **Do not attempt to release the allocation for a library data set without first deassigning the libref.**

- You can deassign a SAS library in the SAS Explorer window by selecting the **DELETE** menu.

# Allocating Disk Space for SAS Libraries

## Overview of Allocating Disk Space for SAS Libraries

SAS direct access bound libraries and SAS sequential access bound libraries reside in a z/OS data set. When creating a new bound library, you must specify various parameters that control the amount and type of disk space to be allocated to the new z/OS data set in which the library is to reside. When using an existing bound library, you can specify parameters that control the increments of space (secondary allocations) to be added if the data library needs to be enlarged. This section provides recommendations and examples for allocating disk space for SAS libraries in z/OS data sets. It gives particular attention to the z/OS features that support large data libraries (such as those with a size exceeding 1 terabyte).

This section does not pertain to UNIX file system libraries. Members of UFS libraries reside in files, and UNIX file systems automatically manage space for the individual files that they contain. Allocation of the disk space for UNIX file systems is the responsibility of the system programmer, not the individual z/OS user.

## z/OS Disk Space Allocation

This topic provides a brief summary of the main concepts, terms, and rules involved in allocation of disk space for SAS libraries on disk. This summary is not intended to address all points of this broad subject. For more information, see the following

IBM publications and documentation for any third-party DASD space management software that is installed on z/OS at your site:

- *DFSMS Using Data Sets*
- *MVS JCL Reference*
- *MVS JCL User's Guide*

Both direct access and sequential access bound libraries reside in data sets that have the attribute DSORG=PS. On disk, these data sets can be extended to as many as 59 volumes. Each time space is requested for a library data set, the disk space is supplied in extents, which are one or more chunks of contiguous space. A regular format DSORG=PS data set can have up to 16 extents per volume. Extended format DSORG=PS data sets can have as many as 123 extents per volume, but they can be used only for sequential access bound libraries.

SAS library data sets can be allocated externally with JCL or TSO statements. Data sets can also be allocated internally with the SAS LIBNAME statement, which uses the dynamic allocation interface to establish the MVS allocation, if necessary. For more information, see "Assigning SAS Libraries" on page 72.

Regardless of which method you use, when you allocate a new library data set, you must specify the size of the initial (primary) disk space allocation as well as the size of the extent (secondary) that is to be obtained when the library data set needs to be enlarged. Each request to extend the size of the library data set is satisfied by a secondary extent on the current last volume until 16 extents are allocated for the data set on that volume, the volume does not contain enough free space to satisfy the request, or, for DSNTYPE=BASIC data sets, until more than 64K tracks have been used on the last (or only) volume. If the space request cannot be satisfied, the system attempts to find space on the next volume, if any, that is allocated to the library data set. If no additional volumes are allocated to the data set, then the system issues a system B37 abend. SAS intercepts the abend and reports a library full condition. The operation that was adding data to the library also fails with an error.

The z/OS platform provides a number of facilities that increase the amount of disk space that is available for allocating z/OS data sets. SAS supports the use of the following facilities for SAS libraries in z/OS data sets:

DSNTYPE=LARGE
: increases the number of tracks that a data set can occupy on a single disk volume from 65535, which is the limit for the default, DSNTYPE=BASIC, to a theoretical maximum of more than 16 million for z/OS data sets that are created with this attribute.

Extended Address Volumes (EAV)
: can have a size greater than 65520 cylinders, which is the architectural limit for ordinary disk volumes. SAS fully supports the EAV feature. Note that EAV support requires the appropriate release of z/OS and the appropriate level of DASD hardware. For more information, see the IBM documentation about EAV.

Multi-Volume Data Sets
: allow a disk data set to be extended to as many as 59 volumes on z/OS.

## Recommendations for Allocating Libraries Efficiently

The following recommendations contain information that is helpful when you allocate space for a library:

- When you plan disk space allocation for SAS libraries, consult with your systems programmer or DASD systems administrator for your z/OS system. They can provide information that is important when you allocate large SAS libraries.
- Use DSNTYPE=LARGE for all SAS libraries. This feature is available for all supported releases of z/OS, and the feature has no performance cost. Even if a library is smaller than 64K tracks, DSNTYPE=LARGE simplifies management of the library if the library exceeds 64K tracks in the future.
- If EAV volumes are available, then use them for large SAS libraries, particularly for libraries that exceed 64K cylinders. Specify EATTR=OPT so that the library data set can reside in the extended address space (EAS) of the volume. EAS is the area above 65520 cylinders. The EATTR option is supported in the LIBNAME statement.
- If your SAS library exceeds the amount of space that is available on a single disk volume, then SAS provides complete support for multi-volume data libraries. Space for SAS multi-volume libraries does not need to be pre-allocated. SAS can dynamically extend SAS libraries to additional volumes whenever additional space is required in the library for member data. Therefore, unless space management policies at your installation require pre-allocating disk space, SAS recommends allocating only enough space for the initial requirements of the library.

## Examples

The following examples show how to request space for SAS libraries in z/OS data sets.

The following LIBNAME statement allocates a temporary library of up to three volumes:

```
libname tmp '&lib' unit=(sysda,3) space=(cyl,(300,100)) DSNTYPE=LARGE;
```

The following DD statement creates a direct access bound library. The unit count makes three volumes available for the job that creates the library. Note that there must be three available units in the system for this example to work, even if the library does not require space on all three volumes, because the system chooses the candidate volumes at allocation time.

```
//MASTER DD DSN=MY.MASTER.LIBRARY,DISP=(NEW,CATLG,DELETE),
//     UNIT=(DISK,3),SPACE=(CYL,(300,100)),
//     DSNTYPE=LARGE
```

To extend the preceding library to as many as five volumes using another job, you can use the following DD statement. The secondary space allocation specified at library creation time is used to determine the size of the secondary extents added. DSNTYPE=LARGE does not need to be specified because it is a property of the data set that is established when the data set is created.

```
//MASTER DD DSN=MY.MASTER.LIBRARY,DISP=OLD,UNIT=(DISK,5)
```

**Note:** If you want to extend an existing library, but only on the volumes on which it is already cataloged, it is not necessary to specify the UNIT parameter.

You can also use the LIBNAME statement EXTEND option to extend an existing library that is not managed with SMS . Using the EXTEND option is equivalent to specifying `UNIT=(,n)`, where *n* is one more than the current number of volumes in the existing library:

```
libname payroll 'my.master.library' disp=old extend;
```

The following DD statement creates an SMS-managed library, which can extend to as many as four volumes. For SMS-managed libraries that are allocated without a specific list of volumes, the unit count that is specified when creating the library specifies the volume count for the library data set. Note that the volume count can also be specified with the data class instead of the unit count.

```
//TEST1 DD DSN=MY.PROJECT.LIBRARY,DISP=(NEW,CATLG),
//      UNIT=(DISK,4),SPACE=(CYL,(200,200)),
//      STORCLAS=SASSTD,DATACLAS=SASSTD,DCB=(DSORG=PS,RECFM=FS),
//      DSNTYPE=LARGE
```

For SMS-managed data sets, the volume count represents the maximum number of volumes in which the data set can be extended when you create a job, as well as in subsequent jobs. Therefore, this library can be extended to as many as four volumes using the following DD statement:

```
//TEST1 DD DSN=MY.PROJECT.LIBRARY,DISP=OLD
```

The following LIBNAME statement can be used as well:

```
libname project 'my.project.library';
```

Extending an existing SMS-managed library does not require a UNIT count, and using a UNIT count does not have any effect. To increase the volume count for an existing SMS-managed library, use the ADDVOL command of the IDCAMS utility.

**Note:** An SMS storage class with the GUARANTEED SPACE attribute is not required as it is when you are preallocating libraries.

When you create a SAS library on an EAV volume, EATTR=OPT must be specified so that the data set uses the extended address space (EAS) of the volume. Otherwise, the data set can reside only in the first 65520 cylinders of the volume, which negates the benefit of using an EAV. The following example also specifies a particular SMS storage class that is associated with a pool of EAV volumes. A similar technique might be required at your installation.

```
libname largelib 'prod.large.saslib' disp=(new,catlg)
   eattr=opt storclas=eavpool space=(cyl,(1000,1000));
```

# Allocating a Multivolume Generation Data Group

A collection of SAS libraries, including multivolume libraries, can be stored and managed as a z/OS GDG. Before creating any libraries, you must first create the GDG base, as shown in the following example:

```
//         JOB ...
//* ------------------------------------------
//* CREATE GDG BASE FOR SAS LIBRARIES
//* ------------------------------------------
//STEP01 EXEC PGM=IDCAMS
//SYSPRINT DD SYSOUT=*
//SYSIN DD *
   DEFINE GDG +
   ( +
      NAME(PROD.WEEKLY.PERFSTAT) +
      LIMIT(5) +
      SCRATCH +
   )
//* ------------------------------------------
```

When the GDG base exists, libraries that are members of the GDG can be created using JCL, for example:

```
//         JOB ...
//* ------------------------------------------------------------
//* CREATE MULTI-VOLUME SAS LIBRARY WHICH IS MEMBER OF GDG
//* ------------------------------------------------------------
//STEP01   EXEC SAS
//NEWLIB   DD   DSN=PROD.WEEKLY.PERFSTAT(+1),DISP=(NEW,CATLG),
//         UNIT=(DISK,2),SPACE=(CYL,(50,10)),
//         DCB=PROD.WEEKLY.MODEL
//SYSIN DD *
  DATA NEWLIB.MEMB01;
  ...
//* ------------------------------------------------------------
```

Each execution of the job creates an entirely new library that is a member of the GDG named PROD.WEEKLY.PERFSTAT. The DD statement parameter DCB= is required to specify a data set from which the model DCB attributes for the library are copied.

**Note:**

- A LIBNAME statement should not be used to create a new GDG library, but it can be used to refer to an existing GDG member.
- The z/OS GDG facility is somewhat similar to, but is unrelated to, the SAS concept of generation data groups. A z/OS GDG is a group of SAS libraries. A SAS GDG is a group of members within a SAS library. The former group is managed by z/OS. The latter group is managed by SAS.

# 5

# Specifying Physical Files



## Overview of Physical Files

Wherever you specify the name of a physical file internally (for example, in a SAS LIBNAME or FILENAME statement, in a LIBNAME or FILENAME function, in a DATA step, or in a SAS procedure), the name can be in any of these forms:

- a fully qualified data set name such as 'SAS.SAS9.AUTOEXEC'. A PDS member name, such as 'MY.PDS(MEMBER)', might also be specified, although not for a LIBNAME statement or function.
- a partially qualified data set name such as '.CNTL'. SAS inserts the value of the SYSPREF= system option (which by default is the user ID) in front of the period. For more information, see "SYSPREF= System Option: z/OS" on page 873. In the following example, an OPTIONS statement is used to assign a value of USER12.SAS9 to the SYSPREF= system option. When SAS executes the FILENAME statement, it interprets '.RAW.DATAX' as 'USER12.SAS9.RAW.DATAX'.

  ```
  options syspref=user12.sas9;
  filename raw2 '.raw.datax' disp=old;
  ```

- a temporary data set name such as '&MYTEMP'.
- a UFS path. It can be a full path that begins with a slash (/) or a tilde (~), as the following examples indicate:

  ```
  filename fullpath '~/subdir/filename.sas';
  filename relative 'subdir/filename.sas';
  ```

- a concatenated series of names or a wildcard name consisting of multiple UNIX File System (UFS) files or members of a partitioned data set (PDS, PDSE). For more information, see "Concatenating External Files" on page 104. However,

note that the LIBNAME statement and LIBNAME function does not support the wildcard syntax for members of partitioned data sets. It is possible to concatenate SAS libraries. For more information, see "LIBNAME Statement: z/OS" on page 656.

SAS on z/OS does not support specifying physical files that have a member type of AUDIT. Specifying physical filenames such as the following returns an error:

- `filename mylib './saslib/memb01.sas7baud';`

**Note:** Names of physical files should be enclosed in quotation marks.

For information about encodings for z/OS resources such as data set names and UFS paths, see Appendix 3, "Encoding for z/OS Resource Names," on page 939.

# Specifying Physical Files with the INCLUDE Command

Here are examples of the INCLUDE command that illustrate the various ways that you can specify physical files:

INCLUDE MYPGM
MYPGM is a fileref that was previously associated with an external file.

INCLUDE MYPGM(PGM1)
PGM1 is a member of the partitioned data set that is associated with the fileref MYPGM.

INCLUDE 'USERID.TEST.PGMS'
This is an example of a sequential data set name.

INCLUDE 'MVS:USERID.TEST.PGMS'
This is an example of a sequential data set name that uses the designator for the MVS file system.

INCLUDE 'USERID.TEST.PGMS(AAA)'
This is an example of a data set name with a member specified.

INCLUDE '.TEST.MYPGM'
Assuming that the FILESYSTEM= system option is set to MVS, SAS adds a prefix to this data set name that contains the value of the SAS system option SYSPREF=, which defaults to your system prefix. If FILESYSTEM=HFS, SAS looks into your default UNIX System Services directory for the "hidden" file .TEST.MYPGM.

INCLUDE 'HFS:/u/userid/mypgms/mypgm1.c'
This is an example of a path to a UNIX File System (UFS) file in the Hierarchical File System (HFS), represented by a fully qualified path. For more information about HFS and UFS, see "HFS, UFS, and zFS Terminology" on page 8.

INCLUDE 'pgms/mypgms/mypgm1.c'
This is an example of a relative path to a UNIX File System file. Any filename containing a slash (/) is assumed to be in UNIX File System, regardless of the value of the FILESYSTEM= system option. If the pathname does not begin with a slash (/), then SAS searches for the file in the default UFS directory for that user.

# Handling of Nonstandard Member Names

You can use the SAS system option FILEEXT= to specify how extensions in member names of partitioned data sets are to be handled. For more information, see "FILEEXT= System Option: z/OS" on page 746.

# 6

# Assigning External Files

# Introduction to External Files

External files are files whose format is determined by the operating environment rather than by SAS software. External files include raw data files, JCL libraries, files that contain SAS programming statements, load libraries, and UFS files, which are part of UNIX System Services (USS). In batch and noninteractive line modes, the SAS log and procedure output files are also external files.

**Note:** If you are using files in the UFS file system, SAS views the z/OS file system (zFS) and the Hierarchical File System (HFS) as functionally equivalent.

For information about encodings for z/OS resources such as data set names and UFS paths, see Appendix 3, "Encoding for z/OS Resource Names," on page 939.

# Ways of Assigning External Files

## Overview of Assigning External Files

To work with an external file in SAS software, you must first assign the file. File allocation is the process of identifying an external file to SAS software.

After you assign a file to SAS, you can identify the file by using a short name called a fileref. Filerefs can be assigned dynamically using the FILENAME statement. Any DD name allocated in JCL or by a TSO ALLOCATE command is implicitly available as a fileref with no additional action in your SAS program.

If you are assigning a new data set, such as a sequential file, partitioned data set (PDS), or partitioned data set extended (PDSE), you must specify that it is new. You must also describe its structure and format. These actions are not required for new files in the UNIX System Services (USS) file system.

The method that you use to assign an external file depends on whether you plan to use the file more than once in your SAS program. For more information, see "Assigning a File for a Single Use" on page 95 and "Assigning a File for Multiple Uses" on page 95.

# Assigning a File for a Single Use

If you plan to use an existing external file only once in your SAS program, then you can assign it by specifying the physical filename in a SAS statement or command. For example, this INCLUDE command assigns an existing sequential data set and includes it into the PROGRAM EDITOR window:

```
include 'myid.report.data'
```

Similarly, this PROC PRINTTO statement assigns a new PDS member:

```
proc printto print='userid.output.data(rockport)' new;
```

# Assigning a File for Multiple Uses

If you plan to use the same external file several times in your SAS program, then use one of the following methods to assign the file:

SAS FILENAME statement or function
: You can use these methods in all modes for most types of files. For more information, see "Using the FILENAME Statement or Function to Assign External Files" on page 96 or "FILENAME Function: z/OS" on page 474.

JCL DD statement
: You can use this method if you use z/OS in batch mode. For more information, see "Using the JCL DD Statement to Assign External Files" on page 100.

  **Note:** Unlike the other two methods, if you use the JCL DD statement to assign a file, there is no way to deassign the file until the job ends.

TSO ALLOCATE command
: You can use this method if you use TSO under z/OS. For more information, see "Using the TSO Assign Command to Assign External Files" on page 100.

Each of these methods establishes a fileref or a ddname that you can subsequently use to refer to the file instead of specifying the data set name again. For more information, see "Referring to External Files" on page 108.

# Using the FILENAME Statement or Function to Assign External Files

## Overview of Using the FILENAME Statement or Function to Assign External Files

The FILENAME statement and FILENAME function associate a SAS fileref (file reference name) with the operating environment's name for an external file. This association is equivalent to assigning a physical file externally (using a JCL DD statement or a TSO ALLOCATE command) and assigning a fileref to it.

In interactive mode, if you issue a FILENAME statement or function or attempt to assign a file with the FNAME window for a file that does not exist, and if you do not specify DISP=NEW, and if the file is not a UFS file, one of the following actions occurs:

- If the SAS system option FILEPROMPT is in effect (the default), then a dialog box asks whether you want to create the external file. If you reply `Yes`, SAS creates the external file, using any attributes that you specified in the FILENAME statement. If you do not specify any attributes, SAS uses the values of the SAS system options FILEDEV=, FILEVOL=, FILEUNIT=, FILESPPRI=, and FILESPSEC=. For information about these options, see "System Options in the z/OS Environment" on page 689.
- If the SAS system option NOFILEPROMPT is in effect, an error message indicating that the file could not be assigned is written to the SAS log.

For more information about the FILENAME function, see "FILENAME Function: z/OS" on page 474.

## FILENAME Statement Syntax

This section provides only a brief overview of FILENAME statement syntax. For complete information about the FILENAME statement, see "FILENAME Statement: z/OS" on page 616.

The syntax of the FILENAME statement is

**FILENAME** *fileref* <*device-type* > '*physical-filename*' <*options* ... >;

*fileref*
identifies the external file. The fileref must conform to the rules for ddnames. That is, it can consist of one to eight letters, numbers, or the national characters $, @, and #. The first character must be either a letter or a national character, and an underscore (_) can appear in any position of the name. You can subsequently use the fileref to refer to this file in your SAS session or batch job. For more information, see "Referring to External Files" on page 108.

*device-type*
enables you to route output to an output device, disk, or tape file by specifying device type. If *device-type* is not defined for a new file, its value is taken from the SAS system option FILEDEV=.

'*physical-filename*' | ('*physical-filename-1*' . . . '*physical-filename-n*') | '*physical-filename* (*)' | '*physical-filename*(*beg**)' | '*physical-filename*(**end*)'
is the physical filename of the data set, enclosed in quotation marks (see Chapter 5, "Specifying Physical Files," on page 89), or it can be a concatenation of physical filenames. For a concatenation, enclose each data set name in quotation marks, and enclose the entire group of file-specifications in parentheses. The maximum number of data sets in a concatenation is 200.

For a concatenation of members in a PDS, an asterisk (*) can be used in a wildcard file specification. The syntax '*physical-filename* (*)' applies to all members of the PDS; (*beg**) applies to all members or files whose names begin with *beg*, and (**end*) applies to all files whose names end with *end*.

*options*
include standard options such as file disposition as well as options for SYSOUT data sets such as the destination for output and the number of copies desired. These options are described in detail in "FILENAME Statement: z/OS" on page 616. Generally, values for options can be specified either with or without quotation marks. However, values that contain special characters must be enclosed in quotation marks.

# FILENAME Statement Examples

The following table provides examples of the FILENAME statement for z/OS:

***Table 6.1*** *FILENAME Statement Examples*

| Type of File | New or Existing File? | Example |
|---|---|---|
| sequential | existing | `filename raw 'myid.raw.datax' disp=old;` |
| | new | `filename x`<br>`'userid.newdata' disp=new`<br>`space=(trk,(5,1)) unit=3380 volume=xyzabc`<br>`recfm=fb lrecl=80 blksize=6160;` |

| Type of File | New or Existing File? | Example |
|---|---|---|
| member of partitioned | existing | `filename raw 'sas.raw.data(mem1)' disp=old;` |
| | new | `filename dogcat 'userid.sas8.physn(optwrk)' disp=new space=(trk,(1,3,1)) volume=xxx111 recfm=fb lrecl=255 blksize=6120 dsorg=po;` |
| partitioned extended | existing | `filename mypdse 'sas.test.pdse' disp=old;` |
| | new | `filename tpdse 'sas.test.pdse' dsntype=library space=(trk,(5,2,2)) lrecl=80 blksize=6160 recfm=fb disp=(new,catlg) dsorg=po;` |
| UFS: HFS files | existing | `filename myhfs '/u/userid/myfile';` |
| | new | `filename myhfs '/u/userid/myfile';` |
| temporary | new | `filename nextone '&mytemp' disp=new space=(trk,(3)) lrecl=80 blksize=6160;` |
| tape | existing | `filename mytape 'prod.data' vol=myvol unit=tape label=(1,SL);` |
| | new | `filename tranfile 'sas.cport.file' label=(1,SL) vol='042627' unit=cart blksize=8000 disp=(new,keep);` |
| concatenated | existing | `filename concat12 ('prod.payroll.data' 'prod.trans(may)');` |
| wildcard | existing, in PDS | `filename wild 'prod.payroll(d*)';` |
| | existing, in HFS | `filename all '/u/userid/*.sas';` |
| terminal | not applicable | `filename term1 '*'; or filename term2 terminal;` |
| printer | not applicable | `filename prnt unit=printer sysout=a; or filename prnt printer sysout=a;` |

# Assigning Filerefs to Files on Other Systems (FTP and SOCKET Access Types)

You can access files on other systems in your network by using the FTP and SOCKET access methods. The forms of the FILENAME statement are:

**FILENAME** *fileref* FTP *'external-file'* <*ftp-options*>;

**FILENAME** *fileref* SOCKET *'hostname:portno'* <*tcpip-options*>;

**FILENAME** *fileref* SOCKET *':portno'* SERVER <*tcpip-options*>;

These access methods are documented in the *SAS DATA Step Statements: Reference*. On z/OS, the FTP access method supports an additional option:

MACH=*'machine'*
: identifies which entry in the **.netrc** file should be used to get the user name and password. You cannot specify the MACH option and the HOST option on the same FILENAME statement. The **.netrc** file resides on z/OS.

The SAS FTP access method accesses the **.netrc** file per the following search precedence:

1. NETRC DD statement
2. userid.NETRC
3. UFS Home directory (**~/.netrc**)

The **.netrc** file contains the machine name, user ID, and password of various hosts that a user can FTP to, for example:

```
MACHINE hostname LOGIN userid PASSWORD xxxxxxx
```

If you are transferring a file to any UNIX or Windows file system from SAS in the z/OS operating environment and you want to use either the S370V or S370VB format to access that file, then the file must be of type RECFM=U and BLKSIZE=32760 before you transfer it.

**Note:**

- The permissions of the **.netrc** file on UFS are not checked.
- All characters of the **.netrc** keywords MACHINE, LOGIN, PASSWORD, and PASSWD must be uppercase or lowercase. Mixed case keywords are not supported.
- Line numbers are not recommended in z/OS **.netrc** files, but they are supported.

# Using the JCL DD Statement to Assign External Files

The syntax of the JCL DD statement is

*//ddname* DD DSN=*data-set-name,options*

*options* include options such as file disposition as well as options that describe the format of the file.

Here are some examples:

- Assigning an existing sequential data set:

```
//BOOKS DD DSN=LIBRARY.CATALOG.DATA,DISP=SHR
```

- Assigning a new sequential data set:

```
//REPORT  DD DSN=LIBRARY.REPORT.FEB08,DISP=(NEW,CATLG),
//           SPACE=(CYL,(1,1)),UNIT=SYSDA,
//           DCB=(LRECL=80,RECFM=FB,BLKSIZE=6160)
```

- Concatenating sequential data sets:

```
//INPUT   DD DSN=LIBRARY.DATA.QTR1,DISP=SHR
//        DD DSN=LIBRARY.DATA.QTR2,DISP=SHR
//        DD DSN=LIBRARY.DATA.QTR3,DISP=SHR
//        DD DSN=LIBRARY.DATA.QTR4,DISP=SHR
```

For complete information about the JCL DD statement, see the appropriate JCL User's Guide and JCL Reference for your OS level.

# Using the TSO Assign Command to Assign External Files

The syntax of the TSO ALLOCATE command is

**ALLOC** FILE(*ddname*) DA('*data-set-name*') *options*

*options* include options such as file disposition as well as options that describe the format of the file.

Here are some examples:

- Assigning an existing member of a PDS:

```
alloc fi(in1) da('my.pds(mem1)') shr
```

- Assigning a new sequential data set:

```
alloc fi(report) da('library.report.feb08')
   new sp(1,1) cyl lrecl(80) recfm(f b)
   blksize(6160)
```

- Concatenating sequential data sets:

```
alloc fi(input) da('library.data.qtr1' 'library.data.qtr2'
   'library.data.qtr3' 'library.data.qtr4') shr
```

For complete information about the TSO ALLOCATE command, see the appropriate TSO reference for your OS level.

# Assigning External Files on Tape

Tapes are used primarily in batch mode. Some sites might restrict or prohibit tape mounts in interactive sessions. Because file allocation for external files on tape is done infrequently, the FILENAME statement and FILENAME function give only limited support for parameters that are normally associated with data sets on tape. However, you can use the FILENAME statement or FILENAME function to assign a cataloged tape file, provided that you specify the data set name and disposition (as you would normally do in a JCL DD statement). To assign an uncataloged tape file, do the following:

- For a data set on an IBM standard-label tape (label type SL, the most common type), you must specify the data set name, UNIT= parameter, and volume serial number. You can also specify the label number and type and the disposition, or you can allow default values to be used for these parameters. For example:

```
filename mytape 'prod.data' vol=myvol
   unit=tape label=(2,SL);
```

- For a data set on a nonlabeled tape (label type NL), you must supply the previous information plus DCB information. For more information, see “DCB Attribute Options” on page 628. For example:

```
filename tranfile 'sas.cport.data'
   disp=(new,keep) unit=tape vol=xvol
   label=(1,NL) recfm=fb
   lrecl=80 blksize=8000;
```

# Assigning External Files to a Pipe

BatchPipes offers a way to connect jobs so that data from one job can move to another job without going to DASD or tape. SAS permits both SAS data sets and external files to be written and read with BatchPipes.

**Note:** To use BatchPipes with SAS on z/OS, make sure the BatchPipes service is running before you start your SAS session.

To write an external file using BatchPipes:

```
//jobname  JOB   jobinfo...
//        EXEC  SAS9
//*
//PIPESND DD DSN=TEST.SAS.EXTFILE.BATCHPIPES,
//        LRECL=80,BLKSIZE=3120,RECFM=FB,
//        DISP=NEW,
//        SUBSYS=(BP01,CLOSESYNC)
//*
//SYSIN   DD *
  data _null_;
     file pipesnd;
     put " Line 1 ";
     put " Line 2 ";
  run;
/*
//
```

To read an external file using BatchPipes:

```
//jobname  JOB   jobinfo...
//        EXEC  SAS9
//*
//PIPERCV DD DSN=TEST.SAS.EXTFILE.BATCHPIPES,
//        DISP=OLD,
//        SUBSYS=(BP01,CLOSESYNC)
//*
//SYSIN   DD *
  data _null_;
     infile pipercv;
     input;
     list;
  run;
/*
//
```

See the IBM documentation about BatchPipes z/OS for more information.

# Assigning Generation Data Sets

## Overview of Generation Data Sets

A generation data set (or *generation*) is a version of a z/OS data set that is stored as a member of a generation data group. These generations are supported by z/OS; they differ from the generation data sets supported by SAS. For detailed

information about z/OS generations, see your IBM documentation. For information about SAS generation data sets, see *SAS V9 LIBNAME Engine: Reference*.. For more information, see "Allocating a Multivolume Generation Data Group" on page 88.

Both standard external files and SAS libraries can be stored and managed as generation data groups. The following sections describe the various methods of assigning new and existing generations.

# Assigning a New Generation of a Generation Data Group

To assign a *new* generation of a generation data group, use one of the following methods:

- In a JCL DD statement, you can specify either the relative form of the data set name or the absolute form.

  Relative form:

  ```
  //DD1 DD DSN=PROD.GDG(+1),DISP=(NEW,CATLG)
  ```

  Absolute form:

  ```
  //DD1 DD DSN=PROD.GDG.G0008V00,DISP=(NEW,CATLG)
  ```

- In a SAS FILENAME statement or FILENAME function (for external files) or in a TSO ALLOCATE command, you must specify the absolute form of the data set name.

  FILENAME statement:

  ```
  filename dd1 'prod.gdg.g0008v00' disp=(new,catlg);
  ```

  TSO ALLOCATE command:

  ```
  alloc fi(dd1) da('prod.gdg.g0008v00') new
  ```

# Assigning an Existing Generation of a Generation Data Group

To access an existing generation of a generation data group, you can use either the relative form of the data set name or the absolute form in a FILENAME statement FILENAME function, JCL DD statement, or TSO ALLOCATE command.

- Relative form:

  FILENAME statement:

  ```
  filename gdgds 'my.gdg.data(-1)';
  ```

  JCL DD statement:

  ```
  //DD1 DD DSN=PROD.GDG(-1),DISP=SHR
  ```

  TSO ALLOCATE command:

  ```
  alloc fi(dd1) da('prod.gdg(-1)') shr
  ```

- Absolute form:

  FILENAME statement:

  ```
  filename gdgds 'my.gdg.data.g0008v01';
  ```

  JCL DD statement:

  ```
  //DD1 DD DSN=PROD.GDG.G0008V01,DISP=SHR
  ```

  TSO ALLOCATE command:

  ```
  alloc fi(dd1) da('prod.gdg.g0008v01') shr
  ```

# Assigning Other Types of External Files

## Assigning UNIX System Services Files

For more information, see "Accessing UNIX System Services Files" on page 129.

## Assigning PDSEs

To assign a partitioned data set extended (PDSE), specify the appropriate options in the FILENAME statement or FILENAME function, as shown in the example in Table 6.1 on page 97.

For definitions of SMS options, see "Options That Specify SMS Keywords" on page 632.

You can use a PDSE wherever you can use a PDS, and you can write to multiple members in a PDSE at the same time.

# Concatenating External Files

Multiple sequential data sets can be concatenated with JCL DD statements, a TSO ALLOCATE command, a FILENAME statement, or a FILENAME function. (When accessing concatenated files, performance is better when either of the first two methods is used.) See the examples in

- "Using the FILENAME Statement or Function to Assign External Files" on page 96
- "Using the JCL DD Statement to Assign External Files" on page 100

- "Using the TSO Assign Command to Assign External Files" on page 100
- "Reading Concatenated Data Sets" on page 124

# Displaying Information about External Files

You can issue the FILENAME command from the command line to display the FILENAME window. This window lists all current SAS filerefs plus the name of the physical file to which each fileref has been assigned. Files that were assigned externally (with a JCL DD statement or with the TSO ALLOCATE command) are listed only after you have used them as filerefs in your SAS session.

Under z/OS, three additional windows--FNAME, DSINFO, and MEMLIST--also provide information about external files. For information about these windows, see "Host-Specific Windows in the z/OS Environment" on page 261.

# Deassigning External Files

The method that you use to deassign a file depends on which method you used to assign it:

- If you used the FILENAME statement or FILENAME function to assign the file, specify the CLEAR argument to deassign it:

  ```
  filename books clear;
  ```

  **Note:** The CLEAR argument is optional. Specifying `FILENAME fileref;` has the same effect.

- If you used the JCL DD statement to assign the file, then the file is automatically deassigned when the job step ends. (There is no way to deassign the file before the job step ends.)
- If you used the TSO ALLOCATE command to assign the file, then use the TSO FREE command:

  ```
  free fi(books)
  ```

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# Accessing External Files

# Referring to External Files

After allocating an external file, you can use the fileref or ddname of the file as a convenient way of referring to that file in any subsequent SAS language statement or command.

**Note:** The first time the ddname of an external file is used in a SAS statement or procedure, SAS assigns it as a fileref for the external file. Therefore, any information provided here about filerefs also applies to the ddnames of external files. For more information, see "Summary Table of SAS Software Files" on page 36 and "Reserved z/OS Ddnames" on page 40 for a list of files and ddnames that have special meanings to SAS the operating environment.

In the following example, the FILENAME statement associates the fileref REPORT with the sequential data set MYID.NEWDATA. The FILE statement later uses the fileref rather than the data set name to refer to the data set.

```
filename report 'myid.newdata' disp=old;
data _null_;
   file report;
   put ...;
run;
```

Here is a similar example in which a JCL DD statement associates the ddname IN with a member of a partitioned data set. The INFILE statement later uses the ddname rather than the data set name and member name to refer to the PDS member.

```
//IN DD DSN=MYID.NEWDATA(TRIAL1),DISP=SHR
//SYSIN DD *
data out;
   infile in;
   input ...;
run;
```

When referring to a member of a PDS or a PDSE, you also have the option of specifying only the data set name in the FILENAME statement, in the FILENAME function, or in the DD statement. Then, in subsequent references, you specify the member name with the fileref. For example:

```
//IN DD DSN=MYID.NEWDATA,DISP=SHR
//SYSIN DD *
data out;
   infile in(trial1);
```

```
   input ...;
run;
```

If an external data set is not cataloged, you must also provide the volume serial number. If SAS requires that a file must be identified only by its physical name, that name must represent a cataloged data set or HFS file. Temporary data sets are not cataloged, and SAS cannot locate temporary data sets if you provide only a physical name. For information about other options that you can specify, see "FILENAME Statement: z/OS" on page 616.

**Note:** If you are using files in the USS file system, SAS makes no distinction between the z/OS file system (zFS) and the Hierarchical File System (HFS).

For information about encodings for z/OS resources such as data set names and UFS file paths, see Appendix 3, "Encoding for z/OS Resource Names," on page 939.

# How SAS Determines the File System

A fileref can refer to a native z/OS data set or to a file that is stored in a UFS file system. SAS uses several methods to determine the file system of a particular file.

If a physical name does not contain a slash (/) or a tilde (~) character to identify it as an HFS filename, then SAS uses the following algorithm to determine the device type:

1. Use the access method from the allocation statement, if provided, as in the following example:

   ```
   FILE 'example' HFS;
   ```

   or

   ```
   FILENAME XXX HFS 'example';
   ```

   If the access method is not specified or is **MVS**, use the **MVS** access method.

2. Use the access method specified by the **MVS:** or **HFS:** prefix in the physical filename, if one is provided, such as in this example.

   ```
   FILENAME XXX 'HFS:first';
   FILENAME XXX 'MVS:first';
   ```

3. Use the HFS access method if a slash character ( / ) or tilde character (~) appears in the physical filename, as in the following example:

   ```
   FILENAME XXX '~/first';
   ```

4. Use the access method specified by the FILESYSTEM= system option. See "FILESYSTEM= System Option: z/OS" on page 761.

# Writing to External Files

## Overview of Writing to External Files

After allocating an external file, you can use the FILE statement, FILE command, or FOPEN function to write to the file. This section describes the FILE statement.

**Note:** You can also use FOPEN, FWRITE, FPUT, FNOTE, FPOINT, and FCLOSE to access external files. For more information, see *SAS Functions and CALL Routines: Reference*.

## FILE Statement

### About the FILE Statement

The FILE statement specifies the current output file for PUT statements in the DATA step. For a complete description of the PUT statement, see *SAS DATA Step Statements: Reference*.

When multiple FILE statements are present, the PUT statement builds and writes output lines to the file that was specified in the most recent FILE statement. If no FILE statement was specified, the PUT statement writes to the SAS log.

The specified output file must be an external file, not a SAS library, and it must be a valid access type.

The FILE statement is executable. Therefore, you can use it in conditional processing (in an IF/THEN statement, for example).

As with INFILE, it is possible to alternatively access multiple external files. See the example in "Reading from Multiple External Files" on page 125. You cannot write to multiple members of a single PDS at the same time. However, you can write to multiple members of a PDSE at one time.

Under z/OS, SAS uses the IBM ENQUEUE/DEQUEUE facility to prevent multiple users from writing to the same physical file simultaneously. This facility also prevents SAS software and ISPF from overwriting each other.

## FILE Statement Syntax

This section provides a brief overview of FILE statement syntax. For complete information about the FILE statement, see "FILE Statement: z/OS" on page 604.

The syntax of the FILE statement is

**FILE** *file-specification* <*type*> <*options* > <*host-options*>;

*file-specification*
identifies the file. It can be in the following forms:

***Table 7.1*** *File Specification Examples for the FILE Statement*

| Form | Example |
|---|---|
| fileref | `report` |
| fileref(member) | `report(feb)` |
| 'physical-filename' | `'library.daily.report'` |
| 'physical-filename(member)' | `'library.daily.output(report1)'` |
| reserved filerefs | `LOG` or `PRINT` |
| HFS file | `'/u/userid/file'`<br>`'HFS:myfile'` |

See Chapter 5, "Specifying Physical Files," on page 89 for details about different ways of specifying *physical-filename*.

*type*
specifies the type of file. Nonstandard (host-specific) file types that you can specify for z/OS are

DLI
for IMS databases. For more information, see "Accessing IMS and CA-IDMS Databases" on page 128.

HFS and PIPE
for files in UNIX System Services. For more information, see "Accessing UNIX System Services Files" on page 129.

MVS
for z/OS data sets.

VSAM
for VSAM files. For more information, see "Accessing VSAM Data Sets" on page 128.

*options*
describe the output file's characteristics and specify how it is to be written with a PUT statement. Many of these options are not host-dependent and are documented in *SAS System Options: Reference*. For information about options that are specific to z/OS, see "FILE Statement: z/OS" on page 604. You can use these options to do the following:

- define variables that contain information about the external file
- specify special open and close processing
- specify file characteristics

## FILE Statement Examples

The following table contains examples of the FILE statement for different types of data sets.

***Table 7.2*** *Examples of the FILE Statement*

| Type of Data Set | Example |
|---|---|
| sequential | `file 'my.new.dataset';` |
| member of a PDS or PDSE | `file out(newdata);`<br>or<br>`file 'my.new.dataset(newdata)';` |
| sequential or member of a PDS or PDSE[1] | `file myfilerf;` |
| HFS | `file '/usr/tmp/newdata';` |
| HFS | `file 'newmem.dat' hfs;` |
| HFS | `file 'HFS:raw';` |
| MVS | `file 'newmem.dat' mvs;` |
| MVS | `file 'MVS:raw';` |
| VSAM | `file payroll vsam;` |
| IMS | `file psb dli;` |
| SAS log | `file log;` |

1 The type depends on what the fileref is associated with.

# Writing to Sequential Data Sets

The disposition of a sequential data set can be OLD, MOD, or SHR. Using OLD eliminates the possibility of another job writing to the data set at the same time as your job is writing to it.

If you specify OLD or SHR, SAS begins writing at the beginning of the data set, replacing existing information. To append new information to the existing information, specify the MOD option in the FILE statement.

The following example assigns the fileref RAW to the data set MYID.RAW.DATAX and uses the fileref in a simple DATA step:

```
filename raw 'myid.raw.datax' disp=old;
data _null_;
   file raw;
   msgline='write this line';
   put msgline;
run;
```

# Writing to Members of PDS or PDSE Data Sets

To write to a member of a PDS, include the following information:

- the member name along with the data set name in the FILE statement
- the FILENAME statement
- the FILENAME function
- the TSO ALLOCATE command or the JCL DD statement.

Omitting the member name causes an error message because SAS tries to treat the PDS as a sequential data set.

The disposition of the PDS member can be OLD or SHR; you cannot use a disposition of MOD for a member of a PDS. In both cases, SAS begins writing at the beginning of the member, replacing existing information. Using OLD eliminates the possibility of another job writing into the member at the same time as your job is writing into it.

You can write to only one member of a particular PDS in a single DATA step. However, you can write to members of separate PDSs. To write to more than one member of a given PDS, you must use a separate DATA step for each member. In a single DATA step, you can write to multiple members of a PDSE.

The following example assigns the fileref RAW to the PDS member MEM1 and then uses the fileref in a simple DATA step:

```
/* PDS Example */
filename raw 'myid.raw.data(mem1)' disp=old;
data _null_;
```

```
   file raw;
   put 'write this line';
run;
```

This next example assigns the fileref MYPDSE to the PDSE and then uses the fileref in a simple DATA step:

```
/* PDSE Example */
filename mypdse 'sales.div1.reg3' disp=shr;
data a;
   x=1;
   file mypdse(june97);
   put x;
   file mypdse(jul97);
   put x;
run;
```

# Writing to a Printer

This example uses the FILENAME and FILE statements to route output to a printer:

```
filename prnt printer sysout=a;
data _null_;
   file prnt;
   put 'text to write';
run;
```

# Writing to the Internal Reader

This example uses the FILENAME and FILE statements to write to an internal reader:

```
filename injcl '.misc.jcl' disp=shr;
filename outrdr sysout=a pgm=intrdr
      recfm=fb lrecl=80;
data _null_;
  infile injcl(myjcl);
  file outrdr noprint notitles;
  input;
  put _infile_;
run;
```

# Writing to a Temporary Data Set

The following examples use the FILENAME and FILE statements to write to a temporary data set.

- This example shows how to use default attributes to define a temporary file:

```
filename tempfile '&mytemp' ;
data out;
   file tempfile;
   put ...;
run;
```

- The next example defines a temporary file and specifies some of its attributes:

```
filename nextone '&mytemp' disp=new
   lrecl=80 blksize=320 space=(trk,(3));
data out;
   file nextone;
   put ...;
run;
```

  For information about specifying a temporary data set, see "FILETEMPDIR System Option: z/OS" on page 762.

# Using the FILE Statement to Specify Data Set Attributes

You can specify data set attributes in the FILE statement as well as in the FILENAME statement or FILENAME function. SAS supplies default values for any attributes that you do not specify. For information about default values, see "Overview of DCB Attributes" on page 630 and "DCB Option Descriptions" on page 628.

This example specifies values for LRECL= and RECFM= in the FILE statement and allows SAS to use the default value for BLKSIZE=:

```
filename x 'userid.newdata' disp=new
       space=(trk,(5,1)) volume=xyz111;
data out;
   file x lrecl=80 recfm=fb;
   put ... ;
run;
```

# Using the Data Set Attributes of an Input File

In this example, data is read from the input file. Then the data is written to an output file, using the same file characteristics. The DCB option in the FILE statement tells SAS to use the same data set attributes for the output file as were used for the input file.

```
filename in  'userid.input';
filename out 'userid.output';
data;
   infile in;
```

```
   input;
   file out dcb=in;
   put _infile_;
run;
```

# Using the FILE Statement to Specify Data Set Disposition

## Appending Data with the MOD Option

In this example, the MOD option is used to append data to the end of an external file:

```
filename out 'user.output';
data _null_;
 /* New data is written to 'user.output'  */
   file out;
   put ... ;
run;

data _null_;
 /* data is appended to 'user.output'     */
   file out mod;
   put ... ;
run;
```

## Appending Data with the MOD Disposition

This example is similar to the previous one except that instead of using the MOD option, the DISP= option is used. The OLD option is then used to overwrite the data.

```
filename out 'user.output' disp=mod;
data _null_;
 /* data is appended to 'user.output'    */
   file out;
   put ... ;
run;

data _null_;
 /* data is written at the beginning of  */
 /* 'user.output'                         */
   file out old;
   put ... ;
run;
```

```
data _null_;
 /* data is written at the beginning of  */
 /* 'user.output'                         */
   file out;
   put ... ;
run;

data _null_;
 /* data is appended to 'user.output'    */
   file out mod;
   put ... ;
run;
```

# Writing to Print Data Sets

## Overview of Print Data Sets

A print data set contains carriage-control information (also called ASA control characters) in column 1 of each line. These characters (blank, 0, –, +, and 1) control the operation of a printer, causing it to skip lines, to begin a new page, and so on. They do not normally appear on a printout. A nonprint data set does not contain any carriage-control characters.

When you write to a print data set, SAS shifts all column specifications in the PUT statement one column to the right to accommodate the carriage-control characters in column 1. Therefore, if you expect to print an external file, you should designate the file as a print data set either when you allocate it or when you write to it.

## Designating a Print Data Set

The preferred method for designating a data set as a print data set is to specify the RECFM= option when you allocate the data set with one of the following methods:

- the FILENAME statement
- the FILENAME function
- the JCL DD statement
- the TSO ALLOCATE command.

Adding the letter A to the end of the value for the RECFM= option (RECFM=FBA or RECFM=VBA, for example) causes SAS to include carriage-control characters in the data set that is being created. For information about the RECFM= option, see "FILENAME Statement: z/OS" on page 616.

## Designating a Nonprint Data Set as a Print Data Set

When you write to a data set that was not designated as a print data set when it was allocated, you can designate it as a print data set in several ways. The method that you use to designate it as a print data set depends on what you plan to do with the data set. Here are some examples:

- Use the PRINT option in the FILE statement:

  ```
  file saveit print;
  ```

  SAVEIT is the fileref of the data set. The PRINT type in the FILE statement includes a page number, date, and title; this method is the simplest way to create a print data set.

- Use PRINT as the fileref in the FILE statement (different from the previously discussed PRINT option):

  ```
  file print;
  ```

  The PRINT fileref in the FILE statement causes SAS to write the information either to the standard SAS procedure output file (PRINT=SASLIST), or to another output file if you have used a PROC PRINTTO statement to redirect your output. For information about PROC PRINTTO, see "PRINTTO Procedure Statement: z/OS" on page 566 and "Using the PRINTTO Procedure and the FORM Subsystem" on page 152. In either case, this file contains carriage-control characters by default. You can suppress the carriage-control characters by specifying the NOPRINT option in the FILE statement. For more information, see "Writing to External Files" on page 110.

- Use the letter A as part of the value in the RECFM= option in the FILE statement:

  ```
  file saveit recfm=vba;
  ```

  As in the FILENAME statement or FILENAME function, the letter A in the RECFM= option of the SAS FILE statement causes SAS to include carriage-control characters in the data set that is being created. SAS also changes the record format of the target data set.

For information about how to process print files as input, see "Reading from Print Data Sets" on page 126.

## Designating a Print Data Set as a Nonprint Data Set

The NOPRINT option is useful when you use a DATA step to copy a data set that already contains carriage-control information. In this case, use NOPRINT to prevent SAS from adding an additional column of carriage-control information.

If a data set has been allocated as a print data set, you can use the NOPRINT option in the FILE statement to omit carriage-control information. For example, suppose you specified RECFM=VBA, indicating a print data set, when you allocated

a file and that you assigned the fileref OUTDD. The following SAS statement designates OUTDD as a nonprint data set:

```
file outdd noprint;
```

To write lines without carriage-control information to the SAS procedure output file, specify:

```
file print noprint;
```

# Reading from External Files

## Overview of Reading from External Files

After you allocate an external file, you can read from the file in a SAS DATA step by specifying it in the INFILE statement, the INCLUDE command, or the %INCLUDE statement.

This section describes the INFILE statement. For information about the INCLUDE command and the %INCLUDE statement, see *SAS DATA Step Statements: Reference*. For information about the DATA step, see *Base SAS Utilities: Reference*.

## INFILE Statement

### Overview of the INFILE Statement

In a SAS DATA step, the INFILE statement specifies which external file is to be read by a subsequent INPUT statement. Every external file that you want to read must have a corresponding INFILE statement. The external file can be a sequential data set on disk or tape, a member of a partitioned data set (PDS or PDSE), or any of several nonstandard file types. For more information, see the description of the *type* argument in "INFILE Statement Syntax" on page 120. The file can also be entered from a terminal.

The INFILE statement is executable. Therefore, it can be used in conditional processing - in an IF/THEN statement, for example.

When multiple INFILE statements are present, the INPUT statement reads from the external file that was specified by the most recent INFILE statement. For a complete description of the INPUT statement, see *SAS DATA Step Statements: Reference*.

## INFILE Statement Syntax

This section provides a brief overview of INFILE statement syntax. For complete information about the INFILE statement, see "INFILE Statement: z/OS" on page 647.

The syntax of the INFILE statement is

**INFILE** *file-specification* <*type*> <*options*>;

*file-specification*
identifies the file. It can be in the following forms:

***Table 7.3*** *File Specification Examples for the INFILE Statement*

| Form | Example |
|---|---|
| fileref | `report` |
| fileref(member) | `report(feb)` |
| 'physical-filename' | `'library.daily.report'` |
| 'physical-filename(member)' | `'library.daily.source(report1)'` |
| reserved fileref | `DATALINES` |

See "INFILE Statement: z/OS" on page 647 for information about partial physical filenames and wildcard member names.

*type*
specifies the type of file. When you omit *type*, the default is a standard external file. Nonstandard (host-specific) file types that you can specify for z/OS are

DLI
for IMS databases. For information about IMS options for the INFILE statement, see *SAS/ACCESS Interface to IMS: Reference*.

HFS and PIPE
for files in UNIX System Services. For more information, see "Accessing UNIX System Services Files" on page 129. PIPE enables you to issue UNIX System Services commands from within the INFILE statement.

IDMS
specifies that the file is a CA-IDMS file. For information about CA-IDMS options for the INFILE statement, see*SAS/ACCESS DATA Step Interface to CA-IDMS: Reference* .

ISAM
specifies that the file is an ISAM file. For more information, see "Accessing Other File Types" on page 127.

VSAM
for VSAM files. Fore more information, see "Accessing VSAM Data Sets" on page 128.

VTOC
specifies that the Volume Table of Contents (VTOC) is to be accessed.

*options*
describe the input file's characteristics and specify how it is to be read with an INPUT statement. Many of these options are not host-dependent and are documented in *SAS System Options: Reference*. Those options that are host-specific are documented in "INFILE Statement: z/OS" on page 647. You can use these options to do the following:

- define variables that contain information about the external file
- specify special open and close processing
- specify file characteristics

## INFILE Statement Examples

***Table 7.4*** *Examples of the INFILE Statement*

| Type of Data Set | Example |
|---|---|
| sequential | `infile 'library.daily.data';` |
| member of a PDS or PDSE | `infile report(feb);`<br>or<br>`infile 'lib.daily.src(rpt1)';` |
| sequential or member of a PDS or PDSE[1] | `infile data;` |
| IMS | `infile psb dli;` |
| in-stream | `infile datalines;` |

1 The type depends on what the fileref is associated with.

# Reading from a Sequential File

This example assigns the fileref RAW to the data set MYID.RAW.DATAX and uses the fileref in a simple DATA step:

```
filename raw 'myid.raw.datax' disp=shr;
```

```
data out;
   infile raw;
   input ... ;
run;
```

This example is similar to the previous one. However, it specifies a value for the SYSPREF= system option and then uses a partially qualified data set name in the FILENAME statement:

```
options syspref=sys2.sas7;
filename raw2 '.raw.datax' disp=shr;
data out;
   infile raw2;
   input ... ;
run;
```

For information about using SYSPREF= and partially qualified data set names, see Chapter 10, “SAS Processing Restrictions for Servers in a Locked-Down State,” on page 219.

# Reading from a Member of a PDS or PDSE

This example specifies the PDS name in the FILENAME statement and then specifies the member name in parentheses following the fileref in the INFILE statement:

```
filename mypds 'user.my.pds';
data out;
   infile mypds(mydata);
   input ... ;
run;
```

This example specifies both the PDS name and the member name in the FILENAME statement. Therefore, only the fileref is specified in the INFILE statement:

```
filename mymember 'user.my.pds(mydata)';
data out;
   infile mymember;
   input ... ;
run;
```

Multiple members of a PDS can be open for Read access at the same time.

# Using SAS to Read a PDS or PDSE Directory Sequentially

If you request an OPEN operation in preparation to read from a PDS or PDSE and do not specify a member name or override values for RECFM, LRECL, or BLKSIZE, then SAS concludes that you want to read the directory and supplies the required DCB attributes. The following example demonstrates the use of a FILENAME and

INFILE pair that specifies a PDS or PDSE name with no member names and no overrides.

```
filename mypds 'user.my.pds';
data out;
   infile mypds;
   input ... ;
run;
```

The RECFM, LRECL, and BLKSIZE attributes associated with a PDS or PDSE pertain only to its members. They do not pertain to the directory because it has its own attributes.

z/OS looks for certain conditions to exist during OPEN processing in order to determine that the request is to read a directory, not a member. The following list contains some of these conditions:

- The specified data set name does not include a member name.
- The following attribute values are specified for the PDS or PDSE:
  - RECFM=F or RECFM=U
  - BLKSIZE=256
  - LRECL=256

**Note:**

- All PDS and PDSE directories consist of 256-byte blocks.
- LRECL is required if you are using QSAM. Otherwise, LRECL is optional.

In the preceding code example, SAS provides the directory-specific values for RECFM, BLKSIZE, and LRECL because it encountered an INFILE statement that refers to an entire PDS or PDSE instead of a member or members. Also, no overrides were specified for RECFM, BLKSIZE, or LRECL.

**Note:** If you supply overrides for any of these attributes, then you must supply overrides for all of these attributes.

# Reading from the Terminal

If you run SAS in interactive line mode or in noninteractive mode, you can read input from the terminal. These examples illustrate ways to define a terminal file.

In the first example, TERMINAL is specified as the device type in the FILENAME statement:

```
filename term1 terminal;
data one;
   infile term1;
   input ... ;
```

```
run;
```

In the next example, an asterisk is used in place of a physical filename to indicate that the file is entered from the terminal:

```
filename term2  '*';
data out;
   infile term2;
   input ... ;
run;
```

**Note:** Enter "/*" to signify end-of-file after entering your input from the terminal.

# Reading Concatenated Data Sets

Multiple sequential data sets can be concatenated (with a JCL DD statement, a TSO ALLOCATE command, or a FILENAME statement) and read consecutively using one pair of INFILE or INPUT statements.

Sequential data sets and individual PDS or PDSE members can also be concatenated, as in the following example:

```
x alloc fi(in1)
   da('my.data1' 'my.pds(mem)' 'my.data2');
data mydata;
   infile in1;
   input ... ;
   /* SAS statements  */
run;
```

Here is an example of using the FILENAME statement to concatenate data sets:

```
filename in1 ('my.data1' 'my.pds(mem)' 'my.data2');
```

You can also concatenate external files that are stored on different types of devices and that have different characteristics.

If PDSs or PDSEs are concatenated and a member is specified in the INFILE statement, then SAS searches each PDS or PDSE for that member. SAS searches in the order in which the PDSs appear in the DD statement, the ALLOCATE command, or the FILENAME statement or function. If the member is present in more than one of the PDSs, SAS retrieves the first one that it finds.

# Reading from Multiple External Files

## Overview of Reading from Multiple External Files

You can read from multiple external files either sequentially or in random order from multiple filerefs.

## Reading from Multiple External Files in Sequential Order

To read from multiple external files sequentially, use the END= option or the EOF= option in each INFILE statement to direct program control to a new file after each file has been read. For example:

```
filename outrdr sysout=a pgm=intrdr
      recfm=fb lrecl=80;
data _null_;
   length dsn $ 44;
   input dsn $;
   infile dummy filevar=dsn end=end;
   file outrdr noprint notitles;
   do until(end);
      input;
      put _infile_;
      end;
datalines;
PROD.PAYROLL.JCL(BACKUP)
PROD.PAYROLL.JCL(TRANS)
PROD.PAYROLL.JCL(PRINT)
;
run;
```

For more information about the END= and EOF= options of the INFILE statement, see *SAS DATA Step Statements: Reference*.

## Reading from Multiple External Files in Random Order

To read multiple external files in random order, ensure that the files have different filerefs. You can partially process one file, go to a different file, and return to the original file. An INFILE statement must be executed each time you want to read a file, even if you are returning to a file that was previously read. The DATA step

terminates when SAS encounters the EOF of any of the files. Consider the following example:

```
filename exfile1 'my.file.ex1';
filename exfile2 'my.file.ex2';
data mydata;
   infile exfile1;
   input ... ;
   /* SAS statements  */

   infile exfile2;
   input ... ;

   /* SAS statements  */

   infile exfile1;
   input ... ;

   /* SAS statements  */

run;
```

When a fileref has more than one INFILE statement, and options are specified in each INFILE statement, the options apply cumulatively to successive files.

**Note:** Multiple files inside concatenations cannot be accessed in this manner.

# Reading from Print Data Sets

When reading from a print data set, you can tell SAS to ignore the carriage-control character that is in column 1 of print data sets by specifying SAS system option FILECC. For more information, see "FILECC System Option: z/OS" on page 743.

# Getting Information about an Input Data Set

In the following example, data set information is printed in the SAS log. Control blocks are printed in hexadecimal format. The example can be used with either a sequential data set or a PDS.

```
filename in 'user.data';
data out;
   infile in jfcb=jf dscb=ds volumes=vol
             ucbname=ucb devtype=dev;
   if (_n_ = 1) then
      put @1 'Data Set Name:' @17 jf  $52.     /
          @4 'Volume ='       @20 vol $30.     /
          @4 'JFCB ='         @20 jf  $hex200. /
          @4 'DSCB ='         @20 ds  $hex188. /
```

```
          @4 'Devtype ='      @20 dev $hex48.  /
          @4 'Device Addr ='  @20 ucb $3.      ;
run;
```

# Accessing Other File Types

## Accessing BSAM Files in Random Access Mode

Users of SAS 9.2 with IBM z/OS V1R7.0 or later can use random access (byte-addressable) techniques to read and create BSAM files. For example, fonts files, which previously conformed to certain restrictive rules (**LRECL=1**, **RECFM=F**, **FS, or FBS**) can now be read regardless of their format, including existing as members of a PDS or PDSE. Also, graph procedures can now be used to write image files as BSAM data sets.

Random access (byte addressability) to BSAM files is achieved by copying or creating files in 64-bit storage. The size of this storage is determined by the value of MEMLIMIT, which is determined by the systems programmer at your site. The value set for MEMLIMIT can be overridden in the JCL or by SMF parameters, commands, or exits.

For input files, SAS BSAM allocates 64-bit storage by determining the size of the existing file. For output files, SAS BSAM allocates 64-bit storage by using information for the space allocation request. If no space allocation request is made, then default values from SAS system options FILESPPRI, FILESPSEC and FILEUNIT are used. It is possible that SAS might not be able to use 64-bit storage for a file because of one of the following reasons:

- MEMLIMIT is not set, or it is too small for the file.
- Insufficient 64-bit storage is available due to other uses of this storage.

In cases like these, SAS attempts to open and process the file on disk, if it is an input file and conforms to the file characteristics described. Otherwise, the attempt to open the file for random processing fails. In addition to existing ERROR messages, the following explanatory note is issued:

```
Note: Random access to sequential file dataset-name: storage array
could not be allocated, and mode or file characteristics do not permit
opening file as binary.
```

To avoid possible confusion caused by trailing blank spaces or nulls in the last record, for BSAM random access files that are created with an RECFM, other than V, VS, VB, or VBS, their RECFM is changed to VB. A message is then issued to the SAS log.

Output data is written from above-the-bar storage to disk when the file is closed. If there is more data in the storage array than has been allowed for in the disk space

allocation for the file, then an undetermined I/O error occurs. The following message is then issued:

```
Note: Random access file <name>: output file might be incomplete.
```

Normal file definitions do not apply to a BSAM file resident in an above-the-bar storage array. Certain characteristics are assigned while the file resides in that location (`LRECL=1`, `RECFM=fbs`, `BLKSIZE=`*`total filesize`*) to enable seamless processing. If you display the file's definition during this period, it returns those characteristics.

# Accessing IMS and CA-IDMS Databases

Both the SAS/ACCESS interface to IMS and the SAS/ACCESS interface to CA-IDMS include a DATA step interface. Extensions for certain SAS statements (such as INFILE, FILE, PUT, and INPUT) enable you to format database-specific calls in a SAS DATA step. Therefore, you can access the IMS or CA-IDMS data directly, without using SAS/ACCESS view descriptors. If your site licenses these interfaces, see *SAS/ACCESS Interface to IMS: Reference* and *SAS/ACCESS DATA Step Interface to CA-IDMS: Reference* for more information.

**Note:** The DATA step interface for IMS-DL/I is a read and write interface. The DATA step interface for CA-IDMS is read only.

# Accessing VSAM Data Sets

For information about accessing VSAM data sets, see *SAS VSAM Processing for z/OS*.

# Accessing the Volume Table of Contents (VTOC)

To access a disk's Volume Table of Contents (VTOC), specify the VTOC option in an INFILE statement. For more information about VTOC options for the INFILE statement, see "VTOC Options for the INFILE Statement under z/OS" on page 652.

**Note:** When a SAS server is in the locked-down state, the VTOC access method is disabled. For more information, see Chapter 10, "SAS Processing Restrictions for Servers in a Locked-Down State," on page 219.

# Accessing UNIX System Services Files

## Overview of UNIX System Services

IBMs UNIX System Services (USS) implements a directory-based file system that is very similar to the file systems that are used in UNIX. SAS software under z/OS enables you to read and write UNIX System Services files and to pipe data between SAS and UNIX System Services commands. For information about USS terminology, see "HFS, UFS, and zFS Terminology" on page 8.

## Allocating UNIX System Services Files

You can allocate a UNIX System Services file either externally (using a JCL DD statement or the TSO ALLOCATE command) or internally (using the SAS FILENAME statement or FILENAME function). For information about allocating USS files externally, see your IBM documentation.

There are four ways to specify that a file is in USS when you use the FILENAME statement or FILENAME function:

- Include a slash or tilde in the pathname:

```
filename input1 '/u/sasusr/data/testset.dat';
filename input2 '~/data/testset2.dat';
```

- Specify HFS (for hierarchical file system) as the file type:

```
filename input hfs 'testset.dat';
```

- Specify HFS as the file prefix:

```
filename input 'HFS:testset.dat';
```

- Rely on the setting of the FILESYSTEM= system option:

```
options filesystem=HFS;
filename 'testset.dat';
```

You can also use these specifications in combination. For example, you can specify the USS file type and use a slash in the pathname.

If you do not specify the entire pathname of a USS file, then the directory component of the pathname is the working directory that was current when the file was allocated, not when the fileref is used. For example, if your working directory was

```
/usr/local/sasusr
```

when you allocated the file, then the following FILENAME statement associates the INPUT fileref with the following path:

```
/usr/local/sasusr/testset.dat
```

```
filename input hfs 'testset.dat';
```

If you change your current working directory to

```
/usr/local/sasusr/testdata
```

the FILENAME statement still refers to

```
/usr/local/sasusr/testset.dat
```

not to

```
/usr/local/sasusr/testdata/testset.dat:
infile input;
```

# Allocating a UNIX System Services Directory

To allocate a USS directory, create the directory if necessary, and then allocate the directory using any standard method, such as a JCL DD statement, a TSO ALLOCATE command, or a FILENAME statement (as shown in "Allocating UNIX System Services Files" on page 129).

To open a particular file in a directory for input or output, you must specify the filename in the SAS INFILE or FILE statement, as described in "Accessing a Particular File in a UNIX System Services Directory" on page 135.

# Specifying File-Access Permissions and Attributes

## Overview of Specifying File-Access Permissions and Attributes

How you specify file-access permissions and attributes depends on whether you use SAS statements or operating system facilities to allocate a UNIX System Services file.

## Using SAS

If you use the FILENAME statement or FILENAME function to allocate a USS file, or if you use a JCL DD statement or a TSO ALLOCATE command but do not specify values for PATHMODE and PATHOPTS, then SAS uses the following values for those options:

- For PATHMODE, SAS uses the file-access mode `-rw-rw-rw-`. However, this mode can be modified by the current file-mode creation mask. (For detailed information about the file-mode creation mask, see your IBM documentation.)
- For PATHOPTS, the file-access mode that SAS supplies depends on how the fileref or ddname is being used:
  - If the fileref or ddname appears only in a FILE statement, SAS opens the file for writing only. If the file does not exist, SAS creates it.
  - If the fileref appears only in an INFILE statement, SAS opens the file for reading only.
  - If the fileref appears in both FILE and INFILE statements within the same DATA step, SAS opens the file for reading and writing. For the FILE statement, SAS also creates the file if it does not already exist.

## Using Operating System Facilities

When you use a JCL DD statement or a TSO ALLOCATE command to allocate a USS file, you can use the PATHMODE and PATHOPTS options to specify file-access permissions and attributes for the file. If you later use the file's ddname in a SAS session, SAS uses the values of those options when it opens the file.

For example, if you use the following TSO ALLOCATE command to allocate the ddname INDATA and SAS attempts to open it for output, then SAS issues an "insufficient authorization" error message and does not permit the file to be opened for output. (The ORDONLY value of PATHOPTS specifies "open for reading only.")

```
alloc file(indata)
   path('/u/sasusr/data/testset.dat')
   pathopts(ordonly)
```

In other words, you could use the ddname INDATA in a SAS INFILE statement, but not in a FILE statement. Similarly, if you specify OWRONLY, then you can use the ddname in a FILE statement but not in an INFILE statement.

**CAUTION**

**PATHOPTS values OAPPEND and OTRUNC take precedence over FILE statement options OLD and MOD.** If you specify OAPPEND ("add new data to the end of the file"), the FILE statement option OLD does not override this behavior. Similarly, if you specify OTRUNC ("if the file exists, erase it and re-create it"), the FILE statement options OLD and MOD do not override this behavior. For details about these FILE statement options, see "Standard Host Options for the FILE Statement under z/OS" on page 608.

# Using UNIX System Services Filenames in SAS Statements and Commands

## Overview of Using UNIX System Services Filenames in SAS Statements and Commands

To use an actual USS filename (rather than a fileref or ddname) in a SAS statement or command, include a slash or tilde in the pathname, or use the HFS prefix with the filename. You can use a USS filename anywhere that an external filename can be used, such as in a FILE or INFILE statement, in an INCLUDE or FILE command in the windowing environment, or in the SAS Explorer window. If the file is in the current directory, specify the directory component as `./`. Here is an example:

```
include './testprg.sas'
```

## Concatenating UNIX System Services Pathnames

To concatenate USS files or directories, use any of the following methods:

- Associate a fileref with multiple explicit pathnames enclosed in parentheses.
- Specify a combination of explicit pathnames and pathname patterns enclosed in parentheses.
- Use a single pathname pattern.

**TIP**

- A pathname pattern is formed by including one or more UNIX wildcards in a partial pathname.
- Using wildcards in SAS is essentially the same as using them in the UNIX shell.
- Wildcards that you specify when you pipe data from SAS to USS commands are not expanded within the SAS session. These wildcards are passed directly to the USS commands for interpretation by the UNIX shell.
- Concatenation of directories and files is not allowed and results in an error on the statement or command. Therefore, a thorough knowledge of the directory tree is necessary to create patterns that guarantee that the selected pathnames are limited to only files or only directories.

The parenthesis method is specified in the FILENAME statement. You can use the wildcard method in the FILENAME, INFILE, and %INCLUDE statements and in the INCLUDE command. The wildcard method is only for input. You cannot use wildcards in the FILE statement. The parenthesis method supports input and output. However, for output, data is written to the first file in the concatenation. That first file cannot be the result of resolving a wildcard. By requiring the user to explicitly specify the entire pathname of the first file, the possibility of accidentally writing to the wrong file is greatly reduced.

The set of supported wildcard characters are the asterisk (*), the question mark(?), the square brackets ([]), and the backslash (\).

## Using the Asterisk Wildcard

The asterisk wildcard provides an automatic match to zero or more contiguous characters in the corresponding position of the pathname except for a period (.) at the beginning of the filename of a hidden file.

**Note:** Unless otherwise noted, all of the wildcard examples assume a directory structure that is necessary and sufficient for the specified results.

Here are some examples that use the asterisk as a wildcard:

- In the following FILENAME statement with a stand-alone asterisk:

  ```
  filename test '/u/userid/data/*';
  ```

  If the `data` directory contains:

  only files
  : the FILENAME statement concatenates all of the files, except hidden UNIX files.

  only subdirectories
  : the FILENAME statement concatenates all of the directories.

  a mix of files and subdirectories
  : the FILENAME statement generates an error.

- In the following INCLUDE command, the leading asterisk includes all of the files (in the specified directory) that end with **`test.dat`**.

  ```
  include '/u/userid/data/*test.dat'
  ```

- In the following INCLUDE command, the trailing asterisk includes all of the files (in the specified directory) that begin with **`test`**.

  ```
  include '/u/userid/data/test*'
  ```

- In the following %INCLUDE statement, the period with a trailing asterisk selects all of the hidden UNIX files in the specified directory.

  ```
  %include '/u/userid/data/.*';
  ```

- In the following INFILE statement, the embedded asterisk reads in all of the files (in the specified directory) that begin with **`test`** and end with **`file`**.

  ```
  infile '/u/userid/data/test*file';
  ```

## Using the Question Mark Wildcard

The question mark wildcard provides an automatic match for any character found in the same relative position in the pathname. Use one or more question marks instead of an asterisk to control the length of the matching strings.

Here are some examples that use the question mark as a wildcard:

- In the following FILENAME statement, the stand-alone question mark concatenates all of the files (in the specified directory) that have a one-character filename.

```
filename test '/u/userid/data/?';
```

- In the following INCLUDE command, the leading question mark includes all of the files (in the specified directory) that have filenames that are nine characters long and end with **test.dat**.

```
include '/u/userid/data/?test.dat'
```

- In the following %INCLUDE statement, the trailing question mark includes all of the files (in the specified directory) that have filenames that are five characters long and begin with **test**.

```
%include '/u/userid/data/test?';
```

- In the following INFILE statement, the embedded question mark reads in all of the files (in the specified directory) with filenames that are ten characters long, begin with **test**, and end with **file**.

```
infile '/u/userid/data/test??file';
```

## Using the Square Brackets Wildcard

Square brackets provide a match to all characters that are found in the list enclosed by the brackets that appear in the corresponding relative character position in the pathname. The list can be specified as a string of characters or as a range. A range is defined by a starting character and an ending character separated by a hyphen (-).

The interpretation of what is included between the starting and ending characters is controlled by the value of the LC_COLLATE variable of the locale that is being used by UNIX System Services. Attempting to include both uppercase and lowercase characters, or both alphabetic characters and digits in a range, increases the risk of unexpected results. The risk can be minimized by creating a list with multiple ranges and limiting each range to one of the following sets:

- a set of lowercase characters
- a set of uppercase characters
- a set of digits

Here are some examples of using square brackets as wildcard characters:

- In the following FILENAME statement, the bracketed list sets up a fileref that concatenates any files (in the specified directory) that are named a, b, or c.

```
filename test '/u/userid/data/[abc]';
```

- In the following INCLUDE command, the leading bracketed list includes all of the files (in the specified directory) that have filenames that are nine characters long, start with m, n, o, p, or z, and end with **test.dat**.

```
include '/u/userid/data/[m-pz]test.dat'
```

- In the following %INCLUDE statement, the trailing bracketed list includes all files (in the specified directory) with filenames that are five characters long, begin with **test**, and end with a decimal digit.

```
%include '/u/userid/data/test[0-9]';
```

- In the following INFILE statement, the embedded bracketed list reads in all files (in the specified directory) with filenames that are ten characters long, begin with **test**, followed by an upper or lowercase a, b, or c, and end with **file**.

```
infile '/u/userid/data/test[a-cA-C]file';
```

## Using the Backslash as an Escape Character

The backslash is used as an escape character. It indicates that the character that it precedes should not be used as a wildcard.

All of the pathnames in a concatenation must be for USS files or directories. If your program reads data from different types of files in the same DATA step, then you can use the EOF= option in each INFILE statement to direct program control to a new INFILE statement after each file has been read. For more information about the EOF= option of the INFILE statement, see *SAS DATA Step Statements: Reference*. A wildcard character that generates a list of mixed file types results in an error.

# Accessing a Particular File in a UNIX System Services Directory

If you have associated a fileref with a USS directory or with a concatenation of USS directories, then you can open a particular file in the directory for reading or writing by using an INFILE or FILE statement in the following form:

```
infile fileref(file);
file fileref(file);
```

This form is referred to as aggregate syntax. If you do not enclose *file* in quotation marks, and the filename does not already contain an extension, then SAS appends a file extension to the filename. In the windowing environment commands INCLUDE and FILE, and with the %INCLUDE statement, the file extension is .sas. In the INFILE and FILE statements, the file extension is .dat.

If a filename is in quotation marks, or if it has a file extension, SAS uses the filename as it is specified. If the filename is not in quotation marks, and if it does not have a file extension, SAS converts the filename to lowercase before it accesses the file.

If the file is opened for input, then SAS searches all of the directories that are associated with the fileref in the order in which they appear in the FILENAME statement or FILENAME function. If the file is opened for output, SAS creates the file in the first directory that was specified. If the file is opened for updating but does not exist, SAS creates the file in the first directory.

# Piping Data between SAS and UNIX System Services Commands

## Overview of Piping Data between SAS and UNIX System Services Commands

To pipe data between SAS and USS commands, you first specify the PIPE file type and the command in a FILENAME statement or FILENAME function. Enclose the command in single quotation marks. For example, this FILENAME statement assigns the command `ls -lr` to the fileref OECMD:

```
filename oecmd pipe 'ls -lr';
```

To send the output from the command as input to SAS software, you then specify the fileref in an INFILE statement. To use output from SAS as input to the command, you specify the fileref in a FILE statement.

You can use shell command delimiters such as semicolons to associate more than one command with a single fileref. The syntax within the quoted string is identical to the one that you use to enter multiple commands on a single line when you use an interactive UNIX shell. The commands are executed in the order in which they appear in the FILENAME statement or FILENAME function during a single invocation of a non-login UNIX shell. Commands have the ability to modify the environment for subsequent commands only within this quoted string. This tool enables you to manipulate and customize the environment for each command group without affecting the settings that you have established in your SAS session. The following example demonstrates this action:

```
filename oecmd pipe 'umask; umask 022; umask; umask';
data _null_;
infile oecmd;
input;
put _infile_;
run;
```

You should avoid using the concatenation form of the FILENAME command or FILENAME function when you pipe data between SAS and USS. Members of concatenations are handled by separate invocations of a non-login UNIX shell. Any

changes made to the environment by earlier members of the concatenation do not persist. Running the following example demonstrates the drawback of this technique:

```
filename oecmd pipe ('umask' 'umask 022; umask' 'umask');
data _null_;
infile oecmd;
input;
put _infile_;
run;
```

Note the difference in the FILENAME statements in the preceding two examples. The first example places all of the UMASK shell variables in one set of single quotation marks, and does not use parentheses. The second example includes the variables in parentheses, and places each of the variables in single quotation marks.

The UMASK shell variable was selected for these examples to help emphasize the point that the command or command group is now running in a non-login shell. The use of a non-login shell suppresses the running of the `'/etc/profile'` (site-wide profile) and the `'$HOME/.profile'` (personal profile). Suppressing the running of these profiles eliminates the possibility of having the pipes contaminated by output data that these files might generate. The elimination of profiles also ensures a consistent starting environment for the command or group of commands. Setting UMASK to a site-wide default is often done with the **`/etc/profile`**, which is one of the profiles that runs when a log in shell is invoked.

## Piping Data from a UNIX System Services Command to SAS

When a pipe is opened for input by the INFILE statement, any output that the command writes to standard output or to standard error is available for input. For example, here is a DATA step that reads the output of the `ls -l` command and saves it in a SAS data set:

```
filename oecmd pipe 'ls -l';
data dirlist;
   infile oecmd truncover;
   input mode $ 1-10 nlinks 12-14 user $ 16-23
         group $25-32 size 34-40 lastmod $ 42-53
         name $ 54-253;
run;
```

## Piping Data from SAS to a UNIX System Services Command

When a pipe is opened for output by the FILE statement, any lines that are written to the pipe by the PUT statement are sent to the command's standard input. For example, here is a DATA step that uses the USS `od` command to write the contents of the file in hexadecimal format to the USS file `dat/dump.dat`, as follows:

```
filename oecmd pipe 'od -x -tc - >dat/dump.dat';
data _null_;
   file oecmd;
   input line $ 1-60;
   put line;
datalines;
SAS software is an integrated system of software
products, enabling you to perform data management,
data analysis, and data presentation tasks.
;
run;
```

# Writing Your Own I/O Access Methods

You can write your own I/O access method to replace the default SAS access method. This feature enables you to redirect external file I/O to a user-written program.

**Note:** The user-written I/O access method applies only to external files, not to SAS data sets.

See your on-site SAS support personnel for additional information about writing I/O access methods.

# Accessing SAS Statements from a Program

You can redirect your SAS statements to come from an external program rather than from a file by using the SYSINP= and PGMPARM= system options. SYSINP= specifies the name of the program, and PGMPARM= specifies a parameter that is passed to the program. For more information, see “SYSINP= System Option: z/OS” on page 872 and “PGMPARM= System Option: z/OS” on page 827.

# Using the INFILE/FILE User Exit Facility

User exit modules enable you to inspect, modify, delete, or insert records in a DATA step. Here are some examples of how they can be used:

- encrypting and decrypting data
- compressing and decompressing data
- translating data from one character encoding to another.

User exit modules are an advanced topic. For more information, see Chapter 20, “Using the INFILE/FILE User Exit Facility,” on page 323.

# 8

# Directing SAS Log and SAS Procedure Output

# Types of SAS Output

## Overview of Types of SAS Output

For each SAS process, SAS can create three types of output:

- SAS log file
- SAS procedure output file
- SAS console log file.

## SAS Log File

The SAS log file contains information about the processing of SAS statements. As each program step executes, notes are written to the SAS log along with any applicable error or warning messages. For more information, see "SAS Log File" on page 31.

## SAS Procedure Output File

Whenever a SAS program executes a PROC step that produces printed output, SAS sends the output to the procedure output file. Beginning with Version 7, SAS procedure output is handled by the Output Delivery System (ODS), which enhances your ability to manage procedure output. Procedures that fully support ODS can perform the following actions:

- combine the raw data that they produce with one or more templates to produce one or more objects that contain the formatted results.
- store a link to each output object in the Results folder in the Results window.
- (optional) generate HTML files that contain the formatted results and links to those results, as in a table of contents.
- (optional) generate data sets from procedure output.
- provide a way to customize procedure output by creating templates that you can use whenever you run your procedure.

For more information about ODS, see *SAS Output Delivery System: User's Guide*.

For more information about the procedure output file, see "SAS Procedure Output File" on page 33.

# SAS Console Log File

If an error, warning, or note must be written to the SAS log and the log is not available, the console log is used instead. The console log file is particularly useful for capturing log entries that are generated during SAS initialization, before the SAS log file is opened. For more information about this file, see "Console Log File" on page 35.

# Destinations of SAS Output Files

The following table shows the default destinations of the SAS output files.

***Table 8.1*** *Default Destinations for SAS Output Files*

| Processing Mode | Log File | Procedure Output File |
|---|---|---|
| batch | printer | printer |
| windowing environment (TSO) | Log window | Output window |
| interactive line (TSO) | terminal | terminal |
| noninteractive (TSO) | terminal | terminal |

These default destinations are specified in the SAS cataloged procedure, in the SAS CLIST, or in the SASRX exec, which you use to invoke SAS in batch mode and under TSO. Your system administrator might have changed these default destinations.

If you want to change the destination of these files, use the following table to help you decide which method you should choose.

*Table 8.2* *Changing the Default Destination*

| Output Destination | Processing Mode | Method to Use | Documentation |
|---|---|---|---|
| a printer | any mode | FILENAME statement and PRINTTO procedure | "Using the PRINTTO Procedure and Universal Printing" on page 151 or "Using the PRINTTO Procedure and the FORM Subsystem" on page 152 |
| | windowing environment under TSO | PRINT command and the Universal Printing subsystem option display | "Using the PRINT Command and Universal Printing" on page 153 |
| | | PRINT command and the FORM subsystem option display | "Using the PRINT Command and the FORM Subsystem" on page 154 |
| | | PRTFILE and PRINT commands | "Using the PRTFILE and PRINT Commands" on page 156 |
| an external file | any mode | PRINTTO procedure | "Directing Output to External Files with the PRINTTO Procedure" on page 145 |
| | batch | LOG= and PRINT= system options | "Directing Output to an External File at SAS Invocation" on page 146 |
| | | SASLOG DD and SASLIST DD statements | "Directing Output to External Files with DD Statements" on page 149 |
| its usual location and to an external file | any mode | ALTLOG= and ALTPRINT= system options | "Directing Output to External Files with System Options" on page 146 |
| | windowing environment under TSO | FILE command | "Directing Output to External Files with the FILE Command" on page 149 |
| a remote destination | any mode | FILENAME statement and PRINTTO procedure | "Directing Output to a Remote Destination" on page 159 |

Beginning with SAS 8.2, SAS output can also be routed via electronic mail (email). For information about how SAS implements email delivery, see "Sending Email from within SAS Software" on page 169.

# Directing Output to External Files with the PRINTTO Procedure

Using the PRINTTO procedure with its LOG= and PRINT= options, you can direct the SAS log or SAS procedure output to an external file in any mode. You can specify the name of the external file in the PROC PRINTTO statement. For example, the following statement directs procedure output to MYID.OUTPUT.DATA(MEMBER):

```
proc printto print='myid.output.data(member)' new;
```

However, if you plan to specify the same external file several times in your SAS program, you can allocate the file with one of the following methods:

- a FILENAME statement
- a JCL DD statement
- the TSO ALLOCATE command.

For details and examples, see "Introduction to External Files" on page 94. After the external file is allocated, use the PROC PRINTTO statement options LOG= or PRINT= at any point in your SAS session to direct the log or procedure output to the external file. Specify the fileref or the ddname that is associated with the external file. Here is an example that uses FILENAME statements to allocate external files for both the log and the procedure output:

```
filename printout 'myid.output.prtdata' disp=old;
filename logout 'myid.output.logdata' disp=old;
proc printto print=printout log=logout new;
```

The log and procedure output continue to be directed to the designated external file until another PROC PRINTTO statement redirects them.

The NEW option causes any existing information in the file to be cleared. If you omit the NEW option from the PROC PRINTTO statement, the SAS log or procedure output is appended to existing sequential data sets. You must specify NEW when routing to a PDS or PDSE because you cannot append data to a member of a partitioned data set.

If you want to direct both the log and procedure output to partitioned data set members, the members must be in a PDSE or in different data sets. SAS enables you to write to two members of a PDSE, but not to two members of a PDS.

To return the log and procedure output to their default destinations, submit the following statements:

```
proc printto;
```

```
run;
```

For a list of the default destinations, see Table 8.1 on page 143.

# Directing Output to External Files with System Options

## Overview of Directing Output to External Files with System Options

You can use SAS system options to change the destination of the SAS log and procedure output. The options that you use depend on which of the following tasks you want to accomplish:

- directing your SAS log or procedure output to an external file instead of to their default destinations. For more information, see "Directing Output to an External File at SAS Invocation" on page 146.
- directing the log or output both to their default destinations and to an external file. For more information, see "Copying Output to an External File" on page 147.

Specify the system options in any of the following ways:

- when you invoke the SAS CLIST
- when you invoke the SASRX exec
- in the JCL EXEC statement
- in your SAS configuration file.

For more information about specifying SAS system options, see "Specifying or Changing System Option Settings" on page 19.

## Directing Output to an External File at SAS Invocation

Use the LOG= and PRINT= system options to change the destination of your SAS log or procedure output. The log and procedure output are then not directed to their default destinations.

When you invoke SAS, use the LOG= and PRINT= options to specify the ddnames or physical filenames of the output data sets. For option syntax and other host-

specific details, see "LOG= System Option: z/OS" on page 804 and "PRINT= System Option: z/OS" on page 828.

SAS automatically allocates a file when a system option is specified with a physical filename. The following example illustrates a SAS invocation in noninteractive mode using the SAS CLIST with internal allocation of output files:

```
sas options ('log=myid.output.logdata
   print=myid.output.prtdata')
   input('''myid.sas.program''')
```

The following example illustrates a similar SAS invocation that uses SASRX:

```
sasrx -log 'myid.output.logdata' -print
'myid.output.prtdata' -input
'myid.sas.program'
```

This example illustrates the same SAS invocation using external allocation:

```
alloc fi(logout) da('myid.output.logdata') old
alloc fi(printout) da('myid.output.prtdata') old
sas options('log=logout print=printout')input('''myid.sas.program''')
```

The following example illustrates a similar SAS invocation that uses SASRX:

```
sasrx -log logout -print printout -input
'myid.sas.program'
```

This example illustrates a SAS invocation in batch mode, using a JCL EXEC statement and internal allocation of output files:

```
//SASSTEP EXEC SAS,
//   OPTIONS='LOG=<file> PRINT=<file>'
```

This example illustrates the same SAS invocation with external allocation:

```
//SASSTEP  EXEC SAS,
//              OPTIONS='LOG=LOGOUT PRINT=PRINTOUT'
//LOGOUT   DD   DSN=MYID.OUTPUT.LOGDATA,DISP=OLD
//PRINTOUT DD   DSN=MYID.OUTPUT.PRTDATA,DISP=OLD
//SYSIN    DD   DSN=MYID.SAS.PROGRAM,DISP=SHR
```

The LOG= and PRINT= system options are normally used in batch, noninteractive, and interactive line modes. These options have no effect in the windowing environment, which still displays SAS log and procedure output data in the Log and Output windows. To capture and print data in the Log and Output windows, use the ALTLOG= and ALTPRINT= options, as described in the next section.

For option syntax and other host-specific details, see "ALTLOG= System Option: z/OS" on page 703 and "ALTPRINT= System Option: z/OS" on page 704.

# Copying Output to an External File

Use the ALTLOG= and ALTPRINT= system options to send a copy of your SAS log or procedure output to an external file. After specifying ALTLOG= and ALTPRINT=, the log and procedure output is still displayed in the Log and Output windows as usual. The log and procedure output are still directed to their default SAS file

destinations or to the nondefault destinations specified by the LOG= and PRINT= system options, as described in the preceding section.

When you invoke SAS, use the ALTLOG= and ALTPRINT= options as shown to specify the ddnames or physical filenames of the allocated data sets:

```
sas options('altprint=myid.output.prtdata
   altlog=myid.output.logdata')
```

The following example illustrates a similar SAS invocation that uses SASRX:

```
sasrx -altprint 'myid.output.prtdata' -altlog
'myid.output.logdata'
```

See the previous section for complete examples of SAS invocations in various modes.

# Directing Output to External Files Using the Configuration File

This example illustrates how to direct output to external files using the SAS configuration file:

```
log=myid.output.logdata
* logout ddname must be allocated
log=logout

print=myid.output.prtdata
* printout ddname must be allocated
print=printout

altlog=myid.output.altlog
* altlogx ddname must be allocated
altlog=altlogx
```

# Directing Output to External Files with the DMPRINT Command

Beginning in SAS 8.2, you can use the DMPRINT command to copy the contents of many different windows to external files. Issue the DMPRINT command on the command line of the window whose contents you want to copy. SAS displays the Print window. If the **Use Forms** check box is visible, verify that it is not selected. Select the option **Print to File**. An input window asks you for the name of the file to which to save the window contents. You must enter the fully qualified filename. If the file does not exist, a dialog box asks whether you want to create the file and whether you want to catalog it. If the file does exist, a dialog box asks whether you

want to replace it or to append data to the existing data. This option is not available if SAS is invoked with the NOUNIVERSALPRINT system option set.

# Directing Output to External Files with the FILE Command

You can use the FILE command to copy the contents of many different windows to external files. Issue the FILE command on the command line of the window whose contents you want to copy. For example, to copy the contents of the Log window to a sequential data set, issue the following command on the command line of the Log window:

```
file 'myid.log.out'
```

If the file exists, a dialog box asks whether you want to replace it or to append data to the existing data.

You can also use the FILE command to copy the contents of a window to either a PDS or PDSE member:

```
file 'myid.log.out1(test)'
```

If you have already associated a fileref or ddname with your PDS or PDSE, then you can use the fileref or ddname in the command, followed by the member name in parentheses:

```
file mylib(test)
```

If the member that you specify already exists, it is overwritten because you cannot append data to existing PDS or PDSE members.

# Directing Output to External Files with DD Statements

In a z/OS batch job, you can use the SASLOG DD and SASLIST DD statements to change the destination of the SAS log and procedure output file. These statements override the DD statements in the SAS cataloged procedure. Therefore, the position of these statements in your JCL is important. You must place the SASLOG DD statement and the SASLIST DD statement in the same order as they appear in the SAS cataloged procedure. Also, these statements must follow the JCL EXEC statement, and they must precede the DD statements for any ddnames that are not included in the cataloged procedure (such as SYSIN).

For example, the following example directs the SAS log to member DEPT of an existing partitioned data set and directs the procedure output to an existing sequential data set:

```
//REPORT  JOB accounting-information,
//        MSGLEVEL=(1,1)
//SASSTEP EXEC SAS,OPTIONS='LINESIZE=80 NOSTATS'
//SASLOG  DD DSN=MYID.MONTHLY.REPORT(DEPT),
//        DISP=OLD
//SASLIST DD DSN=MYID.MONTHLY.OUTPUT,DISP=MOD
//SYSIN   DD *
SAS statements
//
```

**Note:** SASLOG and SASLIST are the default ddnames of the SAS log and procedure output files. If these ddnames have been changed in your site's SAS cataloged procedure, then use your site's ddnames in place of SASLOG and SASLIST.

**CAUTION**

**The SAS cataloged procedure specifies default DCB characteristics unless you specify them in the SASLOG or SASLIST DD statement.** If you are directing the SAS log to a member of a partitioned data set whose DCB characteristics are different from the characteristics given in "SAS Log File" on page 31, then you must include the existing DCB characteristics in the SASLOG DD statement. Similarly, if you are directing the SAS procedure output to a member of a partitioned data set whose DCB characteristics are different from the characteristics that are given in "SAS Procedure Output File" on page 33, then you must include the existing DCB characteristics in the SASLIST DD statement. Otherwise, the existing DCB characteristics of the partitioned data set are changed to the characteristics that are specified for SASLOG or SASLIST in the SAS cataloged procedure, making the other members of the partitioned data set unreadable.

# Directing Output to a Printer

## Overview of Directing Output to a Printer

Beginning in SAS 8.2, SAS supports two printing destinations for directing procedure output on z/OS: Universal Printing and Xprinter (line) printing. A Universal printer is an email message, network printer, or file that exists on a local area network (LAN). Universal Printing is the default printing destination. Xprinter translates to a printer device on an SNA network. The FORM subsystem is one way to direct output that is destined for a line printer.

The printing destination and default printer at a site are typically determined by data center personnel. This section contains instructions for directing procedure output using either of the printing destinations. You can direct SAS output to a printer as follows:

- by using the PRINTTO procedure combined with Universal Printing
- by using the PRINT command or menu selection combined with Universal Printing
- by using the PRINT command or menu selection combined with the FORM subsystem
- by using the PRTFILE command and the PRINT command or menu selection combined with the FORM subsystem.

Universal Printing and the FORM subsystem are portable and are documented in the Base SAS section of the SAS Help and in *SAS Language Reference: Concepts*. To help customer sites get started with Universal Printing, some common z/OS printer definitions, sample printer setup programs, and sample print commands are also provided in Chapter 9, "Universal Printing," on page 185.

# Using the PRINTTO Procedure and Universal Printing

## Overview of the PRINTTO Procedure and Universal Printing

You can use the FILENAME statement with the PRINTTO procedure to route your output directly to a printer. Specify a device type of UPRINTER to direct your output to the default Universal Printing printer. Then specify the fileref with the PRINT= or LOG= option in the PROC PRINTTO statement. The following example establishes a fileref and uses it in the PROC PRINTTO statement to redirect the procedure output:

```
filename output UPRINTER;
proc printto print=output;
```

The Universal Printing default printer is usually determined by your site's data center personnel. You can define your own default printer in the windowing environment by selecting **File** ⇨ **Print Setup** or by issuing the DMSETPRINT *printer-name* command, where *printer-name* is the name of the printer that you want to make the default. You can also define a temporary default printer by specifying the PRINTERPATH= system option. This option is typically used in the batch environment.

### Example

Follow these steps to direct output to the default Universal Printing printer:

1 Identify a print destination:

```
filename myprint UPRINTER;
```

2 Identify the print destination to SAS:

```
proc printto print=myprint; run;
```

3 Submit a print procedure:

```
proc print data=work.myfile;
run;
```

4 Remove the print destination from SAS:

```
proc printto; run;
```

## Using the PRINTTO Procedure and the FORM Subsystem

### Overview of the PRINTTO Procedure and the FORM Subsystem

You can use the FILENAME statement or FILENAME function with the PRINTTO procedure to route your output directly to a printer. Use the SYSOUT= option in the FILENAME statement or function to direct your output to the system printer. The default system printer is controlled by the FORM subsystem. Then specify the fileref with the PRINT= or LOG= option in the PROC PRINTTO statement. The following example establishes a fileref and uses it in the PROC PRINTTO statement to redirect the procedure output:

```
filename output sysout=a;
proc printto print=output;
```

Usually, SYSOUT=A specifies that the destination is a printer. However, this value is determined by the data center personnel at your site.

### Example

Follow these steps to direct output to the system printer:

1 Identify a print destination:

```
filename myprint dest=dest99 sysout=a hold;
```

2 Identify the print destination to SAS:

```
proc printto; print=myprint; run;
```

3 Submit a print procedure:

```
proc print data=work.myfile;
run;
```

4 Remove the print destination from SAS:

```
proc printto; run;
```

# Using the PRINT Command and Universal Printing

## Overview of the PRINT Command and Universal Printing

Use the PRINT command or menu selection to direct the contents of a window to your default printer. This method is the easiest way to print output. For example, issue the PRINT command from the command line of your Output window to send the contents of that window to your default printer. The default printer - as well as other aspects of your output such as printer margins, printer control language, and font control information - are controlled by the Universal Printing subsystem. The Universal Printing subsystem consists of five windows that are described in detail in *SAS Language Reference: Concepts*.

## Selecting a Printer

To direct the contents of a window to a printer that is not your default printer, you can issue a DMSETPRINT *printer-name* command, where *printer-name* is the name of the printer that you want to make the default. You can also specify a temporary default printer by using the PRINTERPATH= system option.

## Modifying Printer Properties

To use the default printer and change one or more of its parameters, issue the DMPRINT command on the command line of the window whose contents you want to copy. SAS displays the Print window. If the **Use Forms** window check box is visible, verify that it is not selected. Select **Properties** and change any of the parameters. Select **OK** to accept and **OK** to print. The new definition is saved in

your Sasuser file, and it overrides any definition of a printer of the same name in the Sashelp file.

### Creating a New Printer Definition

There are several ways to set up a printer using Universal Printing:

- Select **File** ⇨ **Print Setup** from a menu.
- Issue the DMPRTSETUP command.
- Issue the DMPRTCREATE command.
- Override the active printer settings using PROC PRTDEF. You can also use PROC PRTDEF to set up multiple printers at one time.

Typically, your system administrator sets up the printers. Your system administrator can save printer definitions to Sashelp so that all users have access to them. When you use PROC PRTDEF, you can save the definitions in the Sasuser or Sashelp libraries.

### Printing a Graphics Window

When printing a graphics window, you can print to the default printer, to any other Universal Printer, or to a SAS/GRAPH graphics driver. To print from a printer that is not the default, select from the list of available printers. To print with a SAS/GRAPH driver, select the **Use SAS/GRAPH Drivers** check box in the Print Method group box. The software displays a list of available drivers from which you can select.

### Previewing a Print Job

You cannot currently preview a print job on a mainframe.

## Using the PRINT Command and the FORM Subsystem

### Overview of the PRINT Command and the FORM Subsystem

Use the PRINT command or menu selection to direct the contents of a window to your default printer. The default printer — as well as other aspects of your output

such as printer margins, printer control language, and font control information — is controlled by the FORM subsystem. The FORM subsystem consists of six frames that are described in detail in *SAS Language Reference: Concepts* and in "Host-Specific Windows of the FORM Subsystem" on page 273. You use these frames to define a form for each printer that is available to you at your site. You can also define multiple forms for the same printer. For more information, see "Adding a Form" on page 156. Your on-site SAS support personnel can give you information about your default form and about any other forms that have been defined at your site.

## Specifying a Form

To direct the contents of a window to a printer that is not your default printer, you can use the FORM= option with the PRINT command. Use this option to specify a form that has been defined for a different printer. For example, to copy output to a printer destination that is described in a form named MYOUTPUT, you would enter the following command-line command:

```
print form=myoutput
```

## Modifying Your Default Form

To change the default destination printer and to customize other features of the output that the PRINT command generates, you can modify the default form that the FORM subsystem uses. To modify your default form, do the following:

1. Enter `fsform default` from the command line to display your default form. If your SASUSER.PROFILE catalog contains a form named DEFAULT, then that form is displayed. If you do not have a form named DEFAULT, then the Printer Selection frame is displayed.
2. Select a printer from the Printer Selection frame. When you select a printer, SAS copies the default form for that printer into your SASUSER.PROFILE catalog.

   **Note:** Printer information is site-specific; see your system administrator if you need help with selecting a printer.

3. Make other changes to the default form, if desired, by changing the information in the other frames of the FORM subsystem. Issue the NEXTSCR command to scroll to the next FORM frame, and issue the PREVSCR command to scroll to the previous frame. The two Print File Parameters frames are used to specify host-specific printer information; they are described in "Host-Specific Windows of the FORM Subsystem" on page 273. The other frames are described in the *SAS Language Reference: Concepts*.
4. Enter the END command to save your changes.

## Adding a Form

You can also add additional forms to the FORM subsystem. These forms can then be used with the PRINT command, as described in "Specifying a Form" on page 155, and they can be modified in the same manner as described in "Modifying Your Default Form" on page 155. For example, to create a form named MYOUTPUT, do the following:

1. Enter `fsform myoutput` from the command line.
2. Select a printer from the Printer Selection frame.
3. Use the NEXTSCR and PREVSCR commands to scroll through the other frames of the FORM subsystem. Use these other frames to provide additional information that is associated with the MYOUTPUT form.
4. Enter the END command to save your changes.

## Examples

- To create or update a SAS form:

  ```
  fsform myoutput
  ```

- To identify the SAS form:

  ```
  FORMNAME myoutput
  ```

- To print the contents of a window:

  ```
  PRINT
  ```

- To send a file to the printer:

  ```
  FREE
  ```

# Using the PRTFILE and PRINT Commands

## Overview of the PRTFILE and PRINT Commands

You can also use the PRTFILE command, followed by the PRINT command, to print the contents of windows. This method enables you to override some of the defaults that are established by the FORM subsystem, such as the destination printer or the SYSOUT class.

**Note:** The PRTFILE command does not apply to Universal Printing printers. Default values of system-defined printers in the Universal Printing subsystem can be overridden in the Properties window. The modified printer definition is saved to the SASUSER file, which overrides any definition of a printer of the same name in the Sashelp file.

PRTFILE establishes the destination, and PRINT sends the contents of the window to that destination. If you do not specify a destination with the PRTFILE command, PRINT automatically sends the window contents to your default printer. For information about using the PRINT command alone, see "Using the PRINT Command and the FORM Subsystem" on page 154.

For example, to print the contents of your Output window on RMT5 instead of on your default printer, follow these steps:

1 From the Program Editor window, submit a FILENAME statement or FILENAME function to allocate a destination file for the output. You can use the DEST= and SYSOUT= options to specify the destination and SYSOUT class, respectively. You can also direct the output to the HOLD queue by specifying the HOLD option. For information about other options that you can specify, see "SYSOUT Data Set Options for the FILENAME Statement" on page 634.

```
filename myrpt dest=rmt5 sysout=a hold;
```

**Note:** The destination printer that you specify in the FILENAME statement or FILENAME function must be the same type of printer as your default printer.

2 From a command line, issue the PRTFILE command, specifying the fileref from your FILENAME statement or FILENAME function.

```
prtfile myrpt
```

3 From the command line of the window whose contents you want to print, issue the PRINT command.

4 If you want to print the contents of any other windows, issue the PRINT command from the command line of those windows. A dialog box warns you that the destination file already exists. Enter `A` in the dialog box to append the window contents to the destination file.

5 From the command line of the first window that you printed, issue the FREE command.

6 From the Program Editor window, submit a FILENAME statement or FILENAME function to clear (deassign) the fileref. Your output is not actually printed until you perform this step.

```
filename myrpt clear;
```

## Example

Follow these steps to print a file with PRTFILE and PRINT:

1 Establish a print destination with the FILENAME statement:

```
filename myprint dest=dest99 sysout=a;
```

2 Identify the fileref as a print destination:

```
prtfile myprint replace
```

3 Print the file with the PRINT command or menu selection.

When directing output to a print device, for immediate printing use the FREE command or menu selection, and then submit:

```
filename myprint clear;
```

For delayed printing, ending the SAS session or process forces printing to an output device.

# SAS System Options That Relate to Printing When Using Universal Printing

The NOUNIVERSALPRINT system option is related to the printing of SAS output when using Universal Printing. NOUNIVERSALPRINT turns Universal Printing off.

# SAS System Options That Relate to Printing When Using the FORM Subsystem

The following system options relate to the printing of SAS output when using the FORM subsystem:

- SYSPRINT= is used when the PRINT command or PMENU selection is issued and the print file default has not been established with the PRTFILE command, Set Print File menu selection, or Set Form Name menu selection.
- FILEFORMS= specifies the default form that is used in the operating environment. The default form is used when a printer file is dynamically allocated, when FORMS= is not specified in the FILENAME statement, or when the SAS form being used does not have a FORMS= value.
- FORMS= specifies the name of the default form that is used by the SAS FORM subsystem in the windowing environment.
- FILESYSOUT= specifies the default SYSOUT= class that is used when a printer file is allocated dynamically and SYSOUT= is omitted from the FILENAME statement, or when the SAS form being used does not have a CLASS= value.

  A valid *sysout-class* is a single character (number or letter only). Valid classes are site dependent. At some sites, data center personnel might have set up a default class that cannot be overridden.

# Directing Output to a Remote Destination

For Universal Printing, you direct output to a remote destination by specifying the DEST= option on the host option parameter of the printer definition. You can modify or create a printer definition by using PROC PRTDEF, by issuing the DMPRTSETUP command, or by selecting **File** ⇨ **Print Setup** in the windowing environment.

In the FORM subsystem, you use the DEST= option of the FILENAME statement or FILENAME function to direct output to a remote destination. The destination can be a workstation, a local or remote printer, or other device.

In order to direct your output to a remote destination, you must know the remote station ID of the device that receives your output. The station ID is an identifying label that is established by your data center; it is one to eight characters in length. You must also know the appropriate SYSOUT class for output that is directed to the remote device. Your data center personnel can provide you with this information.

After determining the remote station ID and the SYSOUT class, you use either the TSO ALLOCATE command or a SAS FILENAME statement or FILENAME function to establish a ddname or fileref for the destination. Then use the ddname or fileref with the PRINTTO procedure to direct your output. Here is an example that directs the procedure output file to a remote printer:

```
filename output sysout=a dest=xyz16670;
proc printto print=output;
proc print data=oranges;
run;
```

The FILENAME statement includes the options SYSOUT=A and DEST=xyz16670. The values of these options are site specific. In this case, the output class, A, specifies that the output is directed to a printer. The destination, xyz16670, links the fileref to a particular printer.

The PROC PRINTTO statement then specifies the fileref OUTPUT in the PRINT= option. This option directs the procedure output file to the destination that was associated with the fileref OUTPUT in the FILENAME statement. When the PRINT procedure is executed, SAS sends the procedure output to the job entry subsystem (JES); the output is not displayed in the Output window. JES holds the output until the file identified by the fileref OUTPUT is closed and deassigned. Then the output is printed at the remote destination.

To send the output to the printer for the previous example, submit:

```
proc printto; run;
filename output;
```

To direct the SAS log to a remote destination, use the same procedure, but use the LOG= option instead of the PRINT= option with the PROC PRINTTO statement.

# Directing Procedure Output: ODS Examples

## Overview of ODS Output

SAS supports three output formats for procedure output: the Output Delivery System (ODS), SAS/GRAPH, and the FORM subsystem.

Most of ODS is portable and documented elsewhere, including the *SAS Output Delivery System: User's Guide* and the *SAS Language Reference: Concepts*. Two format options provided by ODS are HTML and XML. This section shows examples of how the ODS HTML and ODS XML statements are used and the steps that are required to route the output between operating environments. A SAS/GRAPH example is also provided.

In a mainframe environment, by default, ODS produces a binary file that contains embedded record-separator characters. Although this approach means that the file is not restricted by the line-length restrictions on ASCII files, it also means that if you view the file in an editor, the lines all run together.

If you want to format the HTML files so that you can read them with an editor, use RECORD_SEPARATOR=NONE. In this case, ODS writes one line of HTML at a time to the file. When you use a value of NONE, the logical record length of the file that you are writing to must be at least as long as the longest line that ODS produces. If it is not, the HTML can wrap to another line at an inappropriate place. We recommend that you use `rs=none` if you are writing to a standard z/OS file, but not if you are writing to a UFS file. For an example that uses `rs=none` to format output, see "Writing ODS XML Output to EBCDIC, and ASCII Transfer to UNIX" on page 167.

# Line-Feed Characters and Transferring Data between EBCDIC and ASCII

## Overview of Transferring Data between EBCDIC and ASCII

When you exchange data between an operating environment that uses ASCII encoding and an operating environment that uses EBCDIC encoding, formatting errors can occur. EBCDIC and ASCII do not always use the same characters to indicate the end of a line of data. EBCDIC indicates the end of a line with either a line-feed character or a newline character. ASCII uses only the line-feed character to indicate the end of a line. If you exchange data between an EBCDIC operating environment, such as z/OS, and an ASCII operating environment, such as Windows, then you should specify the ENCODING= option to match the operating environment of the destination.

## Details of Transferring Data

Software running on ASCII platforms requires that the end of the line be indicated by a line-feed character. When data is transferred from z/OS to a machine that supports ASCII encodings, formatting problems can occur, particularly in HTML output, because the EBCDIC newline character is not recognized.

Software running on UNIX environments requires the ASCII line-feed character. Software running on Windows environments requires a carriage return that is followed by a new line. Use the TERMSTR= option to specify which line termination to use.

SAS supports the following two sets of EBCDIC-based encodings for z/OS:

- The encodings with EBCDIC in their names generate or interpret the end-of-line character that is to be the EBCDIC line-feed character. Many text-based file transfer protocols map the EBCDIC line-feed character to something other than the ASCII line-feed character when the text is being transcoded. This situation could cause problems when the file is used in other environments.
- The encodings with OPEN_ED in their names generate or interpret the end-of-line character to be the EBCDIC newline character. Many text-based file transfer protocols map the EBCDIC newline character to the ASCII line-feed character when the text is being transcoded.

For more information about these encodings, see the *SAS National Language Support (NLS): Reference Guide*.

If you need to exchange data between ASCII and EBCDIC, you can specify encodings from the list of encodings in "ENCODING System Option" in the *SAS National Language Support (NLS): Reference Guide*. There are several language elements and commands that enable you to specify encodings when creating or exchanging data:

- "FILE Statement: z/OS" on page 604
- "INFILE Statement: z/OS" on page 647
- "FILE Command: z/OS" on page 280
- "INCLUDE Command: z/OS" on page 283
- "ENCODING= Data Set Option" and "ENCODING System Option" in the *SAS National Language Support (NLS): Reference Guide*

# Viewing ODS Output on an External Browser

The following example stores ODS HTML output in a UNIX System Services (USS) file. You can then display the output in an external HTML browser with the universal resource locator (URL) appropriate to your site.

```
/* if needed, create web directory */
%sysexec mkdir '/u/myuid/public_html' ;

ods html
/* specify locations of HTML files */
  body='examplb.htm'
  page='examplp.htm'
  contents='examplc.htm'
  frame='example.htm'
  path='/u/myuid/public_html'(url=none);

/* Do not send output to proc output */
ods listing close;

title1 'z/OS UNIX System Services
   Example';

proc plan seed=9544455;
  factors a=3 b=4 c=5 ordered; run;
  title1;
  quit;

/* close the HTML destination */
ods html close;
```

Here is a typical URL for this example:

```
http://corp.dept.com/~myuid/example.htm
```

For more information about viewing ODS output with a browser, see "Using Remote Browsing with ODS Output" on page 226.

# Storing ODS HTML Output in a Sequential File, and FTPing It from UNIX

The following example runs partly on SAS in the z/OS operating environment and partly on the command line in the UNIX operating environment.

```
ods html
/* specify HTML files and destination URLs */
  body='.seqb.htm'     (url='seqb.htm')
  page='.seqp.htm'     (url='seqp.htm')
  contents='.seqc.htm' (url='seqc.htm')
  frame='.seqf.htm'
  trantab=ascii;

/* Do not send output to procedure output destination*/
ods listing close;

title1 'z/OS HTML Example';

proc plan seed=9544455;
  factors a=3 b=4 c=5 ordered; run;
  title1;
  quit;

/* close the html destination */
ods html close;
```

When you use physical filename syntax and run in interactive mode, you are prompted to specify whether you want to create the files. You are not prompted in batch mode.

When you use JCL or a FILENAME statement, the disposition parameter controls file creation.

The TRANTAB= option generates ASCII stream files. You cannot read ASCII stream files with TSO ISPF browse. The default file characteristics are record format VB and record length 8,196.

You might need to update links between the files after you transfer the files to UNIX. To avoid the need to update links, use the URL= option in the ODS statement to identify how you would like to generate the links.

This second part of the example transfers the ODS output file from z/OS to UNIX. Issue the following commands on a UNIX workstation:

```
ftp
...
ftp> binary
...
ftp> get 'myuid.seqb.html'
     /u/myuid/public_html/seqb.htm
...
```

To view the output file, point your UNIX browser at the file that you moved to UNIX with FTP, using a URL such as

```
http://corp.dept.com/~myuid/seqb.htm
```

# Storing ODS HTML Output in a z/OS PDSE, and FTPing It from UNIX

The filename in this example stores ODS output as a member of a partitioned data set extended (PDSE).

```
/* create a PDSE */
filename ODSPDSE '.exampl.pdse'
  dsntype=library
  disp=(new,catlg) dsorg=po ;

ods html
/* specify HTML files and destination URLs */
  body='examplb'     (url='examplb.htm')
  page='examplp'     (url='examplp.htm')
  contents='examplc' (url='examplc.htm')
  frame='examplf'
  path='.exampl.pdse' (url=none)
  trantab=ascii;

/* Do not send output to procedure output destination */
ods listing close;

title1 'z/OS PDSE Example';

proc plan seed=9544455;
  factors a=3 b=4 c=5 ordered; run;
  title1;
  quit;

/* close the HTML destination */
ods html close;
```

The TRANTAB= option generates ASCII stream files. You cannot read ASCII stream files with TSO ISPF browse.

You might need to update links between the files after you transfer the files to UNIX. To avoid the need to update links, use the URL= option in the ODS statement to identify how you would like to generate the links.

In the UNIX operating environment, use the following FTP command to transfer a file from the PDSE:

```
ftp> get 'myuid.exampl.pdse(examplb)'
     /u/myuid/public_html/examplb.html
```

# Writing ODS HTML Output Directly to UNIX

The following example uses the FTP access method to write HTML output that is generated on z/OS directly to a UNIX file.

Each of the following FILENAME statements uses the FTP access method to specify a file on a UNIX host. Each file contains part of the ODS HTML output that is generated by this SAS job. You need to provide the correct host, user, password, and directory information for your site. See the section on the FILENAME, FTP access method in the *SAS DATA Step Statements: Reference* for more information about the FTP access method options.

```
filename myfram ftp 'example_frame.htm'         /* Specify frame file */
                    cd='mydir'                  /* Specify directory  */
                    host='myhost.mycompany.com' /* Specify your host  */
                    user='myuser'               /* Specify user       */

                    pass='mypass'               /* Specify password   */
      /* or */      /* prompt */                /* Password prompting */

                    rcmd='site umask 022'       /* Set permissions to */
                                                /* -rw-r--r--         */
                    recfm=s                     /* binary transfer    */
                    debug;                      /* Write ftp messages */

filename mybody ftp 'example_body.htm'          /* Specify body file  */
                    cd='mydir'                  /* Specify directory  */
                    host='myhost.mycompany.com' /* Specify your host  */
                    user='myuser'               /* Specify user       */

                    pass='mypass'               /* Specify password   */
      /* or */      /* prompt */                /* Password prompting */

                    rcmd='site umask 022'       /* Set permissions to */
                                                /* -rw-r--r--         */
                    recfm=s                     /* binary transfer    */
                    debug;                      /* Write ftp messages */

filename mypage ftp 'example_page.htm'          /* Specify page file  */
                    cd='mydir'                  /* Specify directory  */
                    host='myhost.mycompany.com' /* Specify your host  */
                    user='myuser'               /* Specify user       */

                    pass='mypass'               /* Specify password   */
      /* or */      /* prompt */                /* Password prompting */

                    rcmd='site umask 022'       /* Set permissions to */
                                                /* -rw-r--r--         */
                    recfm=s                     /* binary transfer    */
                    debug;                      /* Write ftp messages */
```

```
filename mycont ftp 'example_contents.htm'      /* Specify contents   */
                    cd='mydir'                  /* Specify directory  */
                    host='myhost.mycompany.com' /* Specify your host  */
                    user='myuser'               /* Specify user       */

                    pass='mypass'               /* Specify password   */
      /* or */      /* prompt */                /* Password prompting */

                    rcmd='site umask 022'       /* Set permissions to */
                                                /* -rw-r--r--         */
                    recfm=s                     /* binary transfer    */
                    debug;                      /* Write ftp messages */


/* Specify the HTML files using the filerefs defined above */
ods html body=mybody
         page=mypage
         contents=mycont
         frame=myfram
         trantab=ascii;

/* Do not send output to procedure output destination */
ods listing close;

title1 'z/OS FTP Access Method Example';
proc plan seed=9544455;
  factors a=3 b=4 c=5 ordered; run;
  title1;
  quit;

/* Close the HTML destination */
ods html close;
```

# Writing ODS XML Output to ASCII, and Binary FTP to UNIX

The following ODS XML example generates ASCII output with embedded record separators and does a binary transfer to UNIX.

```
/* Use FTP access method to direct the output to UNIX */

filename myxml ftp 'odsxml1.xml'               /* specify xml file   */
                   cd='public_html/ods_test'   /* specify directory  */
                   host='unix.corp.dept.com' /* specify host       */
                   user='userid'               /* specify user       */

                   /* pass='mypass' */         /* specify password   */
      /* or */     prompt                      /* password prompting */

                   rcmd='site umask 022'       /* set permissions to */
                                               /* -rw-r--r--         */
                   recfm=s                     /* binary transfer    */
```

```
                  debug;                        /* write ftp messages */


/* Do not write to output window */
ods listing close;

/* Specify XML file using fileref specified above        */
/* Specify ascii representation and do a binary transfer */
ods xml file=myxml
    trantab=ascii;

title1 'z/OS ODS XML Example - Binary transfer to UNIX';
proc plan seed=9544455; factors a=3 b=4 c=5 ordered; run;
title1;
quit;

/* Close the XML destination */
ods xml close;
```

To view the output file, point your UNIX browser at the file that you moved to UNIX with FTP, using a URL such as

```
http://corp.dept.com/~userid/ods_test/odsxml1.xml
```

# Writing ODS XML Output to EBCDIC, and ASCII Transfer to UNIX

This example generates ODS XML output in EBCDIC and uses RS=NONE to format the output for a text (ASCII) transfer to UNIX.

```
/* Use FTP access method to direct the output to UNIX */

filename myxml ftp 'odsxml2.xml'               /* specify xml file   */
                  cd='public_html/ods_test'    /* specify directory  */
                  host='unix.corp.dept.com' /* specify host       */
                  user='userid'                /* specify user       */

                  /* pass='mypass' */          /* specify password   */
      /* or */    prompt                       /* password prompting */

                  rcmd='site umask 022'        /* set permissions to */
                                               /* -rw-r--r--         */
                  recfm=v                      /* text transfer      */
                  debug;                       /* write ftp messages */


/* Do not write to output window */
ods listing close;

/* Specify XML file using fileref specified above                 */
/* Specify RS=NONE, generate EBCDIC and do a TEXT (ASCII) transfer */
ods xml file=myxml
        rs=none;
```

```
title1 'z/OS ODS XML Example - TEXT transfer to UNIX';
proc plan seed=9544455; factors a=3 b=4 c=5 ordered; run;
title1;
quit;

/* Close the XML destination */
ods xml close;
```

To view the output file, point your UNIX browser at the file that you moved to UNIX with FTP, using a URL such as

```
http://corp.dept.com/~userid/ods_text/odsxml2.xml
```

# Directing ODS XML Output to UFS

The following example stores ODS XML output in a UFS file.

```
/* Do not write to output window */
ods listing close;

/* Direct output to UNIX System Services (USS) file */
/* Specify ascii representation */
ods xml file='/u/userid/public_html/odsxml3.xml'
        trantab=ascii;

title1 'z/OS ODS XML Example - Output to UNIX System Services';
proc plan seed=9544455; factors a=3 b=4 c=5 ordered; run;
title1;
quit;

/* Close the XML destination */
ods xml close;
```

To view the output file, point your UNIX browser at the file that you moved to UNIX System Services, using a URL such as

```
http://s390.corp.dept.com/~userid/ods_text/odsxml1.xml
```

# Directing Procedure Output to a High-Quality Printer via ODS

Follow these steps to send high-resolution procedure output created with the Output Delivery System to a Universal Printing destination:

1 Establish the print destination with the PRINTERPATH= option:

```
options printerpath='prt23lj5';
```

The OPTIONS statement assigns PRT23lJ5 as the default Universal printer. PRT23lJ5 remains the default printer for the duration of the SAS session, unless it is overridden by another OPTIONS statement.

2 Identify the print destination to SAS:

```
ods printer;
```

The ODS PRINTER statement opens an ODS printer destination, enabling procedure output to be formatted for a high-resolution printer. Because the ODS PRINTER statement does not specify a filename or a fileref, ODS output is sent to the Universal Printing default printer (PRT23lJ5).

3 Run a SAS procedure, such as PROC PRINT, to produce output to the SAS procedure output file:

```
proc print data=sashelp.shoes;
   where region="Canada";
run;
```

PROC PRINT generates procedure output in ODS format.

4 Remove the print destination:

```
ods printer close;
```

The ODS PRINTER CLOSE statement removes the ODS printing destination and sends the procedure output to PRT23lJ5. Subsequent procedure output is routed to the default Universal Printing destination.

# Sending Email from within SAS Software

## Overview of SAS Support for Email

SAS software enables you to send email by way of a DATA step, SAS procedure, or SCL. Specifically, you can perform one of the following actions:

- use the logic of the DATA step or SCL to subset email distribution based on a large data set of email addresses.
- send email automatically upon completion of a SAS program that you submitted for batch processing.
- direct output through email that is based on the results of processing.

SAS email is implemented in the following language elements:

- the EMAILHOST= and EMAILPORT= SAS options. SAS software sends all email over a socket to an SMTP server. You or your system administrator might have to specify the EMAILHOST= system option to identify the host that runs an SMTP server on your network. The EMAILHOST= option defaults to *localhost*.The EMAILPORT= system option identifies the port number on the

SMTP server for email access. The default port number is 25. For more information about SMTP, see "The SMTP Email Interface" in *SAS Language Reference: Concepts*.

- the FILE and FILENAME statements, which are used to specify the name of an email fileref and the mailing instructions that are used to send it. For more information, see "FILENAME Statement, EMAIL (SMTP) Access Method" in the *SAS DATA Step Statements: Reference*. Options that you specify in the FILE statement override any corresponding options that you specified in the FILENAME statement.
- the PUT statement, which is used in the DATA step or SCL to create the email message and to specify or change mailing directives. For more information, see the PUT statement syntax for email in the following topic.

# Using CSSMTP to Send Email in SAS

SAS 9.4M5 added support for Communications Server Simple Mail Transfer Protocol (CSSMTP). CSSMTP is an interface that transports email across the internet much like SMTP. CSSMTP is supported only on z/OS hosts. It supports most of the functionality of SMTP.

IBM removed support for the SMTPD email server in z/OS V2R3. If you are running SAS on z/OS V2R3, you cannot use the SMTPD server. You have to use the SMTP email server. CSSMTP is a mail-forwarding SMTP client application. To use the CSSMTP application, set EMAILSYS=CSSMTP. For information about the CSSMTP configuration, contact your email or network administrator. For information about CSSMTP, see the IBM documentation.

## See Also

- "FILENAME Statement: EMAIL (CSSMTP and SMTP) Access Method" on page 640
- "FILENAME Statement: EMAIL (SMTP) Access Method" in *SAS Global Statements: Reference*
- "EMAILSYS= System Option: z/OS" on page 736

# PUT Statement Syntax for Email

In your DATA step, after using the FILE statement to define your email fileref as the output destination, use PUT statements to define the body of the message.

You can also use PUT statements to specify email directives that override the attributes of your electronic mail message (TO, CC, SUBJECT, TYPE, ATTACH) or

perform actions with it (such as SEND, ABORT, and start a NEWMSG). Specify only one directive in each PUT statement; each PUT statement can contain only the text associated with the directive that it specifies. Use quotation marks as necessary to construct the arguments of the PUT statement. However, the final string written by the PUT statement does not need to be enclosed in quotation marks.

The directives that change the attributes of a message are

!EM_TO! *addresses*
replaces the current primary recipient addresses with *addresses*. For example:

```
PUT "!EM_TO!" "joe@somplace.org";
```

or

```
user="joe@somplace.org"; put '!EM_TO!' user;
```

To specify more than one address, enclose the list of addresses in parentheses and each address in single or double quotation marks, and separate each address with a space:

```
PUT "!EM_TO!" "('joe@smplc.org' 'jane@diffplc.org')";
```

or

```
list="('joe@smplc.org' 'jane@diffplc.org')"; put '!EM_TO!' list;
```

To specify a name with the address, enclose the address in angle brackets, as follows:

```
PUT "!EM_TO!" "Joe Smith <joe@somplace.org>";
```

or

```
user="Joe Smith <joe@somplace.org>"; put '!EM_TO!' user;
```

!EM_CC! *addresses*
replaces the current copied recipient addresses with *addresses*. For example:

```
PUT "!EM_CC!" "joe@somplace.org";
```

or

```
user="joe@somplace.org"; put '!EM_CC!' user;
```

To specify more than one address, enclose the list of addresses in parentheses, enclose the parentheses in double quotation marks, enclose each address in single or double quotation marks, and separate the addresses with a space:

```
PUT "!EM_CC!" " "('joe@smplc.org' 'jane@diffplc.org')";
```

or

```
list="('joe@smplc.org' 'jane@diffplc.org')"; put '!EM_CC!' list;
```

To specify a name with the address, enclose the address in angle brackets, as follows:

```
PUT "!EM_CC!" "Joe Smith <joe@somplace.org>";
```

or

```
user="Joe Smith <joe@somplace.org>"; put '!EM_CC!' user;
```

!EM_BCC! *addresses*
replaces the current blind copied recipient addresses with *addresses*. For example:

```
PUT "!EM_BCC!" "joe@somplace.org";
```

or

```
user="joe@somplace.org"; put '!EM_BCC!' user;
```

To specify more than one address, enclose the list of addresses in parentheses and each address in single or double quotation marks, and separate addresses with a space:

```
PUT "!EM_BCC!" "('joe@smplc.org' 'jane@diffplc.org')";
```

or

```
list="('joe@smplc.org' 'jane@diffplc.org')"; put '!EM_BCC!' list;
```

To specify a name with the address, enclose the address in angle brackets, as follows:

```
PUT "!EM_BCC!" "Joe Smith <joe@somplace.org>";
```

or

```
user="Joe Smith <joe@somplace.org>"; put '!EM_BCC!' user;
```

!EM_FROM! '*address*'
replaces the current address of the sender of the message with *address*. For example:

```
PUT "!EM_FROM! "john@hisplace.org"
```

or

```
user="john@hisplace.org"; put '!EM_FROM!' user;
```

!EM_SUBJECT! *subject*
replaces the current subject of the message with *subject*.

!EM_CONTENTTYPE! *content-type*
replaces the current content type of the message body with *content-type*. The default value is *text/plain*.

**Note:** SAS does not scan file extensions on z/OS unless the file is on the UNIX file system (UFS).

!EM_ATTACH! "*file-specification*"
replaces the current list of attachments with *file-specification*. Enclose the *file-specification* in double quotation marks.

To attach more than one file or a file with additional attachment options, enclose the list of file specifications or options in parentheses and separate each *file-specification* with a space. The attachment options are

CONTENT_TYPE='*content/type*'
specifies the MIME content type that should be associated with this attachment. The default content type is text/plain. CONTENT_TYPE= can be specified as one of the following types:

- CONTENT_TYPE=
- CONTENT-TYPE=
- TYPE=
- CT=

EXTENSION='*extension*'
specifies the file extension on the recipient's file that is attached. This extension is used by the recipient's email system for selecting the appropriate utility to use for displaying the attachment. The default attachment extension is "txt". EXTENSION= can be specified as EXT=.

NAME='*name*'
specifies a different name to be used for the attachment.

The following examples show the syntax for specifying attachment options in a PUT statement:

```
put '!EM_ATTACH!' "('user.misc.pds(member)' content_type='text/html'                    exter
put '!EM_ATTACH!' "('user.misc.jcl(sasjcl)' extension='doc',                  'userid.sas.ou
mycfg="'user.misc.jcl(sasjcl)'";
syscfg="'user.sas.output' content_type='image/gif' ext='gif'";
put '!EM_ATTACH!' "("mycfg","syscfg")";
```

These directives perform actions:

!EM_SEND!
sends the message with the current attributes. By default, SAS sends a message when the fileref is closed. The fileref closes when the next FILE statement is encountered or the DATA step ends. If you use this directive, SAS software sends the message when it encounters the directive and again at the end of the DATA step.

!EM_ABORT!
stops the current message. You can use this directive to stop SAS software from automatically sending the message at the end of the DATA step.

!EM_NEWMSG!
clears all attributes of the current message, including TO, CC, SUBJECT, TYPE, ATTACH, and the message body.

# Example: Sending Email from the DATA Step

Suppose you want to share a copy of your SASV9 CONFIG file with your coworker Jim, whose user ID is JBrown. You could send it by submitting the following DATA step:

```
filename mymail email 'JBrown@ajax.com'
         subject='My SASV9 CONFIG file'
         attach="jbrown.tso.config(sasV9)";

data _null_;
  file mymail;
  put 'Jim,';
```

```
  put 'This is my SASV9 CONFIG file.';
  put 'I think you might like the new options I added.';
run;
```

The following example sends a message and two attached files to multiple recipients. It specifies the email options in the FILE statement instead of in the FILENAME statement:

```
filename outbox email 'ron@acme.com';

data _null_;
  file outbox
     to=('ron@acme.com' 'lisa@acme.com')
     /* Overrides value in */
     /* filename statement */

     cc=('margaret@yourcomp.com'
         'lenny@laverne.abc.com')
     subject='My SAS output'
     attach=("my.sas.output" "my.sas.code")
     ;
  put 'Folks,';
  put 'Attached is my output from the
      SAS program I ran last night.';
  put 'It worked great!';
run;
```

You can use conditional logic in the DATA step to send multiple messages and to control which recipients receive which message. For example, suppose you want to send customized reports to members of two different departments. Here is a DATA step example:

```
filename reports email 'Jim@corp.com';

data _null_;
  file reports;
  infile cards eof=lastobs;
  length name dept $ 21;
  input name dept;
  put '!EM_TO!' name;
   /* Assign the TO attribute      */

  put '!EM_SUBJECT! Report for ' dept;
   /* Assign the SUBJECT attribute */

  put name ',';
  put 'Here is the latest report for ' dept '.';
  if dept='marketing' then
    put '!EM_ATTACH!' "userid.market.report";
  else
    /* ATTACH the appropriate report */

    put '!EM_ATTACH!' "userid.devlpmnt.report";
  put '!EM_SEND!';
    /* Send the message */

  put '!EM_NEWMSG!';
    /* Clear the message attributes */
```

```
  return;
lastobs: put '!EM_ABORT!';
    /* Abort the message before the */
    /*   RUN statement causes it to */
    /*   be sent again.             */

  datalines;
Susan          marketing
Jim            marketing
Rita           development
Herb           development
;
run;
```

The resulting email message and its attachments are dependent on the department to which the recipient belongs.

**Note:** You must use the !EM_NEWMSG! directive to clear the message attributes between recipients. The !EM_ABORT! directive prevents the message from being automatically sent at the end of the DATA step.

# Sending Procedure Output as Email

## Overview of Sending Procedure Output as Email

Email can be used to send procedure output. ODS HTML procedure output must be sent with the RECORD_SEPARATOR (RS) option set to NONE. For z/OS, ODS produces an HTML stream with embedded record-separator characters, by default. When the RS option is set to NONE, ODS writes one line of HTML at a time to the file. Make sure that the file's record length is large enough to accommodate the longest HTML line.

The following section contains examples that illustrate how to send ODS HTML and graph output in the body of an email message and also as attachments to email.

## Examples: Sending Procedure Output via Email

The following example shows how to use ODS to send HTML output in email:

```
filename outbox email
        to='susan@mvs'
        type='text/html'
        subject='Temperature conversions'
        ;
```

```
data temperatures;
   do centigrade = -40 to 100 by 10;
      fahrenheit = centigrade*9/5+32;
      output;
   end;
run;

ods html
  body=outbox /* Mail it! */
  rs=none;

  title 'Centigrade to Fahrenheit conversion table';
proc print;
  id  centigrade;
  var fahrenheit;
run;

ods html close;
```

The following example shows how to create and send a GIF image in an email message:

```
filename gsasfile email
        to='Jim@acme.com'
        type='image/gif'
        subject="SAS/GRAPH output."
        ;

goptions dev=gif gsfname=gsasfile;

proc gtestit pic=1; run;
```

The following example shows how to create ODS HTML and send it as attachments to an email message:

```
 /* ---------------------------------------- */
 /* allocate PDSE to contain the HTML output */
 /* ---------------------------------------- */
filename odsout '.mvsmail1.pdse' disp=(new,catlg,delete)
               dsorg=po dsntype=library;

 /* ---------------------------------- */
 /* stop sending output to OUTPUT window */
 /* ---------------------------------- */
ods listing close;

 /* ------------------------------------------------- */
 /* Assign frame, contents and body files.            */
 /* Specify the URLs to have the .html extension.     */
 /* Specify the PATH to be the PDSE.                  */
 /* Specify RS=NONE to write one line of HTML per record. */
 /* This is necessary when emailing the HTML output.    */
 /* ------------------------------------------------- */
ods html frame='shoes1f'
    contents='shoes1c' (url='shoes1c.html')
    body='shoes1b'     (url='shoes1b.html')
    path=odsout
```

```
    rs=none;

data newshoes;
   set sashelp.shoes;
   where Region in ('Canada' 'Central America/Caribbean'
                    'South America' 'United States');
run;

 /* ---------------------------------------- */
 /* sort the data set and generate the report */
 /* ---------------------------------------- */
proc sort data=newshoes;
   by Region Subsidiary Product;
run;

options nobyline;
title1 'Sales for Regions #byval(Region)';
proc report data=newshoes nowindows;
  by Region;
  column Region Product Subsidiary Sales;
  define Region / noprint group;
  define Product    / display group;
  define Subsidiary / display group;
  define Sales   / display sum format=dollar8.;
  compute after Region;
          Product='Total';
  endcomp;
  break after Region    / summarize style=rowheader;
run;

 /* ------------------------------------------------- */
 /* Close the HTML destination and open the listing output */
 /* ------------------------------------------------- */
ods html close;
ods listing;

 /* ----------------- */
 /* E-mail the report */
 /* ----------------- */
filename email email 'fred@bedrock.com'
     subject="Shoe report 1"
     type="text/plain"
attach=(".mvsmail1.pdse(shoes1f)" content_type='text/html' extension='html'
        ".mvsmail1.pdse(shoes1c)" content_type='text/html' extension='html'
        ".mvsmail1.pdse(shoes1b)" content_type='text/html' extension='html') ;
data _null_;
   file email;
   put 'Here is the latest Shoe sales report';
run;
```

The following example shows how to create ODS HTML and GIF files and send them as email attachments:

```
 /* ---------------------------------------------- */
 /* Define the UNIX System Services USS directory to */
 /* contain the graphics and HTML output.          */
 /* ---------------------------------------------- */
```

```
filename odsout '/u/myhome/public_html';

 /* ---------------------------------------------- */
 /* stops sending output to GRAPH and OUTPUT windows */
 /* ---------------------------------------------- */
ods listing close;

 /* --------------------------- */
 /* set the graphics environment */
 /* --------------------------- */
goptions reset=global gunit=pct
         colors=(black blue green red)
         hsize=8.42 in vsize=6.31 in ftitle=zapfb
         ftext=swiss htitle=4 htext=2.5
         device=gif transparency noborder;

 /* -------------------------------- */
 /* add the HTML variable to NEWSHOES */
 /* -------------------------------- */
data newshoes;
   set sashelp.shoes;
   where Region in ('Canada' 'Central America/Caribbean'
                    'South America' 'United States');
   length regdrill $40;

if Region='Canada' then
   regdrill='HREF="shoes1_regsales.html#IDX1"';

else if Region='Central America/Caribbean' then
   regdrill='HREF="shoes1_regsales.html#IDX2"';

else if Region='South America' then
   regdrill='HREF="shoes1_regsales.html#IDX3"';

else if Region='United States' then
   regdrill='HREF="shoes1_regsales.html#IDX4"';

run;

 /* ---------------------------------------------------------*/
 /* Assign the destination for the ODS graphics output    */
 /* and ODS HTML files.                                   */
 /* Specify RS=NONE to write one line of HTML per record. */
 /* This is necessary when emailing the HTML output.     */
 /* ---------------------------------------------------- */
ods html path=odsout
         body='shoe_report.html'
         rs=none
         nogtitle;

 /* ---------------------------------- */
 /* define title and footnote for chart */
 /* ---------------------------------- */
title1 'Total Sales for the Americas';
footnote1 h=3 j=l 'click on bars' j=r 'REPORT3D ';
```

```
 /* ---------------------------------- */
 /* assign a pattern color for all bars */
 /* ---------------------------------- */
pattern color=cyan;

 /* -------------------------- */
 /* define axis characteristics */
 /* -------------------------- */
axis1 order=(0 to 7000000 by 1000000)
      minor=(number=1)
      label=none;
axis2 label=none offset=(4,4)
      value=('Canada' 'C. Amr./Car.'
             'S. America' 'USA');

 /* -------------------------- */
 /* generate vertical bar chart */
 /* -------------------------- */
proc gchart data=newshoes;
   vbar3d Region / discrete
                width=6
                sumvar=sales
                html=regdrill
                coutline=black
                cframe=blue
                maxis=axis2
                raxis=axis1
                name='shoes1 ';
run;
quit;

 /* ------------------------------------------------- */
 /* Open the HTML destination for the PROC PRINT output.  */
 /* Specify RS=NONE to write one line of HTML per record. */
 /* This is necessary when emailing the HTML output.     */
 /* ------------------------------------------------- */
ods html body='shoes1_regsales.html'
         rs=none
         path=odsout;

 /* ---------------------------------------- */
 /* sort data set NEWSHOES in order by region */
 /* ---------------------------------------- */
proc sort data=newshoes;
   by Region Subsidiary Product;
run;
quit;

 /* ---------------------------------------- */
 /* print a report of shoe sales for each Region */
 /* ---------------------------------------- */
goptions reset=footnote;
option nobyline;
title 'Sales Report for #byval(Region)';
proc report data=newshoes nowindows;
  by Region;
```

```
  column Region Subsidiary Product Sales;
  define Region    / noprint group;
  define Subsidiary    / display group;
  define Product / display group;
  define Sales   / display sum format=dollar12.;
  compute after Region;
          Subsidiary='Total';
  endcomp;
  break after Region / summarize style=rowheader page;
run;

 /* ------------------------------------------------------ */
 /* Close the HTML destination and open the listing output */
 /* ------------------------------------------------------ */
ods html close;
ods listing;

 /* ---------------- */
 /* Email the report */
 /* -----------------*/
filename email email 'barney@bedrock.com'
     subject="Shoe report 2"
     type="text/plain"
attach=("./public_html/shoe_report.html" content_type='text/html'
        "./public_html/shoes1_regsales.html" content_type='text/html'
        "./public_html/shoes1.gif" content_type='image/gif') ;
data _null_;
   file email;
   put 'Here is the latest Shoe sales report';
run;
```

# Example: Directing Output as an Email Attachment with Universal Printing

Follow these steps to send procedure output as an attachment to an email message.

1 Define a Universal printer with a device type of **`'EMAIL'`**.

2 Establish a printing destination with the PRINTERPATH= option:

```
options printerpath='emailjoe';
```

The OPTIONS statement assigns EMAILJOE as the default Universal printer. EMAILJOE remains the default printer for the duration of the SAS session, unless it is overridden by another OPTIONS statement.

3 Identify the print destination to SAS:

```
ods printer;
```

The ODS PRINTER statement enables procedure output to be formatted for a high-resolution printer. Because the ODS PRINTER statement does not specify

a filename or fileref, ODS output is sent to the Universal Printing default printer (EMAILJOE).

4 Issue a PRINT command or procedure:

```
proc print data=sashelp.shoes;
  where region="Canada";
  run;
```

PROC PRINT generates procedure output in standard ODS format. The output is sent to the attachment file associated with EMAILJOE.

5 Remove the print destination:

```
ods printer close;
```

The second ODS PRINTER statement removes the ODS print destination. The procedure output is sent to EMAILJOE, which sends the email message with the attached file to the email recipient.

The following program defines a registry entry for printing procedure output to an email attachment:

```
/* STEP 1 */
data printers;
  name = 'emailjoe';
  protocol = 'Ascii';
  trantab = 'GTABCMS';
  model = 'PostScript Level 1 (Gray Scale)';
  device = 'EMAIL';
  dest = 'John.Doe@sas.com';
  hostopt = "recfm=vb ct='application/PostScript'
    subject='Canada Report' ";
  run;

/* STEP 2 */
proc prtdef data=printers replace list;
run;
```

# Example: Sending Email By Using SCL Code

The following example is the SCL code that underlies a frame entry design for email. The frame entry includes these text-entry fields:

**mailto**
the user ID of the email recipient

**copyto**
the user ID of the recipient of the email copy (CC)

**attach**
the name of the file to attach

**subject**
the subject of the email message

**line1**
the text of the email message

The frame entry also contains a push button named SEND that causes this SCL code (marked by the `send:` label) to execute.

```
send:

   /* set up a fileref */

   rc = filename('mailit','userid','email');

   /* if the fileref was successfully set up
      open the file to write to */

   if rc = 0 then do;
      fid = fopen('mailit','o');
      if fid > 0 then do;

         /* fput statements are used to
            implement writing the
            mail and the components such as
            subject, who to mail to, etc. */


         fputrc1  = fput(fid,line1);
         rc = fwrite(fid);

         fputrc2  = fput(fid,'!EM_TO! '||mailto);
         rc = fwrite(fid);
         fputrc3  = fput(fid,'!EM_CC! '||copyto);
         rc = fwrite(fid);

         fputrc4  = fput(fid,'!EM_ATTACH! '||attach);
         rc = fwrite(fid);
         fputrc5  = fput(fid,'!EM_SUBJECT! '||subject);
         rc = fwrite(fid);

         closerc  = fclose(fid);
      end;
   end;
return;

cancel:
   call execcmd('end');
return;
```

# Using the SAS Logging Facility to Direct Output

The SAS 9.2 logging facility enables the categorization and collection of log event messages and to write them to a variety of output devices. The logging facility supports problem diagnosis and resolution, performance and capacity management, and auditing and regulatory compliance. The following features are provided:

- Log events are classified by using a hierarchical naming system that enables you to configure logging at either a broad level or a specific level.
- Log events can be directed to multiple output destinations, including files, operating system facilities, databases, and client applications. For each output destination, you can specify one of the following attributes:
  - the categories and levels of events to report
  - the message layout, including the types of data to be included, the order of the data, and the format of the data
  - filters based on criteria such as diagnostic levels and message content
- For each log destination, you can configure the message layout, including the contents, the format, the order of information, and literal text.
- For each log destination, you can configure filters to include or exclude events that are based on diagnostic levels and message contents.
- Logging diagnostic levels can be adjusted dynamically without starting and stopping processes.
- Performance-related events can be generated for processing by an Application Response Measurement (ARM) 4.0 server.

The logging facility is used by most SAS server processes. You can also use the logging facility within SAS programs.

For z/OS, log messages can be written to "ZOSFacilityAppender" in *SAS Logging: Configuration and Programming Reference* or "ZOSWtoAppender" in *SAS Logging: Configuration and Programming Reference*.

For more information about using the logging facility in z/OS, see "Overview of the SAS Logging Facility" in *SAS Logging: Configuration and Programming Reference*.

# 9

# Universal Printing

# Introduction to Universal Printing

Universal Printing is a printing mechanism provided by SAS that supplies printing support for all operating environments. It is especially helpful for those operating environments in which printing can be a challenge. Universal Printing enables you to direct output to printers that are attached to your local area network. You can also use all of the font and graphic capabilities of those printers when you generate output.

With SAS Release 8.2, Universal Printing became the default printing method in the z/OS windowing environment. It is also the default printing method used to generate ODS (Output Delivery System) and SAS/GRAPH output in all mainframe environments. Universal Printing is not the default printing method used to generate procedure output that is text based (such as PROC PRINT output), unless ODS is also used.

Universal Printing is also the default in the UNIX operating environment. It is supported, but it is not the default, in the Microsoft Windows operating environment.

Universal Printing produces output in PostScript, PDF, PCL, GIF, or a file that is sent directly to an output device.

# Using Universal Printing in the Windowing Environment

## Setting the Default Printer

A default printer is required for Universal Printing. Unless you define a default printer, SAS uses a predefined default printer that generates output in PostScript Level 1 language with a 12-point Courier font.

On z/OS, output goes by default to a sequential data set called <*prefix*>.SASPRT.PS where <*prefix*> is the value of the SYSPREF= SAS option.

# Defining a New Printer Interactively

To create a new printer definition interactively:

1 Select **File** ⇨ **Print Setup**.

Or, issue the command `DMPRTSETUP`.

2 Select **New** ⇨ **Printer**

The first of four Define a New Printer dialog boxes is displayed. Fill out the fields in these dialog boxes to complete your new printer definition. Alternatively, you can issue the command **`DMPRTCREATE PRINTER`** to start the Define a New Printer dialog box directly.

**Note:** The Define a New Printer dialog box does not prompt you for printer detail fields, including the Protocol and Translate Table (TRANTAB) fields. The printer details are automatically initialized to the details in the prototype that you select. When the Define a New Printer dialog boxes are complete, you are returned to the Printer Setup window with the new printer highlighted.

Follow these steps if you need to change any of the printer detail fields:

1 Select **Properties**.

2 Select **Advanced**.

3 Change the values of **Protocol** and **Translate Table** as necessary.

4 Select **OK**.

For further details about values for **Protocol** and **Translate Table**, see "Setting Up Printers in Your Environment" on page 199.

# Changing the Default Printer

You can use any of the following procedures to change the default printer:

- Use the Print Setup window.

  1 Select **File** ⇨ **Print Setup**.

  Or, issue the command `DMPRTSETUP`.

  2 Select the printer that you want to use as the default.

  3 Select **`OK`**.

- Issue the command `DMSETPRINT <'printer-name'>`, where `<'printer-name'>` is the name of the printer that you want to set as the default.

- Submit the statement `OPTIONS PRINTERPATH=('printer-name' <fileref> )`. For more information about the **PRINTERPATH** option, see "The PRINTERPATH SAS Option" on page 195.

**Note:** DMPRTSETUP and DMSETPRINT generate an entry in the Sasuser library, and they remain in effect until they are changed. Setting a default printer with the OPTIONS PRINTERPATH= command does not generate an entry in the Sasuser library. It remains in effect for the duration of the session only.

# Setting Printer Properties

Use the following procedure to set the properties for a printer:

1. Select **File** ⇨ **Print Setup**.

   Or, issue the command `DMPRTSETUP`.

2. From the **Printer** list box, select a printer.

3. Select **Properties**.

4. In the Printer Properties window, select the **Destination** tab to set the device type, destination, and host options.

   **Device Type**
   refers to the type of device to which your output is routed, such as a printer or a disk.

   **Destination**
   refers to the target location used by the device.

   **Host Options**
   includes any host-specific options that you can set for the selected device type.

5. (Optional) Select **Advanced** to set resolution, protocol, translate table, buffer size, previewer, and preview command information for the printer.

   **Resolution**
   specifies the resolution to use for printed output in dots per inch.

   **Protocol**
   specifies how to convert the output to a format that can be processed by a protocol converter that connects the mainframe to an ASCII device. Protocol information is applicable only to IBM hosts.

   **Translate Table**
   specifies the translate table to use for generating your printed output. A translate table is needed when an EBCDIC host sends data to an ASCII device.

   **Buffer Size**
   refers to the buffer size to use when sending output to the printer.

6 (Optional) Select **Font** to open a window where you can set the default font information for your printer.

**Note:** Printer properties are stored in the Sasuser library and remain in effect until changed. For information about how printer properties are used in the mainframe environment, see "Setting Up Printers in Your Environment" on page 199.

# Changing the Default Font

The font included in the definition of the current default printer is the font used to generate output, unless you override it with the SYSPRINTFONT= system option. SYSPRINTFONT= sets the font to use when printing to the current default printer or to the printer identified with the optional keywords NAMED or ALL. You can specify SYSPRINTFONT= in your configuration file, at SAS invocation, or in an OPTIONS statement.

The syntax is as follows:

**SYSPRINTFONT**=(*face-name* <*weight*> <*style*> <*character-set*> <*point-size*> <NAMED *printer-name* | DEFAULT | CHOICE>)

*face-name*
specifies the name of the font face to use for printing. This value must be a valid font face name. If the *face-name* consists of more than one word, it must be enclosed in single or double quotation marks. Valid font face names are listed in the Printer Properties window under the **Font** tab.

*weight*
specifies the weight of the font, such as bold. A list of valid values for your specified printer appears in the Printer Properties window. The default value is NORMAL.

*style*
specifies the style of the font, such as italic. A list of valid values for your specified printer appears in the Printer Properties window. The default is REGULAR.

*point-size*
specifies the point size to use for printing. This value must be an integer. If you omit this argument, SAS uses the default point size.

*character-set*
specifies the character set to use for printing. Valid values are listed in the Printer Properties window, under the **Font** tab. If the font does not support the specified character set, the default character set is used. If the default character set is not supported by the font, the font's default character set is used.

NAMED *printer-name*
must match exactly the name shown in the Print Setup window (except that the printer name is not case sensitive). If it is more than one word, the *printer-name* must be enclosed in double quotation marks.

DEFAULT
is the current default printer if you do not specify another printer.

ALL
updates the font information for all installed printers.

# Setting Page Properties

1 Select **File** ⇨ **Page Setup**.

Or, issue the command `DMPAGESETUP`.

2 From the Page Setup window, make selections that apply to the pages printed for the remainder of your SAS session or until the values are changed again through this window or through specification of options.

The selections that you can make in this window correspond to options that can be set by submitting an OPTIONS statement. These options are listed in the following table:

***Table 9.1*** *Options That Control Page Setup*

| General Options | Paper | Margins | Other |
|---|---|---|---|
| BINDING | PAPERDEST | TOPMARGIN | ORIENTATION |
| COLLATE | PAPERSIZE | RIGHTMARGIN | |
| DUPLEX | PAPERSOURCE | LEFTMARGIN | |
| COLORPRINTING | PAPERTYPE | BOTTOMMARGIN | |

Changes made by issuing these options in an OPTIONS statement remain in effect for the current SAS session only. Changes made through the Page Setup window remain in effect for subsequent SAS sessions.

Options not supported by your default printer are dimmed and are not selectable.

# Testing Printer Properties

1 Select **File** ⇨ **Print Setup**.

Or, issue the command `DMPRTSETUP`.

2 Select a printer from the **Printer** list box.

3 Select **Print Test Page**.

# Setting a Page Range Value

When you print the contents of an active window in the SAS windowing environment (such as the Program Editor or Log window), all pages are printed by default. In certain situations, the Print window includes a **Page Range** group box that you can use to control the page ranges that are printed.

1. Select the appropriate SAS window.
2. Select **File** ⇨ **Print**.

   Or, issue the command `DMPRINT`.
3. If the **Page Range** group box is available, select either **All Pages**, **Current Page**, or **Select Range** from the **Range** combo box. If you choose **Select Range**, then specify the pages that you want to print in the **Pages** field. You must separate individual pages or page ranges with either a comma or a blank space.

   *n*-*m* prints all pages from *n* to *m* (where *n* and *m* are both numbers).

   -*n* prints all pages from page 1 to *n*.

   *n*- prints all pages from page *n* to the last page.

# Previewing a Print Job

You cannot preview a print job in the mainframe environment.

# Printing Selected Text

You cannot print selected text in the mainframe environment.

# Printing the Contents of a SAS Window

To print the contents of a SAS window with Universal Printing:

1. Select the window that you want to print.
2. Select **File** ⇨ **Print**.

   Or, issue the command `DMPRINT`.
3. If the **Use Forms** check box is visible, verify that it is not selected.

4 From the **Printer** group box, select the appropriate printer name and the number of copies that you want to print.

**Note:** If you choose to print multiple copies and Collation is turned off, each page prints the given number of times before the next page begins printing.

5 Select or deselect additional Print window fields, if any additional fields are available.

The fields that appear depend on the content that exists in the SAS window that you are trying to print. For example, if a window is active (such as the Program Editor), then the **Page Range** group box is available.

6 Select the page range or specify the pages that you want to print.

For more information about printing the contents of a graphics window, see "Printing the Contents of a Graphics Window" on page 193.

# Directing the Contents of a SAS Window to a File

1 Select **File** ⇨ **Print**.

Or, issue the command `DMPRINT`.

2 Select the **`Print to File`** check box in the **Printer** group box.

3 Select **`OK`**.

A window opens that enables you to save your contents to a specific filename.

- The filename must be fully qualified. Quotation marks are not needed, but you can use them.
- If the file does not exist, you are asked if you want to create it, and if you want to delete it or catalog it. The file is created as a variable blocked (RECFM=VB) file.
- If the file does exist, you are asked if you want to replace it or append to it.

**Note:** The protocol and prototype properties of the selected printer definition are used to format the records that are written to the file. Thus, if you select a printer that has a protocol value of ASCII and a prototype value of PostScript Level 1 (Gray Scale), you generate a file that contains PostScript records written with the ASCII character set. To move this file to an ASCII platform, you must execute a Binary (FTP) transfer.

# Printing the Contents of a Graphics Window

1 Select the graphics window that you want to print.

2 Select **File** ⇨ **Print**.

Or, issue the command `DMPRINT`.

3 Select the appropriate printer name and the number of copies that you want to print from the Printer group box.

**Note:** If you choose to print multiple copies and Collation is turned off, each page prints the given number of times before the next page begins printing.

4 In the **Print Method** group box, verify that the **Use SAS/GRAPH Drivers** check box is not selected.

# Creating Printer Definitions When Universal Printing Is Turned Off

You can create printer definitions with PROC PRTDEF when Universal Printing is turned off, but the printer definitions do not appear in the Print window. When Universal Printing is turned on, the menu options change to offer the Universal Printing options. When Universal Printing is turned off, the Universal Printing options are not available.

If you want to specify your printer definitions when Universal Printing is turned off, do one of the following:

- Specify the printer definition as part of the PRINTERPATH SAS system option.
- Submit the following statement:

```
ODS PRINTER SAS PRINTER = myprinter;
```

where *myprinter* is the name of your printer definition.

# Universal Printing and the SAS Registry

Universal Printing printer definitions are stored in the SAS registry. To access the SAS registry:

1 Select: **Solutions** ⇨ **Accessories** ⇨ **Registry Editor**.

Or, issue the command **REGEDIT**.

2 Select: **Core** ⇨ **Printing** ⇨ **Printers**

The printer definitions in SASUSER are listed first, followed by the printer definitions in Sashelp, along with all their options. You can modify any of the options for the printer definitions in Sasuser if you have permission to write to the Sasuser library. To modify the options:

Select: **Edit** ⇨ **Modify**.

Or, click the right mouse button and select **MODIFY**.

**CAUTION**
**Making a mistake in editing the registry can cause your system to become unstable, unusable, or both.**

Wherever possible, use the administrative tools, such as the New Library window, the PRTDEF procedure, Universal Print windows, and the Explorer Options window to make configuration changes, rather than editing the registry directly. Using the administrative tools ensures that values are stored properly in the registry when you change the configuration.

**CAUTION**
**If you use the Registry Editor to change values, you are not warned if any entry is incorrect. Incorrect entries can cause errors, and can even prevent you from bringing up a SAS session.**

# Using Universal Printing in a Batch Environment

## Setting the Default Printer

A default printer is required for Universal Printing. Unless you specify a default printer, SAS uses a predefined default printer that generates output in PostScript Level 1 language with a 12-point Courier font.

On z/OS, output goes by default to a sequential data set called <*prefix*>.SASPRT.PS where <*prefix*> is the value of the SYSPREF= SAS option.

# Directing Output to a Universal Printer

## Sending Output to a UPRINTER Device

If you are using the SAS windowing environment, you can issue the DMPRINT command in many windows, including the Log, Output, and Program Editor windows, to send window contents to the Universal Printing default printer. You can also use the FILENAME statement to associate a fileref with the default printer, using the device type UPRINTER:

```
filename myuprt uprinter;
```

Once a fileref is associated with a printer, you can use that fileref in a PROC PRINTTO statement to print the log or procedure output. For example, the following statement directs any subsequent output to the default UPRINTER:

```
proc printto log=myuprt print=myuprt; run;
```

The fileref can also be used in other SAS statements that accept filerefs or in any window command or field that accepts filerefs.

**Note:** The **-ovp** option (typically used when a PROC routes log output to a universal printer) is incompatible with the UPRINTER driver. Messages are not overprinted.

## The PRINTERPATH SAS Option

Use the PRINTERPATH= SAS option to specify the destination printer for SAS print jobs.

```
PRINTERPATH=('printer-name'
fileref)
```

*printer-name*
must be one of the defined printers. Quotation marks are required around the printer name only when it contains blank spaces.

*fileref*
is an optional fileref. If a fileref is specified, it must be defined with a FILENAME statement or external allocation. If a fileref is not specified, output is directed to the destination defined in the printer definition or setup. Parentheses are required only when a fileref is specified.

**Note:** The PRINTERPATH= option is an important option in batch processing. It causes Universal Print drivers to be used for SAS/GRAPH and ODS PRINTER output whenever it is set.

## Changing the Default Font

The font that is included in the definition of the current default printer is the font used to generate output, unless you override it with the SYSPRINTFONT= system option. SYSPRINTFONT= sets the font to use when printing to the current printer or to the printer identified with the optional keywords NAMED or ALL. You can specify SYSPRINTFONT= in your configuration file, at SAS invocation, or in an OPTIONS statement.

The syntax is as follows:

**SYSPRINTFONT**=(*face-name* <*weight*> <*style*> <*character-set*> <*point-size*> <NAMED *printer-name* | DEFAULT | ALL>)

For more information, see "Changing the Default Font" on page 189.

# Setting Up a Universal Printer with PROC PRTDEF

## Overview of Setting Up a Universal Printer with PROC PRTDEF

Printer definitions can be created in batch mode for an individual or for all SAS users at your site using PROC PRTDEF. The system administrator can create printer definitions in the registry and make these printers available to all SAS users at your site by using PROC PRTDEF with the SASHELP option. You can create printer definitions for yourself by using PROC PRTDEF. Printer definitions that you create with PROC PRTDEF, and without the SASHELP option, are stored in the SASUSER registry. The complete syntax of the PROC PRTDEF statement is as follows:

**PROC PRTDEF** <DATA=*SAS-data-set*><SASHELP><LIST><REPLACE>;

DATA=
specifies a SAS data set that contains the printer definition records. The SAS data set is required to have the variables **`name`**, **`model`**, **`device`**, and **`dest`**. The variables **`hostopt`**, **`preview`**, **`protocol`**, **`trantab`**, **`lrecl`**, **`desc`**, and **`viewer`** are optional. For more information about these variables, see "Required Variables" on page 197 and "Optional Variables" on page 197.

SASHELP
specifies the output location where the printer definitions are stored. Use this option to specify whether the printer definitions are available to all users or just

the user who is running PROC PRTDEF. Specifying SASHELP makes the definitions available to all users. You must have permission to write to the Sashelp library. Otherwise, the definitions are stored in Sasuser and are available to the users who are using that Sasuser library.

LIST
specifies that a list of printers that were created or replaced is written to the log.

REPLACE
specifies that any printer name that already exists is to be modified using the information in the printer definition data record.

The following sections contain information about the printer definition variables in the input data set specified by DATA=.

## Required Variables

**`name`**
The name of the printer is the key for the printer definition record. The name is limited to 80 characters. If a record contains a name that already exists, the record is not processed unless the REPLACE option has been specified. The printer name must have at least one non-blank character and cannot contain a backslash. Leading and trailing blanks are stripped from the name.

**`model`**
For a valid list of prototypes or model descriptions, look in the SAS registry editor, which can be invoked with the `regedit` command. Once the SAS registry editor is open, follow the path **Core** ⇨ **Printing** ⇨ **Prototypes** to the list of prototypes. Or invoke the Print Setup window `(DMPRTSETUP)` and select **New** to view the list that is displayed on the second window of the Printer Definition wizard.

**`device`**
Valid devices are listed in the third window of the Printer Definition wizard and in the SAS registry editor under **Core** ⇨ **Printing** ⇨ **Device Types** The device column is not case-sensitive.

If you specify a device type of **`catalog`**, **`disk`**, **`ftp`**, **`socket`**, or **`pipe`**, you must also specify the **`dest`** variable.

**`dest`**
The destination name is limited to 256 characters. Whether this name is case-sensitive depends on the type of device that is specified.

## Optional Variables

**`hostopt`**
The host options column is not case-sensitive. Host options are limited to 256 characters.

**preview**
This variable is not used on mainframe platforms. It is used to specify the printer to use for print preview.

**protocol**
This variable specifies the I/O protocol to use when sending output to the printer. On IBM hosts, the protocol describes how to convert the output to a format that can be processed by a protocol converter that connects the mainframe to an ASCII device. For more information about the use of PROTOCOL, see "Setting Up Printers in Your Environment" on page 199.

**trantab**
This variable specifies which translate table to use when sending output to the printer. The translate table is needed when an EBCDIC host sends data to an ASCII device. For more information about the use of TRANTAB, see "Setting Up Printers in Your Environment" on page 199.

**lrecl**
This variable specifies the buffer size or record length to use when sending output to the printer.

**desc**
This variable specifies the description of the printer. It defaults to the prototype used to create the printer.

**viewer**
This variable is not used on mainframe platforms. It is used to specify the host system command used during print previews.

# Example PROC PRTDEF Jobs in z/OS

## Example 1: Defining PostScript, PCL, and PDF Universal Printers

The following SAS program provides an example of how to use PROC PRTDEF in the z/OS operating environment to set up Universal Printing printer definitions.

The following example shows you how to set up various printers. The INPUT statement contains the names of the four required variables. Each data line contains the information that is needed to produce a single printer definition. The DATA= option on the PROC PRTDEF specifies PRINTERS as the input data set that contains the printer attributes. PROC PRTDEF creates the printer definitions for the SAS registry.

**Note:** You can use an ampersand (&) to specify that two or more blanks separate character values. This feature allows the name and model value to contain blanks.

```
data printers;
  dest = " ";
```

```
  device = "PRINTER";

  input @1 name $14. @16 model $18. @35 hostopt $24.;
datalines;
Myprinter             PostScript Level 1   SYSOUT=T  DEST=printer1
Laserjet              PCL 5 Printer        SYSOUT=T  DEST=printer5
Color LaserJet        PostScript Level 2   SYSOUT=T  DEST=printer2
;

proc prtdef data=printers;
run;
```

**Note:** **SYSOUT=T** indicates a binary queue, which is a queue that has no EBCDIC to ASCII conversion.

## Example 2: Defining a Universal Printer for an Email Message with a PostScript Attachment

The following SAS program provides an example of how to use PROC PRTDEF in the z/OS operating environment to set up a Universal Printing printer definition that generates an email message with a PostScript attachment.

```
data printers;
   name='email';
   protocol = 'None';
   model = 'PostScript Level 2 (color)';
   device = 'email';
   dest = 'John.Doe@sas.com';
   hostopt = "recfm=vb Subject='Weekly Report'
      ct='application/PostScript' ";
   run;
proc prtdef data=printers replace list; run;
```

**Note:** **ct** is an abbreviation for the MIME keyword **content_type**.

# Setting Up Printers in Your Environment

## Introduction to Output Variables

The following tables contain information about the required and optional variables that you need to use to create different types of outputs. Use these option values when you define variables for printing to a Universal Printer in a specific operating environment.

## z/OS PostScript

***Table 9.2*** *PostScript Variables*

| | Print to a PostScript Printer | Generate PostScript Output and Save to a File |
|---|---|---|
| Model | One of these:<br>■ PostScript<br>■ Gray scale PostScript<br>■ Color PostScript<br>■ Duplex PostScript<br>■ PostScript Level 1<br>■ PostScript Level 2 | One of these:<br>■ PostScript<br>■ Gray scale PostScript<br>■ Color PostScript<br>■ Duplex PostScript<br>■ PostScript Level 1<br>■ PostScript Level 2 |
| Device Type | PRINTER | DISK |
| Destination | not applicable | <syspref>.SASPRT.PS |
| Host Options | sysout=t dest=<*printer-address*>[1] | recfm=vb |
| Protocol | ASCII | ASCII |
| Translate Table | NONE | NONE |
| FTP | not applicable | Binary |

1 **SYSOUT=T** indicates a binary queue, which is a queue that has no EBCDIC to ASCII conversion. <*printer-address*> is the LAN queue name, such as PRT23LJ5.

## z/OS PCL

***Table 9.3*** *PCL Variables*

| | Print to a PCL Printer | Generate PCL Output and Save to a File |
|---|---|---|
| Model | One of these:<br>■ PCL4<br>■ PCL5<br>■ PCL5e | One of these:<br>■ PCL4<br>■ PCL5<br>■ PCL5e |

| | Print to a PCL Printer | Generate PCL Output and Save to a File |
|---|---|---|
| | ■ PCL5c | ■ PCL5c |
| Device Type | PRINTER | DISK |
| Destination | not applicable | <syspref>.SASPRT.PDF |
| Host Options | sysout=t dest=<*printer-address*>[1] | recfm=vb |
| Protocol | ASCII | ASCII |
| Translate Table | NONE | NONE |
| FTP | not applicable | Binary |

1 **SYSOUT=T** indicates a binary queue, which is a queue that has no EBCDIC to ASCII conversion. <*printer-address*> is the LAN queue name, such as PRT23LJ5. Check with your system administrator to determine the SYSOUT class and valid destination values at your location.

## z/OS PDF

***Table 9.4*** *PDF Variables*

| | Generate PDF Output and Save to a File |
|---|---|
| Model | PDF |
| Device Type | DISK |
| Destination | Userid.sasprt.pdf |
| Host Options | recfm=vb |
| Protocol | ASCII |
| Translate Table | NONE |
| Buffer Size | 255 |
| FTP to PC | Binary |

# Using FTP with Universal Printing

## Overview of Using FTP with Universal Printing

SAS enables you to use FTP to send universal printing output to a printer or to a file that is on another server, another machine, or another operating system. When you use FTP, such as in the FILENAME statements in the following examples, you have to specify the **recfm=s** parameter.

## Sending Output to a Printer

The following code example sends PostScript output to the printer that you specify with the host option of the FILENAME statement. The host option specifies the IP address that your printer is connected to, and the user option specifies your user ID. The pass option specifies your password. You can replace pass with the prompt option if you prefer to be prompted for your password at run time.

The following example produces output that has a border and contains the text, “Example Output with recfm=s.”

```
filename grafout ftp ' '
   host="IP address"
   user="username"
   recfm=s
   pass="user password";

options printerpath=('PostScript Level 2' grafout);
goptions reset=all dev=sasprtc gsfname=grafout gsfmode=replace;
proc gslide border;
    title 'Example Output with recfm=s';
run;
quit;
filename grafout clear;
```

## Sending Output to a File

The following code example sends PostScript output to a file in a UFS directory on a remote system that you specify with the host option of the FILENAME statement. The host option specifies the name of the server that your UFS directory is located on, and the user option specifies your user ID. The pass option specifies your

password. You can replace pass with the prompt option if you prefer to be prompted for your password at run time.

The following example produces output that has a border and contains the text, "Example Output with recfm=s."

```
filename grafout ftp '~username/filename.ps'
   host="hostname"
   user="username"
   recfm=s
   pass="user password";

options printerpath=('PostScript Level 2' grafout);
goptions reset=all dev=sasprtc gsfname=grafout gsfmode=replace;
proc gslide border;
   title 'Example Output with recfm=s';
run;
quit;
filename grafout clear;
```

# Example Programs and Summary

## Overview of Example Programs and Summary

All of the example programs access the SASLIB.HOUSES data set, which is shown in "The SASLIB.HOUSES Data Set" on page 216. Examples 1 through 4 execute the same PROC PRINT using different combinations of output formats and printing destinations. Example 5 and Example 6 use SAS/GRAPH code to execute PROC REG followed by PROC GPLOT, again with different output formats and printing destinations. For a summary of the results, see "Summary of Printing Examples" on page 217.

The example programs were developed on the z/OS platform. A printer device of PostScript output is written to a file.

To generate output to other printer definitions, use the printers defined at your site, or include your own printer definitions. For more information about printer definitions, see "Setting Up a Universal Printer with PROC PRTDEF" on page 196.

## Example 1: ODS and a Default Universal Printer

**Output:**

```
   Default Universal Printer
```

**Format:**

**ODS**

```
options linesize=80 nodate;
libname saslib '.saslib.data';

ods listing close;
ods printer;

title1 'ods and up default';

proc print data=saslib.houses;
   format price dollar10.0;
run;

ods printer close;
```

The following output shows the results of this code:

**ods and up default**

| Obs | style | sqfeet | brs | baths | price |
|---|---|---|---|---|---|
| 1 | CONDO | 1400 | 2 | 1.5 | $80,050 |
| 2 | CONDO | 1390 | 3 | 2.5 | $79,350 |
| 3 | CONDO | 2105 | 4 | 2.5 | $127,150 |
| 4 | CONDO | 1860 | 2 | 2.0 | $110,700 |
| 5 | CONDO | 2000 | 4 | 2.5 | $125,000 |
| 6 | RANCH | 1250 | 2 | 1.0 | $64,000 |
| 7 | RANCH | 1535 | 3 | 3.0 | $89,100 |
| 8 | RANCH | 720 | 1 | 1.0 | $35,000 |
| 9 | RANCH | 1300 | 2 | 1.0 | $70,000 |
| 10 | RANCH | 1500 | 3 | 3.0 | $86,000 |
| 11 | SPLIT | 1190 | 1 | 1.0 | $65,850 |
| 12 | SPLIT | 1615 | 4 | 3.0 | $94,450 |
| 13 | SPLIT | 1305 | 3 | 1.5 | $73,650 |
| 14 | SPLIT | 1590 | 3 | 2.0 | $92,000 |
| 15 | SPLIT | 1400 | 3 | 2.5 | $78,800 |
| 16 | TWOSTORY | 1810 | 4 | 3.0 | $107,250 |
| 17 | TWOSTORY | 1040 | 2 | 1.0 | $55,850 |
| 18 | TWOSTORY | 1240 | 2 | 1.0 | $69,250 |
| 19 | TWOSTORY | 1745 | 4 | 2.5 | $102,950 |
| 20 | TWOSTORY | 1300 | 2 | 1.0 | $70,000 |

# Example 2: ODS and the PRINTERPATH System Option

**Output:**
**Universal Printer 'Postscript'**

**Format:**
**ODS**

```
options linesize=80 nodate;
libname saslib '.saslib.data';

options printerpath = PostScript;
ods listing close;
ods printer;

title1 'ods and printerpath (no fileref)';

proc print data=saslib.houses;
   format price dollar10.0;
run;

ods printer close;
```

The following output shows the results of this code:

ods and printerpath (no fileref)

| Obs | style | sqfeet | brs | baths | price |
|---|---|---|---|---|---|
| 1 | CONDO | 1400 | 2 | 1.5 | $80,050 |
| 2 | CONDO | 1390 | 3 | 2.5 | $79,350 |
| 3 | CONDO | 2105 | 4 | 2.5 | $127,150 |
| 4 | CONDO | 1860 | 2 | 2.0 | $110,700 |
| 5 | CONDO | 2000 | 4 | 2.5 | $125,000 |
| 6 | RANCH | 1250 | 2 | 1.0 | $64,000 |
| 7 | RANCH | 1535 | 3 | 3.0 | $89,100 |
| 8 | RANCH | 720 | 1 | 1.0 | $35,000 |
| 9 | RANCH | 1300 | 2 | 1.0 | $70,000 |
| 10 | RANCH | 1500 | 3 | 3.0 | $86,000 |
| 11 | SPLIT | 1190 | 1 | 1.0 | $65,850 |
| 12 | SPLIT | 1615 | 4 | 3.0 | $94,450 |
| 13 | SPLIT | 1305 | 3 | 1.5 | $73,650 |
| 14 | SPLIT | 1590 | 3 | 2.0 | $92,000 |
| 15 | SPLIT | 1400 | 3 | 2.5 | $78,800 |
| 16 | TWOSTORY | 1810 | 4 | 3.0 | $107,250 |
| 17 | TWOSTORY | 1040 | 2 | 1.0 | $55,850 |
| 18 | TWOSTORY | 1240 | 2 | 1.0 | $69,250 |
| 19 | TWOSTORY | 1745 | 4 | 2.5 | $102,950 |
| 20 | TWOSTORY | 1300 | 2 | 1.0 | $70,000 |

# Example 3: ODS and the PRINTERPATH System Option (with FILEREF)

**Output:**
**File '.sasprt.out' with the characteristics of the Universal Printer 'Postscript'**

**Format:**
**ODS**

```
options linesize=80 nodate;
libname saslib '.saslib.data';

filename outlist '.sasprt.out';
options printerpath = ('Postscript' outlist);
ods listing close;
ods printer;

title1 'ods and up file';
title2 'printerpath with fileref';

proc print data=saslib.houses;
   format price dollar10.0;
```

```
run;

ods printer close;
```

The following output shows the results of this code:

**ods and up file printerpath with fileref**

| Obs | style | sqfeet | brs | baths | price |
|---|---|---|---|---|---|
| 1 | CONDO | 1400 | 2 | 1.5 | $80,050 |
| 2 | CONDO | 1390 | 3 | 2.5 | $79,350 |
| 3 | CONDO | 2105 | 4 | 2.5 | $127,150 |
| 4 | CONDO | 1860 | 2 | 2.0 | $110,700 |
| 5 | CONDO | 2000 | 4 | 2.5 | $125,000 |
| 6 | RANCH | 1250 | 2 | 1.0 | $64,000 |
| 7 | RANCH | 1535 | 3 | 3.0 | $89,100 |
| 8 | RANCH | 720 | 1 | 1.0 | $35,000 |
| 9 | RANCH | 1300 | 2 | 1.0 | $70,000 |
| 10 | RANCH | 1500 | 3 | 3.0 | $86,000 |
| 11 | SPLIT | 1190 | 1 | 1.0 | $65,850 |
| 12 | SPLIT | 1615 | 4 | 3.0 | $94,450 |
| 13 | SPLIT | 1305 | 3 | 1.5 | $73,650 |
| 14 | SPLIT | 1590 | 3 | 2.0 | $92,000 |
| 15 | SPLIT | 1400 | 3 | 2.5 | $78,800 |
| 16 | TWOSTORY | 1810 | 4 | 3.0 | $107,250 |
| 17 | TWOSTORY | 1040 | 2 | 1.0 | $55,850 |
| 18 | TWOSTORY | 1240 | 2 | 1.0 | $69,250 |
| 19 | TWOSTORY | 1745 | 4 | 2.5 | $102,950 |
| 20 | TWOSTORY | 1300 | 2 | 1.0 | $70,000 |

## Example 4: PRINTERPATH and FILENAME UPRINTER Statement

The following example code uses a line printer to format output to a PostScript printer. Because no font is specified, the font that is used is the default 12-point Courier font.

**Output:**

**Universal Printer 'Postscript'**

**Format:**

**LINE PRINTER**

```
options linesize=80 nodate;
libname saslib '.saslib.data';

title1 'proc printto';
```

```
title2 'filename upr and printerpath';

options printerpath = Postscript;
filename upr uprinter;

proc printto print=upr; run;

proc print data=saslib.houses;
   format price dollar10.0;
run;
```

The following output shows the results of this code:

```
1                                  proc
printto
     1
                              filename upr and printerpath

                  style       sqfeet    brs    baths         price

                  CONDO         1400      2      1.5        $80,050
                  CONDO         1390      3      2.5        $79,350
                  CONDO         2105      4      2.5       $127,150
                  CONDO         1860      2      2.0       $109,250
                  CONDO         2000      4      2.5       $125,000
                  RANCH         1250      2      1.0        $64,000
                  RANCH         1535      3      3.0        $89,100
                  RANCH          720      1      1.0        $35,000
                  RANCH         1300      2      1.0        $70,000
                  RANCH         1500      3      3.0        $86,000
                  SPLIT         1190      1      1.0        $65,850
                  SPLIT         1615      4      3.0        $94,450
                  SPLIT         1305      3      1.5        $73,650
                  SPLIT         1590      3      2.0        $92,000
                  SPLIT         1400      3      2.5        $78,800
                  TWOSTORY      1810      4      3.0       $107,250
                  TWOSTORY      1040      2      1.0        $55,850
                  TWOSTORY      1240      2      1.0        $69,250
                  TWOSTORY      1745      4      2.5       $102,950
                  TWOSTORY      1200      4      1.0        $70,000
```

# Example 5: SAS/GRAPH: ODS and PRINTERPATH System Option

**Output:**
**File '.graphip.ps' with the characteristics of the Universal Printer 'Postscript'**

**Format:**
**ODS**

```
options nodate;
```

```
goptions reset=all;
libname saslib '.saslib.data';

filename out '.graphip.ps';
options printerpath=(Postscript out);
ods listing close;
goptions device=sasprtc cback=white gsfmode=append;
ods printer style=default;

footnote "ODS and Universal Printer";
title1 "Linear Regression";
title2 "Results";

proc reg data=saslib.houses;
  /* Regression model */
     Linear_Regression_Model: MODEL price = sqfeet / ;

  /* output dataset to use as input for plots */
   output out = WORK._PLOTOUT
          predicted = _predicted1
          residual  = _residual1
          student   = _student1
          rstudent  = _rstudent1;
     run;
quit;

goptions hsize=5in vsize=5in;
goptions border;

title1 "Regression Analysis";
title2 "Plots";
axis1 major=(number=5) width=1;
axis3 major=(number=5) offset=(5 pct) width=1;

proc gplot data=WORK._PLOTOUT;
   where price is not missing and
     sqfeet is not missing;

   /* ********* PREDICTED plots ********* */

   title4 "Observed price by Predicted price";
   symbol1 C=GREEN V=DOT height=2PCT interpol=NONE L=1 W=1;
   label _predicted1 = "Predicted price";
   where price is not missing and _predicted1 is not missing;
   plot price * _predicted1 /
      vaxis=AXIS1 vminor=0 haxis=AXIS3 hminor=0
      description = "Observed price by Predicted price";
   run;

    /* ********* RESIDUAL plots ********* */

   title9 "Studentized Residuals of price by Predicted price";
   symbol1 C=GREEN V=DOT height=2PCT interpol=NONE L=1 W=1;
   label _rstudent1 = "Residuals";
   label _predicted1 = "Predicted price";
   where _rstudent1 is not missing and _predicted1 is not missing;
```

```
   plot _rstudent1 * _predicted1 /
     vaxis=AXIS1 vminor=0 haxis=AXIS3 hminor=0 vref=0
     description = "Studentized Residuals of price by Predicted price";
   run;
   symbol;
quit;

proc delete data=WORK._PLOTOUT; run;
title; footnote; run;

ods printer close;
```

The following output shows the results of PROC REG:

***Linear Regression Results***

***The REG Procedure***
***Model: Linear_Regression_Model***
***Dependent Variable: price***

| | |
|---|---|
| Number of Observations Read | 20 |
| Number of Observations Used | 20 |

| Analysis of Variance | | | | | |
|---|---|---|---|---|---|
| Source | DF | Sum of Squares | Mean Square | F Value | Pr > F |
| Model | 1 | 9992917564 | 9992917564 | 2609.90 | <.0001 |
| Error | 18 | 68919436 | 3828858 | | |
| Corrected Total | 19 | 10061837000 | | | |

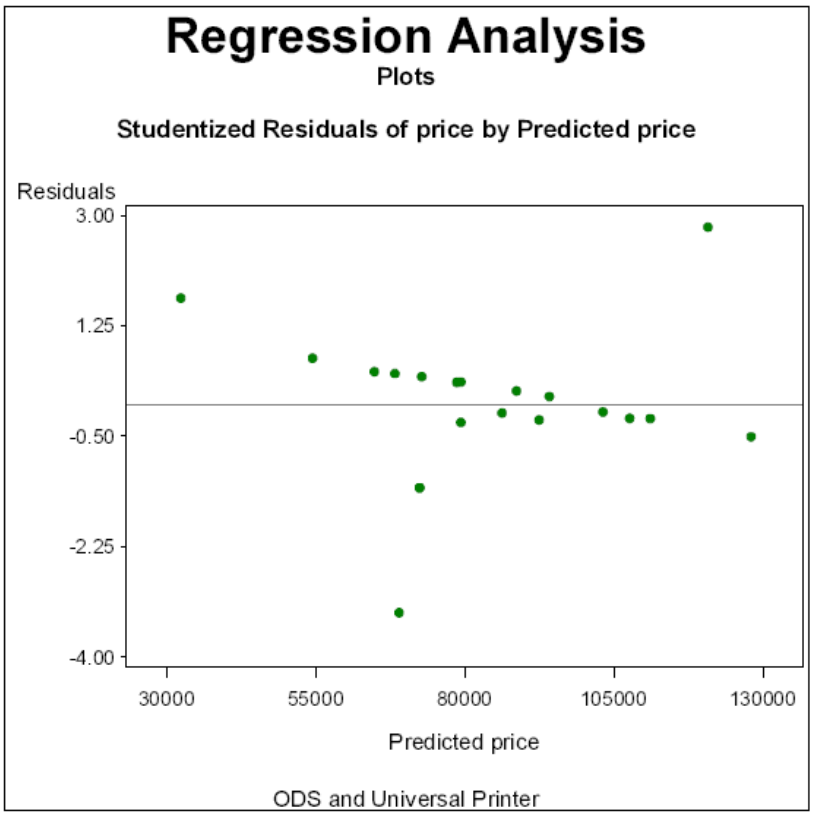
| | | | |
|---|---|---|---|
| Root MSE | 1956.74668 | R-Square | 0.9932 |
| Dependent Mean | 83820 | Adj R-Sq | 0.9928 |
| Coeff Var | 2.33446 | | |

| Parameter Estimates | | | | | |
|---|---|---|---|---|---|
| Variable | DF | Parameter Estimate | Standard Error | t Value | Pr > \|t\| |
| Intercept | 1 | -17323 | 2027.59312 | -8.54 | <.0001 |
| sqfeet | 1 | 69.05163 | 1.35164 | 51.09 | <.0001 |

***ODS and Universal Printer***

The following output shows the “Observed price by Predicted price” plot for this example:


The following output shows the "Studentized Residuals of price by Predicted price" plot for this example:



# Example 6: SAS/GRAPH: No ODS or PRINTERPATH System Option

**Output:**
**File '.graphip.ps'**

**Format:**
**As specified by the SAS/GRAPH device driver**

```
options linesize=80 nodate;
goptions reset=all;
filename out '.graphip.ps';
goptions device=ps gsfname=out;
goptions cback=white gsfmode=append;
libname saslib '.saslib.data';

footnote "Regular SAS/GRAPH PS Output; no ODS, no Universal Printer";
title1 "Linear Regression";
title2 "Results";

proc reg data=saslib.houses;
  /* Regression model */
     Linear_Regression_Model: MODEL price = sqfeet / ;

  /* output dataset to use as input for plots */
   output out = WORK._PLOTOUT
          predicted = _predicted1
          residual  = _residual1
          student   = _student1
          rstudent  = _rstudent1;
    run;
quit;

goptions hsize=5in vsize=5in;
goptions border;

title1 "Regression Analysis";
title2 "Plots";
axis1 major=(number=5) width=1;
axis3 major=(number=5) offset=(5 pct) width=1;

proc gplot data=WORK._PLOTOUT;
   where price is not missing and
     sqfeet is not missing;

   /* ********* PREDICTED plots ********* */

   title4 "Observed price by Predicted price";
   symbol1 C=GREEN V=DOT height=2PCT interpol=NONE L=1 W=1;
   label _predicted1 = "Predicted price";
   where price is not missing and _predicted1 is not missing;
   plot price * _predicted1 /
```

```
   vaxis=AXIS1 vminor=0 haxis=AXIS3 hminor=0
   description = "Observed price by Predicted price";
run;

 /* ********* RESIDUAL plots ********* */

title9 "Studentized Residuals of price by Predicted price";
symbol1 C=GREEN V=DOT height=2PCT interpol=NONE L=1 W=1;
label _rstudent1 = "Residuals";
label _predicted1 = "Predicted price";
where _rstudent1 is not missing and _predicted1 is not missing;
plot _rstudent1 * _predicted1 /
  vaxis=AXIS1 vminor=0 haxis=AXIS3 hminor=0 vref=0
  description = "Studentized Residuals of price by Predicted price";
run;
symbol;
quit;

proc delete data=WORK._PLOTOUT; run;
title; footnote; run;
```

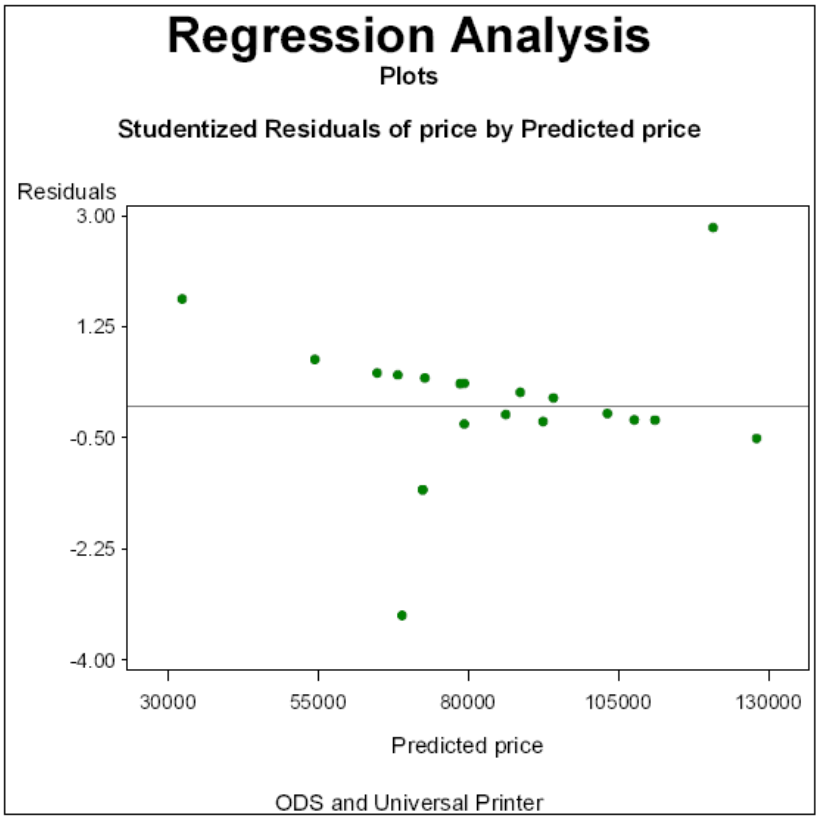
The following output shows the results of PROC REG. This output appears in the SAS Output window.

```
1                                 Linear Regression
     1

                                      Results

                                 The REG Procedure

                            Model: Linear_Regression_Model

                              Dependent Variable: price

                                 Analysis of Variance

                                           Sum of           Mean
  Source                     DF          Squares         Square    F Value    Pr > F

  Model                       1    12798244470    12798244470    3791.82    <.0001

  Error                      26       87755798        3375223

  Corrected Total            27    12886000268

                 Root MSE           1837.17800    R-Square     0.9932
                 Dependent Mean        83716      Adj R-Sq     0.9929
                 Coeff Var              2.19453

                                 Parameter Estimates
                               Parameter       Standard

       Variable     DF       Estimate          Error    t Value    Pr > |t|
       Intercept     1         -16246     1660.05685      -9.79      <.0001
       sqfeet        1       68.52572        1.11283      61.58      <.0001
```

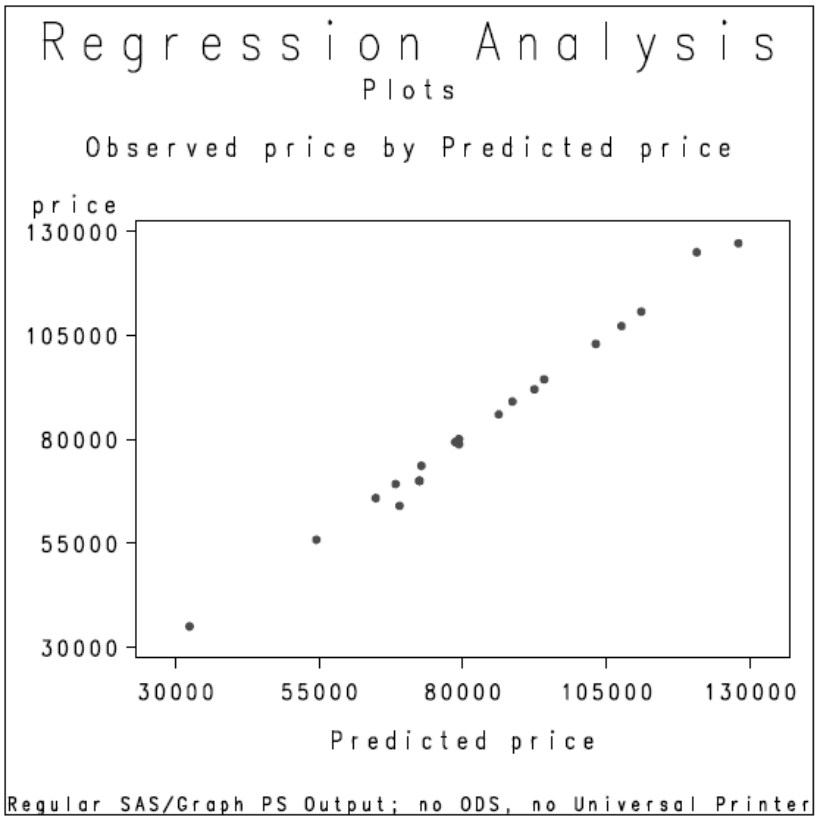
```
Regular SAS/GRAPH PS Output; no ODS, no Universal Printer
```

The following output shows the “Observed price by Predicted price” plot for this example. The two graphs are written to **.GRAPHIP.PS**.

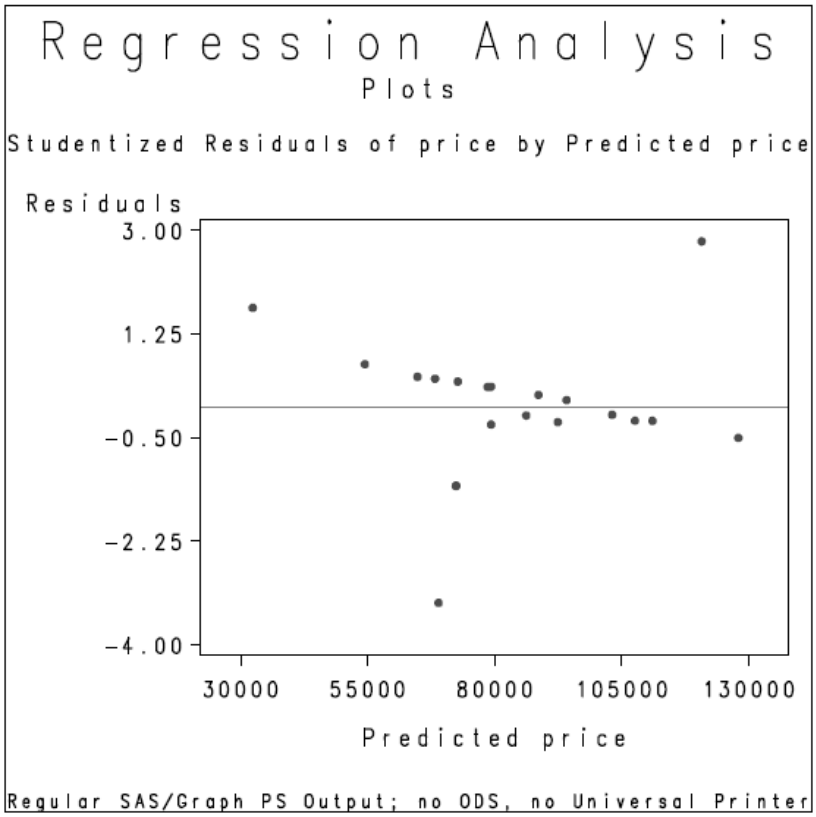

The following output shows the “Studentized Residuals of price by Predicted price” plot for this example:




The following output shows the "Observed price by Predicted price" plot for this example. The two graphs are written to a PostScript file.



The following output shows the “Studentized Residuals of price by Predicted price” plot for this example:




# The SASLIB.HOUSES Data Set

## Contents of the SASLIB.HOUSES Data Set

The SASLIB.HOUSES data set contains the data used by the example programs in this section.

```
libname saslib '.saslib.data';
data saslib.houses;
  input style $ 1-8 sqfeet 15-19 brs 22 baths 25-27 price 30-38;
  datalines;
CONDO         1400   2  1.5     80050
CONDO         1390   3  2.5     79350
CONDO         2105   4  2.5    127150
CONDO         1860   2    2    110700
CONDO         2000   4  2.5    125000
RANCH         1250   2    1     64000
RANCH         1535   3    3     89100
```

```
RANCH          720   1    1     35000
RANCH         1300   2    1     70000
RANCH         1500   3    3     86000
SPLIT         1190   1    1     65850
SPLIT         1615   4    3     94450
SPLIT         1305   3  1.5     73650
SPLIT         1590   3    2     92000
SPLIT         1400   3  2.5     78800
TWOSTORY      1810   4    3    107250
TWOSTORY      1040   2    1     55850
TWOSTORY      1240   2    1     69250
TWOSTORY      1745   4  2.5    102950
TWOSTORY      1300   2    1     70000
run;
```

# Summary of Printing Examples

| Example | Where Printed | Output Format |
|---|---|---|
| `ods listing close;`<br>`ods printer;`<br>`proc print data=saslib.houses; run;`<br>`ods printer close;` | Default Universal Printer | ODS |
| `options printerpath=MYPRINT;`<br>`ods listing close;`<br>`ods printer;`<br>`proc print data=saslib.houses; run;`<br>`ods printer close;` | Universal Printer MYPRINT | ODS |
| `filename MYFILE ".myfile.out";`<br>`options printerpath= (Postscript MYFILE);`<br>`ods listing close;`<br>`ods printer;`<br>`proc print data=saslib.houses; run;`<br>`ods printer close;` | File .MYFILE.OUT with the characteristics of the Universal Printer "PostScript" | ODS |
| `options printerpath=MYPRINT;`<br>`filename upr uprinter;`<br>`proc printto print=upr; run;`<br>`proc print data=saslib.houses; run;` | Universal Printer MYPRINT | Line Printer [1] |
| `filename upr uprinter;`<br>`proc printto print=upr; run;`<br>`proc print data=saslib.houses; run;` | Default Universal Printer | Line Printer [1] |
| `options printerpath=MYPRINT;`<br>`ods listing close;`<br>`ods printer;`<br>`goptions device=sasprtc; *`<br>`proc reg data=saslib.houses; .... run;`<br>`proc gplot; .... run;` | Universal Printer MYPRINT | ODS |

| Example | Where Printed | Output Format |
|---|---|---|
| `ods printer close;` | | |
| `filename OUT ".graphip.ps";`<br>`goptions device=ps gsfname=OUT;`<br>`proc reg data=saslib.houses; .... run;`<br>`proc gplot; .... run;` | File .GRAPHIP.SAS | As specified by the SAS/GRAPH device driver |
| `options printerpath=postscript`<br>`device=sasprtc;`<br>`proc gplot; .... run;` | Universal Printer PostScript file **`.SASPRT.PS`** | SAS/GRAPH |

[1] The default font is 12-point Courier unless otherwise specified.

* **`goptions device=`** is needed only in batch mode.

# 10

# SAS Processing Restrictions for Servers in a Locked-Down State



## Overview of SAS Processing Restrictions for Servers in a Locked-down State

When you access a SAS Foundation server that is running on z/OS in the locked-down state, some SAS features are restricted and some features are disabled. For more information, see "Sign On to Locked-Down SAS Sessions" in *SAS/CONNECT User's Guide* and "SAS Processing Restrictions for Servers in a Locked-Down State" in *SAS Programmer's Guide: Essentials*. In addition, certain SAS features specific to the z/OS environment are also restricted or disabled as described in the following sections.

## Restricted Features

Access to permanent z/OS data sets and UFS files and directories is not permitted unless enabled in the lockdown list. This restriction applies to all SAS features, most notably FILENAME and LIBNAME statements in SAS programs that are submitted for execution on the server. It also applies to the ability to list files on the server through SAS clients such as SAS Enterprise Guide. When SAS is in the

locked-down state, SAS does not permit access to uncataloged z/OS data sets except through externally allocated ddnames that are established by the server administrator. However, there are no restrictions on creating temporary z/OS data sets and UFS files, and processing them within the context of a single client session. The z/OS data sets are considered temporary if they are allocated DISP=(NEW,DELETE). External files are considered temporary if they are assigned using the FILENAME device of TEMP. All members of the client WORK library are considered temporary.

The SAS server administrator at your installation is responsible for the content of the lockdown list. Therefore, if you need to access a z/OS data set or UFS file that is unavailable in the locked-down state, contact your server administrator.

# Disabled Features

The following SAS procedures, which are specific to z/OS, cannot be executed when SAS is in the locked-down state:

| | |
|---|---|
| PDS | SOURCE |
| PDSCOPY | TAPECOPY |
| RELEASE | TAPELABEL |

The following DATA step functions, which are specific to z/OS, cannot be executed when SAS is in the locked-down state:

| | |
|---|---|
| ZVOLLIST | ZDSATTR |
| ZDSLIST | ZDSRATT |
| ZDSNUM | ZDSXATT |
| ZDSIDNM | ZDSYATT |

The following access method, which is specific to z/OS, cannot be executed when SAS is in the locked-down state:

VTOC

# Specifying Functions in the Lockdown Path List

If the SAS session in which you are specifying a function is in a locked-down state, and the pathname specified in the function has not been added to the lockdown path list, then the function will fail and a file access error related to the locked-

down data will not be generated in the SAS log unless you specify the SYSMSG function.

The SYSMSG function can be placed after the function call in a DATA step to display lockdown-related file access errors.

This condition is true for the following functions as well as any other functions that take physical pathname locations as input:

- DCREATE
- FILEEXIST
- FILENAME
- RENAME
- DSNCATLGD (specific to z/OS)

# 11

# Using the SAS Remote Browser



## What Is the Remote Browsing System?

The remote browsing system enables users who access SAS through a 3270 emulator (or a real 3270) to view SAS documentation from a web browser on the user's PC. Prior to SAS 9.2, all documentation was displayed by the item store help in the SAS Help Browser window in the 3270 display. By displaying this documentation in your web browser, you have better browsing capability and more complete documentation content.

## Starting the Remote Browser Server

Remote browsing is invoked when SAS displays HTML output, usually from ODS, the Help system, or from the WBROWSE command. SAS attempts to detect your desktop computer's network address and send remote browser requests to it. If you have not installed the remote browser server on your desktop computer, SAS displays a dialog box that contains the address that is necessary to download the

installer. The Help server provides the remote browser installer, so you do not have to end your SAS session to install the remote browser server. Copy the address in the dialog box to your browser, download the installer, and run it. The installer places the remote browser server in the **Startup Items** folder, so that it starts each time you start your desktop computer.

# Setting Up the Remote Browser

## Overview of Setting Up the Remote Browser

After the remote browser server is running on your computer, you can run the Help by using the defaults for the HELPBROWSER, HELPHOST, and HELPPORT system options. If the HELPHOST option is not coded, SAS attempts to connect to the remote browser at the network address to which your computer's 3270 emulator (or your 3270 terminal) points. If the address is not the correct address for the remote browser, then you have to set the appropriate value for the HELPHOST option.

- The HELPBROWSER system option specifies whether you want to use the new help (**REMOTE**, the default) or the traditional item store-based help (SAS) that uses the SAS Help browser. See the *SAS System Options: Reference* for more information.
- The HELPHOST system option specifies the network name of your computer, which runs the remote browser server. If the HELPHOST option value is not specified, it defaults to the network address of the computer that is running your 3270 display emulator. This computer is usually the same computer that is running the remote browser server. For more information, see "HELPHOST System Option: z/OS" on page 774.
- The HELPPORT system option specifies the port number that the remote browser server is listening on. The default port is 3755, the port that is registered for the Remote Browser Server. For more information, see the *SAS System Options: Reference*.

You can set these options at SAS invocation, in your configuration file, or during your SAS session in the OPTIONS statement or in the OPTIONS window.

## Example 1: Setting Up the Remote Browser at SAS Invocation

The following code shows you how to set up the remote browser at SAS invocation:

```
sas o('helphost=mycomputer')
```

## Example 2: Setting Up the Remote Browser during a SAS Session

The following code shows you how to set up the remote browser during your SAS session:

```
options helphost=mycomputer;
```

# Remote Browsing and Firewalls

## For General Users

If your network has a firewall between desktop computers and the computer that hosts SAS, browsers cannot display web pages from your SAS session. Usually, this is indicated by a time-out or connection error from the web browser. If you receive a time-out or connection error, contact your system administrator.

## For System Administrators

To enable the display of web pages when a firewall exists between desktop computers and SAS, a firewall rule that enables a browser to connect to SAS must be added. The firewall rule specifies a range of network ports for which SAS remote browsing connections are allowed. Contact the appropriate administrator who can select and configure a range of firewall ports for remote browsing. The range size depends on the number of simultaneous SAS users. A value of approximately three times the number of simultaneous users should reserve a sufficient amount of network ports.

Once the firewall rule has been added, SAS must be configured to listen for network connections in the port range. Normally, SAS selects any free network port, but the HTTPSERVERPORTMIN and HTTPSERVERPORTMAX system options limit the ports that SAS selects. Add these options to your SAS configuration file. Set the HTTPSERVERPORTMIN option to the lowest port in the range. Set the HTTPSERVERPORTMAX option to the highest port in the range. For example, if the network administrator defines a port range of 8000–8200, the system options are set as follows:

```
httpserverportmin=8000
httpserverportmax=8200
```

After the firewall rule is added and these system options are set, desktop computers can view web pages through the firewall. If there are insufficient ports or the system options are specified incorrectly, a message is displayed in the SAS log.

For more information about these options, see “HTTPSERVERPORTMIN= System Option” and “HTTPSERVERPORTMAX= System Option” in the *SAS System Options: Reference*.

# Using Remote Browsing with ODS Output

The SAS Output Delivery System can be used to generate graphical reports of your SAS data. Remote browsing enables you to view your output directly from the SAS session, either in real time as the output is generated, or on demand from the Results window.

Remote browsing displays ODS output that is generated to z/OS native data sets (sequential, PDS, or PDSE) or a UFS directory. HTML, PDF, RTF, and XLS file types are displayed with the remote browsing system. If your browser does not have the appropriate plug-in for non-HTML data types, it is displayed a download dialog box rather than the actual data. This dialog box enables you to download the report to your PC and view it using a local program, such as Excel for an XLS file.

**Note:** When images or graphics are written to a z/OS native data set and remote browsing is being used to view the output, the URL=NONE option should not be used with the ODS statement. Using this option causes the HTML to be written with incomplete filenames, and the remote browsing system is not able to determine the location of the image or graphics. When this situation occurs, the browser displays broken image icons in the HTML output.

The automatic display of ODS output is turned off by default. You can turn on the automatic display of ODS output by issuing the AUTONAVIGATE command in the Results window.

For more information about viewing ODS output with a browser, see “Viewing ODS Output on an External Browser” on page 162.

# 12

# Using Item Store Help Files



## Accessing SAS Item Store Help Files

**Note:** SAS supports item store help files. However, SAS help files are available only in HTML. If you are using item store help files, then we strongly recommend that you convert them to HTML. You can then use your HTML help files with the SAS help files that are in HTML. For information about converting your item store files to HTML, see "Converting Item Store Help to HTML Help" on page 230 and "%ISHCONV Macro Macro Statement: z/OS" on page 520.

Help is available through the SAS online Help facility. To obtain host-specific help, execute the PMENU command as necessary to display SAS menus. Then select **Help** ⇨ **SAS System Help** ⇨ **Main TOC** ⇨ **Using SAS Software in z/OS**. Then select topics of interest at increasing levels of detail.

Issue the KEYS command to determine the function keys used to page up, down, left, and right through help pages, and to move backward and forward between Help topics.

# Using User-Defined Item Store Help Files

Your site might provide user-defined help that provides site-specific information via the standard SAS help browser. To access user-defined help via the SAS help browser, you need to allocate a user-defined help library at SAS invocation.

The user-defined help library contains help information in the form of one or more item store files, which use a file format that enables SAS to treat the item store as a file system within a file. Each item store can contain directories, subdirectories, and individual Help topics. For information about loading user-defined help into item store files, see "ITEMS Procedure Statement: z/OS" on page 548.

Help for SAS software is contained in item store files. SAS automatically allocates libraries for SAS software help at SAS invocation. To invoke SAS so that it recognizes user-defined help, follow these steps:

1. In an autoexec file, allocate the SAS library that contains the user-defined item store files using the LIBNAME statement. For example, if the libref is to be MYHELP and the item store is named APPL.HELP.DATA, the LIBNAME statement in the SAS invocation would be

   ```
   libname myhelp 'appl.help.data' disp=shr;
   ```

   For more information, see "Autoexec Files" on page 14 and "LIBNAME Statement: z/OS" on page 656.

2. Concatenate your item store files to the SAS help item store named by the HELPLOC= system option at SAS invocation. For example, if the libref for your user-defined help was MYHELP, and if the item store in the libref was named PRGAHELP, then the HELPLOC= specification in the SAS invocation would be as follows:

   ```
   helploc='myhelp.prgahelp'
   ```

   For more information about the HELPLOC= system option, see "HELPLOC= System Option: z/OS" on page 775.

User-defined help cannot be added to the SAS help item store because most users have Read-Only access to the SAS help library.

After SAS has been invoked so that it can recognize user-defined help, you can access that help with the standard SAS help browser by issuing the HELP command and specifying the appropriate universal resource locator (URL). For example, if the Help topic that you want to display is named DIRAHLP1.HTM, and if that Help topic is contained in an item store directory named PRGADIRA, the HELP command would be as follows:

```
help helploc://prgadira/dirahlp1.htm
```

See the next section for information about developing user-defined help for the SAS help browser.

# Creating User-Defined Item Store Help Files

You can create help for your site or for your SAS programs that can be displayed in the standard SAS help browser. To ensure that your user-defined help is displayed as it is written, use only the subset of tags from HTML that are supported on the SAS help browser. Help information in tags that are not supported by the SAS help browser might be ignored by the SAS help browser.

The following table describes the HTML tags supported by the SAS help browser. The TABLE tag is the only frequently used tag that is not supported at this time. To add tables to your help, use the PRE tag and format the text manually using blank spaces, vertical bars, hyphens, and underscores as needed.

***Table 12.1*** *HTML Tags Supported by the SAS Help Browser*

| Tag Type | Tag Names | Description |
|---|---|---|
| heading | H1, H2, H3, H4, H5, H6 | for hierarchical section headings |
| paragraph | P | for text in the body of a help file |
| list | UL, OL, DIR, MENU | for unordered (bullet) lists, ordered (numbered) lists, directory (unordered, no bullets) lists, and menu (unordered) lists |
| definition list | DL, DT, DD | for definition lists, titles of items, and definitions of items |
| preformatted text | PRE, XMP, LISTING | for tables, which must be manually formatted with blank spaces |
| font specification | I, B, U | for italic, bold, and underlined text |
| phrase | EM, STRONG, DFN, CODE, SAMP, KBD, VAR, CITE | for emphasis, strong emphasis, definitions, code examples, code samples, keyboard key names, variables, citations |

| | | |
|---|---|---|
| link | A, LINK | for anchors and the links that reference those anchors |
| document | TITLE, BASE, HEAD, HTML | for titles in the browser, base URLs, heading sections at the top of a page |

For information about the options available for these tags, see any reference for the version of HTML supported by your browser.

For information about loading your help into item store files, see "ITEMS Procedure Statement: z/OS" on page 548.

# Converting Item Store Help to HTML Help

## Overview of Converting Item Store Help

The SAS 9.4 remote browser does not read item store help files. The SAS %ISHCONV macro enables you to convert your item store help files into HTML files that you can use with the remote browser.

**Note:** If your location uses item store help files with SAS, then your SAS system programmer is the person who usually converts the item store files to HTML files. Contact your system programmer if you cannot access the HTML help files.

## Creating a Common Directory

In order for SAS users at your location to access your HTML help files with the remote browser, you need to create a common directory in UFS. The common directory contains the HTML files that are created by the %ISHCONV macro. It can also contain subdirectories that contain more HTML files. The %ISHCONV macro uses the **htmdir** parameter to specify the common directory if you do not create it before running the macro. However, you have to specify a directory pathname for the **htmdir** parameter, so it is best to create the directory before you convert the item store files.

The common directory should allow all SAS users at your location to access the files, so you should place it in a directory path that is accessible to them. As always, it is a good idea to determine the best location for the directory before you create it

and put your files in it. Such planning can prevent you from having to move the directory and its files at a later date.

# Converting Your Files to HTML

The SAS macro, %ISHCONV, converts your item store files into HTML files. %ISHCONV uses the **ishelp** and **ishref** parameters to specify the data set name of the catalog that contains the item store help and the member of the item store help. It uses the **exphlp** and **htmdir** parameters to specify the filename of a work file for conversion processing and the pathname for the HTML files.

**Note:** The converted HTML files have a file extension of **.htm**.

For more information about using %ISHCONV to convert your item store files to HTML, see "%ISHCONV Macro Macro Statement: z/OS" on page 520.

# Adding HELPLOC Path Values

The INSERT system option enables you to add new path values to the HELPLOC option. Path values that are added with the INSERT option are read before paths that are already assigned to the HELPLOC option in your configuration file. You can insert multiple paths for the HELPLOC option.

The following commands insert a new path value for the HELPLOC option before other paths that are specified in your configuration file. The following example inserts a path in a directory that contains files in ASCII:

```
-insert (helploc='/u/userid/ishconv_dir_ascii')
```

The following example inserts a path in a directory that contains files in EBCDIC:

```
-insert (helploc='/u/userid/ishconv_dir_ed-1047;ebcdic')
```

After you use the INSERT command to assign additional path values, you can issue the following command:

```
proc options option=helploc; run;
```

To display the new value for HELPLOC that combines the two paths:

```
HELPLOC=( '/u/userid/ishconv_dir_ascii'
        '/u/userid/ishconv_dir_ed-1047;ebcdic'
        '/usr/local/SASdoc' )
```

The path value **'/usr/local/SASdoc'** is the value that was set for HELPLOC in your configuration file.

# Accessing Your HTML Help Files

After your item store help files are converted to HTML, you can access the HTML help files by the same methods that you used to access the item store help:

- Select **Help** from the **SAS menu bar**.
- Enter the HELP command from the SAS command line.

The SAS HELP command:

```
help helploc://user.hlp/index.htm
```

accesses the **index.htm** file in the UFS directory that has the fully qualified name:

```
/u/userid/ishconv_dir_ascii/user.hlp/index.htm
```

**Note:** You are not limited to using the HELP command to access only the **index.htm** file of your help. You can issue the HELP command to access Help with the remote browser for Windows, SAS language elements, and so on. This behavior is the same as you have seen with previous SAS Help systems.

If a help file with the same relative path and filename exists in multiple HELPLOC path values, SAS displays the file from the first path that is encountered. This feature enables you to amend an existing file that is available to SAS.

If you get an error message that the Help is not available, use the HELPLOC system option to specify the location of the Help files. You can include the HELPLOC option in your configuration file, or you can issue it at SAS invocation. Contact your system programmer for the location of the Help files that you need to use with the HELPLOC option.

# See Also

- "HELPBROWSER= System Option" in *SAS System Options: Reference*
- "HELPLOC= System Option: z/OS" on page 775
- "HELPTOC System Option: z/OS" on page 776
- "INSERT= System Option: z/OS" on page 783
- "%ISHCONV Macro Macro Statement: z/OS" on page 520
- "Macros in the z/OS Environment" on page 511
- *SAS Macro Language: Reference*

# Creating User-Defined Help Files in HTML

You can write your own HTML help files to use with SAS. Use the same tools or file editors to write these HTML files that you would use to write any other HTML files. After you have written these files, place them in a location where SAS can access them. If your HTML help files are encoded in EBCDIC, you need to include the **;ebcdic** attribute in the declaration for the HELPLOC system option. For information about working with ASCII-encoded files in the z/OS USS environment, see the IBM *z/OS UNIX System Services User's Guide*.

For information about using the HELPLOC system option, see "HELPLOC= System Option: z/OS" on page 775.

**Note:** SAS provides the ITEMS procedure to enable you to produce item store files, but we encourage you to create and use HTML help files. Any item store file that you create is used with SAS item store files that have not been updated for this release of SAS.

# 13

# Exiting or Terminating Your SAS Session in the z/OS Environment



## Preferred Methods for Exiting SAS

These are the preferred methods for exiting a SAS session:

- select **File** ⇨ **Exit** from the menu bar in interactive SAS
- use **`endsas;`** in SAS code
- enter **`BYE`** or **`ENDSAS`** on the command line.
- enter the SIGNOFF command if you are using SAS/CONNECT.

## Additional Methods for Terminating SAS

If SAS is running as a server task that started in MVS, a system operator can terminate it in the following ways:

STOP
: This method is the equivalent of an application requesting a normal shutdown. You should have no problems with your files.

CANCEL
: The operating system initiates the termination of SAS, but application error handlers can still run and cleanup is possible. Your files are closed, and the

buffers are flushed to disk. However, there is no way to ensure that the shutdown is always orderly. Your files might be corrupted.

FORCE
The operating system terminates all application processes with no recovery. This is the equivalent to what would happen if the system were rebooted.

Some databases, such as DB2, are able to recover from both the CANCEL and FORCE types of failures. These applications accomplish this task by logging every change so that, regardless of when a failure occurs, the log can be replayed to enable recovery to a valid state. However, some transactions could still be lost.

Although you can terminate SAS using these techniques, you should try one of the three preferred techniques listed first. For more information, see "What If SAS Does Not Start?" on page 6.

PART 3

# Troubleshooting SAS under z/OS

# 14

# Solving Problems under z/OS



## Overview of Solving Problems under z/OS

As you use SAS software under z/OS, you might encounter problems within your SAS program. Or, problems might occur with some component of the operating environment or with computer resources rather than with SAS software. For example, problems might be related to job control language or to a TSO command.

# Problems Associated with the z/OS Operating Environment

If a problem is detected by the operating environment, it sends messages to the job log or to the terminal screen (not the SAS log). In this case, you might need to consult an appropriate IBM manual or your on-site systems staff to determine the problem and the solution.

Most error messages indicate which part of the operating environment is detecting the problem. Here are some of the most common message groups, along with the operating environment component or utility that issues them:

ARC
: IBM Hierarchical Storage Manager

BPX
: IBM UNIX System Services

CEE
: IBM Language Environment (LE)

CSV
: z/OS load module management routines

FSUM
: IBM UNIX System Services Shell and Utilities

ICE
: IBM sort utility

ICH
: RACF system-security component of z/OS

IDC
: catalog-management component of z/OS

IEC
: z/OS data-management routines

IEF
: IBM JCL Interpreter

IKJ
: TSO terminal monitor program (TMP) and other TSO components

LSC
: SAS/C Run-Time Library

WER
: SYNCSORT program

Consult the appropriate system manual to determine the source of the problem.

# Solving Problems with Scroll Bars, Borders, Buttons, and Text

Some 3270 emulators can use nonstandard sizes for character cells that are not compatible with the SAS Programmed Symbol display. If you are having problems with the text display or with using the SAS window components such as scroll bars, borders, buttons, and text, then your 3270 emulator might be using a nonstandard size for character cells. If any of these problems occur, check your log for the following message:

```
NOTE: Non-standard character cell size detected.
      Use TERMSTAT command for more information.
```

If the message appears in your SAS log, then close SAS and select an appropriate size for character cells in your 3270 emulator's configuration settings. You might need to contact your site's system programmer for information about how to change your emulator's configuration settings.

The following table contains the appropriate sizes for the character cell:

| Character Cell Width | Character Cell Height |
|---|---|
| 6 | 12 |
| 8 | 14 |
| 9 | 13 |
| 9 | 14 |
| 9 | 16 |

To verify that you have specified an appropriate size for character cells, restart SAS and issue the TERMSTAT command from any SAS command line. You should receive a series of log messages that contains the terminal characteristics for your emulator.

The following log excerpt shows an example of the information for terminal characteristics that is returned by the TERMSTAT command. Note the values that are specified for the Character Cell Width and the Character Cell Height in the example. They match the values in the last row of the preceding table. The values that you receive should match one set of the values in the table.

```
   Terminal Characteristics
       Terminal Type           = PCGX
       FSDEVICE Option         =
```

```
Primary Rows            = 24
Primary Columns         = 80
Alternate Rows          = 32
Alternate Columns       = 80
Number of Colors        = 7
Number of Highlight     = 3
Character Cell Width    = 9
Character Cell Height   = 16
Pixels/in. - X          = 96
Pixels/in. - Y          = 96
Loadable Symbols Sets   = 6
```

# Solving Problems within SAS Software

## Overview of Solving Problems within SAS Software

Several resources are available to help you if you determine that your problem is within SAS software. These resources are discussed in the following sections.

## Examining the SAS Log

The primary source of information for solving problems that occur within SAS software is the SAS log. The log lists the SAS source statements along with notes about each step, warning messages, and error messages. Errors are flagged in the code, and a numbered error message is printed in the log. It is often easy to find the incorrect step or statement just by glancing at the SAS log.

**Note:** Some errors require that diagnostic messages are written before the SAS log is opened or after it is closed. Such messages are written to the SASCLOG data set. Under TSO, SASCLOG is normally allocated to the terminal. Occasionally, operating system error messages might be issued during execution of a SAS program. These messages appear in the job log or, under TSO, on the terminal.

**Note:** Some system messages are written to your TSO terminal only if you have set the TSO PROFILE option to WTPMSG. This setting is sometimes useful in diagnosing issues related to z/OS.

# Checking the Condition Code

Upon exit, SAS returns a condition code to the operating environment that indicates its completion status. The condition code is translated to a return code that is meaningful to the operating environment.

SAS issues the condition codes in the following table:

***Table 14.1*** *z/OS Condition Codes*

| Return Code | Meaning |
|---|---|
| 0 | Successful completion |
| 4 | WARNING messages issued |
| 8 | Nonfatal ERROR messages issued |
| 12 | Fatal ERROR messages issued |
| 16 | ABORT; executed |
| 20 | ABORT RETURN; executed |
| ABND | ABORT ABEND; executed |

# DATA Step Debugger

The DATA step debugger is an interactive tool that helps you find logic errors, and sometimes data errors, in SAS DATA steps. By issuing commands, you can execute DATA step statements one by one or in groups, pausing at any point to display the resulting variable values in a window. You can also bypass the execution of one or more statements. For further information about the DATA step debugger, see the *Base SAS Utilities: Reference*.

# Using SAS Statements, Procedures, and System Options to Identify Problems

If you are having a problem with the logic of your program, there might be no error messages or warning messages to help you. You might not get the results or output that you expect. Using PUT statements to write messages to the SAS log or to dump the values of all or some of your variables might help. Using PUT statements enables you to follow the flow of the problem and to see what is going on at strategic places in your program.

Some problems might be related to the data. However; these problems can be difficult to trace. Notes that appear in the SAS log following the step that reads and manipulates the data might be very helpful. These notes provide information such as the number of variables and observations that were created. You can also use the CONTENTS and PRINT procedures to look at the data definitions as SAS recorded them or to look at all or parts of the data in question.

SAS system options can also assist with problem resolution. See the *SAS System Options: Reference* for more information about the following system options and others that affect problem resolution:

MLOGIC
: controls whether SAS traces execution of the macro language processor.

MPRINT
: displays SAS statements that are generated by macro execution.

SOURCE
: controls whether SAS writes source statements to the SAS log.

SOURCE2
: writes secondary source statements from included files to the SAS log.

SYMBOLGEN
: controls whether the results of resolving macro variable references are written to the SAS log.

# Host-System Subgroup Error Messages

For brief explanations of many of the host-system subgroup error messages that you might encounter during a SAS session, see “Messages from the SASCP Command Processor” on page 980.

# z/OS System Log

The z/OS system log can also contain useful information that might assist you with diagnosing a problem with SAS. Consult your system administrator for assistance with viewing the system log.

# 15

# Support for SAS Software



## Overview of Support for SAS Software

Support for SAS software is shared by SAS and your installation or site. SAS provides maintenance for the software; the SAS Installation Representative, the on-site SAS support personnel, and the SAS Training Coordinator for your site are responsible for giving you direct user support.

- The SAS Installation Representative receives all shipments and correspondence and distributes them to the appropriate personnel at your site.
- The on-site SAS support personnel are knowledgeable SAS users who support the other SAS users at your site. The SAS Technical Support Division is available to assist your on-site SAS support personnel with problems that you encounter.
- The SAS Training Coordinator works with the SAS Education Division to arrange training classes for SAS users.

# Working with Your On-Site SAS Support Personnel

At your site, one or more on-site SAS support personnel have been designated as the first point of contact for SAS users who need help with resolving problems.

If the on-site SAS support personnel are unable to resolve your problem, then the on-site SAS support personnel contact the SAS Technical Support Division for you. In order to provide the most efficient service possible, the company asks that you do not contact SAS Technical Support directly.

# SAS Technical Support

The SAS Technical Support Division can assist with suspected internal errors in SAS software and with possible system incompatibilities. It can also help answer questions about SAS statement syntax, general logic problems, and procedures and their output. However, the SAS Technical Support Division cannot assist with special-interest applications, with writing user programs, or with teaching new users. It is also unable to provide support for general statistical methodology or for the design of experiments.

# Generating a System Dump for SAS Technical Support

Follow these steps to generate a system dump that can be interpreted by SAS Technical Support:

1. Disable ABEND-AID or any other dump formatting system software before generating the dump.
2. Create a sequential data set with the DCB attributes DSORG=PS RECFM=FB LRECL=560 and the following contents:

```
set tkopt_dumpprol=
set tkopt_nostae=
set tkopt_nostaex=
```

3 In the batch job or TSO session in which SAS is started, allocate the following ddnames:

- Specify the ddname of the sequential data set that is described with the TKMVSENV option of the procedure, the REXX exec, or the CLIST.
- If an unformatted dump is desired, which is normally the case unless otherwise advised by SAS Technical Support, allocate the ddname SYSMDUMP to a disk data set. Specifying `SPACE=(CYL,(50,50))` is usually sufficient. In batch, it is usually convenient to allocate the dump data set `DISP=(,DELETE,CATLG)` so that it is created only if the job abends.
- If a formatted dump is desired or requested, instead of an unformatted dump, allocate the ddname SYSUDUMP to a disk data set or an appropriate SYSOUT class. In most cases, this would be a SYSOUT class that is not automatically printed.
- Specify the following options at SAS invocation: NOSTAE, DUMPPROL, SOURCE, SOURCE2, NOTES, MPRINT, and SYMBOLGEN.

To deliver the dump to SAS, use one of the following methods:

FTP
: Send unformatted dumps in BINARY mode and inform SAS Technical Support of the DCB attributes of the original dump data set. Send formatted dumps in ASCII mode.

Tape
: Use IEBGENER to copy the dump data set to a magnetic tape cartridge using IBM standard labels.

PART 4

# SAS Windows and Commands in z/OS Environments

# 16

# Windows in z/OS Environments

# Overview of Windows in the z/OS Environment

Portable features of the SAS windowing environment are documented in the Help for Base SAS. Only features that are specific to z/OS or that have aspects that are specific to z/OS are documented in this section.

This section also includes information about terminals and special devices that you can use with SAS software in the z/OS environment.



# Using the Graphical Interface

## Overview of Using the Graphical Interface

The graphical user interface provides windows, commands, and menus that are compatible with 3270 terminals, with 3270 terminal emulation, and with other graphics terminals used in the z/OS environment. This section describes the ways that SAS windows and window controls function on these terminals.

For information about hardware support for terminals and mouse input devices, see "Terminal Support in the z/OS Environment" on page 257.

## Window Controls and General Navigation

This section explains some of the basic capabilities of the SAS windowing environment under z/OS. The word **select** indicates positioning the cursor with a

single click of the mouse button or with the Tab or Shift+Tab keys if you do not have a mouse. Press the Enter key to confirm your selection. The word **choose** refers to the selection and confirmation of a menu option.

Function keys
: Issue the KEYS command to display and edit function key settings.

Displaying SAS menus
: Issue the PMENU command to display the **SAS** menu bar at the top of each window. Then use a function key or choose**Tools** ⇨ **Options** ⇨ **Command...** to display a command line window without removing the menus. You can also use the default function keys F9 for pmenus and F10 for a command line.

Moving between windows
: Issue the PREVWIND command (F7 by default) or the NEXT command (F8 by default) to move the cursor and bring different windows to the foreground. If a mouse is available, clicking in a particular window brings that window to the foreground. The LOG, PGM, and OUT commands move the Log, Program, or Output window to the foreground, respectively.

Resizing a window
: - Select the window border that you want to resize.
  - Select the new position of that window border.
  - Select a top, bottom, or side border to resize horizontally or vertically.
  - Choose a corner to resize horizontally and vertically at the same time.

  You can also issue the ZOOM, ICON RESIZE, WGROW, and WSHRINK commands to change window dimensions.

Arranging windows
: Choose **View** ⇨ **Change Display** to see a list of window arrangement options. For example, the Cascade option moves and resizes windows to display the top row of all active windows. You can also issue the RESIZE, CASCADE, and TILE commands to arrange windows.

Moving a window
: Select the title of the window in the upper left corner of the window border. The word MOVE appears in the bottom of the display area. A second click determines the new position of the top left corner of the window, which does not change size. You can also issue the WMOVE command to move a window.

Navigating in a window
: Scrolling
  : Scroll down through a file with the FORWARD command (F20 by default). Scroll up with the BACKWARD command (F19 by default). Scroll right with the RIGHT command (F23 by default), and scroll left with the LEFT command (F22 by default).

    You can also use scroll bars to scroll through a file. Issuing the SCROLLBAR command displays vertical and horizontal scroll bars in all of the open SAS windows. The SCROLLBAR command has two short forms, SCROLL and SBAR. SCROLLBAR, SCROLL, and SBAR operate like toggle commands. Issuing any of the commands either turns on the scroll bars or turns them off.

    The SCROLLBAR command has two optional parameters, **`on`** and **`off`**. You can issue any of the forms of the SCROLLBAR command with the **`on`** or **`off`**

parameters. For example, issuing `scrollbar on` displays the scroll bars in the same way that issuing **`scrollbar`** or **`sbar`** displays them.

Selecting a view
: In windows that contain a tree view on the left and a list view on the right, such as the SAS Explorer window, select a view, press the Enter key, and then move the cursor from field to field within that view.

Selecting a control or widget
: A widget or a control is a screen character that implements a control function for the window or the application. An example is the X character that indicates the current position in a scroll bar. With the cursor positioned on a control or widget, issue the WDGNEXT or WDGPREV commands to move to the next, or the previous, control or widget.

Scrolling a view or column
: Select a position in the scroll bar to change the displayed portion of a view or column. Selecting in various places causes the display to move up or down one screen width or move to the beginning or end of the view or column.

Resizing a view or column
: Select the diamond symbol in the upper right corner of the tree view or column heading. The view title changes to the resize symbol. Select again to fix the new horizontal position of the corner.

Sorting a column
: Select the heading of the column that you want to sort. Not all columns can be sorted.

# Selection-Field Commands

Selection fields enable you to accomplish tasks in windows using keystrokes or mouse clicks. This section introduces the selection-field commands that are generally available in the z/OS windowing environment.

Certain SAS windows display a tree view on the left and a list view on the right. Each view has its own set of selection-field commands. (You might want to display one of these windows to test the following commands.)

The tree view shows hierarchical structures such as SAS libraries and members. To display or hide a level of detail, position the cursor on the plus sign (+) or the hyphen (–) to the far left of the library or member name and press the Enter key. A single mouse click does the same job.

In the tree view and list view, you can perform tasks using the selection field represented by an underscore character (_) just to the left of an item. To issue selection-field commands, position the cursor and type in a single character, or issue the WPOPUP command (right mouse button by default) or a question mark (?) to see a menu of available selection field commands.

The following table lists some of the selection-field commands:

| | |
|---|---|
| S or X | Select or emulate a double-click |
| D | Deassign or delete |
| P | Properties |
| N | New |
| R | Rename |

# Terminal Support in the z/OS Environment

## Overview of Terminal Support in the z/OS Environment

The information in the following sections might be useful to you if you use graphics or special device drivers in the SAS windowing environment.

**Note:** SAS best supports those terminal emulators that closely conform to the original IBM specifications for the 3270 terminal. If you are having difficulties with the SAS vector graphics in your emulator session, make sure that the settings for your emulator match the specifications for the 3270 terminal as closely as possible.

## Text Device Drivers

SAS uses two interactive windowing text (nongraphics) device drivers: a non-Extended-Data-Stream (non-EDS) driver and an Extended-Data-Stream (EDS) driver. An EDS device supports IBM 3270 extended attributes such as colors and highlighting, whereas a non-EDS device does not. Note that EDS devices also support the non-EDS data stream. The ability to do graphics on a 3270 terminal implies that it is an EDS device.

The following table lists some examples of EDS and non-EDS IBM terminals:

*Table 16.1* EDS and non-EDS IBM Terminals

| EDS | Non-EDS |
|---|---|
| 3179, 3290 (LT-1) | 3277 |
| 3279, 3270-PC | 3278 (most) |
| 3278 with graphics RPQ | 3290 (LT-2, 3, or 4) |

On non-EDS terminals, vertical window borders occupy three display positions on the screen: the first position for the field attribute byte, the second position for the border character itself, and the third position for the attribute byte for the following field. Because a window has both left and right vertical borders, six display positions are used by the vertical borders. Therefore, on an 80-column non-EDS device, the maximum display and editing area in a window is 74 columns.

Vertical window borders on EDS devices occupy two display positions: the border character and the attribute for the next field (left vertical border) or the attribute and the border character (right vertical border). Therefore, on an 80-column EDS device, the maximum display or editing area in a window is 76 columns.

# Graphics Device Drivers

There are two 3270 graphics device drivers in the SAS windowing environment: the Programmed Symbol driver and the Vector-to-Raster driver. On terminals that support graphics, these two drivers are used to produce graphics as well as mixed text and graphics. Both graphics drivers communicate with the text driver, which controls the terminal display.

- The Programmed Symbol graphics driver uses user-definable characters to display graphics. A programmed symbol is a character on the device in which certain pixels are illuminated to produce a desired shape in a position (cell) on the display. A loadable programmed symbol set is a terminal character set that contains these application-defined programmed symbols. (The default symbol set on a device is the standard character set--that is, those symbols that are normally displayed and that can be entered from the keyboard.) Examples of terminals that use programmed symbols to display graphics are the 3279G, 3290, and 3270-PC.
- The Vector-to-Raster graphics driver is used to produce graphics on terminals that support graphics drawing instructions such as MOVE and DRAW. Examples of these devices are the 3179G/3192G and the IBM5550. The 3179G/3192G terminals also have limited support for programmed symbol graphics.

# Using a Mouse in the SAS Windowing Environment under z/OS

## Overview of z/OS Terminals

The IBM 3179G, 3192G, 3472G, and 5550 terminals are all graphics terminals that support the use of a mouse. The IBM 3179G, 3192G, and 5550 terminals use the three-button IBM 5277 Model 1 optical mouse, whereas the IBM 3472G terminal uses the two-button PS/2 mouse.

SAS recognizes when the mouse is attached and automatically places the graphics cursor under the control of the mouse.

## Using a Three-Button Mouse

The IBM 5277 Model 1 optical mouse has three buttons:

leftmost button
: SAS uses the leftmost button as an Enter key. The Enter key is used to select menu items; to grow, shrink, or move windows; to scroll using scroll bars; and so on. Therefore, having the Enter key on the mouse is useful. The text cursor moves to the location of the mouse pointer whenever you press this mouse button.

center button
: By default, SAS assigns a function key to the center button. You can use the KEYS window or the KEYDEF command to change the definition of this button. The button is designated as MB2. See the Help for Base SAS for more information about the KEYS window and the KEYDEF command.

rightmost button
: The rightmost button is a reset button that unlocks the keyboard.

For additional information about using a mouse, see the appropriate documentation at your site.

## Using a Two-Button Mouse

The 3472G terminal is a multiple-session graphics terminal. This device uses the two-button PS/2 mouse. With the graphics cursor attached, these buttons have the same functions as the leftmost and center buttons on the three-button mouse.

# Appearance of Window Borders, Scroll Bars, and Widgets

Depending on the type of terminal, SAS uses either programmed symbols or APL symbols to create window borders, scroll bars, and widgets (radio buttons, push buttons, and check boxes). This feature can cause SAS windows to look somewhat nicer on some terminals than on others.

- On devices that support programmed symbols, the SAS windowing environment uses a predefined set of programmed symbols for its window components. Programmed symbols give window components a nicer appearance than APL symbols. These programmed symbols are available for the four most common character cell sizes: 9 x 12, 9 x 14, 9 x 16, and 6 x 12. Programmed symbols are not used for any device that has a different character cell size (for example, 10 x 14 on a Tektronix 4205), even though the device supports programmed symbols.
- On 3270 terminals that do not support programmed symbols, but that support the APL character set, the SAS windowing environment uses APL symbols. APL is supported only on EDS devices, including all nongraphic 3279 and 3179 terminals, and on many PC 3270 emulators.

**Note:** The APL language relies heavily on mathematical-type notation, using single-character operators in a special character set.

# Improving Screen Resolution on an IBM 3290 Terminal

The IBM 3290 terminal gives you the ability to change character cell size (and, therefore, to change screen resolution). This capability is useful if you are working with graphics, for example.

You use the CHARTYPE= system option to modify the character cell size. For example, on a 3290 terminal that is configured as having 43 rows by 80 columns, CHARTYPE=1 (the default) produces a 62 x 80 display size.

If you specify CHARTYPE=2, then the display size is 46 x 53. Note that if you configure the 3290 as 62 x 160 (the maximum display size available on the 3290), CHARTYPE=2 results in a display size of 46 x 106. This results in a very legible and attractive windowing environment. For more information about this option, see “CHARTYPE= System Option: z/OS” on page 718.

**Note:** If you are running in interactive graphics mode and you receive a message, your display might become corrupted. To correct this problem and return the screen to its original display, press Enter in response to the SCREEN ERASURE message.

Alternatively, you can configure the 3290 as one logical terminal with a 62 x 160-character cell size.

# SAS System Options That Affect the z/OS Windowing Environment

You can use the following SAS system options to customize the windowing environment under z/OS:

CHARTYPE=
specifies which character set or screen size to use for a device.

FSBORDER=
specifies what type of symbols to use in window borders and other widgets.

FSMODE=
specifies which type of IBM 3270 data stream to use for a terminal.

PFKEY=
specifies which set of function keys to designate as the primary set.

For detailed information about these system options, see "System Options in the z/OS Environment" on page 689.

# Host-Specific Windows in the z/OS Environment

Portable windows are documented primarily in the Help for Base SAS. In the Help for SAS in the z/OS environment, coverage is limited to the following windows:

- windows that are specific to the z/OS environment
- portable windows with contents or behavior that are specific to the z/OS environment.
- "DSINFO Window Command" on page 262
- "Explorer Window" on page 263
- "DSLIST Window Command" on page 264
- "My Favorite Folders Window Command" on page 265
- "FILENAME Window Command" on page 266

# Dictionary

## DSINFO Window Command

Provides information about a cataloged physical file.

z/OS specifics: All

### Syntax

**DSINFO**

**DSINFO** *ddname*

**DSINFO** *'physical-filename'*

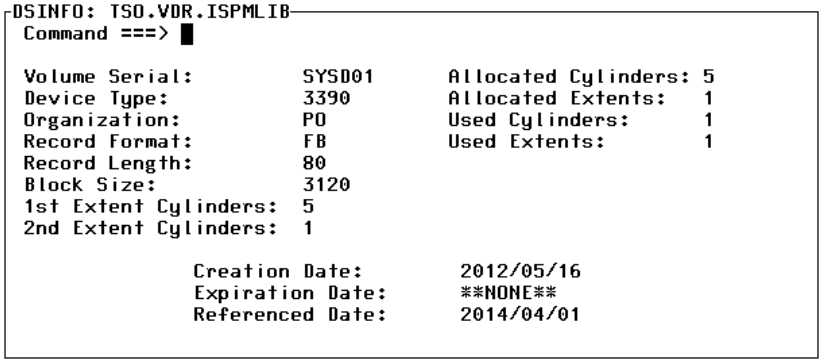
**DSINFO** *'UFS filename'*

### Details

You can invoke the DSINFO window from any window in the windowing environment, including the windows in SAS/FSP and SAS/AF. To invoke the DSINFO window, type DSINFO followed by either a ddname, a fully qualified physical filename, a partially qualified name such as *'.misc.text'*, or a full or relative UFS path. For information about using partially qualified data set names, see Chapter 5, "Specifying Physical Files," on page 89.

If you are referencing a concatenated file with a ddname, then the DSINFO window displays information for the first data set in the concatenation.

*Figure 16.1* DSINFO Window




# Explorer Window

Provides a central access point to data such as catalogs, tables (data sets), libraries, and host files.

z/OS specifics: ALL

## Syntax

**EXPLORER**

## Details

### Overview of the Explorer Window

You can invoke the Explorer window from any window in the windowing environment. The Explorer window provides a central access point to data such as catalogs, tables (data sets), libraries, and host files. When you issue the EXPLORER command at a SAS command prompt, an Explorer window appears with the tree and list views turned on. The Explorer window enables you to do basic SAS tasks such as the following:

- create new libraries and file shortcuts
- create new library members and catalog entries
- open and edit SAS files

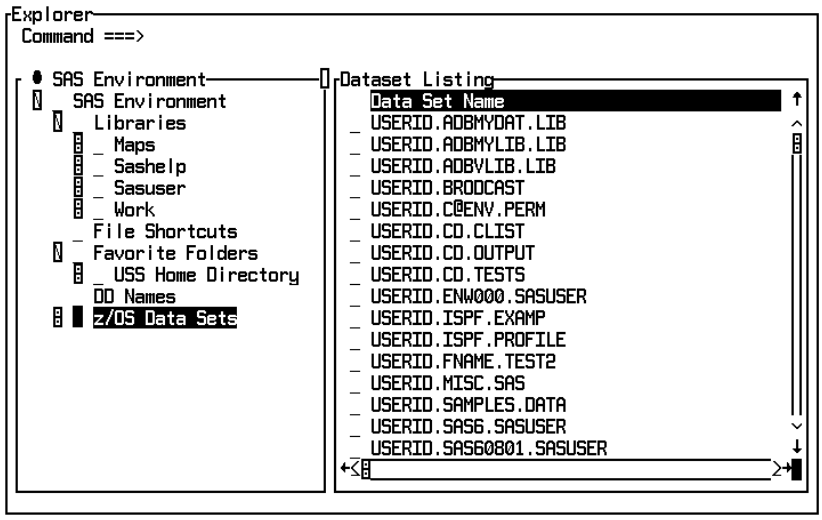
For more information about the Explorer Window, see the SAS Help and Documentation.

### Additional Nodes in the Explorer Tree View

In SAS 9.3, the USS Home Directory and the z/OS Data Sets nodes were added to the tree view, as shown in the following example. These nodes enable you to transition between your native data sets and your UFS files.

The Explorer window showing the USS Home Directory and the z/OS Data Sets nodes in the tree view:

***Figure 16.2*** *The Explorer Window*




# DSLIST Window Command

Displays a list of your z/OS native data sets.

z/OS specifics: Display of externally allocated ddnames

## Syntax

**DSLIST**

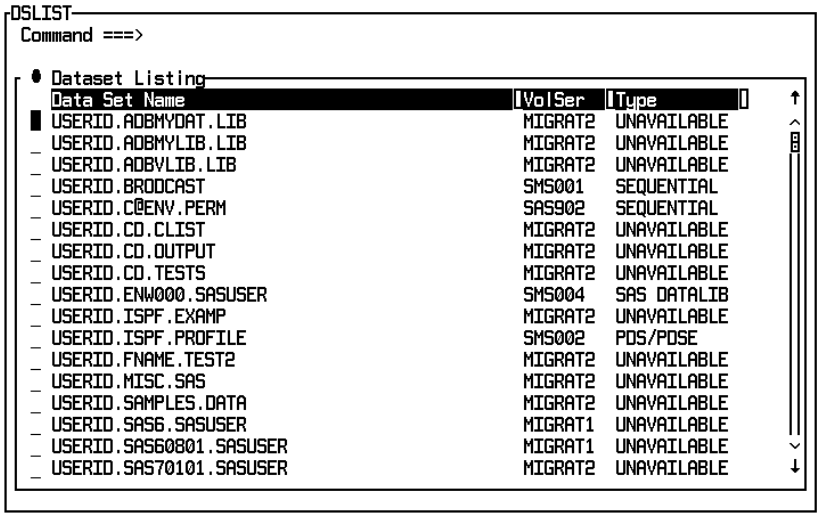
## Details

The DSLIST command can be issued from the command line of any SAS window.

The FORWARD and BACKWARD commands are not recognized if focus is on the DSLIST window command line instead of on a data set list. When you open the DSLIST window, make it the active window. Then make sure you have the focus on a data set list and not on the command line.

The following example shows a list of native z/OS data sets in a DSLIST window that has been opened with the DSLIST command:

***Figure 16.3*** *The DSLIST Window*




# My Favorite Folders Window Command

Displays a list of your UFS files.

z/OS specifics: Displays a list of UFS files

## Syntax

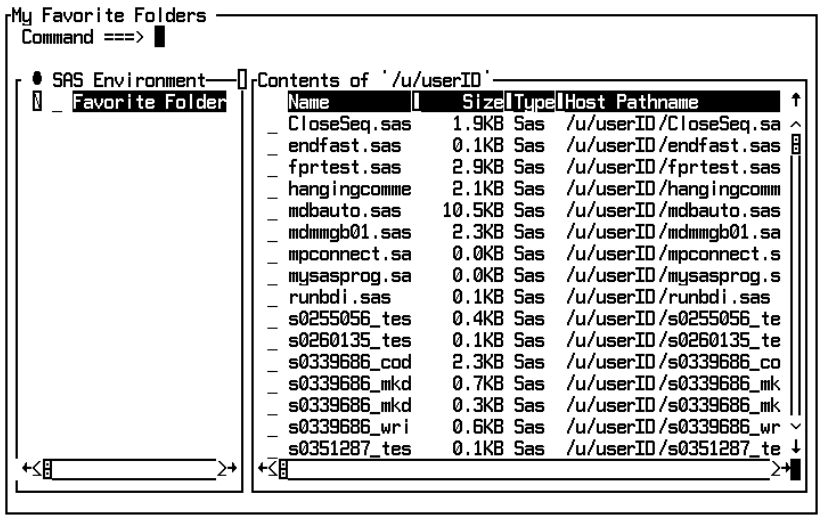
**UDLIST**

## Details

The UDLIST command can be issued from the command line of any SAS window.

The following example shows a list of UFS files in a Favorites Folder that has been opened with the UDLIST command:

*Figure 16.4* *A Favorites Folder Opened with a UDLIST Command*




# FILENAME Window Command

Displays assigned filerefs and their associated filenames.

z/OS specifics: Display of externally allocated ddnames

## Syntax

**FILENAME**

## Details

A ddname that was allocated externally (using the JCL DD statement or the TSO ALLOCATE command) is not listed by the FILENAME window or by the Active File Shortcuts window until after you have used it as a fileref in your SAS session.

# FNAME Window Command

Displays allocated ddnames, their associated data set names, and data set information.

z/OS specifics: All

## Syntax

**FNAME**

**FNAME** <*ddname*>

**FNAME** <*partial-ddname**>

**FNAME** <*partial-ddname*:>

## Details

You can invoke the FNAME window from any window in the windowing environment, including the windows in SAS/FSP and SAS/AF. To invoke it, type FNAME.

The FNAME window displays ddnames that are currently allocated to the operating system and the data sets or UFS files that are associated with each ddname. These ddnames might include some files that are necessary for TSO or for initializing the SAS system. Typically, UFS files or SAS libraries are not allocated to the operating system by SAS. These files are not displayed in the FNAME window, unless an external allocation is provided with the TSO ALLOC command that specifies the PATH operand.

If you do not supply the optional ddname, then the FNAME window displays all ddnames that are associated with your TSO login session and your SAS session. It also displays the names of the physical files that are associated with them. If you supply a ddname, it can be either a specific name or a prefix. For example, to see only ddnames that begin with the letter A, you can use either of the following prefixes as the specifications:

- FNAME A*
- FNAME A:

Some libraries and external files that are currently assigned by SAS might not be allocated to a ddname. To see a list of all external files currently assigned by SAS, use the syntax shown in "FILENAME Window Command" on page 266. To see a list of all libraries that are currently assigned by SAS, use the syntax shown in "LIBNAME Window Command" on page 269.

If you attempt to browse or edit a file that is not a text file, then the SAS editor detects any non-printable bytes that might be present. It then asks whether you want them to be treated as text attribute bytes. You can treat these bytes as text attributes or stop opening the file. If you choose to treat them as text attributes, SAS opens the file and attempts to display the contents of the file as normal text characters whose appearance is modified by the presumed text attribute bytes. Although SAS is able to open the file, if the file is not a text file with embedded text attribute bytes, then the data appears as random normal text characters with random colors and highlighting. If you choose to stop opening the file, SAS returns to the FNAME window.

In the FNAME window that you can perform various tasks by entering one of the following selection-field commands:

B
selects a sequential data set, a partitioned data set (PDS) member, or a UFS file for browsing.

E
selects a sequential data set, PDS member, or a UFS file for editing.

I
includes a sequential data set, PDS member, or UFS file in the Program Editor window.

F
frees (deallocates) an allocated ddname.

M
opens the MEMLIST window, which lists the members in a single PDS.

C
lists the members in a concatenation of PDSs. C must be specified on the first line of a concatenation. That is, the ddname cannot be blank. C does not work if the concatenation contains a USS file.

S
selects or emulates a double-click. The action taken varies according to file type. Selecting a PDS brings up the MEMLIST window, for example.

X
displays file properties.

%
submits a %INCLUDE statement to SAS to include a sequential data set or PDS member.

?
displays a pop-up menu of available selection-field commands.

***Figure 16.5*** *FNAME Window with TSO Ddnames*

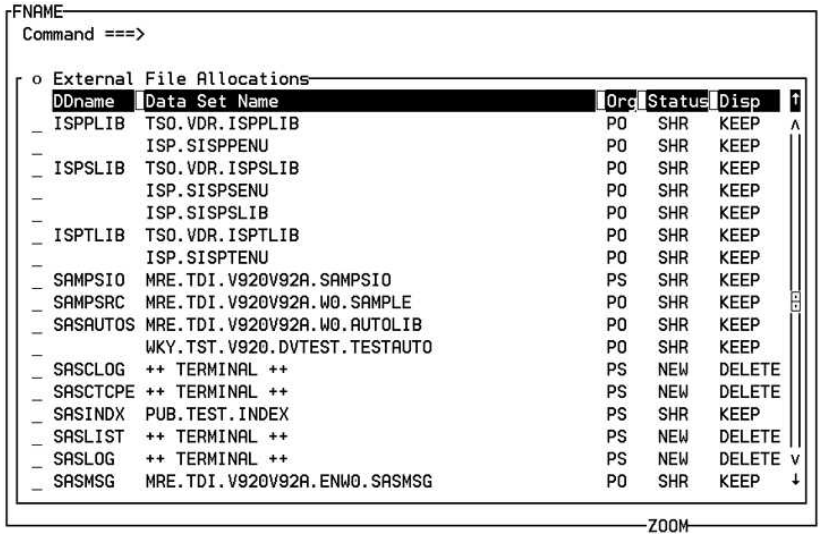
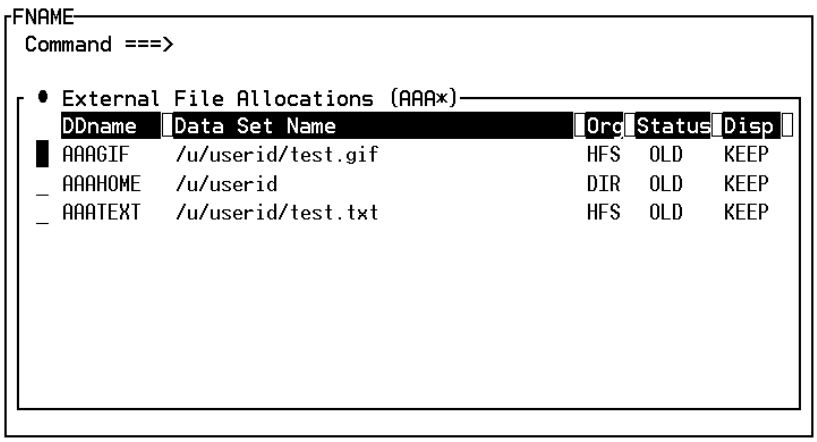


*Figure 16.6* FNAME Window with USS Pathnames




# LIBASSIGN Window Command

Assigns a SAS libref and engine to a SAS library.

z/OS specifics: Options field

## Syntax

**DMLIBASSIGN**

## Details

The **Options** field of the New Library window allows only 53 characters. To allow more characters, assign the "EXPLODE Command: z/OS" on page 279 command to a function key. Then use the function key to open a dialog box with a longer (but not unlimited) text entry field.

# LIBNAME Window Command

Lists all the libraries that are currently assigned in your SAS session.

z/OS specifics: Display of externally allocated libraries

## Syntax

**LIBNAME**

**LIBNAME** <*libref*>

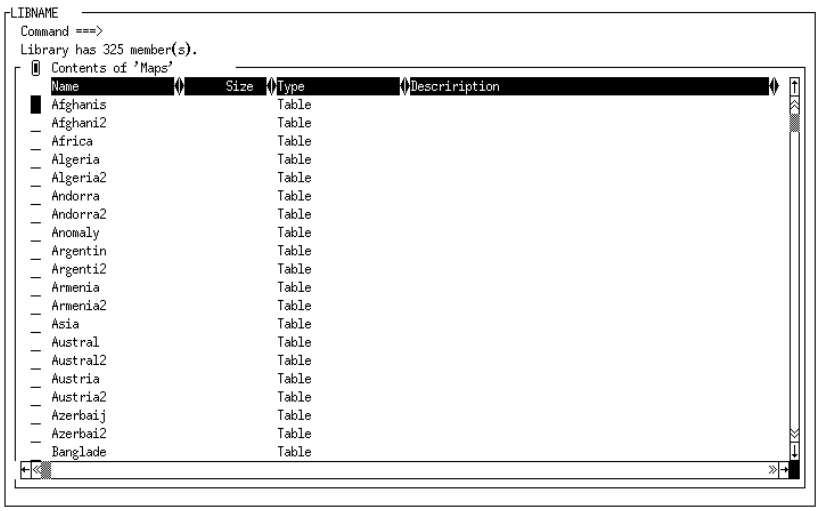
## Details

If you specify *libref*, the Active Libraries window appears with a list of members of the specified library. Otherwise, the Active Libraries window lists the currently assigned libraries. You can select a library to list its members.

A library that was allocated externally (using the JCL DD statement or the TSO ALLOCATE command) is not listed by the LIBNAME window until after you have used it in your SAS session.

The following example displays the list of libraries currently assigned to the Maps library:

***Figure 16.7*** *Active Libraries Window*




# MEMLIST Window Command

Displays a member list for a partitioned data set (PDS) or for a series of partitioned data sets in a concatenation.

z/OS specifics: All

## Syntax

**MEMLIST**

**MEMLIST** *ddname*

**MEMLIST** *ddname* (*member*)

**MEMLIST** *ddname* (*generic-name**)

**MEMLIST** *ddname* (*generic-name*:)

**MEMLIST** *fileref*

**MEMLIST** '*physical-filename* '

**MEMLIST** '*physical-filename* (*member* )'

**MEMLIST** '*physical-filename* (*partial-ddname**)'

**MEMLIST** '*physical-filename* (*partial-ddname*:)'

## Details

You can invoke the MEMLIST window from any window in the windowing environment, including the windows in SAS/FSP and SAS/AF. You can specify either a specific member name or a partial member name. For example, the following specification lists all of the members in a PDS to which you have assigned the fileref MYPDS: MEMLIST MYPDS. To list only members whose names begin with TEST in this PDS, you would use the following specification: MEMLIST MYPDS(TEST*) .

You can also invoke the MEMLIST window by using the M selection-field command in the FNAME window.

By entering one of the following selection-field commands in the MEMLIST window, you can perform various functions on the displayed list of PDS members:

B or S
: selects a member for browsing.

E
: selects a member for editing.

I
: includes a member into the Program Editor window and makes Program Editor the active window.

%
: submits a %INCLUDE statement for a member.

R
: renames a member.

D
: deletes a member.

?

displays a pop-up menu.

The LIB column uses numbers to indicate the library in which each member is found. The numbers represent the order in which the PDSs were specified at concatenation. For example, a “1” in the LIB column indicates the member exists in the first PDS that was specified. The number “2” indicates it exists in the second PDS that was specified, and so on. A plus (+) sign next to a number indicates that multiple members in the concatenation have the same name.

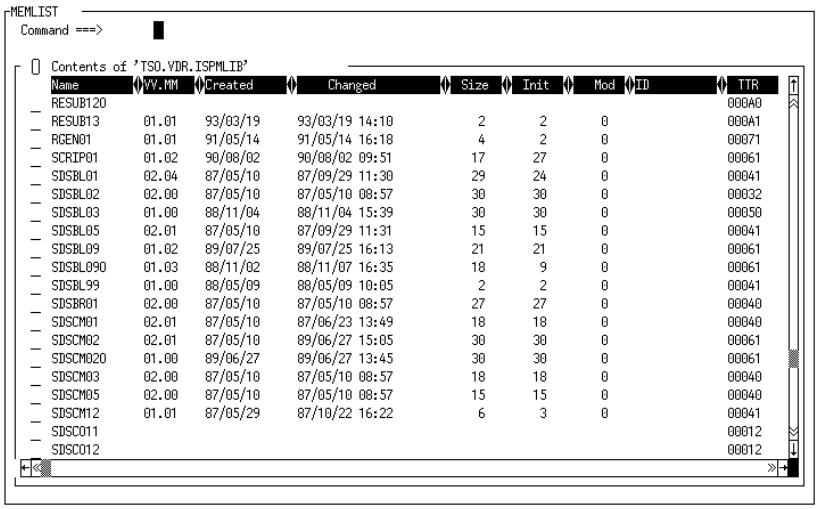
The MEMLIST window supports concatenated PDSs in SAS 9.2. However, selection-field commands issued on concatenated PDSs operate only on the first library in the concatenation. For example, you cannot save the result of editing a member that exists in a library other than the first library in the concatenation.

You can use the DELETE and RENAME commands for members of the first library that have the same name as members in lower libraries. If you delete a file in the first library, the member of the first library is deleted and the next lower member with that name is displayed. If you rename a file in the first library, the member of the first library is renamed and the next lower member with that name is displayed.

If you have more than one MEMLIST window displaying the same PDS, and you create, rename, or delete a member of the PDS, then only the active window is updated on screen when the change is completed. The other MEMLIST windows are updated at the same time as the active window. However, you do not see the change to the member list until you select one of these windows as your active window.

The following example displays the members of a PDS:

***Figure 16.8*** *MEMLIST Window*



# 17

# Host-Specific Windows of the FORM Subsystem



## Host-Specific Windows of the FORM Subsystem

### Overview of Host-Specific Windows of the FORM Subsystem

The FORM subsystem consists of six windows that are described in detail in the Help for Base SAS. You use these frames to define a form for each printer that is available to you at your site.

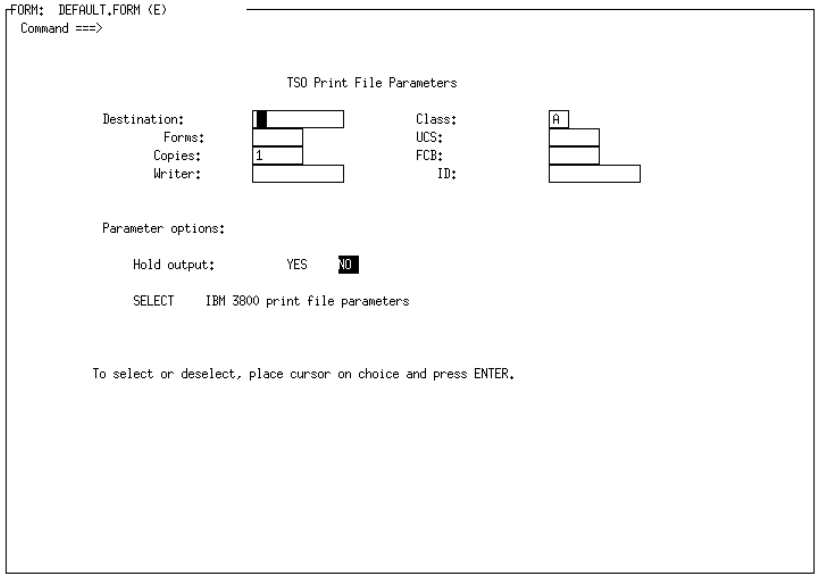
Two of the windows in the FORM subsystem contain host-specific information. Both are print-file parameter windows that you use to specify the printer, text format, and destination for your output. Figure 17.1 on page 274 and Figure 17.2 on page 275 show these two frames. Figure 17.2 on page 275 appears only if you select IBM 3800 print-file parameters.

This section contains brief discussions of the fields in the z/OS FORM windows. For additional information, select the field that you are interested in and press the function key that you use to issue the HELP command. For more information about using the FORM subsystem, see "Using the PRINT Command and the FORM Subsystem" on page 154.

# TSO Print-File Parameter Frame

The TSO print-file parameters in the first window are the same parameters that you would use in a TSO ALLOCATE statement.

***Figure 17.1*** *TSO Print-File Parameter Frame*




Many of the values that are entered for these parameters are site specific. The data center personnel at your site can give you information about the Destination, Forms, and Class codes that are used at your site.

Destination
: routes the output to a particular device. Destination is a one to eight alphanumeric or national character name that is defined for a device by your site.

Class
: refers to the SYSOUT class of the file. The SYSOUT parameter is used to route output to printers and other devices. Class can be any alphanumeric character. Ask your data center personnel which specifications are appropriate for this field.

Forms
: are specified by using one to four alphanumeric or national characters. Form numbers are used to request special paper. Ask your data center personnel which values are appropriate for this field.

UCS
: requests that a print chain or print train that contains the Universal Character Set be mounted for a device. Ask your data center personnel which values are appropriate for this field.

Copies
: specifies how many copies to print. The range is from 1 to 255, with a default value of 1.

FCB
: is the forms control-buffer value, which specifies the movement of forms on a device. Ask your data center personnel which values are appropriate for this field.

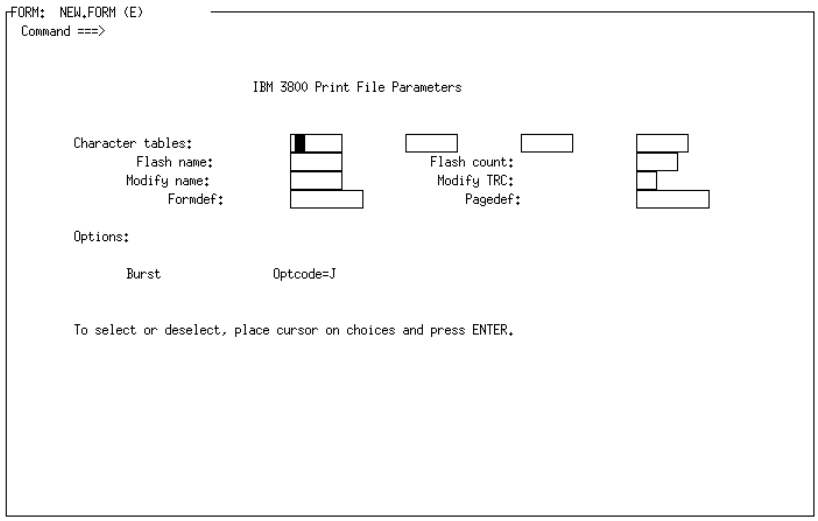
Writer
: specifies the name of a program in the SYS1.LINKLIB library that is to be used to write the output instead of JES2 or JES3. Ask your data center personnel for information about using this parameter.

ID
: specifies the maximum number of output lines that can be printed. The range is from 1 to 16,777,215. If ID is exceeded, the job is automatically terminated.

Hold
: requests that output be held in the output queue instead of going directly to the device.

# IBM 3800 Print-File Parameter Frame

***Figure 17.2*** *IBM 3800 Print-File Parameter Frame*




This frame requests the following print-file parameters. For more information, consult the Help facility. Also see the IBM JCL reference manual for your system for additional information about these parameters.

Character tables
: specifies which character table to use for printing output. Ask your data center personnel which values are appropriate for this field.

Flash name and Flash count
: controls the use of overlay forms. Ask your data center personnel for details.

Modify name and Modify TRC
: controls the use of copy modification modules in SYS1.IMAGELIB for printing output. Ask your data center personnel for details.

Burst
: requests that your output be torn apart into separate sheets of paper. When Burst is not specified, the default is normal fanfold (continuous) printing.

Optcode
: works in conjunction with the character tables option. Ask your data center personnel for details.

# 18

# SAS Window Commands under z/OS



## Overview of Window Commands in the z/OS Environment

Command-line commands are documented in the *SAS Language Elements by Name, Product, and Category* and in the Help for Base SAS. This section includes detailed information about commands that are specific to the z/OS windowing environment.

# Dictionary

## CLOCK Command: z/OS

Displays the current time according to a 24-hour clock.

z/OS specifics: All

### Syntax

**CLOCK**

### Details

The time is shown as *hh.mm* in the lower right corner of the display. Repeat the command to toggle the clock on and off. Issuing the command CLOCK OFF removes the clock.

## DFLTACTION Command: z/OS

Simulates a mouse double-click.

z/OS specifics: All

### Syntax

**DFLTACTION**

### Details

To enter a double-click without using a mouse, position the cursor (set the keyboard focus) on the control and issue the command. The DFLTACTION

command applies to the following controls: text pad, combo box, list view, spin box, tree view, push button, desk top icon, and list box.

The DFLTACTION command is best used by assigning the command to a function key. Enter the KEYS command to display and edit function key assignments.

To use a function key to issue the DFLTACTION command, position the cursor in a text entry field and press the function key.

# DLGENDR Command: z/OS

Ends the SAS session.

z/OS specifics: All

## Syntax

**DLGENDR**

## Details

This command causes SAS to display a window that asks you to confirm that you want to end your SAS session. An affirmative response ends the session.

# EXPLODE Command: z/OS

Displays the full length of text entry fields that are truncated.

z/OS specifics: All

## Syntax

**EXPLODE**

## Details

This command opens the EXPLODE window to display text that could not be fully displayed in the narrow width of a text entry field. If a window displays a maximum of 10 characters in a text entry field, and the value displayed in that field contains

20 characters, only the first 10 are displayed. To see the entire 20 characters, enter EXPLODE on the command line, place the cursor on the text entry field, and press the Enter key. The resulting EXPLODE window displays up to the first 255 characters of the text entry field. Any blank spaces are retained.

In the EXPLODE window, you can edit all the text in the field, but only if the field is accessible for read and write. You cannot edit read-only fields, nor can you edit any part of a field that is longer than 255 characters. However, the EXPLODE command displays the first 255 characters of any text entry field from SAS 7 or later.

The EXPLODE window displays text on five lines of 51 characters. Each line is edited individually. Text does not scroll from one line to the next as you add and delete characters. Selecting the **OK** button concatenates the text on any of the five lines into the single text entry field, preserving any blank spaces in between.

EXPLODE is best used by assigning the command to one of your function keys. Enter the KEYS command to display and edit your function key assignments.

To use a function key to issue the EXPLODE command, position the cursor in a text entry field and press the function key.

The EXPLODE command cannot expand normal text fields.

# FILE Command: z/OS

Writes the contents of that current window to an external file.

z/OS specifics: *file-specification*, ENCODING= option

## Syntax

**FILE** *file-specification* <ENCODING=*encoding-value*> <*options*>

### Required Argument

***file-specification***
specifies a valid z/OS external file specification, such as one of the following specifications:

- a fileref
- the physical filename of a sequential data set
- a member of a partitioned data set (PDS)
- a member of an extended partitioned data set (PDSE)
- a file in UNIX System Services (USS)

For information about encodings for z/OS resources such as data set names and UFS paths, see Appendix 3, “Encoding for z/OS Resource Names,” on page 939.

### Optional Argument

**ENCODING=*encoding-value***
specifies the encoding to use when writing to the output file. Typically, you would specify a value for ENCODING= that indicates that the output file has a different encoding from the current session encoding. However, you can also specify the same encoding for the output file as for the current session encoding. You must enclose the value in quotation marks if it contains a hyphen.

If you specify an encoding value that is different from the session encoding, SAS transcodes the data from the session encoding to the specified encoding when you write data to the output file. The default encoding is the session encoding, which is the value of the ENCODING= SAS system option.

For valid encoding values, see "Encoding Values in SAS Language Elements" in *SAS National Language Support (NLS): Reference Guide*.

# GCURSOR Command: z/OS

When applicable, turns the graphics cursor on or off.

z/OS specifics: All

## Syntax

**GCURSOR** <ON> | <OFF>

## Details

This command is used only with 3179G, 3192G, IBM5550, and IBM3472G graphics terminals. When a mouse is attached, the default setting for GCURSOR is ON. Without a mouse, the cursor movement keys are used to position the graphics cursor. The GCURSOR command acts like a toggle switch. Alternatively, you can use the ON and OFF operands.

# HOSTEDIT Command: z/OS

Starts the ISPF editor.

z/OS specifics: host editor invoked

## Syntax

**HOSTEDIT | HED**

## Details

Under z/OS, this command temporarily suspends the current SAS session and starts a session of the ISPF editor or browser. Under other operating environments, it invokes other host-specific editors.

**Note:** The HOSTEDIT command works only if you have invoked SAS from the ISPF environment.

You can execute the HOSTEDIT command from the command line of any SAS window that involves the SAS Text Editor, such as the Program Editor, Log, Output, and Notepad windows, among others.

When the ISPF EDIT session begins, the screen displays the contents of the window from which it was invoked. Depending on how the window was defined when it was created, one of the following actions occurs:

- If the window can be edited, you are placed in an ISPF EDIT session editing the contents of the window. You can then use the standard ISPF EDIT commands to edit the text or to call up any of the ISPF EDIT models, and you can save changes back to the window from which the HOSTEDIT command was issued.
- If the window is read only, you are placed in an ISPF BROWSE session that displays the contents of the window.
- If the window cannot be edited by the host editor, a message to that effect appears in the window, and no other action occurs.

Special text attributes such as color or highlighting are lost during a host editing session. When the HOSTEDIT command is issued from a window that contains text with these attributes, a dialog box appears. The dialog box gives you the option of either continuing or ending the HOSTEDIT command.

When you have finished editing in the ISPF EDIT session, do one of the following:

- To save the contents back to the window, issue the END command.
- To discard the changes that you made, issue the CANCEL command.
- To save the contents of the window to an external file, use the standard ISPF EDIT commands such as CREATE or REPLACE. Then issue the END or CANCEL command, depending on whether you also want to save the changes back to the window.

In each case, you are returned to the window in the SAS session that was suspended.

## See Also

"Using the ISPF Editor from Your SAS Session" on page 299

# INCLUDE Command: z/OS

Copies the entire contents of an external file into the current window.

z/OS specifics: *file-specification*

## Syntax

**INCLUDE** *fileref*

**INCLUDE** *fileref*(*member*)

**INCLUDE** '*physical-filename*' <ENCODING=*encoding-value*>

**INCLUDE** '*physical-filename*(*member*)' <ENCODING=*encoding-value*>

### Optional Argument

**ENCODING=*encoding-value***
specifies the encoding to use when reading to the input file. Typically, you would specify a value for ENCODING= that indicates that the input file has a different encoding from the current session encoding. However, you can also specify the same encoding for the input file as for the current session encoding. You must enclose the value in quotation marks if it contains a hyphen.

If you specify an encoding value that is different from the session encoding, SAS transcodes the data from the specified encoding to the session encoding when you read data from the input file. The default encoding is the session encoding, which is the value of the ENCODING= SAS system option.

For valid encoding values and more information about encoding, see "Encoding Values in SAS Language Elements" in *SAS National Language Support (NLS): Reference Guide*. For information about encodings for z/OS resources such as data set names and UFS paths, see Appendix 3, "Encoding for z/OS Resource Names," on page 939.

## Details

This command is available in the Program Editor window as well as in any other window that uses the SAS Text Editor such as the Notepad window. You can also include an external file from the MEMLIST or FNAME windows by using selection-field commands. You can identify the external file by specifying either a fileref or

the physical filename. If you specify the physical filename, you must enclose it in quotation marks.

Here are examples of the INCLUDE command that illustrate the various ways that you can specify physical files:

INCLUDE MYPGM
MYPGM is a fileref that was previously associated with the external file.

INCLUDE MYPGM(PGM1)
PGM1 is a member of the partitioned data set that is associated with the fileref MYPGM.

INCLUDE 'USERID.TEST.PGMS'
sequential data set name.

INCLUDE 'USERID.TEST.PGMS(AAA)'
data set name with member specified.

INCLUDE '.TEST.MYPGM'
Assuming that the FILESYSTEM= system option is set to MVS, SAS prepends this data set name with the value of the SAS system option SYSPREF=, which defaults to the system prefix. If FILESYSTEM=HFS, SAS looks into your default UNIX file system directory for the "hidden" file .TEST.MYPGM.

INCLUDE 'UFS:/u/userid/mypgms/mypgm1.c'
name of a UNIX System Services file in the hierarchical file system, represented by a partially qualified path. SAS searches for the file in the default UFS directory for that user. If the FILESYSTEM= system option was set to HFS and if MYPGM was a standard z/OS data set, the alternate syntax of `MVS:` would be required in the previous example. For more information, see "FILESYSTEM= System Option: z/OS" on page 761.

INCLUDE 'pgms/mypgms/mypgm1.c'
This is another example of a relative path to a UNIX System Services file. Any filename containing a slash (/) is assumed to be in UNIX System Services, regardless of the value of the FILESYSTEM= system option.

INCLUDE 'pgms/mypgms/*'
The * wildcard character specifies a concatenation of UNIX System Services files, which in this case, includes all of the files in the directory MYPGM. For more information about the use of the wildcard character, see "Concatenating UNIX System Services Pathnames" on page 132.

Use the ENCODING= option to dynamically change the character-set encoding for processing external data. When data is read into SAS, it is changed from the specified encoding to the session encoding. For a list of valid encoding values, see "ENCODING System Option" in the *SAS System Options: Reference*.

## See Also

- "%INCLUDE Statement: z/OS" on page 644
- Chapter 5, "Specifying Physical Files," on page 89

# NULLS Command: z/OS

Specifies whether NULLS is on or off for all input fields of all windows.

z/OS specifics: All

## Syntax

**NULLS** <ON> | <OFF>

## Details

When NULLS is ON, all input fields are padded with null characters instead of blanks. The NULLS command acts like a toggle switch. Alternatively, you can use the ON and OFF operands.

# TSO Command: z/OS

Executes a TSO command, emulated USS command, or MVS program.

Restriction: A TSO command executes successfully only in a TSO SAS session. In a non-TSO session, the command is disabled and the return code is set to 0.

z/OS specifics: All

## Syntax

**TSO** <*command*>

## Details

Under z/OS, the TSO command is an alias of the X command, which provides the same function and has the same syntax as the X statement. In other operating environments, the TSO command has no effect, but the X command is always processed.

## See Also

### Commands

- “X Command: z/OS” on page 288

### Statements

- “TSO Statement: z/OS” on page 679
- “X Statement: z/OS” on page 681

### CALL Routines

- “CALL SYSTEM Routine: z/OS” on page 459
- “CALL TSO Routine: z/OS” on page 461

### Functions

- “SYSTEM Function: z/OS” on page 494
- “TSO Function: z/OS” on page 497

### Macro Statements

- “Macro Statements” on page 514

# WBROWSE Command: z/OS

Opens a World Wide Web (WWW) browser.

z/OS specifics: All

## Syntax

**WBROWSE** <*URL* | *data set*>

### Optional Arguments

**no argument**
invokes the preferred web browser as defined in the Preferences dialog box web page.

**URL**
specifies a URL (Uniform Resource Locator), which contains the server and path information needed to find a document on the internet or on a local intranet.

**data set**
specifies the name of a z/OS data set that contains the Help files to be used with the remote browser.

## Details

WBROWSE invokes the web browser that is specified by the SAS Remote Browser. If you specify a URL, the document that the URL identifies is automatically displayed. If you do not specify a URL, the SAS home page is displayed.

## See Also

Chapter 11, “Using the SAS Remote Browser,” on page 223

# WIDGNEXT Command: z/OS

Moves the keyboard focus from one widget to the next widget.

z/OS specifics: All

## Syntax

**WIDGNEXT**

## Details

With the keyboard focus on a widget in a window, entering the WIDGNEXT command moves the keyboard focus to the next widget in the window. This behavior is similar to the one seen with the Tab key. For example, in the SAS Explorer window, you can use this command to change the keyboard focus from the list view to the tree view.

The WIDGNEXT command is best used by assigning the command to a function key. Enter the KEYS command to display and edit function key assignments.

To use a function key to issue the WIDGNEXT command, position the cursor in a text entry field and press the function key.

## See Also

"WIDGPREV Command: z/OS" on page 288

# WIDGPREV Command: z/OS

Moves the keyboard focus from one widget to the previous widget.

z/OS specifics: All

## Syntax

**WIDGPREV**

## Details

With the keyboard focus on a widget in a window, entering the WIDGPREV command moves the keyboard focus to the previous widget in the window. This behavior is similar to the one seen with the Shift+Tab keys. For example, issuing WIDGPREV in the SAS Explorer window moves the keyboard focus between the list view and the tree view.

The WIDGPREV command is best used by assigning the command to a function key. Enter the KEYS command to display and edit function key assignments.

To use a function key to issue the WIDGPREV command, position the cursor in a text entry field and press the function key.

## See Also

"WIDGNEXT Command: z/OS" on page 287

# X Command: z/OS

Executes a TSO command, emulated USS command, or MVS program.

Restriction: A TSO command executes successfully only in a TSO SAS session. In a non-TSO session, the command is disabled and the return code is set to 0.

z/OS specifics: The command must be a TSO command, emulated USS command, or MVS program.

## Syntax

**X** <*command*>

## Details

The X command provides the same function and has the same syntax as the X statement.

## See Also

"X Statement: z/OS" on page 681

PART 5

# Application Considerations

# 19

# SAS Interfaces to ISPF and REXX



# SAS Interface to ISPF

## Overview of SAS Interface to ISPF

The SAS interface to ISPF consists of CALL routines, system options, and other facilities that enable you to write interactive ISPF applications in the SAS language or in a combination of the SAS language and other languages that are supported by ISPF. It provides access to ISPF both from the windowing environment and from SAS Component Language (SCL).

Using this interface, you can implement interactive applications that can be used even by novice users. Users need only know how to log on to a real or emulated 3270 terminal. All other information can be supplied as part of the application itself.

For SAS programmers, using this interface is often preferable to using other languages to implement interactive ISPF applications because existing SAS data files and applications can be exploited. The interface also reduces the need for the SAS programmer to learn another language.

For detailed information about ISPF, see the IBM documents *ISPF Dialog Developer's Guide* and *ISPF Services Guide*.

# Software Requirements

The following table summarizes the software requirements for using the interface.

***Table 19.1*** *Software Requirements for Using the SAS Interface to ISPF*

| Software | Version Required |
|---|---|
| Base SAS Software | SAS Release 6.08 or later |
| Operating Environment | MVS/SP Version 2 or later, TSO/E Version 2 or later |
| ISPF | ISPF Version 2 or later |

# Enabling the Interface

The interface is available to you whenever you invoke SAS in the z/OS environment under ISPF. There is no separate procedure for enabling the interface.

# Invoking ISPF Services

## Overview of ISPF Services

The interface provides CALL routines that enable you to use ISPF services from a SAS DATA step. The ISPF services facilitate many other tasks. For example, they provide an efficient way to convert SAS files to ISPF tables and ISPF tables to SAS

files. They also enable display input to be validated by the ISPF panel processing section, by the SAS DATA step, or both, which gives cross-variable-checking capability.

The IBM documents *ISPF Dialog Developer's Guide* and *ISPF Services Guide* describe the ISPF services and their syntax conventions. To invoke these services, you can use either the ISPLINK CALL routine or the ISPEXEC CALL routine. However, ISPEXEC has the following limitations:

- The following ISPF services cannot be invoked from ISPEXEC:

**GRERROR**

**GRINIT**

**GRTERM**

**VCOPY**

**VDEFINE**

**VDELETE**

**VREPLACE**

**VRESET**

- The SAS services described in "Changing the Status of ISPF Interface Options during Execution of a DATA Step" on page 298 cannot be invoked from ISPEXEC.
- You cannot use abbreviated variable lists (described in "Variable-Naming Conventions" on page 300) with ISPEXEC.

**Note:** Remember that ISPF restricts a name list to 254 names.

## Using the ISPEXEC CALL Routine

To invoke ISPEXEC from a SAS DATA step, use a CALL statement with one of these formats:

```
call ispexec(value1,value2 );
call ispexec(,value2 );
call ispexec(value2 );
```

where *value1* and *value2* are variables, literals, or expressions to be passed as parameters to ISPF. Use the same parameters that you would use with an ISPF ISPEXEC. *Value1*, if specified, is the length of *value2*. If you use the second or third form of the call, the ISPF interface provides this value. *Value2* is a character expression that contains the service name and parameters, specified as they would be in a CLIST or SASRX exec. Parameters can be specified as symbolic ISPF variables that are replaced with the ISPF variable values at run time. Only one scan for symbolic variables is done, and the resulting service request must not exceed 512 bytes in length.

**Note:** If you use symbolic ISPF variables, remember that both SAS and ISPF use ampersands to define symbolic variables. Enclose the ISPF symbolic variable specifications in single quotation marks to prevent them from being replaced by SAS.

## Using the ISPLINK CALL Routine

To invoke ISPLINK from a SAS DATA step, use a CALL statement with this format:

```
call isplink(value1,...,value15 );
```

where *value1,...,value15* are variables, literals, or expressions to be passed as parameters to ISPF. You use the same parameters that you would use with an ISPF ISPLINK. For a description of special parameter considerations, see "Using Special Facilities for Passing Parameters to ISPF" on page 300.

Trailing blanks are sometimes used by ISPF to determine the end of a parameter; they are optional because the interface supplies them. If more than 15 positional parameters are required (for example, TBSTATS can have up to 19 parameters), parameters 15 through 20 can be specified in *value15*. The values must be separated by commas. The interface parses *value15* into parameters 15 through 20.

## Testing ISPEXEC and ISPLINK Return Codes

Each ISPEXEC or ISPLINK CALL subroutine results in a return code that is described in IBMs *ISPF Dialog Services Guide*. You can test the return code with the SAS numeric variable ISP_RC. Because this variable is set by ISPEXEC or ISPLINK, the SAS compiler produces a `Note: Variable` *varname* `is uninitialized` message. To avoid receiving this message, specify the following SAS statement in your program:

```
retain isp_rc 0;
```

## Using ISPF Dialog Development Models

A standard ISPF function called Dialog Development Models uses the ISPF EDIT facility to simplify the development of programs. For more information, see "Using the ISPF Editor from Your SAS Session" on page 299, "Copying ISPF EDIT Models to Your SAS Session" on page 300, and the information about using edit models in the IBM manual *ISPF Edit and Edit Macros*.

If you specify PL/I as the model class, the statements that the model facility produces are in the proper SAS form. To simplify the use of the Dialog Development Models, the PL/I return code variable, PLIRETV, is recognized and used by the interface in the same way as ISP_RC. The following examples could have been created using the `SELECT` Edit model:

```
data _null_;
   call ispexec('SELECT PANEL(ISR@PRIM)');
   if pliretv ¬ = 0 then put pliretv=;
run;

data _null_;
   call isplink('SELECT','  ','PANEL(ISR@PRIM)');
   if pliretv ¬ = 0 then put pliretv=;
run;
```

**Note:** Current versions of the ISPF PL/1 models use the function **`pliretv()`** to access the return code. The SAS interface to ISPF does not currently provide this function. You have to convert the function to a variable reference by removing the parentheses.

# Using Special SAS System Options with the Interface

## Overview of Special SAS System Options

The SAS interface to ISPF includes the following SAS system options. These options are useful in developing and debugging ISPF applications. Most of them are used in conjunction with the ISPF VDEFINE service, which is described in "VDEFINE, VDELETE, and VRESET Services" on page 303.

- ISPCAPS
- ISPCHARF
- ISPCSR=
- ISPEXECV=
- ISPMISS=
- ISPMSG=
- ISPNOTES
- ISPNZTRC
- ISPPT
- ISPTRACE
- ISPVDEFA
- ISPVDLT
- ISPVDTRC
- ISPVIMSG=
- ISPVRMSG=

- ISPVTMSG=
- ISPVTNAM=
- ISPVTPNL=
- ISPVTRAP
- ISPVTVARS=

To determine which of these options are in effect for your SAS session, submit the following statements from the Program Editor window and view the output in the Log window.

```
proc options group=ispf;
run;
```

You specify these options as you would specify any other SAS system option. For more information, see "Specifying or Changing System Option Settings" on page 19 and "System Options in the z/OS Environment" on page 689.

## Changing the Status of ISPF Interface Options during Execution of a DATA Step

You can use the interface's SAS service in conjunction with the ISPLINK CALL routine to change the status of some of the SAS system options that relate to the ISPF interface. For example, the following ISPLINK CALL specifies the ISPNZTRC system option:

```
call isplink ('SAS','ISPNZTRC');
```

The system options whose status can be changed in this manner are listed in the following table. For more information about these options, see "System Options under z/OS" on page 685.

***Table 19.2*** *SAS Services and Their SAS/DMI Equivalents*

| SAS Service | Equivalent DMI Service |
|---|---|
| ('SAS','ISPCAPS') | ('DMI','CAPS') |
| ('SAS','NOISPCAPS') | ('DMI','NOCAPS') |
| ('SAS','ISPCHARF') | ('DMI','CHARFORMATTED') |
| ('SAS','NOISPCHARF') | ('DMI','NOCHARFORMATTED') |
| ('SAS','ISPNOTES') | ('DMI','NOTES') |
| ('SAS','NOISPNOTES') | ('DMI','NONOTES') |
| ('SAS','ISPNZTRC') | ('DMI','NZRCTRACE') |

| SAS Service | Equivalent DMI Service |
|---|---|
| ('SAS','NOISPNZTRC') | ('DMI','NONZRCTRACE') |
| ('SAS','ISPPT') | ('DMI','PT') |
| ('SAS','NOISPPT') | ('DMI','NOPT') |
| ('SAS','ISPTRACE') | ('DMI','TRACE') |
| ('SAS','NOISPTRACE') | ('DMI','NOTRACE') |
| ('SAS','ISPVDTRC') | ('DMI','VDEFTRACE') |
| ('SAS','NOISPVDTRC') | ('DMI','NOVDEFTRACE') |
| ('SAS','ISPVDLT') | ('DMI','VDELVDEF') |
| ('SAS','NOISPVDLT') | ('DMI','NOVDELVDEF') |
| ('SAS','ISPVTRAP') | ('DMI','VTRAP') |
| ('SAS','NOISPVTRAP') | ('DMI','NOVTRAP') |

**Note:** For compatibility with SAS/DMI, you can use the DMI service to change the status of the corresponding system option.

# Using the ISPF Editor from Your SAS Session

## Selecting the Editor to Use

If you prefer to use the ISPF editor rather than the SAS editor, or if you need to use the ISPF editor in order to use edit models, then you can use the SAS HOSTEDIT command. For more information, see the next section, "Copying ISPF EDIT Models to Your SAS Session" on page 300. Under z/OS, the HOSTEDIT command temporarily suspends the current SAS session and initiates a session of the ISPF editor or browser. For more information, see "HOSTEDIT Command: z/OS" on page 281.

## Copying ISPF EDIT Models to Your SAS Session

A major advantage of being able to access the ISPF editor with the HOSTEDIT command is that it enables you to access and modify ISPF EDIT models. You can then copy them to your SAS Program Editor window.

To access an ISPF EDIT model, do the following:

1. Invoke SAS from ISPF and enter HOSTEDIT on the command line of the Program Editor window.
2. Enter `MODEL CLASS PLI` on the ISPF editor command line.
3. Enter `MODEL` plus the model name to include a particular model (for example, `MODEL TBDISPL`), or enter `MODEL` alone and specify a model from the list of EDIT models that appears.

You can then modify the model as necessary and use the END command to save it back to your Program Editor window.

For more information about the ISPF EDIT facility and EDIT models, see the IBM manual *ISPF Edit and Edit Macros*.

# Using Special Facilities for Passing Parameters to ISPF

## Overview of the Special Facilities

The interface provides special facilities and services that simplify the coding and processing of parameters for ISPF services. These facilities include

- variable-naming conventions that simplify the specification of variables to ISPF
- methods for specifying fixed binary parameters
- a way to pass parameters that are longer than the usual 200-byte limit
- a way to bypass SAS parameter processing.

## Variable-Naming Conventions

To simplify the specification of variables to ISPF, the interface recognizes _ALL_ or an asterisk (*) to reference all variable names. Variable names can also be selected by their prefixes. When a name ends in a colon, all variables that begin with the specified name are referenced.

You can also use other types of SAS variable lists, including numbered range lists (for example, x1-x*n*) and name range lists (x-numeric-a), as described in the section about rules of the SAS language in "Words and Names" in *SAS Programmer's Guide: Essentials*.

When a variable list is passed to the VDEFINE service, the special naming conventions refer to all variables in the current DATA step that are legal ISPF variable names. For more information, see "VDEFINE, VDELETE, and VRESET Services" on page 303.

**Note:** A name that contains an underscore is not a legal ISPF variable name.

SAS arrays, temporary DATA step variables such as FIRST.*variable* and LAST.*variable*, and the variable PLIRETV are not considered candidates for VDEFINE. The special naming conventions for services other than VDEFINE refer only to the list of currently defined variables and not to all of the variables in the DATA step.

Specifically, the special variable-naming conventions can be used in the following places:

- in the second parameter for the VCOPY, VDEFINE, VDELETE, VERASE, VGET, VMASK, VPUT, and VREPLACE services
- in the third parameter for the TBADD, TBCREATE, TBMOD, TBPUT, TBSARG, and TBSCAN services
- in the fourth parameter for the TBCREATE service.

## Specifying Fixed Binary Parameters

The interface supports the use of simple numeric constants or variables in ISPF service parameters for services that require numeric parameters. However, for compatibility with SAS/DMI, the following two ways of creating full-word fixed binary parameters in SAS DATA steps are also supported:

```
length fixed10 $4;
retain fixed10;
if _n_=1 then fixed10=put(10,pib4.);
```

or

```
retain fixed10 '0000000a'x;
```

You can specify a hexadecimal value as a literal parameter by enclosing the value in single or double quotation marks and entering the letter X after the closing quotation mark.

Some of the services that have numeric parameters are CONTROL, TBDISPL, TBCREATE, TBQUERY, TBSKIP, VDEFINE, and VCOPY.

**Note:** Never use a blank or null value for a numeric parameter.

The ISPF SELECT service has a special parameter list because it requires a full-word fixed binary parameter that specifies the length of the buffer. The SAS interface to ISPF provides this length parameter. If you use the ISPLINK CALL routine to invoke the SELECT service, then you must reserve the parameter's place in the parameter list. Use either a comma or two single quotation marks with a blank between them (' ')to represent the parameter, as in the following example:

```
isplink('SELECT', ,'CMD(%MYDIALOG)');
```

If you use the ISPEXEC CALL routine to invoke the SELECT service, then you do not need to reserve the parameter's place:

```
ispexec('SELECT CMD(%MYDIALOG)');
```

## Passing Parameters That Are Longer Than 200 Bytes

Previous releases of SAS limit the length of a CALL routine parameter to 200 bytes, but it is sometimes necessary to pass more than 200 bytes as an ISPF service request parameter. For this reason, the interface has a special parameter form that allows parameters up to 65,535 bytes long for both ISPLINK and ISPEXEC calls.

When a parameter longer than 200 bytes is required, use the following form in place of the parameter:

*=varname=length*

where *varname* is the name of a SAS character variable in the current DATA step, and *length* is the length of *varname*, expressed as a two-byte binary value. Blanks are not permitted before or after the equal signs.

Using this parameter form does not change ISPF parameter restrictions. For example, ISPEXEC allows a maximum of 512 bytes in its second parameter regardless of how you specify the parameter.

## Bypassing SAS Parameter Processing

There might be times when parameters must be passed to ISPF without modification. If the interface encounters a parameter whose first position contains a PL/I "not" symbol (¬), then the parameter that follows the "not" symbol is passed to ISPF unchanged. This facility prevents the parameter from being translated to uppercase and prevents names from being replaced within the parameter.

# Accessing SAS Variables from ISPF

## Introduction to Accessing SAS Variables from ISPF

This section describes how the SAS interface to ISPF processes three ISPF services–VDEFINE, VDELETE, and VRESET. These services are used to grant and revoke ISPF access to variables in the SAS DATA step. This section also provides an explanation of how SAS numeric and character variables are handled by VDEFINE, and it includes examples of how VDEFINE and VDELETE are used.

## VDEFINE, VDELETE, and VRESET Services

The ISPF VDEFINE service is used to give ISPF access to variables in the SAS DATA step. When you call the VDEFINE service, the interface adds the SAS variables that you specify to its list of defined variables.

The ISPF VDEFINE service enables you to specify seven parameters. The form is

```
'VDEFINE', namelist, variable,
format,
          length, optionlist, userdata
```

The interface provides the values for *variable*, *format*, *length*, and *userdata*. You need only specify *namelist*.

The *optionlist* parameter is optional and can be used when you are defining either SAS character variables or SAS numeric variables. The two VDEFINE options that you can specify are COPY and NOBSCAN. The LIST option is not supported. COPY allows the value of the variable that is being defined to be initialized to the value of a dialog variable that has the same name in the function pool, shared pool, or profile pool. The NOBSCAN option prevents ISPF from stripping trailing blanks from variables.

To define all SAS variables in the current DATA step, use the following statement:

```
call isplink('VDEFINE','_ALL_');
```

For more information about specifying variables, see “Variable-Naming Conventions” on page 300.

The VDELETE service ends ISPF access to specified variables in the SAS DATA step, and the interface drops the variables from the list of defined variables that it maintains. The interface recognizes the end of a SAS DATA step and deletes any variables that remain on its list of defined variables.

The VRESET service ends ISPF access to *all* variables that have been passed to the VDEFINE service. However, in addition to removing *all* variables that the user has passed to VDEFINE, VRESET also removes variables that the interface has passed

to VDEFINE. To prevent variables that it is using from being removed, the interface changes VRESET to ('VDELETE','_ALL_').

## Handling Numeric Variables

Numeric SAS variables are in double-word floating-point format. You can pass them to the VDEFINE service with either the FLOAT format or the USER format. If you use the FLOAT format, you should specify (or let the interface provide) a length of 8, because all SAS numeric variables have a length of 8 during the execution of the SAS DATA step.

**Note:**

- For numeric variables, the LENGTH statement applies to the length of the variables when they are stored in a SAS data set. The statement does not apply to the length of the variables in memory while the DATA step is executing.
- When the FLOAT format is used, certain features of the SAS interface to ISPF are unavailable: SAS formats and informats that are associated with the variable are not used, null values are not changed to the special missing value "._" (period underscore), and accessing of variables cannot be traced with the ISPVTRAP option.

Because earlier releases of ISPF did not support the FLOAT format, SAS (and previously SAS/DMI) supports the use of the USER format. If you specify the USER format, or if you let SAS default to it, then SAS provides a user exit that uses any format, informat, or both that is associated with the variable. If no format or informat is associated with the variable, then the default SAS format or informat is used.

## Handling Character Variables

In addition to containing strings of printable characters, SAS character variables can actually contain any data value. Therefore, you can use any valid ISPF VDEFINE format with a SAS character variable. ISPF treats the variable accordingly. Within the SAS DATA step, the SAS functions INPUT or PUT can be used to perform data conversion as required. The SAS system option ISPCHARF | NOISPCHARF determines whether SAS informats and formats are used to convert SAS character variable values when they are used as ISPF variables. The following list explains how this option determines whether the SAS variable formats are to be used when a variable is passed to the VDEFINE service:

- If the system option NOISPCHARF is in effect when a SAS character variable is passed to the VDEFINE service, the SAS character variable is defined to ISPF with a *format* of CHAR, and both ISPF and SAS reference and modify the values of these variables directly in main storage.
- If the system option ISPCHARF is in effect when a SAS character variable is passed to the VDEFINE service, and if the SAS variable has a SAS informat or

format, then the SAS character variable is defined to ISPF with a *format* of USER, and the interface uses the SAS informat or format in its conversion routine whenever ISPF references the variable. The interface also applies the following rules:

- If the variable contains an invalid value for the SAS informat, the variable is set to the value of the system option MISSING=.
- If the variable contains an invalid value for the SAS format, ISPF receives the value of the system option MISSING= for the variable.
- If no value is specified for an ISPF character variable, the variable is set to the value of the ISPMISS= option.

If an application requires an ISPF dialog variable that is longer than the maximum SAS character variable length of 32,767, then the *length* parameter of VDEFINE can be specified and associated with the variables that are being defined to ISPF. In order to prevent the data from being overwritten, you must do the following:

- Create multiple variables whose total length equals or exceeds the length required.
- Ensure that the SAS compiler assigns storage for the variables contiguously by using SAS ARRAY statements to arrange the variables as needed. Either all or none of the variables must be specified in the RETAIN statement.

It is good practice to code the SAS ARRAY and RETAIN statements for these extra-long variables immediately following the SAS DATA statement.

The following example shows how ISPF dialog variables named LONG1 and LONG2, each 32,000 bytes long, would be defined.

```
data _null_;
   array anyname1 $32000 long1 long1_c;
   array anyname2 $32000 long2 long2_c;
   retain long1 long1_c long2 long2_c  ' ';
   call isplink('VDEFINE','(LONG1 LONG2)',,,64000);
```

## Examples of Defining Variables

The following statement defines to ISPF all variables in the current DATA step that begin with the letters PPR:

```
call isplink('VDEFINE','PPR:');
```

The next statement defines the variables SASAPPLN, ZCMD, and ZPREFIX to ISPF. The variables are to be initialized with the values from variables of the same name that already exist in the variable pools.

```
call isplink('VDEFINE',
   '(SASAPPLN  ZCMD  ZPREFIX)',,,,'COPY');
```

This next statement removes all previously defined variables from the variable pool, making them inaccessible to ISPF:

```
call isplink('VDELETE','_ALL_');
```

# Tips and Common Problems

## Checking for Invalid Values in SAS Variables

If a SAS variable in an ISPF table or display has a specified informat, invalid values are replaced with missing values. When you create ISPF panels through which a user can enter or modify SAS values, the values can be checked for validity either with the action section of the panel or with the SAS DATA step. If missing values are not appropriate, you can redisplay the panel (along with an appropriate error message) and prompt the user to enter the correct values.

## Checking for Null Values in ISPF Variables

The special missing value of underscore indicates an ISPF variable with a length of 0. (Null values are valid for ISPF values.) The special missing value of underscore distinguishes between an invalid value from an informat (which has a missing value) and a value that was not provided.

## Truncated Values for Numeric Variables

To avoid truncating the values of numeric variables, you must either provide a format whose length does not exceed the size of the display field, or you must increase the length of the display field itself. If no format is associated with a numeric variable, the default format width is 12 characters.

## Uninitialized Variables

When a variable is neither specified with an initial value in a RETAIN statement nor appears on the left side of the equal sign in an assignment statement, the SAS log shows the `Note: Variable` *varname* `is uninitialized` message. For example, the following statements would result in the message `NOTE: Variable ZCMD is uninitialized`.

```
data _null_;
length zcmd $200;
call isplink('VDEFINE','ZCMD');
call isplink('DISPLAY','ISRTSO');
put zcmd=;
run;
```

However, in this example the message is misleading because the call to ISPF actually assigns a value to ZCMD. To prevent the message from being generated, put the variable in a RETAIN statement with an initial value, or use the variable in an assignment statement. For example, the following RETAIN statement assigns an initial value (a blank) to the variable ZCMD:

```
retain zcmd ' ';
```

### Character Values Passed for Numeric Variables

Under SAS/DMI (the Version 5 predecessor to the SAS interface to ISPF), it was not possible to pass numeric values directly to ISPF services for which numeric values are required. Instead, an alternate method was provided. For more information, see "Specifying Fixed Binary Parameters" on page 301. The alternate method is still supported but is not required. Therefore, if you used SAS/DMI to develop ISPF applications, you might prefer to modify those applications so that numeric values are passed directly to these ISPF services instead.

## Testing ISPF Applications

When you are testing code that uses ISPF services, there are techniques and facilities that can greatly simplify the testing process. The IBM manual *ISPF Dialog Developer's Guide* describes the ISPF dialog test modes. This facility provides aids for testing functions, panels, variables, messages, tables, and skeletons.

In addition, SAS provides the MPRINT system option to help you find coding errors. If you want to see the SAS statements that are generated by SAS macros, specify MPRINT in a SAS OPTIONS statement. (The MPRINT system option is documented in *SAS System Options: Reference*.)

The ISPF parameters are written to the SAS log when the ISPTRACE option is specified. The tracing can also be turned on and off with the ISPLINK CALL subroutine, as in the following example, which stops the tracing of ISPF parameters.

```
call isplink('SAS','NOISPTRACE');
```

## Sample Application

### Introduction to the Sample Application

The IBM manual *ISPF Examples* provides examples of ISPF applications written in APL2, COBOL, Fortran, PASCAL, PL/I, and as CLISTs.

This section shows how one of those applications would be written in the SAS language.

**Note:** You must have ISPF running for these applications to work. Start ISPF before you start SAS if you want to test an ISPF application.

## Employee Records Application

```
DATA _NULL_;
   LENGTH EMPSER $6 FNAME LNAME $16 ADDR1 ADDR2 ADDR3 ADDR4 $40 PHA $3
          PHNUM MSG TYPECHG CHKTYPE $8 I STATE $1;
   RETAIN EMPSER FNAME LNAME I ADDR1 ADDR2 ADDR3 ADDR4 PHA PHNUM MSG
          TYPECHG CHKTYPE ' ' STATE '1' PLIRETV 0;
   CALL ISPLINK('VDEFINE',                  /* DEFINE VARIABLES      */
            '(EMPSER FNAME LNAME I ADDR: PHA PHNUM TYPECHG CHKTYPE)');
   MSG=' ';                                 /* INITIALIZE MESSAGE    */
CALL ISPLINK('TBCREATE',                    /* IF TABLE DOESN'T EXIST*/
        'SASEMPTB','(EMPSER)',              /* CREATE IT             */
        '(LNAME FNAME I ADDR: PHA PHNUM)',
        'NOWRITE');                         /* DON'T SAVE THE TABLE  */
DO WHILE (STATE NE '4');                    /* LOOP UNTIL TERM SET   */
  CALL ISPLINK('DISPLAY','SASEMPLA',MSG);   /* SELECT EMPLOYEE       */
  IF PLIRETV=8 THEN STATE='4';              /* END KEY THEN TERMINATE*/
  ELSE DO;                                  /* ENTER KEY PRESSED     */
    MSG=' ';                                /* RESET MESSAGE         */
    STATE='2';                              /* PROCESS EMPLOYEE PANEL*/
    CALL ISPLINK('TBGET','SASEMPTB');       /* OBTAIN EMPLOYEE DATA  */
    IF PLIRETV=0 THEN                       /* IF RECORD EXISTS THEN */
      TYPECHG='U';                          /*   SET UPDATE FLAG     */
    ELSE DO;                                /* RECORD DOES NOT EXIST */
      TYPECHG='N';                          /*   SET TYPE=NEW        */
      LNAME=' ';FNAME=' ';I=' ';            /* INITIALIZE PANEL VARS */
      ADDR1=' ';ADDR2=' ';ADDR3=' ';
      ADDR4=' ';PHA=' ';PHNUM=' ';
    END;
    CHKTYPE=TYPECHG;                        /* SAVE TYPE OF CHANGE   */
    CALL ISPLINK('DISPLAY','SASEMPLB',MSG); /* DISPLAY EMPLOYEE DATA */
    IF PLIRETV NE 8 THEN DO;                /* END KEY NOT PRESSED   */
      IF TYPECHG='N' THEN DO;               /* IF NEW EMPLOYEE       */
        CALL ISPLINK('TBADD','SASEMPTB');   /*   ADD TO TABLE        */
        MSG='SASX217';                      /*                       */
        END;                                /*                       */
      ELSE DO;                              /*                       */
        IF TYPECHG='U' THEN DO;             /* IF UPDATE REQUESTED   */
          CALL ISPLINK('TBPUT','SASEMPTB'); /*   UPDATE TABLE        */
          MSG='SASX218';                    /*                       */
          END;                              /*                       */
        ELSE DO;                            /*                       */
          CALL ISPLINK('TBDELETE','SASEMPTB'); /* DELETED MESSAGE    */
          MSG='SASX219';                    /*                       */
          END;                              /*                       */
        END;                                /* END TABLE MODS        */
```

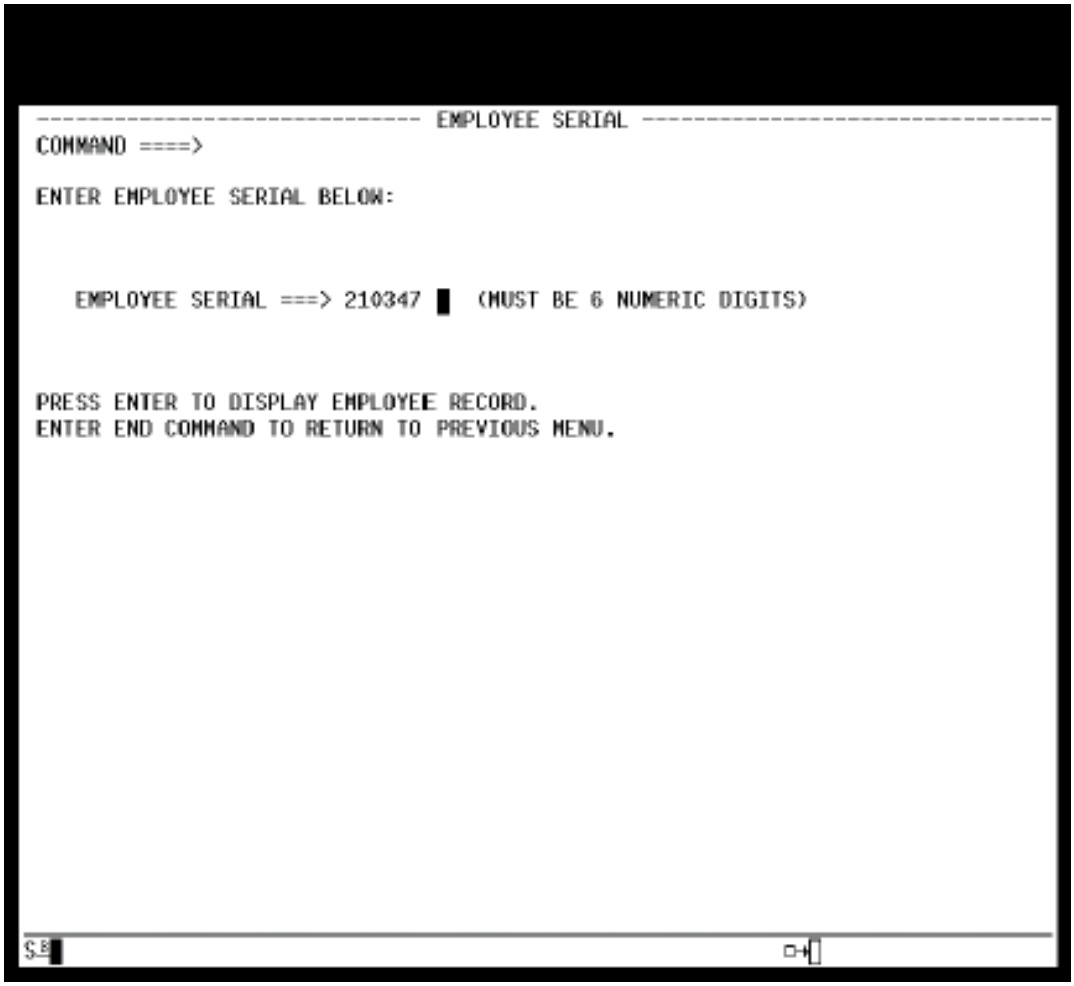
```
      END;                                    /* END 2ND PANEL PROCESS */
    END;                                      /* END 1ST PANEL PROCESS */
  IF MSG NE ' ' THEN CALL ISPLINK('LOG',MSG); /* LOG MESSAGE         */
END;                                          /* END DO LOOP           */
CALL ISPLINK('TBCLOSE','SASEMPTB');           /* CLOSE TABLE           */
CALL ISPLINK('VDELETE','_ALL_');              /* DELETE ALL VARIABLES  */
RUN;
```

## Contents of Member SASEMPLA in ISPPLIB

```
Contents of Member SASEMPLA in ISPPLIB:



%------------------------ EMPLOYEE SERIAL ------------------------------
%COMMAND ====>_ZCMD                                                    %
+
%ENTER EMPLOYEE SERIAL BELOW:
+
+
+
+   EMPLOYEE SERIAL%===>_EMPSER+    (MUST BE 6 NUMERIC DIGITS)
+
+
+
+PRESS%ENTER+TO DISPLAY EMPLOYEE RECORD.
+ENTER%END COMMAND+TO RETURN TO PREVIOUS MENU.
)PROC
  VER (&EMPSER,NONBLANK)
  VER (&EMPSER,PICT,NNNNNN)
)END
```

## First Employee Record Application Panel

***Figure 19.1*** *First Employee Record Application Panel*



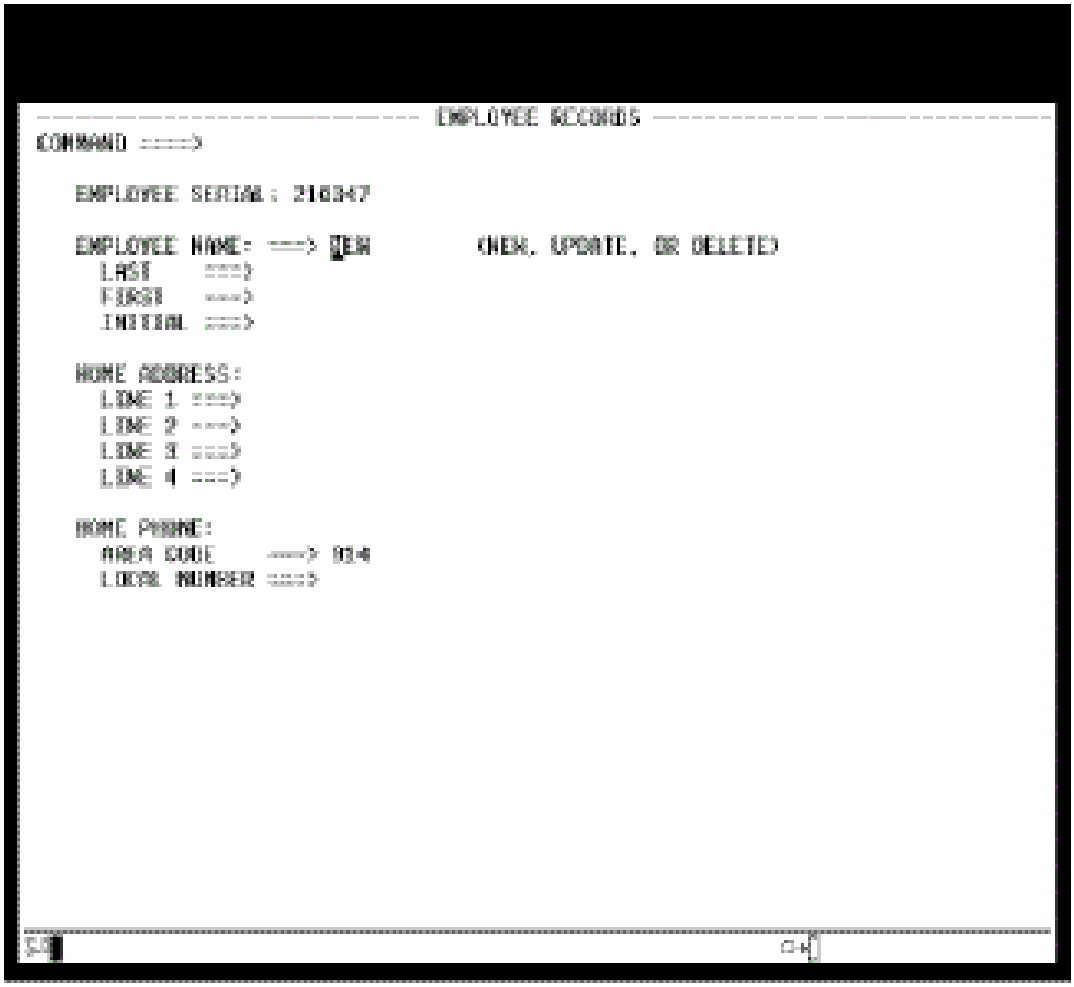

## Contents of Member SASEMPLB in ISPPLIB

```
%----------------------- EMPLOYEE RECORDS -----------------------------
%COMMAND ====>_ZCMD                                                   %
+
+   EMPLOYEE SERIAL: &EMPSER
+
+   EMPLOYEE NAME:%===>_TYPECHG +   (NEW, UPDATE, OR DELETE)
+     LAST    %===>_LNAME           +
+     FIRST   %===>_FNAME           +
+     INITIAL%===>_I+
+
+   HOME ADDRESS:
```

```
+     LINE 1%===>_ADDR1                                        +
+     LINE 2%===>_ADDR2                                        +
+     LINE 3%===>_ADDR3                                        +
+     LINE 4%===>_ADDR4                                        +
+
+   HOME PHONE:
+     AREA CODE   %===>_PHA+
+     LOCAL NUMBER%===>_PHNUM   +
+
)INIT
  .CURSOR = TYPECHG
  IF (&PHA = ' ')
     &PHA = 914
    &TYPECHG = TRANS(&TYPECHG N,NEW U,UPDATE D,DELETE)
)PROC
  &TYPECHG = TRUNC (&TYPECHG,1)
  IF (&TYPECHG = N)
    IF (&CHKTYPE NE N)
      .MSG = SASX211
  IF (&TYPECHG NE N)
    IF (&CHKTYPE = N)
      .MSG = SASX212
  VER (&LNAME,ALPHA)
  VER (&FNAME,ALPHA)
  VER (&I,ALPHA)
  VER (&PHA,NUM)
  VER (&PHNUM,PICT,'NNN-NNNN')
  IF (&TYPECHG = N,U)
    VER (&LNAME,NONBLANK,MSG=SASX214)
    VER (&FNAME,NONBLANK,MSG=SASX213)
    VER (&ADDR1,NONBLANK,MSG=SASX215)
    VER (&ADDR2,NONBLANK,MSG=SASX215)
    VER (&ADDR3,NONBLANK,MSG=SASX215)
)END
```

## Second Employee Record Application Panel

***Figure 19.2*** *Second Employee Record Application Panel*




## Contents of Member SASX21 in ISPMLIB

```
SASX210  'INVALID TYPE OF CHANGE'                              .ALARM=YES
'TYPE OF CHANGE MUST BE NEW, UPDATE, OR DELETE.'
SASX211  'TYPE ''NEW'' INVALID'                                .ALARM=YES
'EMPLOYEE SERIAL &EMPSER ALREADY EXISTS.  CANNOT BE SPECIFIED AS NEW.'

SASX212  'UPDATE OR DELETE INVALID'                            .ALARM=YES
'EMPLOYEE SERIAL &EMPSER IS NEW.  CANNOT SPECIFY UPDATE OR DELETE.'

SASX213  'ENTER FIRST NAME'                                    .ALARM=YES
'EMPLOYEE NAME MUST BE ENTERED FOR TYPE OF CHANGE = NEW OR UPDATE.'
```

```
SASX214  'ENTER LAST NAME'                                    .ALARM=YES
'EMPLOYEE NAME MUST BE ENTERED FOR TYPE OF CHANGE = NEW OR UPDATE.'

SASX215  'ENTER HOME ADDRESS'                                 .ALARM=YES
'HOME ADDRESS MUST BE ENTERED FOR TYPE OF CHANGE = NEW OR UPDATE.'

SASX217  '&EMPSER ADDED'
'EMPLOYEE &LNAME, &FNAME &I ADDED TO FILE.'

SASX218  '&EMPSER UPDATED'
'EMPLOYEE &LNAME, &FNAME &I UPDATED.'

SASX219  '&EMPSER DELETED'
'EMPLOYEE &LNAME, &FNAME &I DELETED.'
```

# SAS Interface to REXX

## Overview of the SAS Interface to REXX

The SAS interface to REXX enables users to supplement the SAS language with REXX and thus provides new programming possibilities in the z/OS environment.

## Enabling the Interface

The SAS system options REXXMAC and REXXLOC control the REXX interface.

- The REXXMAC option enables or disables the REXX interface. If REXXMAC is in effect, then the REXX interface is enabled. When SAS encounters an unrecognized statement, it searches for a REXX exec whose name matches the first word of the unrecognized statement. If the default, NOREXXMAC, is in effect, then the REXX interface is disabled. When SAS encounters an unrecognized statement, a "statement is not valid" error occurs. You can specify this option in the configuration file, when you invoke SAS, or in the OPTIONS statement.
- When the REXXMAC option is in effect, the REXXLOC= option specifies the ddname of the REXX exec library to be searched for any SAS REXX execs. The default is REXXLOC=SASREXX. You can specify this option either in the configuration file or when you invoke SAS, or in the OPTIONS statement.

# Invoking a REXX Exec

SAS REXX execs are REXX programs. They are stored in a library that is allocated to the SASREXX ddname (or to another ddname, as specified by the SAS system option REXXLOC=). A REXX exec is submitted as part of a SAS program in the same way as any other global SAS statement.

To run a REXX exec from within SAS, do the following:

1. Put the REXX exec in a partitioned data set and allocate that PDS to the ddname SASREXX.
2. Either invoke SAS with the REXXMAC option or specify the REXXMAC option later in an OPTIONS statement.
3. Code a statement that begins with the name of the REXX exec.

**Note:** You can invoke a REXX exec from an SCL program, but you should enclose the statement in a SUBMIT block. Otherwise, the exec is executed at compile time rather than at run time.

The following example invokes a REXX exec called `YOUREXEC`, which resides in `YOUR.REXX.LIBRARY`. This example works in both batch and TSO environments.

```
options rexxmac;
filename sasrexx 'your.rexx.library' disp=shr;
yourexec;
```

In batch, you can also use a JCL DD statement to allocate the REXX library externally:

```
//jobname JOB  ...
//        EXEC SAS
//SASREXX  DD  DSN=YOUR.REXX.LIBRARY,DISP=SHR
//SYSIN    DD  *
options rexxmac;
yourexec;
/*
//
```

A REXX exec can have zero, one, or multiple arguments. You call the exec by specifying its name, followed by arguments (if any), followed by a semicolon. You can place the exec anywhere that a global SAS statement, such as an OPTIONS or TITLE statement, can be placed.

The exec can generate code that is then processed by the SAS supervisor. That code can be a partial DATA step or PROC step, or one or more complete DATA steps or PROC steps.

"A Simple REXX Exec" on page 319 provides an example of a REXX exec called VERIFY that takes as its argument a single data set name. This REXX exec can be invoked by submitting the following statement from a SAS program:

```
verify data.set.name;
```

A SAS REXX exec submits SAS statements through the SAS subcommand environment by specifying or defaulting to `'SAS'` as its address. When a REXX exec receives control, the default subcommand environment for that program is `'SAS'`. As illustrated in "A Simple REXX Exec" on page 319, any SAS language statement can then be passed to SAS for execution.

# Interacting with the SAS Session from a REXX Exec

## The REXX Interface

One of the main advantages of using the REXX interface is that it provides four types of communication between the REXX exec and the SAS session:

- You can submit SAS statements and obtain their return code.
- You can print messages on the SAS log.
- You can retrieve and set the value of any variable in the submitting REXX exec by using the GETEXEC DATA step function and the PUTEXEC DATA step routine.
- You can retrieve the value of a string that is returned by a REXX exec by using the global macro variable SYSRXRLT.

## Routing Messages from REXX Execs to the SAS Log

A set of SAS directives enables a REXX exec to print to the SAS log. SAS directives use a leading ++ sequence to differentiate them from normal SAS language statements that are submitted to the SAS subcommand environment.

Three directives are available:

address SAS '++SASLOG'
: causes all subsequent SAS statements to be printed to the SAS log.

address SAS '++NOLOG'
: stops subsequent SAS language statements from being printed to the SAS log.

address SAS '++SASLOG' *message*
: writes *message* into the SAS log and also causes subsequently submitted SAS statements to be written to the SAS log. *Message* is interpreted as a REXX expression before being passed to SAS.

## GETEXEC and PUTEXEC Require a Batch TMP

The GETEXEC DATA step routine and the PUTEXEC DATA step function have to run in a TSO environment. If you are running in batch mode, set up your session to run SAS under a batch TMP. The following example contains the basic JCL for running SAS under a z/OS batch TMP.

```
//   EXEC PGM=IKJEFT01,DYNAMNBR=50
//SYSTSPRT DD SYSOUT=*
//SYSPROC  DD DISP=SHR,DSN=library.where.sas.clist.is
//SASREXX   DD DISP=SHR,DSN=library.with.your.sasrexx.pgms
//SYSTSIN    DD *
  SAS
/*
//SYSIN        DD *
   OPTIONS REXXMAC;
    yourexec;
/*

//
```

## The GETEXEC DATA Step Function

You can use the GETEXEC function in SAS statements that are submitted to the SAS subcommand environment to retrieve the value of any variable in the submitting REXX exec. The syntax of the GETEXEC function is as follows:

*value*=GETEXEC(*REXX-variable*)

where *REXX-variable* is a SAS expression that represents the name of a REXX variable in uppercase and *value* receives the value of the specified REXX variable.

**Note:** When GETEXEC is called from a DATA step in a REXX macro, it accesses a variable in the REXX macro. When it is called from a DATA step that is not in a REXX macro, it accesses a variable in the REXX exec or CLIST that invoked SAS, if there is one, or else returns an error (for example, in batch). If the referenced REXX variable does not exist, it is created with a value equal to its name, as in the REXX language.

For an example of the GETEXEC function, see "Using the GETEXEC DATA Step Function" on page 319.

## The PUTEXEC DATA Step Routine

You can call the PUTEXEC routine in SAS statements that are submitted to the SAS subcommand environment to assign the value of any variable in the submitting REXX EXEC. The syntax of the PUTEXEC routine is as follows:

**CALL** PUTEXEC(*REXX-variable*, *value*)

where *REXX-variable* is a SAS expression that represents the name of a REXX variable in uppercase and *value* is a SAS expression representing the value to be assigned to the specified REXX variable.

**Note:** When PUTEXEC is called from a DATA step in a REXX macro, it sets a variable in the REXX macro. When it is called from a DATA step that is not in a REXX macro, it sets a variable in the REXX exec or CLIST that invoked SAS, if there is one, or else returns an error (for example, in batch).

For an example of the PUTEXEC routine, see "Using the PUTEXEC DATA Step Routine" on page 320.

## Checking Return Codes in REXX Execs

The REXX special variable RC is always set when any command string is submitted to an external environment.

SAS REXX execs are slightly different from ordinary execs in how RC is set. When an ordinary exec submits z/OS commands, the RC variable is set to the command return code when control returns to REXX. The strings that are submitted to SAS, however, are not necessarily complete execution units. SAS collects SAS language elements until a RUN statement is encountered, at which point the SAS step is executed. While partial program fragments are being submitted, the RC is set to 0. The SAS return code is not assigned to the REXX variable RC until the string that contains the RUN statement is submitted.

The RC value is set to the value of the &SYSERR macro variable. For an example of how the REXX variable RC can be tested after a SAS step has been executed, see "Checking the SAS Return Code in a REXX Exec" on page 321.

# Changing the Host Command Environment

When a REXX EXEC that is invoked under SAS receives control, the default host command environment for that program is `'SAS'`. You can use the ADDRESS instruction followed by the name of an environment to change to a different host command environment:

```
address tso
```

```
address sas
address mvs
```

For an example of using the ADDRESS instruction to execute a TSO statement, see "Using the GETEXEC DATA Step Function" on page 319.

You can also use the ADDRESS built-in function to determine which host command environment is currently active:

```
hcmdenv = address()
```

Use the SUBCOM command to determine whether a host command environment is available before trying to issue commands to that environment. The following example checks to see whether SAS is available:

```
/*  REXX  */
address mvs "subcom sas"
say "subcom sas rc:" rc
if rc = 1
   then sas="not "
   else sas=""
say "sas environment is "sas"available"
```

# Comparing the REXX Interface to the X Statement

The X statement can be used to invoke a REXX exec. For more information, see "X Statement: z/OS" on page 681. However, compared to the REXX interface, the X statement has the following limitations:

- With the X statement, the command that you invoke has no way to communicate information back to the SAS session.
- With the X statement, you have to press Enter to return to SAS.
- The X statement is available only when SAS is running in the TSO environment. A REXX exec can be invoked from a SAS program running in the batch environment, though it cannot issue TSO commands in the batch environment.

# Comparing SAS REXX Execs to ISPF Edit Macros

In their structure and invocation, SAS REXX execs are analogous to ISPF EDIT macros.

- SAS REXX execs are REXX programs in a library that is allocated to the SASREXX ddname (or to another ddname, as specified by the SAS system option REXXLOC=). They are submitted as part of a SAS program in the same way as any other global SAS statement. A SAS REXX exec submits SAS statements through the SAS subcommand environment by specifying or defaulting to `'SAS'` as its "address".

- ISPF edit macros can be REXX programs in the standard command procedure library (SYSPROC, SYSEXEC, or other). They are started from an ISPF EDIT command line in the same way as any other ISPF EDIT subcommand. An ISPF EDIT macro submits editor subcommands through the ISREDIT subcommand environment by specifying or defaulting to 'ISREDIT' as its "address" (the destination environment for a command string).

# Examples of REXX Execs

## A Simple REXX Exec

This REXX exec, called VERIFY, takes as its argument a single data set name. The REXX exec checks to see whether the data set exists. If so, the REXX exec routes a message to the SAS log to that effect. If the data set does not exist, the REXX exec creates the data set and then sends an appropriate message to the SAS log.

```
/*-------------- REXX exec VERIFY --------------*/
Parse Upper Arg fname .
retcode = Listdsi("'"fname"'")
If retcode = 0 Then Do
   Address SAS  "++SASLOG" fname "already exists"
   End
Else Do
   Address TSO "ALLOC FI(#TEMP#) DA('"fname"')
                RECFM(F B) LRECL(80) BLKSIZE(6160)
                DSORG(PS) SPACE(10 5) TRACK NEW"
   Address SAS  "++SASLOG" fname "created"
   Address TSO "FREE  FI(#TEMP#)"
   End
Exit
```

## Using the GETEXEC DATA Step Function

This REXX exec executes a TSO command that generates a list of all filenames beginning with a specified prefix, and then deletes the files named in the list and places the names of the deleted files in a SAS data set.

```
/*------------- REXX exec DELDIR --------------*/
Parse Upper Arg file_prefx .
/*------ Execute the TSO LISTC Command --------*/
x = Outtrap('list.')
Address TSO "LISTC LVL('"FILE_PREFX"') "

/*--- Process Output from the LISTC Command ---*/
idx = 0
file_del.= ''
```

```
Do line = 1 To list.0 By 1
   Parse Var list.line word1 word2 word3
   If word1 = 'NONVSAM' Then Do
      fname = word3
      Address TSO  "DELETE '"fname"'"
      idx = idx + 1
      file_del.idx  = fname
      file_stat.idx = 'DELETED'
      End
   End

/*--- Pass a DATA step into the SAS System ----*/
Address SAS '++SASLOG'

"data results (keep = dsname status);            "
" total = getexec('IDX');                        "
" put 'Total z/OS files deleted: ' total;      "
" do i = 1 to total;                             "
"  dsnm = getexec('FILE_DEL.'  || trim(left(i)));"
"  stat = getexec('FILE_STAT.' || trim(left(i)));"
"  output;                                       "
"  end;                                          "
" run;                                           "

/*---------- Execute a SAS Procedure ----------*/
" proc print;                                    "
" run;                                           "

/*---------- Return to the SAS System ---------*/
Exit
```

## Using the PUTEXEC DATA Step Routine

This REXX exec reads a set of high-level qualifiers from a SAS data set and writes them to REXX stem variables so that they can be processed by the REXX exec. Then the REXX exec loops through the high-level qualifiers, calling the DELDIR routine for each one in turn.

```
/*------------ REXX exec DELMANY -------------*/
/* Accepts as arguments up to 5 high-level    */
/* qualifiers
Parse Upper Arg arg1 arg2 arg3 arg4 arg5 .
hlq.=''
/*-=- Pass a DATA step into the SAS System ---*/
Address SAS '++SASLOG'
" data prefixes;                               "
"    input prefix $ 1-20;                      "
"    cards;                                    "
""arg1
""arg2
""arg3
""arg4
""arg5
";                                          "
```

```
" data _null_;                                "
" set prefixes;                               "
" rexxvar = 'HLQ.' || trim(left(_N_));        "
" call putexec(trim(rexxvar),prefix);         "
" call putexec('HLQ.0', trim(left(_N_)));     "
" run;                                        "
/*---------- Call the DELDIR REXX exec -------*/
Do idx = 1 To hlq.0
   pre = hlq.idx
   Call deldir pre
   End
/*------------ Return to SAS -----------------*/
Exit rc
```

## Checking the SAS Return Code in a REXX Exec

This REXX exec, called SHOWRC, demonstrates how the REXX variable RC can be tested after a SAS step has run:

```
/*-------------- REXX exec SHOWRC ------------*/
/* Accepts as argument a SAS data set         */
Parse Upper Arg ds_name .
Address SAS '++SASLOG'
"data newdata;                                "
"   set "ds_name";                            "
"   run;                                      "
If rc = 0 Then
   Say 'SAS DATA step completed successfully'
Else
   Say 'SAS DATA step terminated with rc=' rc
Exit
```

# 20

# Using the INFILE/FILE User Exit Facility



## Introduction

The INFILE/FILE User Exit Facility provides an interface for accessing user exit modules during the processing of external files in a SAS DATA step. A user exit module (or user exit) consists of several functions that you write in order to perform special processing on external files. For example, you can write user exits that inspect, modify, delete, or insert records. Here are some more specific examples of how user exits can be used:

- encrypting and decrypting data

- compressing and decompressing data
- translating data from one character encoding to another

If a user exit is active, SAS invokes it at various points during the processing of an external file.

**Note:** The INFILE/FILE User Exit Facility is provided for host access methods only. These methods include BSAM, BPAM, VSAM, and VTOC. Portable access methods, such as FTP, HTTP, email, socket, and so on, do not use this facility.

# Writing a User Exit Module

## Overview of Writing a User Exit Module

You can write a user exit module in any language that meets the following criteria:

- The language runs in 31-bit addressing mode.
- The language supports standard OS linkage.

Examples of such languages are IBM assembly language and C. For an example of an exit that is written in assembly language, see "Sample Program" on page 339.

**Note:** In all the figures in this appendix, the field names that are shown in parentheses (for example, EXITIDB in Figure 20.2 on page 326) are the ones that were used in the sample program.

In your user exit module, you should include code for all seven of the functions that are described in "Function Descriptions" on page 328. At the beginning of your user exit module, examine the function code that was passed to you in the Function Request Control Block (described in the next section), and branch to the routine or function that is being requested.

When you write the user exit module, you must follow IBM conventions for assembler linkage. You must also set R15 to a return code value that indicates whether the user exit was successful. Any nonzero return code causes execution to stop. If you want to write an error message to the SAS log, use the SAS LOG service routine. For more information, see "LOG" in "SAS Service Routines" on page 335.

If the user exit terminates with a nonzero return code value, then you must put the address of a user-defined message string that ends in a null ('00'x) character in the Pointer to User Error Message (ERRMSG) field of the User Exit BAG Control Block. For more information, see "User Exit BAG Control Block" on page 326. This message is printed in the SAS log.

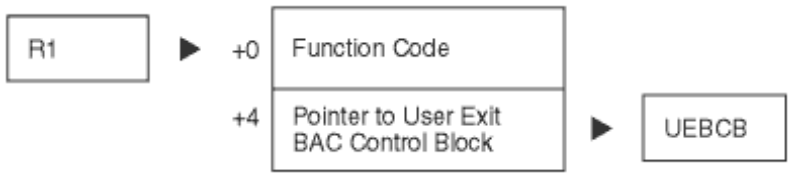
Return code values that apply to particular function requests are listed with the descriptions of those functions in later sections of this appendix.

Be sure to take advantage of the SAS service routines when you write your user exit functions. For more information, see "SAS Service Routines" on page 335.

# Function Request Control Block

The Function Request Control Block (FRCB) provides a means of communication between SAS and your user exit functions. Each time SAS invokes the user exit module, R1 points to a Function Request Control Block (FRCB) that contains, at a minimum, the fields shown in the following figure:

***Figure 20.1*** *Function Request Control Block Fields*




The 4-byte Function Code communicates the current user exit phase to the user exit. It contains one of the following values:

0
indicates the Initialization function.

4
indicates the Parse Options function.

8
indicates the Open function.

12
indicates the Read function.

16
indicates the Concatenation function.

20
indicates the Write function.

24
indicates the Close function.

These functions are described in "Function Descriptions" on page 328. Each time SAS calls the user exit, the user exit should branch to the appropriate exit routine, as determined by the Function code.

# User Exit BAG Control Block

In Figure 20.1 on page 325, the UEBCB (User Exit BAG Control Block) serves as a common anchor point for work areas that SAS has obtained on behalf of the user exit. SAS reserves a user word in the UEBCB for the user exit to use. You can use this word to store a pointer to memory that you allocate for use by all your exit routines. SAS does not modify this word during the lifespan of the user exit. The lifespan is defined as the time period between the Initialization function request and the end of the DATA step.

The following two figures illustrate the structure of the UEBCB and its relationship to other data areas:

***Figure 20.2*** *UEBCB Structure, Part 1 of 2*

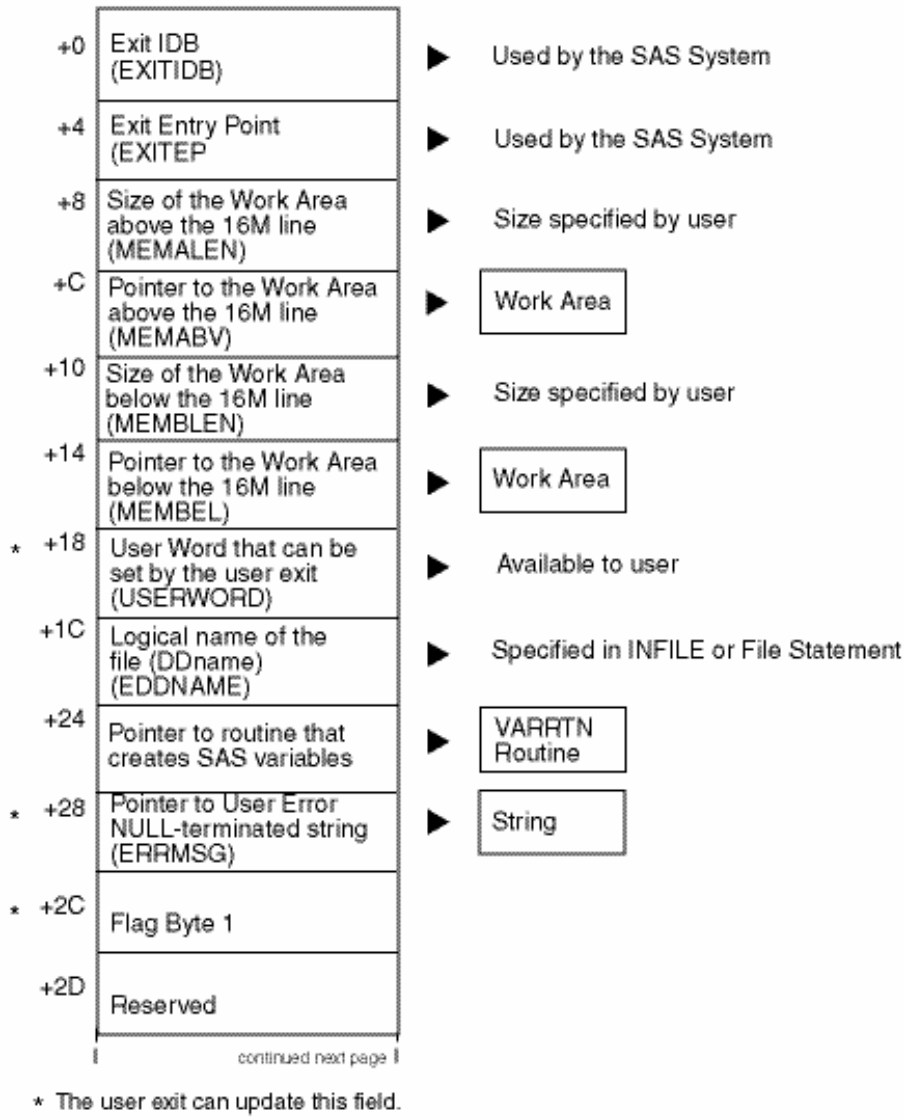
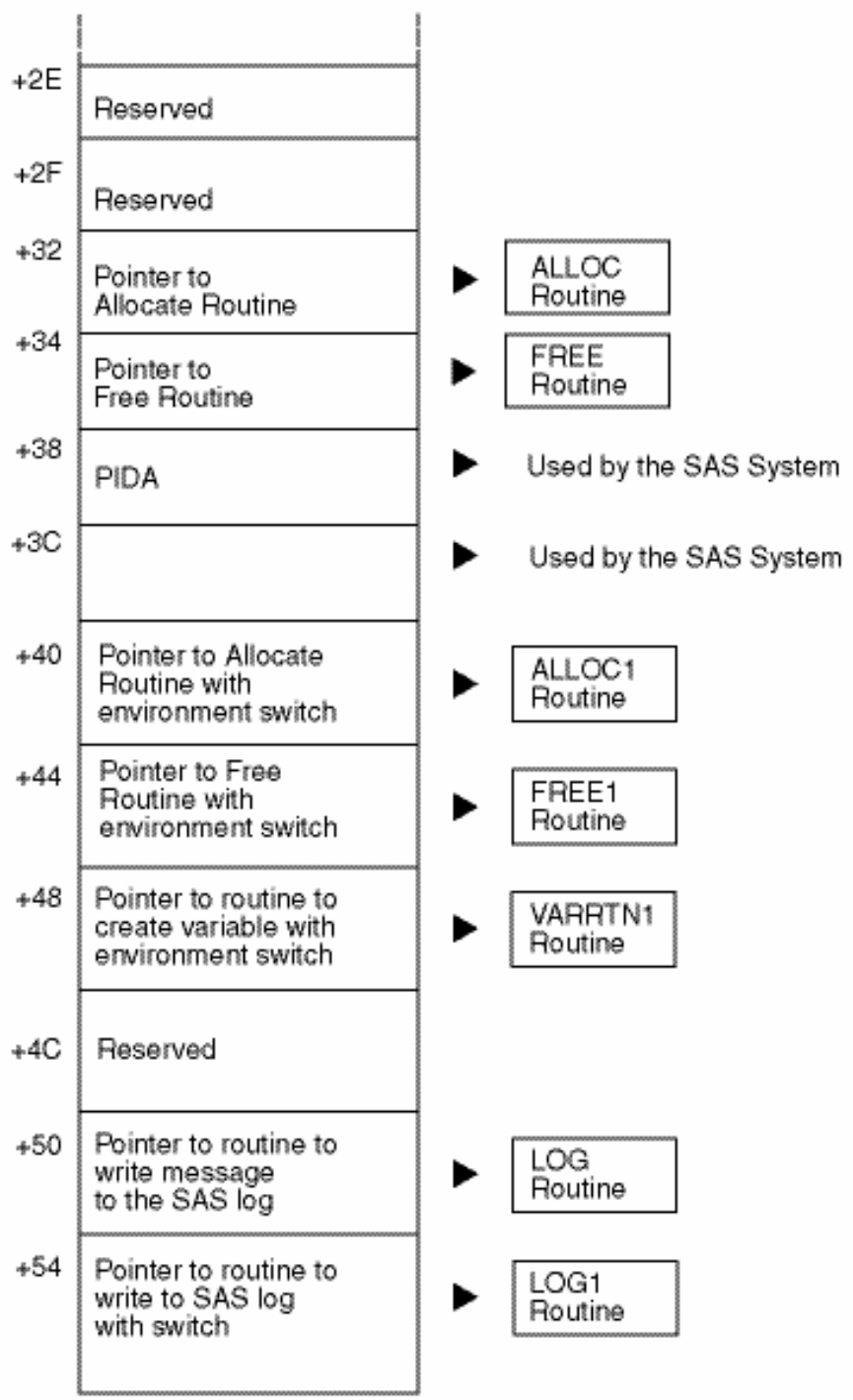


***Figure 20.3*** *UEBCB Structure, Part 2 of 2*




The Flag Byte 1 field can have one of several values. The following list gives the values and their meanings:

'80'x EX_NEXT
Prompt the exit for the next record.

'40'x EX_DEL
Ignore the current record.

'20'x EX_EOF
End-of-file has been reached.

'10'x EX_EOFC
This exit supports read and write calls after end-of-file has been reached.

'08'x EX_ALC
This exit uses the ALLOC and FREE routines.

'04'x EX_STOR
This exit supports stored programs and views.

# Function Descriptions

## Introduction to Function Descriptions

The following sections provide the information that you need in order to write the functions that are part of the user exit module.

## Initialization Function

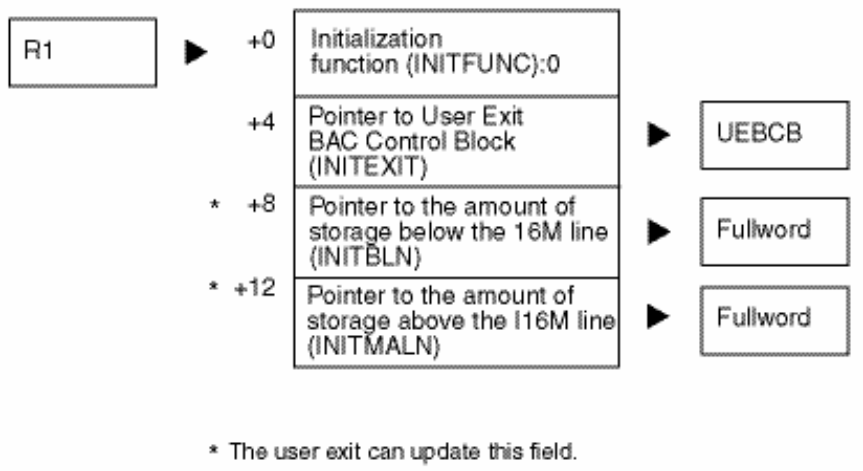
SAS calls the Initialization function before it calls any of the other functions. In the Initialization function, you specify the amount of virtual memory that your routine needs above and below the 16-megabyte address line. You store the length of the work area that you need above the line in the fullword that is pointed to by the INITMALN field of the Initialization FRCB. You store the length of the work area that you need below the line in the fullword that is pointed to by the INITMBLN field of the Initialization FRCB. All pointers in the Initialization FRCB point to valid data areas.

In the amount of storage that you request, you should include space for a Local Register Save Area (LRSA) of 72 bytes. You must also include any other work areas that your Parse Options function and Open function needs.

SAS allocates the memory that you request when it returns from this function, and it stores pointers to the allocated memory in the UEBCB. The pointer to the memory that was allocated above the line is stored in the MEMABV field of the UEBCB. The pointer to the memory that was allocated below the line is stored in the MEMBEL field.

The following figure illustrates the Initialization FRCB structure and its relationship with other control blocks:

*Figure 20.4* Initialization FRCB




# Parse Options Function

In the Parse Options function, you validate both the name of the user exit and any INFILE or FILE statement options that SAS does not recognize. SAS calls this function once to process the user exit module name. SAS then calls the function for each statement option that it does not recognize so that the function can process each option and value string.

You can use two types of statement options in your user exit:

- options that take a value, such as *name=value*. For example:

  ```
  myopt=ABC
  ```

  Note that quotation marks are considered part of the value. If you want them to be stripped off, then you must provide the code to do so.

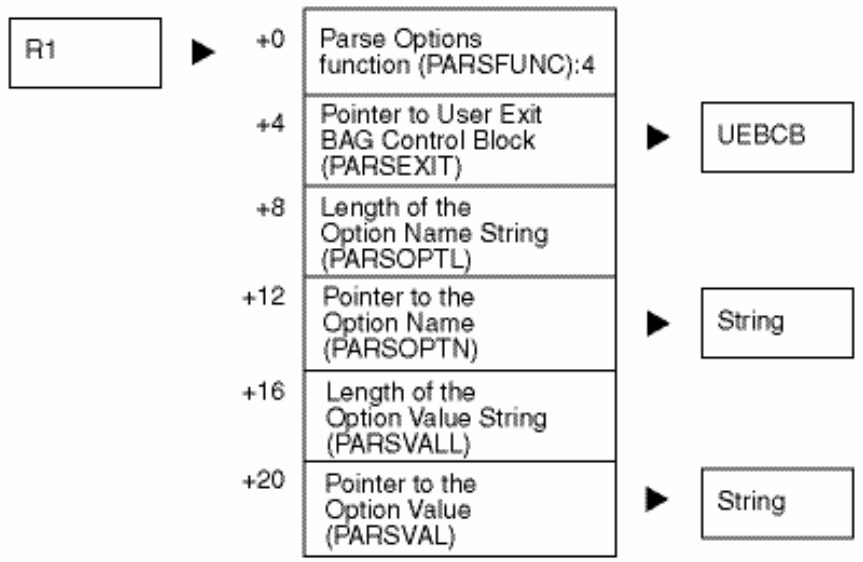
- options that do not take a value.

The first time the Parse Options function is invoked, it should do the following:

- verify that the virtual storage that was requested during the Initialization function has been allocated
- initialize both the allocated virtual storage and the two data areas in the UEBCB (User Word and Pointer to User Error Message).

The following figure illustrates the Parse Options FRCB structure and its relationship to other control blocks:

*Figure 20.5* Parse Options FRCB



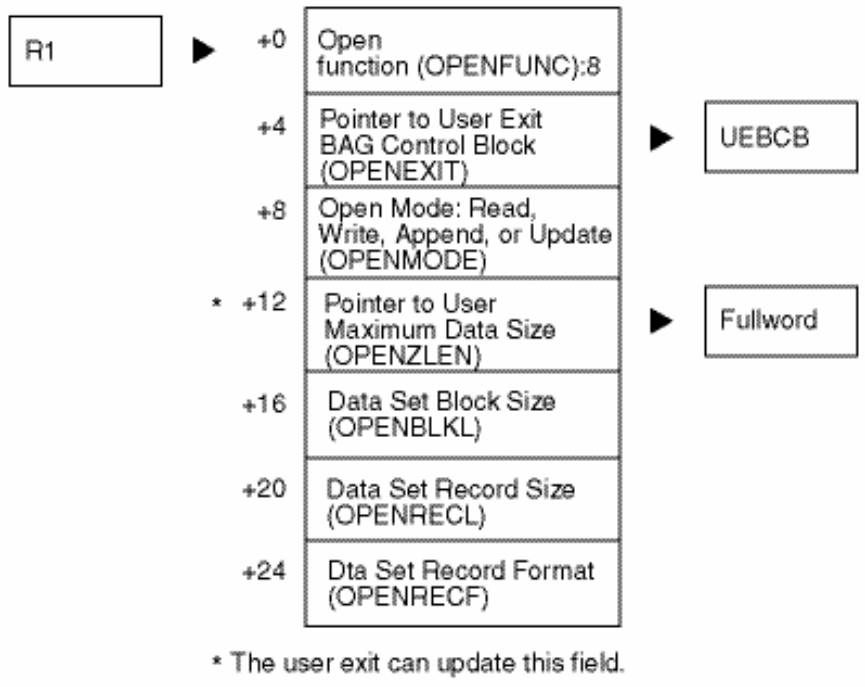

When the Parse Options function receives control, PARSOPTL is set to the length of the option name, and the address of the option name is stored in PARSOPTN. For options that take a value, PARSVALL is set to the length of the value, and the address of the option value is stored in PARSVAL. For options that do not take a value, both PARSVALL and PARSVAL are set to 0.

If an invalid option name or option value is detected, R15 should be set to a return code value of 8.

# Open Function

SAS invokes the Open function after INFILE or FILE statement processing opens the associated data set. The following figure illustrates the Open FRCB and its relationship to other control blocks:

*Figure 20.6* Open FRCB




The OPENMODE field can be one of the following values:

1
: The data set is opened for input mode.

2
: The data set is opened for output mode.

4
: The data set is opened for Append mode.

8
: The data set is opened for Update mode (read and write).

When this function receives control, the Pointer to User Maximum Data Size field (OPENZLEN) points to a fullword that contains the Data Set Record Size. In this function, set the pointer so that it points to a fullword that you initialize. The fullword should contain the size of the largest record that you expect to process with the Read function. If it contains a lesser value, then truncated records might be passed to the Read function.

The **Data Set Record Format** field (OPENRECF) can be any combination of the following values:

'C0'x
: indicates Undefined format.

'80'x
: indicates Fixed format.

'40'x
: indicates Variable format.

'10'x
indicates Blocked format.

'08'x
indicates Spanned format.

'04'x
indicates ASA Control Characters format.

The Open function should activate any subprocesses or exits and should solicit from them any virtual storage requirements.

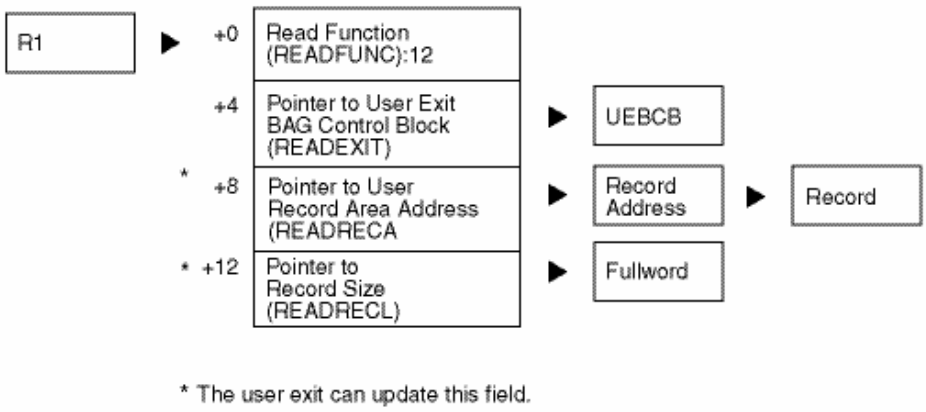
In this function, if you turn on the EX_NEXT flag in the UEBCB, then SAS calls the Read function for the first record before it reads any records from the file itself.

If you use any SAS service routines (such as the ALLOC and FREE routines) in this function, then you must set the EX_ALC flag in the UEBCB.

# Read Function

SAS invokes the Read function during execution of the INPUT statement to obtain the next input record. The following figure illustrates the Read FRCB structure and its relationship to other control blocks:

***Figure 20.7*** *Read FRCB*




When the Read function receives control, the READRECA field (or Pointer to User Record Area Address) points to the address of the current record from the file. The READRECL field points to a fullword that contains the length of the record that is in the Record Area.

In this function, you can change the Record Address so that it points to a record that was defined by your user exit. If you make this change, then SAS passes your record to the INPUT statement, rather than passing the record that was read from the file. However, in this case you must also update the fullword that the Pointer to Record Size points to. It must equal the actual size of the record that the Record Address points to.

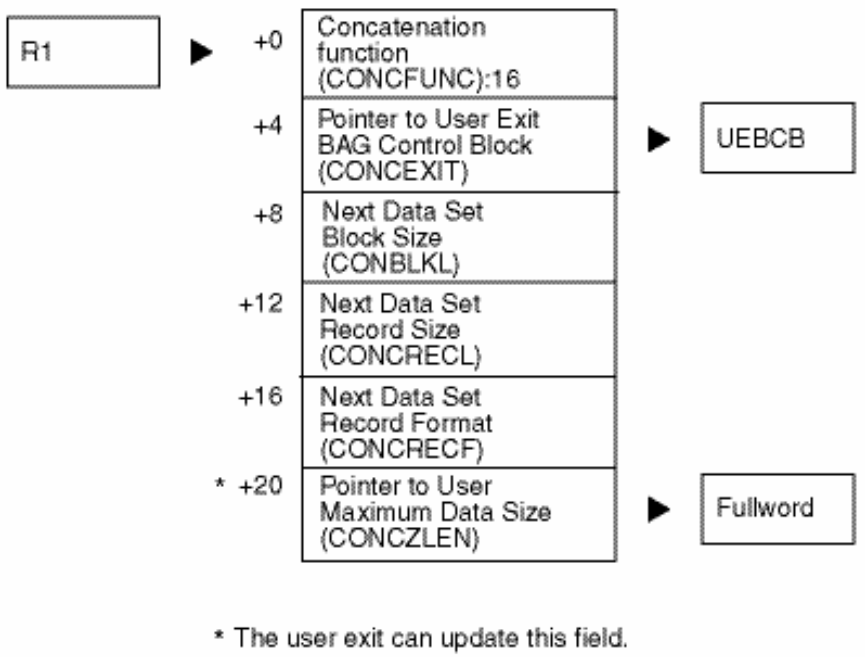
As long as the EX_NEXT flag is on, SAS invokes the Read function to obtain the next record. SAS reads no records from the file itself until you turn off the EX_NEXT flag.

If you set the EX_DEL flag, then SAS ignores the current record, and processing continues to the next record.

# Concatenation Function

SAS invokes the Concatenation function whenever a data set in a concatenation of data sets has reached an end-of-file condition and the next data set has been opened. The following figure illustrates the Concatenation FRCB structure and its relationship to other control blocks:

***Figure 20.8*** *Concatenation FRCB*

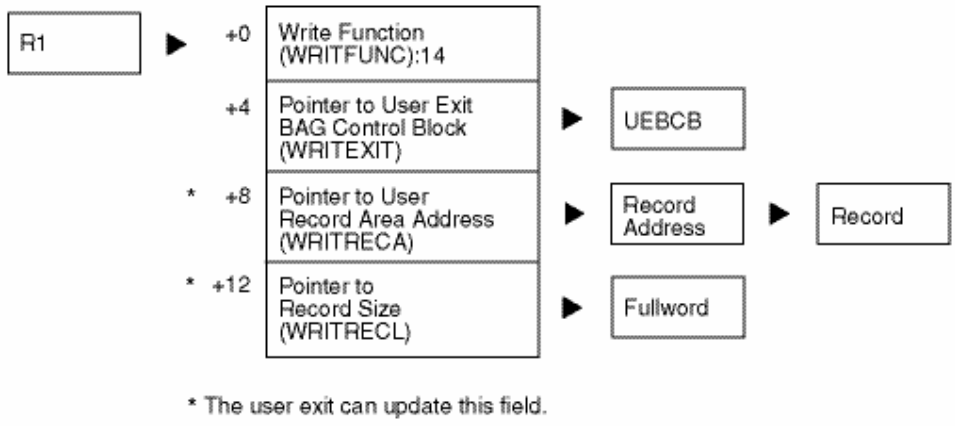



In this function, you can modify the maximum data size for the next data set by changing the Pointer to User Maximum Data Size so that it points to a fullword that you initialize.

# Write Function

SAS invokes the Write function during the execution of the PUT statement whenever a new record must be written to the file. The following figure illustrates the Write FRCB and its relationship to other control blocks:

*Figure 20.9* Write FRCB




When the Write function receives control, the WRITRECA field (or Pointer to User Record Area Address) points to a Record Address. The Record buffer is allocated by SAS and contains the record that was created by the PUT statement.

In this function, you can change the Record Address so that it points to a record that is defined by your user exit. If you make this change, then SAS writes your record to the file, instead of writing the record that was created by the PUT statement. However, in this case you must also update the fullword that the Pointer to Record Size points to. It must equal the actual size of the record that the Pointer to Record Area points to.

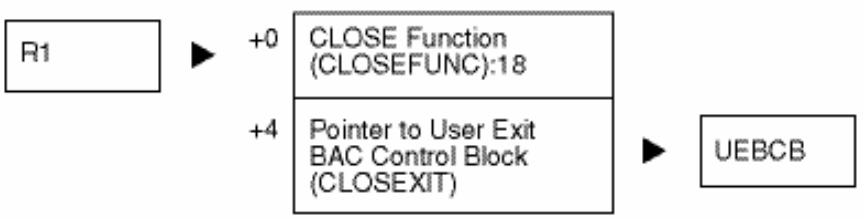
In the Write function, you can also change the setting of flags in the UEBCB. As long as the EX_NEXT bit in the UEBCB is on, SAS calls the Write function to write the next output record. The DATA step is not prompted for any new records to write until the EX_NEXT flag has been set. At any time, if the EX_DEL bit in the UEBCB is on, SAS ignores the current record, and processing continues to the next record.

# Close Function

SAS invokes the Close function after it closes the associated data set. In this function, you should close any files that you opened, free any resources that you obtained, and terminate all subprocesses or exits that your user exit initiated.

The following figure illustrates the Close FRCB structure and its relationship to other control blocks:

*Figure 20.10* Close FRCB



# SAS Service Routines

SAS provides four service routines that you can use when writing INFILE/FILE user exits. These service routines allocate memory, free memory, access DATA step variables, or write a message to the SAS log. Whenever possible, use the SAS service routines instead of the routines that are supplied with z/OS. For example, use the ALLOC SAS service routine instead of GETMAIN. When you use the ALLOC routine, SAS frees memory when you are finished with it. By contrast, if you use the GETMAIN routine, cleaning up memory is your responsibility, so you also have to use the FREEMAIN routine.

The following list describes the four SAS service routines. You invoke one of these routines by loading its address from the appropriate field in the UEBCB and then branching to it. All of these routines are used in the "Sample Program" on page 339.

ALLOC routine
: allocates an area of memory from within the SAS memory pool. This memory is automatically freed when the Close function is processed. The ALLOC routine takes the following parameters:

  ALCEXIT
  : a pointer to the UEBCB.

  ALCPTR
  : a pointer to a fullword in which the allocated area address is stored.

  ALCLEN
  : the amount of memory required.

  ALCFLG
  : a flag byte that controls whether the memory is allocated above or below the 16M line. It has the following values:

***Table 20.1*** *Values of the Flag Byte*

| Value | Description |
|---|---|
| 1 | allocates the memory below the 16M line. |
| 0 | allocates the memory above the 16M line. |

FREE routine
: frees an area of memory that was previously allocated by a call to the ALLOC routine. The FREE routine takes the following parameters:

  FREEXIT
  : a pointer to the UEBCB.

FREPTR
a pointer to the area to be freed.

FREFLG
a flag byte that indicates whether the memory that is to be freed is above or below the 16M line. It has the following values:

***Table 20.2*** *Values of the Flag Byte*

| Value | Description |
|---|---|
| 1 | the memory below the 16M line. |
| 0 | the memory above the 16M line. |

LOG routine
prints a message to the SAS log. The LOG routine takes the following parameter:

LOGSTR
a pointer to a character expression that ends with a null (x'00').

VARRTN routine
defines or gets access to a SAS DATA step variable. The VARRTN routine takes the following parameters:

VARNAME
a pointer to the name of the variable.

VARNAMEL
the length of the variable name.

VARTYPE
the type of variable that is being defined. It takes the following values:

***Table 20.3*** *Values of the Flag Byte*

| Value | Description |
|---|---|
| 1 | the variable is numeric (double precision). |
| 2 | the variable is character. |

VARSIZE
the size of the variable, if the variable type is character.

VARFLAG
a flag byte that controls whether the variable is considered internal or external. It takes the following values:

*Table 20.4* *Values of the Flag Byte*

| Value | Description |
|---|---|
| X'01 | the variable is an internal variable; it does not appear in any output data set. |
| X'02 | >the variable is an external variable; it does appear in the output data set. |

VARADDR
: a pointer to a fullword into which SAS places the address at which the current value of the variable is stored. For numeric variables, the value is stored as a double precision value. For character variables, the stored value consists of three components:

*Table 20.5* *Pointer Descriptions*

| Pointer | Description |
|---|---|
| MAXLEN | is 2 bytes and represents the maximum length of the character variable. |
| CURLEN | is 2 bytes and represents the current length of the character variable. |
| ADDR | is 4 bytes and is a pointer to the character variable string data. |

Here are the return codes for the VARRTN routine:

*Table 20.6* *Return Code Descriptions*

| Return Code | Description |
|---|---|
| 0 | the routine was successful (the variable was created or accessed). |
| 1 | the variable already exists as a different type. |
| 2 | the variable already exists as a character variable, but with a shorter length. |
| 3 | the variable already exists. |

SAS provides two versions of the four service routines that are described in this section. The versions of the routines can be used from a SAS/C environment. Here are the service routines:

- Assembler language programs that conform to the SAS/C standard, such as the example in "Sample Program" on page 339
- ALLOC1, FREE1, LOG1, and VARRTN1

These routines contain extra logic to reestablish the SAS/C environment when the exit does not conform to this standard. If R12 is modified by the user exit, or by the run-time library for the language that the user exit is written in, then you must use this set of functions.

# Building Your User Exit Module

After you have coded your user exit module, you must assemble or compile it and then link it into a load library. The name that you choose for your load module must consist of a four-character prefix, followed by the letters IFUE. Do not use a prefix that is the same as the name of a FILE or INFILE statement option.

After your load module is built, use the LOAD parameter of the SAS CLIST, SASRX exec, or cataloged procedure when you invoke SAS. It specifies to SAS the name of the load library that contains your user exit module.

# Activating an INFILE/FILE User Exit

To activate an INFILE/FILE user exit, you generally specify the first four characters of the name of the user exit module following the ddname or data set name in an INFILE or FILE statement. For example:

```
infile inputdd abcd;
```

Only the first four characters of the user exit module name in the INFILE or FILE statement are significant; SAS forms the load module name by adding the constant IFUE to these characters. Therefore, in the previous example, SAS loads a module named ABCDIFUE.

You can also specify the name of the user exit module by using the ENGINE= option in the FILENAME statement or FILENAME function.

**Note:** If you use an INFILE/FILE user exit with a DATA step view, then specify the name of the exit in the FILENAME statement or FILENAME function that you use to allocate the file, instead of in the INFILE or FILE statement. (If you specify the exit name in an INFILE or FILE statement, the exit is ignored when the view is executed.) For example:

```
filename inputdd 'my.user.exit' abcd;
```

# Sample Program

The following sample program illustrates the process of writing an INFILE/FILE user exit. Notice that this program is not trivial. Writing user exits requires a firm understanding of register manipulation and other fairly advanced programming techniques.

The example uses z/OS services to compress data. The data is compressed on output and decompressed on input.

**Note:** This code is actually implemented in SAS, to support the CSRC option in the INFILE and FILE statements. The CSRC option is described in "Standard Host Options for the FILE Statement under z/OS" on page 608 and in "Standard Options for the INFILE Statement under z/OS" on page 650.

The example consists of several assembly macros, followed by the assembly language program itself. The macros define how the parameter lists are to be interpreted. Each macro begins with a MACRO statement and ends with a MEND statement. The actual program begins on the line that reads `SASCSRC START`. Here is the example:

```
TITLE 'INFILE/FILE USER EXIT TO COMPRESS DATA USING ESA SERVICES'
*-------------------------------------------------------------------------
* COPYRIGHT (C) 2002 - 2012 BY SAS INSTITUTE INC., CARY, NC 27513 USA
*
* NAME:      ==> SASCSRC
* TYPE:      ==> EXTERNAL FILE USER EXIT
* LANGUAGE:  ==> ASM
* PURPOSE:   ==> TO COMPRESS/DECOMPRESS DATA USING CSRCESRV SERVICES
* USAGE:     ==> DATA;INFILE MYFILE CSRC;INPUT;RUN;
*-------------------------------------------------------------------------
* - - - - - - - - - -
         MACRO
*-------------------------------------------------------------------------
* COPYRIGHT (C) 2002 - 2012 BY SAS INSTITUTE INC., CARY, NC 27513 USA
*
*  NAME      ==> VXEXIT
*  PURPOSE   ==> DSECT MAPPING OF INFILE EXIT TABLE
*-------------------------------------------------------------------------
        VXEXIT
*-----------------------------------------------------------------
* MAP OF USER EXIT HOST BAG
*-----------------------------------------------------------------
VXEXIT   DSECT
         SPACE 1
*-----------------------------------------------------------------
* THE FOLLOWING FIELDS MUST NOT BE CHANGED BY THE EXIT ROUTINE
* EXCEPT USERWORD
*-----------------------------------------------------------------
```

```
EXITIDB  DS    A
EXITEP   DS    A
MEMALEN  DS    F               LENGTH OF WORK AREA ABOVE 16M LINE
MEMABV   DS    A               POINTER TO WORK AREA ABOVE 16M LINE
MEMBLEN  DS    F               LENGTH OF WORK AREA BELOW 16M LINE
MEMBEL   DS    A               POINTER TO WORK AREA BELOW 16M LINE
USERWORD DS    A    (USER UPD) WORD AVAILABLE TO EXIT
EDDNAME  DS    CL8             LOGICAL NAME OF THE FILE
VARRTN   DS    A               SAS VARIABLE CREATING ROUTINE ADDRESS
ERRMSG   DS    A    (USER UPD) NULL TERMINATED ERROR MESSAGE POINTER
EFLAG1   DS    XL1  (USER UPD) FLAG BYTE-1
EX_NEXT  EQU   X'80'           GET NEXT RECORD FROM EXIT
EX_DEL   EQU   X'40'           DELETE THIS RECORD
EX_EOF   EQU   X'20'           EOF OF DATASET REACHED
EX_EOFC  EQU   X'10'           CALL USER EXIT AFTER EOF
EX_ALC   EQU   X'08'           WILL USE ALLOC/FREE ROUTINES
EX_STOR  EQU   X'04'           WILL SUPPORT STORED PROGRAMS
EX_TERM  EQU   X'02'           WILL NEED A TERMINAL CALL
EFLAG2   DS    XL1             FLAG BYTE-2
EFLAG3   DS    XL1             FLAG BYTE-3
EFLAG4   DS    XL1             FLAG BYTE-4
ALLOC    DS    A               ALLOC ROUTINE
FREE     DS    A               FREE ROUTINE
PIDA     DS    F               PID ABOVE
PIDB     DS    F               PID BELOW
ALLOC1   DS    A               ALLOCATE ROUTINE WITH SWITCH
FREE1    DS    A               FREE ROUTINE WITH SWITCH
VARRTN1  DS    A               SAS VARIABLE CREATING ROUTINE WITH SWITCH
VXCRAB   DS    A               CRAB ADDRESS
LOG      DS    A               LOG ROUTINE WITHOUT SWITCH
LOG1     DS    A               LOG ROUTINE WITH SWITCH
         SPACE 1
         DS    0D
         SPACE 1
VXEXITL  EQU   *-VXEXIT
*-------------------------------------------------------------------
* MAP OF VARRTN FUNCTION CALL
*-------------------------------------------------------------------
PARMVAR  DSECT
*
VARNAME  DS    A                POINTER TO VARIABLE NAME
VARNAMEL DS    F                VARIABLE NAME LENGTH
VARTYPE  DS    F                VARIABLE TYPE 1=NUM, 2=CHAR
VARSIZE  DS    F                SIZE OF VARIABLE IF CHAR
VARFLAG  DS    F                FLAGS , X'01' - INTERNAL
*                                      X'02' - EXTERNAL
VARADDR  DS    A                POINTER TO VAR LOC ADDRESS (RETURNED)
*
* FOR CHARACTER VARIABLE IT RETURNS A POINTER TO A STRING STRUCTURE
*
* MAXLEN DS    H                MAX LENGTH OF STRING
* CURLEN DS    H                CURRENT LENGTH OF STRING
* ADDR   DS    A                ADDRESS OF STRING DATA
PARMVARL EQU   *-PARMVAR
*-------------------------------------------------------------------
* MAP OF ALLOC FUNCTION CALL
```

```
*-------------------------------------------------------------------
PARMALC  DSECT
*
ALCEXIT  DS    A                POINTER TO THE EXIT BAG
ALCPTR   DS    A                PLACE TO RETURN ALLOCATED ADDRESS
ALCLEN   DS    F                LENGTH OF MEMORY REQUIRED
ALCFLG   DS    F                FLAG BYTE  1=BELOW 16M, 0=ABOVE 16M
PARMALCL EQU   *-PARMALC
*-------------------------------------------------------------------
* MAP OF FREE FUNCTION CALL
*-------------------------------------------------------------------
PARMFRE  DSECT
*
FREEXIT  DS    A                POINTER TO THE EXIT BAG
FREPTR   DS    A                ADDRESS OF FREEMAIN
FREFLG   DS    F                FLAG BYTE  1=BELOW 16M, 0=ABOVE 16M
PARMFREL EQU   *-PARMFRE
*-------------------------------------------------------------------
* MAP OF INIT EXIT CALL
*-------------------------------------------------------------------
PARMINIT DSECT
*
INITFUNC DS    F                FUNCTION CODE
INITEXIT DS    A                USER EXIT BAG ADDRESS
INITMBLN DS    A                PTR TO AMT OF MEMORY NEEDED BELOW LINE
INITMALN DS    A                PTR TO AMT OF MEMORY NEEDED ABOVE LINE
PARMINIL EQU   *-PARMINIT
*-------------------------------------------------------------------
* MAP OF PARSE EXIT CALL
*-------------------------------------------------------------------
PARMPARS DSECT
*
PARSFUNC DS    F                FUNCTION CODE
PARSEXIT DS    A                USER EXIT BAG ADDRESS
PARSOPTL DS    F                OPTION NAME LENGTH
PARSOPTN DS    A                POINTER TO OPTION NAME
PARSVALL DS    F                OPTION VALUE LENGTH
PARSVAL  DS    A                OPTION VALUE
PARMPARL EQU   *-PARMPARS
*-------------------------------------------------------------------
* MAP OF OPEN EXIT CALL
*-------------------------------------------------------------------
PARMOPEN DSECT
*
OPENFUNC DS    F                FUNCTION CODE
OPENEXIT DS    A                USER EXIT BAG ADDRESS
OPENMODE DS    F                OPEN MODE
OPENZLEN DS    A                POINTER TO DATA LENGTH
OPENBLKL DS    F                DATA SET BLOCK SIZE
OPENRECL DS    F                DATA SET RECORD LENGTH
OPENRECF DS    F                DATA SET RECORD FORMAT
PARMOPEL EQU   *-PARMOPEN
*-------------------------------------------------------------------
* MAP OF READ EXIT CALL
*-------------------------------------------------------------------
PARMREAD DSECT
```

```
*
READFUNC DS    F                FUNCTION CODE
READEXIT DS    A                USER EXIT BAG ADDRESS
READRECA DS    A                POINTER TO RECORD AREA ADDRESS
READRECL DS    A                POINTER TO RECORD LENGTH
PARMREAL EQU   *-PARMREAD
*-------------------------------------------------------------------
* MAP OF WRITE EXIT CALL
*-------------------------------------------------------------------
PARMWRIT DSECT
*
WRITFUNC DS    F                FUNCTION CODE
WRITEXIT DS    A                USER EXIT BAG ADDRESS
WRITRECA DS    A                POINTER TO RECORD AREA ADDRESS
WRITRECL DS    F                RECORD LENGTH
PARMWRIL EQU   *-PARMWRIT
*-------------------------------------------------------------------
* MAP OF CLOSE EXIT CALL
*-------------------------------------------------------------------
PARMCLOS DSECT
*
CLOSFUNC DS    F                FUNCTION CODE
CLOSEXIT DS    A                USER EXIT BAG ADDRESS
PARMCLOL EQU   *-PARMCLOS
*-------------------------------------------------------------------
* MAP OF CONCAT EXIT CALL
*-------------------------------------------------------------------
PARMCONC DSECT
*
CONCFUNC DS    F                FUNCTION CODE
CONCEXIT DS    A                USER EXIT BAG ADDRESS
CONCBLKL DS    F                NEXT DATA SET IN CONCAT BLOCK SIZE
CONCRECL DS    F                NEXT DATA SET IN CONCAT RECORD LENGTH
CONCRECF DS    F                NEXT DATA SET IN CONCAT RECORD FORMAT
CONCZLEN DS    A                POINTER TO DATA LENGTH
PARMCONL EQU   *-PARMCONC
*
*-------------------------------------------------------------------
* MAP OF LOG ROUTINE PARMLIST
*-------------------------------------------------------------------
PARMLOG  DSECT
LOGSTR   DS    A                ADDRESS OF THE NULL-TERMINATED STRING
PARMLOGL EQU   *-PARMLOG
*
*-------------------------------------------------------------------
* EQUATES AND CONSTANTS
*-------------------------------------------------------------------
EXITPARS EQU   4
EXITOPEN EQU   8
EXITREAD EQU   12
EXITCONC EQU   16
EXITWRIT EQU   20
EXITCLOS EQU   24
EXITP2HB EQU   28   NOT SUPPORTED YET
EXITHB2P EQU   32   NOT SUPPORTED YET
*
```

```
*  EXITMODE     VALUES
EXITINP  EQU   1
EXITOUT  EQU   2
EXITAPP  EQU   4
EXITUPD  EQU   8
*  RECFM        VALUES
EXITRECF EQU   X'80'
EXITRECV EQU   X'40'
EXITRECB EQU   X'10'
EXITRECS EQU   X'08'
EXITRECA EQU   X'04'
EXITRECU EQU   X'C0'
&SYSECT  CSECT
         MEND
         DS    OD
VXEXITL  EQU   *-VXEXIT
         SPACE 1
         MACRO
&LBL     VXENTER &DSA=,&WORKAREA=MEMABV,&VXEXIT=R10
         DROP
&LBL     CSECT
         USING &LBL,R11
         LR    R11,R15                 LOAD PROGRAM BASE
         USING VXEXIT,&VXEXIT
         L     &VXEXIT,4(,R1)          LOAD -> VXEXIT STRUCTURE
         AIF   ('&DSA' EQ 'NO').NODSA
         AIF   ('&DSA' EQ '').NODSA
         L     R15,&WORKAREA           LOAD -> DSA FROM VXEXIT
         ST    R15,8(,R13)             SET FORWARD CHAIN
         ST    R13,4(,R15)             SET BACKWARD CHAIN
         LR    R13,R15                 SET NEW DSA
         USING &DSA,R13
.NODSA   ANOP
         MEND
* - - - - - - - - - -
         MACRO
&LBL     VXRETURN &DSA=
         AIF   ('&LBL' EQ '').NOLBL
&LBL     DS    0H
.NOLBL   AIF   ('&DSA' EQ 'NO').NODSA
         L     R13,4(,R13)             LOAD PREVIOUS DSA
.NODSA   ANOP
         ST    R15,16(,R13)            SAVE RETURN CODE
         LM    R14,R12,12(R13)         RELOAD REGS
         BR    R14                     RETURN
         LTORG
         MEND
* - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
* - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
SASCSRC  START
*
* MAIN ENTRY POINT FOR ALL EXITS
*
         USING SASCSRC,R15
         STM   R14,R12,12(R13)
         L     R2,0(,R1)               LOAD FUNCTION CODE
```

```
         L     R15,CSRCFUNC(R2)        LOAD FUNCTION ADDRESS
         BR    R15
*
CSRCFUNC DS    0A                      CSRC FUNCTIONS
         DC    A(CSRCINIT)                  INITIALIZATION
         DC    A(CSRCPARS)                  PARSE CSRC OPTIONS
         DC    A(CSRCOPEN)                  OPEN EXIT
         DC    A(CSRCREAD)                  READ EXIT
         DC    A(CSRCCNCT)                  CONCATENATION BOUNDARY EXIT
         DC    A(CSRCWRIT)                  WRITE EXIT
         DC    A(CSRCCLOS)                  CLOSE EXIT
*
* INITIALIZATION EXIT
*
CSRCINIT VXENTER DSA=NO
         SPACE 1
         USING PARMINIT,R1
*
* THIS EXIT RUNS ONLY IN ESA AND ABOVE RELEASES
* WHICH SUPPORT DECOMPRESSION.
* THE CODE CHECKS FOR IT FIRST. IF NOT ESA, THE INIT FAILS
*
         L     R15,16                  LOAD CVT POINTER
         USING CVT,R15                 BASE FOR CVT MAPPING
         TM    CVTDCB,CVTOSEXT         EXTENSION PRESENT
         BNO   NOTESA                  FAIL, NOT ESA
         TM    CVTOSLV0,CVTXAX         SUPPORTS ESA
         BNO   NOTESA                  NOT AN ESA
         DROP  R15
         L     R3,=A(PWALENL)          SET WORK AREA LENGTH...
         L     R2,INITMALN
         ST    R3,0(,R2)               AS ABOVE THE 16M LINE LENGTH
         SLR   R15,R15                 GOOD RC
         XC    EFLAG1,EFLAG1           CLEAR
         OI    EFLAG1,EX_ALC           WILL USE ALLOC/FREE ROUTINES
         B     INITX                   RETURN
NOTESA   DS    0H
         LA    R15,BADOS
         ST    R15,ERRMSG              SAVE ERROR MESSAGE
INITX    DS    0H
         SPACE 1
         VXRETURN DSA=NO
BADOS    DC C'THIS SUPPORT IS NOT AVAILABLE IN THIS ENVIRONMENT'
         DC XL1'00'
*
*  PARSE EXIT
*
CSRCPARS VXENTER DSA=PWA
         USING PARMPARS,R4
         LR    R4,R1                   R4 IS PARMLIST BASE
         SPACE 1
         L     R6,PARSOPTL             R6 = OPTION NAME LENGTH
         LTR   R6,R6                   IF 0
         BZ    PARSR                      RETURN OK
         LA    R15,4                   SET BAD OPTION RC
         L     R7,PARSOPTN             R7 -> OPTION NAME
```

```
         L     R8,PARSVALL             R8 = OPTION VALUE LENGTH
         L     R9,PARSVAL              R9 -> OPTION VALUE (VAR NAME)
         SPACE 1
*-------------------------------------------*
* OPTION ACCEPTED IS:                       *
*    CSRC   RECL=                           *
*-------------------------------------------*
         C     R6,=F'4'                IF LENGTH NOT 4
*        BNE   PARSX                   RETURN WITH ERROR
         LTR   R8,R8                   IS IT =
         BNZ   PARSRECL                THEN CHECK FOR RECL=
         CLC   0(4,R7),=CL4'CSRC'      IF NOT 'CSRC'
         BNE   PARSX                   RETURN WITH ERROR
         B     PARSR                    ELSE RETURN OK
*-------------------------------------------*
* PARSE RECL=NUM                            *
*-------------------------------------------*
PARSRECL DS    0H
         CLC   0(4,R7),=CL4'RECL'      IF NOT 'RECL'
         BNE   PARSX                   RETURN WITH ERROR
         CH    R8,=H'16'               GREATER THAN 16
         BNL   PARSX                   INVALID VALUE
         BCTR  R8,0                    MINUS 1 FOR EXECUTE
         XC    TEMP,TEMP               CLEAR
         EX    R8,CONNUM               CONVERT TO NUMBER
*CONNUM  PACK  TEMP(0),0(R9)
         CVB   R0,TEMP                 CONVERT TO BINARY
         ST    R0,RECL                 SAVE RECL
         SPACE 1
PARSR    SLR   R15,R15                 RETURN OK
         SPACE 1
PARSX    VXRETURN DSA=PWA
CONNUM   PACK  TEMP(8),0(0,R9)           *** EXECUTE ****
*
* OPEN EXIT
*
CSRCOPEN VXENTER DSA=PWA
         USING PARMOPEN,R1
         SPACE 1
         LA    R15,NOINPUT             SET -> NO INPUT ERROR MESSAGE
         L     R4,RECL                 LOAD USER RECLEN
         LTR   R4,R4                   HAS IT BEEN SET?
         BNZ   *+8
         LH    R4,=Y(32676)            SET LRECL=32K BY DEFAULT
         SPACE 1
         LA    R15,DLENBIG             SET -> DATALENGTH TOO BIG MESSAGE
         L     R2,OPENZLEN
         L     R3,0(,R2)               R3 = DATA LENGTH OF EACH RECORD
         CR    R3,R4                   IF GREATER THAN CSRC MAXIMUM
         BH    OPENX                      RETURN ERROR
         SPACE 1
         ST    R4,0(,R2)               RETURN LENGTH TO THE SAS SYSTEM
         ST    R4,RECL                 SAVE LENGTH
*
* ALLOCATION OF BUFFER FOR INPUT RECORDS
*
```

```
         LA    R1,PARM                 POINT TO PARMAREA
         XC    PARM,PARM               CLEAR
         USING PARMALC,R1
         ST    R10,ALCEXIT             COPY HOST BAG POINTER
         LA    R15,MEMADDR
         ST    R15,ALCPTR              PLACE TO RETURN MEM ADDRESS
         ST    R4,ALCLEN               LENGTH OF MEMORY NEEDED
         L     R15,ALLOC               LOAD MEMORY ALLOCATE ROUTINE
         BALR  R14,R15                 ALLOCATION OF MEMORY
         LTR   R15,R15                 WAS MEMORY ALLOCATED?
         BNZ   OPENMEM                 IF NOT, OPERATION FAILS
*
* QUERY THE COMPRESS SERVICE
*
         LA    R0,1                    USE RUN LENGTH ENCODING
         CSRCESRV SERVICE=QUERY        QUERY IT
         LTR   R15,R15                 EVERYTHING OK
         BNZ   OPENERR                 IF NOT, FAIL WITH MESSAGE
         LTR   R1,R1                   REQUIRE WORK AREA
         BZ    OPENX                   IF NOT, END
         LR    R0,R1                   SAVE R1
         LA    R1,PARM                 POINT TO PARMLIST
         LA    R15,MEMWK               ALLOCATE WORK AREA
         ST    R15,ALCPTR              PLACE TO RETURN MEM ADDRESS
         ST    R0,ALCLEN               LENGTH OF MEMORY NEEDED
         L     R15,ALLOC               LOAD MEMORY ALLOCATE ROUTINE
         BALR  R14,R15                 ALLOCATION OF MEMORY
         LTR   R15,R15                 WAS MEMORY ALLOCATED?
         BNZ   OPENMEM                 IF NOT, OPERATION FAILS
         B     OPENX                   RETURN, OPERATION IS DONE
OPENERR  DS    0H
         XC    TEMP,TEMP               CONVERT RC TO DECIMAL
         CVD   R15,TEMP                CONVERT TO DECIMAL
         MVC   MSG(BADESRVL),BADESRV   MOVE IN SKELETON
         UNPK  MSG+BADESRVL-3(2),TEMP  UNPACK
         OI    MSG+BADESRVL-2,X'F0'    MAKE IT PRINTABLE
         LA    R15,MSG                 SET MESSAGE
         ST    R15,ERRMSG              SET -> ERROR MESSAGE, IF ANY
         LA    R15,8
         B     OPENX
OPENMEM  DS    0H
         LA    R15,NOMEMORY
         SPACE 1
OPENX    DS    0H
         ST    R15,ERRMSG              SET -> ERROR MESSAGE, IF ANY
*                                      R15 = EITHER 0 OR NONZERO
         VXRETURN DSA=PWA
*
NOINPUT  DC   C'CSRC: DECOMPRESS DOES NOT SUPPORT OUTPUT'
         DC   XL1'00'
NOFIXED  DC   C'CSRC: DECOMPRESS DOES NOT SUPPORT FIXED LENGTH RECORDS'
         DC   XL1'00'
DLENBIG  DC   C'DATASET DATALENGTH > CSRC MAXIMUM'
         DC   XL1'00'
NOMEMORY DC   C'CSRC: UNABLE TO OBTAIN MEMORY'
         DC    XL1'00'
```

```
BADESRV  DC    C'CSRC: NON ZERO RETURN CODE FROM QUERY, RC = '
BADESRVN DC    H'0'
         DC    XL1'00'
BADESRVL EQU   *-BADESRV
*-------------------------------------------------------------
* READ EXIT
*
* THIS EXIT DECOMPRESSES EACH RECORD
*-------------------------------------------------------------
CSRCREAD VXENTER DSA=PWA
         USING PARMREAD,R1
         SPACE 1
         L     R8,READRECL             R8 -> RECORD LENGTH
         L     R9,READRECA             R9 -> RECORD ADDRESS
         L     R3,0(,R8)               R3 = RECORD LENGTH
         L     R2,0(,R9)               R2 = RECORD ADDRESS
         L     R1,MEMWK                LOAD WORK AREA ADDRESS
         L     R4,MEMADDR              R4 = OUTPUT BUFFER
         L     R5,RECL                 R5 = OUTPUT BUFFER LENGTH
         CSRCESRV SERVICE=EXPAND
         LTR   R15,R15                 EVERYTHING OK
         BNZ   READERR                 IF NOT, SET ERROR AND RETURN
         L     R15,MEMADDR             START OF BUFFER
         SR    R4,R15                  MINUS LAST BYTE USED
         ST    R4,0(,R8)               LENGTH OF UNCOMPRESSED RECORD
         ST    R15,0(,R9)              SAVE UNCOMPRESSED REC ADDRESS
         SLR   R15,R15                 SET GOOD RC
         B     READX                   RETURN TO USER
READERR  DS    0H
         XC    TEMP,TEMP               CONVERT RC TO DECIMAL
         CVD   R15,TEMP                CONVERT TO DECIMAL
         MVC   MSG(EXPERRL),EXPERR     MOVE IN SKELETON
         UNPK  MSG+EXPERRL-3(2),TEMP   UNPACK
         OI    MSG+EXPERRL-2,X'F0'     MAKE IT PRINTABLE
         LA    R15,MSG                 SET MESSAGE
         ST    R15,ERRMSG              SET -> ERROR MESSAGE, IF ANY
         LA    R15,8
*
         SPACE 1
READX    DS    0H
         VXRETURN DSA=PWA
         SPACE ,
EXPERR   DC    C'CSRC NON ZERO RETURN CODE FROM EXPAND, RC = '
EXPERRN  DC    H'0'
         DC    XL1'00'
EXPERRL  EQU   *-EXPERR
*
*
* CONCATENATION EXIT
*
CSRCCNCT VXENTER DSA=PWA
         SPACE 1
         SLR   R15,R15
         VXRETURN DSA=PWA
*-------------------------------------------------------------
* WRITE EXIT
```

```
*
* THIS EXIT COMPRESSES EACH RECORD
*-------------------------------------------------------------
CSRCWRIT VXENTER DSA=PWA
         USING PARMWRIT,R1
         L     R8,WRITRECL             R8 -> RECORD LENGTH
         L     R9,WRITRECA             R9 -> RECORD ADDRESS
         L     R3,0(,R8)               R3 = RECORD LENGTH
         L     R2,0(,R9)               R2 = RECORD ADDRESS
         L     R1,MEMWK                LOAD WORK AREA ADDRESS
         L     R4,MEMADDR              R4 = OUTPUT BUFFER
         L     R5,RECL                 R5 = OUTPUT BUFFER LENGTH
         CSRCESRV SERVICE=COMPRESS
         LTR   R15,R15                 EVERYTHING OK
         BNZ   WRITERR                 IF NOT, SET ERROR AND RETURN
         L     R15,MEMADDR             START OF BUFFER
         SR    R4,R15                  MINUS LAST BYTE USED
         ST    R4,0(,R8)               LENGTH OF RECORD
         ST    R15,0(,R9)              SAVE NEW RECORD ADDRESS
         SLR   R15,R15                 SET GOOD RC
         B     WRITEX                  RETURN TO USER
WRITERR  DS    0H
         XC    TEMP,TEMP               CONVERT RC TO DECIMAL
         CVD   R15,TEMP                CONVERT TO DECIMAL
         MVC   MSG(WRTERRL),WRTERR     MOVE IN SKELETON
         UNPK  MSG+WRTERRL-3(2),TEMP   UNPACK
         OI    MSG+WRTERRL-2,X'F0'     MAKE IT PRINTABLE
         LA    R15,MSG                 SET MESSAGE
         ST    R15,ERRMSG              SET -> ERROR MESSAGE, IF ANY
         LA    R15,8
         SPACE 1
         SPACE 1
WRITEX   DS    0H
         VXRETURN DSA=PWA
WRTERR   DC    C'CSRC: NON ZERO RETURN CODE FROM COMPRESS, RC = '
WRTERRN  DC    H'0'
         DC    XL1'00'
WRTERRL  EQU *-WRTERR
         LTORG
*
* CLOSE EXIT
*
CSRCCLOS VXENTER DSA=PWA
         SLR   R15,R15
         LA    R1,PARM
         XC    PARM,PARM
         USING PARMFRE,R1
         ST    R10,FREEXIT
         L     R15,MEMADDR
         ST    R15,FREPTR
         L     R15,FREE
         BALR  R14,R15
         VXRETURN DSA=PWA
*
R0       EQU   0
R1       EQU   1
```

```
R2       EQU   2
R3       EQU   3
R4       EQU   4
R5       EQU   5
R6       EQU   6
R7       EQU   7
R8       EQU   8
R9       EQU   9
R10      EQU   10
R11      EQU   11
R12      EQU   12
R13      EQU   13
R14      EQU   14
R15      EQU   15
*
         VXEXIT ,
*
PWA      DSECT                    PROGRAM WORK AREA
PWASAVE  DS    32F                SAVE AREA
TEMP     DS    D
RECL     DS    F
SAVE     DS    32F
PARM     DS    CL(PARMALCL)
MEMADDR  DS    F
MEMWK    DS    F
MSG      DS    CL200
PWALENL  EQU   *-PWA              LENGTH OF CSRC WORK AREA
         CVT DSECT=YES
*
         END
```

# 21

# SAS Data Location Assist for z/OS



## Overview of SAS Data Location Assist for z/OS

SAS Data Location Assist for z/OS (zDLA) enables you to use the flexibility of the SAS DATA step to gather information about attributes for data sets that reside throughout your operating system. You can use zDLA to retrieve information about all forms of z/OS data sets, including sequential, VSAM, partitioned, and UFS files. The zDLA feature enables you to process the types of attribute information that are obtained from other utility programs without writing lengthy SAS DATA steps. It also eliminates the need for you to use multiple utilities to retrieve this information, or the need to write additional utilities in the Assembler language.

When a SAS server is in a locked-down state, the SAS functions associated with zDLA do not execute. For more information, see Chapter 10, “SAS Processing Restrictions for Servers in a Locked-Down State,” on page 219.

The zDLA feature provides the following SAS functions that you can use to retrieve information about data set attributes:

| | |
|---|---|
| ZVOLLIST | returns a list of volume serial numbers. |
| ZDSLIST | returns a list of data set names. |
| ZDSNUM | returns a count of the number of data set names previously returned from the ZDSLIST function. |
| ZDSIDNM | returns an individual data set name from the results returned by the ZDSLIST function, based on an index. |
| ZDSATTR | returns the attributes for the data set specified by its argument. The attributes returned depend on the type of request and the type of data set. |
| ZDSRATT | returns RACF security attributes for a z/OS data set name, or UNIX security attributes (including ACL definitions) for a UFS file or directory. |
| ZDSXATT | returns the number of attributes retrieved by a previous request (ZDSATTR or ZDSRATT). |
| ZDSYATT | returns one of the attributes retrieved by a previous request (ZDSATTR or ZDSRATT). |

# A Simple zDLA Application

The following zDLA example shows how to combine the various zDLA functions to display attributes of a collection of data sets. The example retrieves and prints attributes of one or more data sets. It also shows how some of the routines are used and how they are interrelated. Following the example is a listing of a portion of the example output.

```
data _NULL_;
  file PRINT;

  length xvols $1024;
  length unitnm vfilter $64;
  unitnm = '3390';
  vfilter = 'SMS*';
  /* Obtain list of SMS* volumes */
  xvols = zvollist(unitnm, vfilter);
  put xvols=;
  put;

  length xdsn $32000;
  length catgry dfilter optparm $256;
```

```
  catgry = 'CATLG';
  dfilter = 'userID.*.LIST';
  optparm = '';
  /* Obtain list of data sets matching userID.*.list */
  xdsn = zdslist(catgry, dfilter, xvols, optparm);

  /* determine number of matching data sets */
  xnum = zdsnum(xdsn);
  put xnum=;
  put;

  length xidnm xattr $4096;
  length xattrc $72;
  do i=1 to xnum;
     /* extract the i-th name */
     xidnm = zdsidnm(xdsn, i);
     put xidnm=;
     put;

     /* obtain attributes for the i-th data set */
     xattr = zdsattr(xidnm, 'ALL');

     /* count the number of lines returned */
     xattrn = zdsxatt(xattr);
     put xattrn=;
     put;
     do j = 1 TO xattrn;
     /* extract the j-th line from xattr for this data set */
     /* comprising both attribute lines and heading/trailer lines */
        xattrc = zdsyatt(xattr, j);
        /* write this line of a data set attribute report */
        put @1 xattrc;
     end;
  put;
end;
run;
```

***Output 21.1*** *Listing Output from the Simple zDLA Application*

```
XVOLS=SMS007,SMSOVR,SMS001,SMS004,SMS002

XNUM=1
XIDNM=userID.SUPERC.LIST

XATTRN=33
userID.SUPERC.LIST                                  Data Set Name
1                                                   Total Volume Count
** FILE ATTRIBUTES **
2014/05/17                                          Creation Date
SASLIB=NO                                           Possible SAS Library
.                                                   Expiration Date
2015/06/12                                          Last Referenced Date
PS                                                  Data Set Organization
NO                                                  EATTR option
NO                                                  Compressible
.                                                   Data Class
STD2YEAR                                            Management Class
STD                                                 Storage Class
NONE                                                Data Set Type
FBA                                                 Record Format
133                                                 Logical Record Size
3325                                                Blocksize
** END FILE ATTRIBUTES **
** VOLUME ATTRIBUTES **
SMS004                                              Volume Serial
3390                                                Device Type
Blocks                                              Unit of Allocation
14                                                  Primary Allocation
12                                                  Secondary Allocation
2                                                   Allocated Extents
28                                                  Allocated Blocks
2                                                   Used Extents
3                                                   Used Blocks
1                                                   Volume Sequence No.
NO                                                  EAV Volume
************                                        **********
** END VOLUME ATTRIBUTES **
```

# Sample Invocations of zDLA Functions

Several samples of DATA step invocations of zDLA functions are available in the SAS sample library. These samples illustrate methods of invoking zDLA functions, and they can provide a base for users to derive their own programs. Note that the samples do not handle all contingencies.

The following list contains the names and descriptions of the samples.

ZDLAPROC
: contains an example of using PROC FCMP to invoke zDLA functions. This SAS program must be saved to a SAS data set before running samples ZDLAGSEQ or ZDLAGPDS.

ZDLAGSEQ
: calls the ZDLAPROC subroutine, sets up an INFILE statement with the FILEVAR option, and reads sequential data sets.

ZDLAGPDS
: calls the ZDLAPROC subroutine, sets up INFILE statements using macro variables, and reads selected members or all members of partitioned data sets.

ZDLARL01
: calls ZDSLIST twice, with CATLG and HSM categories, and uses merge and subsetting IF statements to extract cataloged data sets. Then ZDLARL01 displays PDS member names.

ZDLARL02
: produces the same output as ZDLARL01. However, it dispenses with HSM invocation, and MERGE and IF statements, by using the zDLA function ZVOLLIST to qualify the ZDSLIST filter.

ZDLARDIR
: reads UFS directories and displays entry names.

ZDALRFIL
: reads UFS files and displays file options.

# Dictionary

## ZVOLLIST Function: z/OS

Returns a list of volume serial numbers according to the requested criteria.

Category: External Files

### Syntax

**ZVOLLIST**(*category*, <*volume filter*>, <*option*>);

#### Required Argument

**category**
: can be a device type such as 3390 or a device name such as SYSDA. If ALL or DASD are specified, then all volume serial numbers for all direct access device names are returned.

### Optional Arguments

**volume filter**
returns all volume serial numbers for the specified category if a NULL volume filter is specified. A volume serial number can be a six-character value such as SDS001 or a wildcard such as SDS*. If a wildcard is specified as in the example, then all volume serial numbers beginning with SDS for the specified category are returned. The volume filter can be a list such as SDS001, SMS*, or APP0*. The first character of the filter cannot be a blank space. If it is, then the filter is assumed to be NULL.

**option**
this parameter is accepted, but no values are currently processed.

## Details

Use the following method to invoke the ZVOLLIST function:

```
length xvols $1024;
xvols = zvollist(category, volume-filter, '');
```

## Example

```
length xvols $32000;
length unitnm vfilter $24;
unitnm = '3390';
vfilter = ' ';
xvols=zvollist(unitnm, vfilter);
xvols=zvollist('SYSDA', vfilter);
xvols=zvollist('DASD');
vfilter = 'SDS011,SDS012';
xvols=zvollist(unitnm,vfilter);
unitnm = 'ALL';
vfilter = 'SMF*, SMS*';
xvols=zvollist(unitnm, vfilter);
vfilter = '&sysr1, &sysr2';
xvols=zvollist(unitnm,vfilter);
```

The output format of the ZVOLLIST function is a list of volume serial numbers that are separated by commas and sorted into alphanumeric order.

# ZDSLIST Function: z/OS

Returns a list of data set names according to the requested criteria.

Category: External Files

Restrictions: ZDSLIST processes only direct access and migrated direct access data sets.

The value of the FILEYSTEM= system option is ignored when interpreting data set filters, regardless of the category.

# Syntax

**zdslist**(*category*, *data set filter*, *volume filter*, <*option*>);

## Required Arguments

The following arguments are usually required. They can also be omitted, depending on the specified category.

***category***

The following values are supported:

**CATLG**
returns cataloged data set names.

**HSM**
returns migrated data set names.

**VSAM**
returns VSAM cluster and index names.

**NVSAM**
returns non-VSAM data set names.

**ALL**
returns aliases from the master catalog. Usually, these aliases are one-level alias names of user catalogs.

**VOLS**
returns the names of data sets that are resident on the specified volumes.

**USSDIR**
returns UFS filenames and directories.

***data set filter***

A data set filter can be any of the following:

- a fully qualified data set name that can contain wildcards. Data set names can include a member name or generation number that is enclosed in parentheses. Member names and generation numbers cannot contain wildcards. A prefix of `MVS:` is permitted but is never required. Data set names, with or without wildcards, are converted to uppercase before processing by ZDSLIST.
- a list of data set names separated by commas. Names with and without wildcards can be mixed.
- a list of UFS pathnames separated by commas. Wildcards are permitted. A prefix of `HFS:` is permitted but is never required. Note that UFS pathnames are case-sensitive.

***volume filter***

A volume filter is a set of volume serial numbers restricting the data sets whose names are to be returned. A null (empty or blank) volume filter requests the return of all of the appropriate names, regardless of the volume. If the volume filter is not null, then the volume filter is a list of one or more volume serial numbers or wildcard specifications. An asterisk represents a sequence of one or more characters in the specification. For example, a volume filter of `'SDS*'` requests the return of data sets on volumes whose names begin with SDS, and the filter `'SDS*,SCS001,SCS002'` adds SCS001 and SCS002 to the list of volume serials to be considered. A list of volumes returned from ZVOLLIST is an acceptable volume filter argument. A volume filter can be specified using a system symbol, as discussed in more detail in the following section. Note that ZDSLIST converts volume serials to all uppercase characters before processing them.

### Optional Argument

***option***

The following values are supported for the OPTION argument. Multiple options should not be specified because they apply to distinct types of data sets.

| | |
|---|---|
| MEM \| NOMEM | indicates whether a member name list is included when the name of a PDS or PDSE is returned. NOMEM is the default. |
| ENT \| NOENT | indicates whether the pathnames for directory entries, files, and subdirectories, are returned for a directory name. This value is only for USSDIR processing. NOENT is the default. |

## Details

### Invoking ZDSLIST

Use the following method to invoke the ZDSLIST function:

```
length xdsn $20480;
xdsn=zdslist(category, data set filter, volume filter, option);
```

**Note:** If the declared size of the user-defined output variable is too small to contain the amount of generated data, then ZDSLIST allocates a larger buffer. ZDSLIST continues allocating a larger buffer until enough storage has been allocated or until no more memory is available. These additional buffers are accessible only through the zDLA functions. Messages about the allocation of a larger buffer are posted to the SAS log.

### Sorting UFS Output Data

ZDSLIST sorts UFS output according to the type of request that you make. It also recognizes UFS names that contain asterisks.

## Using Wildcards with the CATLG Category and Similar Categories

The zDLA feature supports two wildcards that can be used to build filters that describe many similar data set names. These wildcards are * and **. A * wildcard can be used as part or all of a qualifier, which is the part of a data set name that is separated by periods. A ** wildcard can be used only as an entire qualifier. For example, the following qualifiers are all valid * wildcard specifications: `userID.my*.data`, `usr*z.my.data`, `userID.index.htm*`, and `userID.project.*.cntl`. If the asterisks in these specifications are replaced with **, only the last specification is valid. Filters such as `usr**z.my.data` are not accepted.

If a wildcard is a complete qualifier, then the filter selects any data set where the wildcard is replaced by any number of qualifiers, including zero. `userID.project.*.cntl` matches `userID.PROJECT.CNTL`, `userID.PROJECT.STREETS.CNTL`, and `userID.PROJECT.CITY.STREETS.CNTL`. Also note that `userID.project.*` matches the data set `userID.PROJECT`, if it exists. It also matches the names that are listed in the previous sentence. This behavior is shared between the * and ** wildcards. For a * wildcard that is part of, but not all of a qualifier, the wildcard selects any data set where the asterisk is replaced by zero or more characters, not including periods. `userID.my*.data` selects `userID.MYSTREET.DATA` and `userID.MYROAD.DATA`, but does not select `userID.MY.ROAD.DATA`.

Note that all filter entries have an implicit .** at the end. A filter specification of `userID.my*.data` also selects `userID.MYROAD.DATA.BASE`, if it exists.

## Using Wildcards with the USSDIR Category

Only the * wildcard is supported for the USSDIR category. This wildcard is interpreted like the shell interprets a * in commands. The * can be replaced by any number of characters (including none), except for a slash, or a period as the initial character of a filename. The filter specification `/u/userID/a.*.sh` matches `/u/userID/a.parser.sh` and `/u/userID/a.archive.2012.sh`. The filter specification `/u/userID/a*.sh` matches the same names as `/u/userID/a.*.sh`, as well as `/u/userID/a.sh` and `/u/userID/alternate.sh`. Neither pattern matches `/u/userID/a.subdir/suburban.sh`, which is different from how the * wildcard works for the other categories.

A difference from the other categories is that a USSDIR wildcard specification never has a .* wildcard appended automatically to the end. The filter `/u/userID/a*.sh` does not select the name `/u/userID/alternate.sh.output`.

You can specify up to two wildcards in each path component specified in a USSDIR filter.

## Data Set Filter Interpretation

## Filters for the CATLG Category

Specifying a null (empty or blank), *, or ** data set filter with CATLG causes retrieval of the names of all of the data sets that start with your user ID. Specifying a filter of

*ALL causes all names in the catalog to be returned. In the latter case, the MEM option is not supported.

Filter entries can be given in the form .specification, such as `.project` or `.*.asm`. These names are processed in the same way that they are processed by the FILENAME statement, by appending the TSO prefix to the start of the name. A filter of the form `.*.asm` is processed like one of the form `SYSPREF.*.asm`, where SYSPREF is the value of the SAS SYSPREF option. SYSPREF defaults to the TSO prefix under TSO and to the user ID in batch.

If a data set matching the filter is a partitioned data set, and the MEM option is specified, then ZDSLIST returns the data set name with a list of members enclosed in braces–for example: `MYDSN{MEMBER1,MEMBER2,...}`.

If a filter specification includes a member name such as `'userID.*.testsrc(absspec)'`, then the output includes the member name if the matching data set is a PDS that contains that member. Otherwise, it does not include the member name. Even if the MEM option is specified, only one member name is present for a returned data set name.

A data set filter that contains a GDG group without a generation number causes ZDSLIST to return all of the expanded GDG names for that group. A GDG name with a qualification such as -1 returns the expanded name that is relevant to that level.

ZDSLIST skips over spurious characters that are present at the beginning or end of a data set filter. It attempts to bypass some errors such as a data set that is in use. However, if the filter contains an error, such as a data set name that is longer than 44 characters, then the whole filter is regarded as being in error.

The location of wildcards in data set filters is crucial. The following table contains examples of wildcards in data set filters. Note the location of the wildcards and the differences in the information that is returned.

***Table 21.1*** *Wildcards in Data Set Filters*

| Data Set Filter | Returned Information |
|---|---|
| `'userID.sas.*'` | `userID.SAS.CNTL,userID.SAS.LOAD.userID.SAS.TESTSRC,...` |
| `'userID.*.cntl'` | `userID.BACKUP.CNTL,userID.SAS.CNTL,`<br>`userID.SAS900.CNTL.BACKUP, userID.SAS900.FINAL.CNTL,...` |
| `'userID.s*.c*'` | `userID.SAS.CLASS.SCHEDULE,userID.SAS.CNTL,userID.SAS900.CNTL.BACKUP,`<br>`userID.SUPERC.CLIST,userID.SYNTAX.CHECK.LOAD,...` |
| `'userID.sas.c*'` | `userID.SAS.CLASS.SCHEDULE,userID.SAS.CNTL,...` |
| `'userID.**.c*l*'` | `userID.BACKUP.CNTL,userID.COOL.STUFF,userID.SAS.CLASS.SCHEDULE,`<br>`userID.SAS.CNTL,`<br>`userID.SAS900.CNTL.BACKUP,userID.SAS900.FINAL.CNTL,userID.SUPERC.CLIST,...` |

## Filters for the VSAM, NVSAM, and HSM Categories

These categories are similar to CATLG, but restrict the results of ZDSLIST to specific types of data sets. Only VSAM data sets are placed in the return list for the VSAM category, and only non-VSAM data sets are processed for the NVSAM category. The HSM category indicates that only migrated data sets are processed, based on a volume serial of MIGRAT. When the category is HSM, any volume filter is ignored.

## Filters for the ALL Category

A category of ALL is similar to CATLG. If the data set filter is null, or *, or **, then the request returns all of the alias names from the master catalog. If the data set filter is not null, then the request is treated as a normal CATLG request.

## Filters for the VOLS Category

A non-null volume filter must always be specified for this category.

If a null (empty or blank) data set filter is specified with the VOLS category, then the names of all of the data sets on the specified volumes are returned.

If a non-null data set filter is specified, then processing is the same as it is for CATLG, and only matching cataloged data sets from the specified volumes are returned.

If no data set filter exists, then the names of all data sets on the volume are read from the Volume Table of Contents (VTOC). The names are returned in indexed order if the VTOC is indexed, or in physical sequential order.

A specific volume filter must specify volume serial numbers or wildcards. If volumes for a device name are required, then first call ZVOLLIST and pass the output variable to ZDSLIST. The maximum number of volumes that can be processed is 671. A warning message is issued if this number is exceeded, and processing occurs for the volumes that are stored in the array, up to the limited number of volumes. A volume filter can also include a system symbol.

## Filters for the USSDIR Category

USSDIR retrieves UFS filenames according to the data set filter specification. If the name of a directory is retrieved, that directory's entries, including files and subdirectories, might also be retrieved depending on whether the ENT option is set.

Wildcards are supported within UFS filters. You can specify up to thirty path components, and up to two wildcards in each of the path components. If you enter the following filter: `/u/userID/dir.*/*_cal/*a*e/**/test*` it might return a UFS path such as this:

`/u/userID/dir.secure/Jan2014_cal/save/older.versions/testCal`.

**Note:**

- An error message is issued if you specify more than the maximum number of wildcards and components.

- The USSDIR category works a little differently with wildcards than they work with other categories. One difference is that an ending specification of `.**` is never added with USSDIR. That is, the path `/u/userID/somename.c` is not returned for a filter of `/u/userID/*name`.
- Typically, an * within a data set filter is interpreted as signifying a wildcard symbol. This might not be accurate for UFS files and directories because the UFS names might contain an embedded *. To prevent this problem, place such file and directory names within quotation marks like this, `'wtes*1'`.

The format of output from a USSDIR request depends on whether wildcards are present, and whether the ENT or NOENT option is set. Filenames are listed prior to directory names (except for sub-entries contained within braces) and the output is sorted alphabetically.

These example requests illustrate the expected outputs.

`'/u/userID/dir7'`
The name of the path is returned in the ZDSLIST() output variable, if the name exists.

`'/u/userID/dir7', '', 'ent'`
The name of the path is returned with entry names contained within braces in alphabetical order. The names are not separated into file and directory names as this example shows.

```
/u/userID/dir7{adirectory,afile,efile,ndirectory,xfile,zdirectory}
```

`'/u/userID/dir7/*'`
This is a wildcard request without the ENT option. Path and entry (file or directory) names are returned in the form `pathname/entry-name`. The output delivers first filenames then directory names. Each of these categories is sorted alphabetically as this example shows.

```
/u/userID/dir7/afile
/u/userID/dir7/efile
/u/userID/dir7/xfile
/u/userID/dir7/adirectory
/u/userID/dir7/ndirectory
/u/userID/dir7/zdirectory
```

`/u/userID/dir7/*', '', 'ent'`
This is a wildcard request with the ENT option specified. The output is the same as for the preceding request, except that sub-entries for directories are returned within braces and sorted alphabetically, regardless of whether they are files or directories as this example shows.

```
/u/userID/dir7/afile
/u/userID/dir7/efile
/u/userID/dir7/xfile
/u/userID/dir7/adirectory{directx,filename4, filenam1,zdir}
/u/userID/dir7/ndirectory{dirx,diry,filea.gif, fileb.tst, filec, ndir1}
/u/userID/dir7/zdirectory{directa,directd,filenam8,filenam9}
```

**Note:**

- The value of the FILESYSTEM= system option is ignored with USSDIR. An explicit file prefix of `HFS:` can be specified within the filter, but is never required.
- Any volume filter specification is ignored by USSDIR processing.
- Directory entries of "." and ".." are omitted from the returned information for category USSDIR.
- If ZDSLIST can determine that two filter specifications refer to exactly the same files (such as `~/mydir` and `/u/userID/mydir`), then the duplicate specification is ignored.

## System Symbols in Volume Filters

A volume filter passed to ZDSLIST can contain a system symbol that is defined in SYS1.PARMLIB member IEASYMxx. If the category is VOLS, the variable symbol is replaced by its value before data sets are listed. If the category is not VOLS, then no replacement occurs, and the data sets that are returned are limited to those data sets whose catalog entries reference the symbol.

If the volume filter is &CPPM1, which references the volume MIASP1, and if the category is VOLS, then only data sets on MIASP1 are returned. Otherwise, data sets cataloged on &CPPM1 are returned, but not data sets that are cataloged specifically on MIASP1.

A system symbol specification cannot include a wildcard. Any specification must reference only one volume serial.

## Returned Information

The ZDSLIST function returns a string that can be used by the ZDSNUM and ZDSIDNM functions to obtain the number and names of the data sets that were returned by ZDSLIST. This string should not be accessed directly, because its format is subject to change in later revisions. The return variable should have a length sufficient to contain the expected number of names, and possibly member names, that are returned. Even though ZDSLIST attempts to obtain additional storage for an unexpectedly large number of data sets, additional overhead might be incurred if the variable length is significantly less than the length required.

The following table contains specific examples of ZDSLIST function requests and names of MVS data sets that might be stored as a result of a call to ZDSLIST.

***Table 21.2*** *MVS Data Sets*

| Filter Specification | Returned Names |
|---|---|
| Simple file list such as `userID.bmp.list,userID.bkm` | `userID.BMPLIB.LIST,userID.BKM.PRINT` |
| Sequential data set and PDS with MEM such as `userID.bkm,userID.sas.cntl` | `userID.BKM.PRINT,userID.SAS.CNTL(MEM1,MEM2,MEM3)` |

| Filter Specification | Returned Names |
|---|---|
| PDS with specific member (MEM or NOMEM) such as `userID.sas.cntl(absspec)` | `userID.SAS.CNTL(ABSSPEC)` |
| GDG index such as `userID.vxcopy.gdge*` | `userID.VXCOPY.GDGEXAMP,`<br>`userID.VXCOPY.GDGEXAMP.G0001V00,`<br>`userID.VXCOPY.GDGEXAMP.G0002V00` |
| Wildcard PDS with specific member such as `userID.*.testsrc(dbfwhere)` | `userID.DBI.TESTSRC,userID.EQAUTO.TESTSRC,`<br>`userID.SAS.V8.TESTSRC,`<br>`userID.SAS.TESTSRC(DBFWHERE),`<br>`userID.VSAM.TESTSRC` |
| GDG index such as `userID.vxcopy.gdgtst1` | `userID.VXCOPY.GDGTST1,userID.VXCOPY.GDGTST1.g0001V00,`<br>`userID.VXCOPY.GDGTST1.G0002V00,...`<br>`userID.VXCOPY.GDGTST1.G0005V00` |
| GDG index and data sets such as `userID.vxcopy.gdgtst1.*` | `userID.VXCOPY.GDGTST1,userID.VXCOPY.GDGTST1.G0001V00,`<br>`userID.VXCOPY.GDGTST1.G0002V00,...`<br>`userID.VXCOPY.GDGTST1.G0005V00` |
| GDG data sets such as `userID.vxcopy.gdgtst1(+0)`, `userID.vxcopy.gdgtst1(-1)` | `userID.VXCOPY.GDGTST1.G0005V00,`<br>`userID.VXCOPY.GDGTST1,G0004V00` |
| PDS with NOMEM option (or default) such as `userID.sas.cntl` | `userID.SAS.CNTL` |
| Multiple PDS data sets with MEM such as `userid.sas.*` | `userID.SAS.CNTL{MEM1,MEM2,MEM3},`<br>`userID.SAS.LOAD{MEM1,MEM2,MEM3},`<br>`userID.SAS.SRC{MEM1.MEM2,MEM3}` |

The following table contains specific examples of UFS filter specifications and names that might be returned by ZDSLIST. In some of the examples, the path `/home/someID` is used to indicate the home directory of a particular user, and `parent/current` is used to indicate the current directory and its parent directory.

***Table 21.3*** *UFS Data Sets*

| Filter Specification | Names Returned | |
|---|---|---|
| Special characters | / | / |
| | . | parent/current |
| | .. | parent |
| | ./ | parent/current |
| | ../ | parent |

| Filter Specification | Names Returned |
|---|---|
| | ~ /home/userID<br>~/ /home/userID<br>~someID /home/someID |
| /u/userID with NOENT option | Returns only the directory.<br>/u/userID |
| /u/userID with ENT option | Returns the directory and entry names within braces.<br>/u/userID{entry1,entry2,entry3} |
| /u/userID/* with NOENT | Returns matching files and then directories. It does not return entries of the directories.<br>/u/userID/a.sh, /u/userID/c.sas,<br>/u/userID/bdir |
| /u/userID/* with ENT | Returns files and directories with their entries appended.<br>/u/userID/a.sh,/u/userID/c.sas,<br>/u/userID/bdir{bsubdir,my.html,my.sas} |
| ~/wxcat1* (NOENT defaulted) | Returns files and then directories. It does not return entries.<br>/home/userID/wxcat1.a.b,/home/userID/wxcat1.c,<br>/home/userID/wxcat1_dir1 |
| ~/w*.* | /home/userID//wxcat1.a.b,/home/userID/wxcat1.c,<br>/home/userID/wxfiles.d |
| ~/w* | /u/userID/wxcat1.a.b, /u/userID/wxcat1.c,<br>/u/userID/wxfiles.d, /u/userID/wxcat1_dir1 |
| /u/userID/fileext,~/fileext,./fileext | /u/userID/fileext<br>duplicates omitted |
| /u/userID/wxcat1_dir,~/wxcat_dir2,~userID/wxcat1_dir3 with NOENT | /u/userID/wxcat1_dir,/u/userID/wxcat1_dir2,<br>/u/userID/wxcat1_dir3 |
| /u/userID/wxcat1_dir,~/wxcat_dir2,~userID/wxcat1_dir3 with ENT | /u/userID/wxcat1_dir{file1},<br>/u/userID/wxcat1_dir2{file1},<br>/u/userID/wxcat1_dir3{file1,file2} |
| /u/userID/dirtst8 (directory with NOENT) | /u/userID/dirtst8 |
| /u/userID/dirtst8 (directory with ENT) | /u/userID/dirtst8{ent1,ent2} |

| Filter Specification | Names Returned |
|---|---|
| /u/userID/dirtst* (directory with NOENT) | /u/userID/dirtst1,/u/userID/dirtst4, /u/userID/dirtst8 |
| /u/userID/dirtst* (directory and ENT) | /u/userID/dirtst1{ent1,ent2,ent3},/u/userID/dirtst4, /u/userID/dirtst8{ent1,ent2} |

### Error Messages

A syntax error in a filter specification generates an error-level diagnostic and terminates the DATA step. A less serious filter problem, such as specifying a file that does not exist, causes the specification to be skipped. Then any remaining items in the filter are processed. If no filenames are stored by ZDSLIST, then (depending on the circumstances), a warning message might be generated by ZDSLIST. In any case, a warning is generated by ZDSNUM when it is invoked to process the ZDSLIST output.

## Example

The following code contains a macro that writes the results of a call to ZDSLIST:

```
%macro put_dslist(title, dslistv, lindexv, lcountv, dsnv);
  Put @1 "*** " &title;
  &lcounty = zdsnum(&dslistv);
  do &lindexv = 1 to &lcounty;
    &dsnv = zdsidnm(&dslistv, &lindexv);
    put @1 "Data set name = " &dsnv;
  end;
%mend put_dslist;

data_null_;
file print;
length xdsn $32000;
length catgry dfilter vfilter optparm $256;
length dsn $4096; /* for put_dslist macro */
length ufs $4000; /* for put_dslist macro */
catgry = 'CATLG';
dfilter = 'userID.sas.cntl';
vfilter = '';
optparm = '';

/* one data set name, no wildcards, no volume filter */
xdsn = zdslist(catgry, dfilter, vfilter, optparm);
%put_dslist("userID.sas.cntl, CATLG category", xdsn, i,
            dscount, dsn);
dfilter = '.sas.cntl,.sas.load';

/* two data set names, no wildcards, no volume filter */
xdsn = zdslist(catgry, dfilter, vfilter, optparm);
%put_dslist(".sas.cntl,.sas.load, CATLG category", xdsn, i,
```

```
            dscount, dsn);
vfilter = 'sds*, sms*';

/* two data set names, no wildcards, volume filter */
xdsn = zdslist(catgry, dfilter, vfilter, optparm);
%put_dslist(".sas.cntl,.sas.load, volume filter sds*,sms*",
            xdsn, i, dscount, dsn);

/* 'MEM' option */
vfilter = '';
xdsn = zdslist(catgry, dfilter, vfilter, 'mem');
%put_dslist(".sas.cntl,.sas.load, MEM option", xdsn, i, dscount,
            dsn);

/* PDS member specified, optparm omitted */
xdsn = zdslist(catgry, 'userID.sas.cntl(absspec)', vfilter);
%put_dslist("userID.sas.cntl(absspec), no option parm", xdsn, i,
            dscount, dsn);

/* wildcard and PDS member specified, optparm omitted */
/* identifies which data sets contains the member */
xdsn = zdslist(catgry, 'userID.*.cntl(absspec)', vfilter);
%put_dslist("userID.*.cntl(absspec), no option parm", xdsn, i,
            dscount, dsn);

/* GDG generation specified, volume filter omitted */
dfilter = 'userID.copy.gdgtst1(+0)'; /* GDG */
xdsn = zdslist(catgry, dfilter);
%put_dslist("userID.copy.gdgtst1(+0), vol filter omitted",
            xdsn, i, dscount, dsn);

/* USSDIR category, path with wildcards */
catgry = 'USSDIR';
dfilter = '/u/sa*dr*/wx*d2a/test*fil*';
xdsn = zdslist(catgry,dfilter,'','');
%put_dslist("UFS path, NOENT defaulted", xdsn, i,
            dscount, ufs);

/* USSDIR category, path with wildcards, ENT option */
xdsn = zdslist(catgry, '/u/userID/ftptst*', '', 'ent');
%put_dslist("UFS path, ENT option", xdsn, i, dscount, ufs);
run;
```

# ZDSNUM Function: z/OS

Returns a count of the number of data set names that are returned from the ZDSLIST function.

Category: External Files

## Syntax

**zdsnum**(*variable name*);

### Required Argument

***variable name***
specifies the result of a call to ZDSLIST.

## Details

Use the following method to invoke the ZDSNUM function:

```
xnum = zdsnum(variable name);
```

## Example

```
length xdsn $4096;
xdsn=zdslist('catlg', 'userID.sas.*', '', '');
xnum=zdsnum(xdsn);
```

The output for ZDSNUM is the number of names stored by ZDSLIST. If the MEM or ENT option was in effect, members or directory entries appended to PDS or directory names are not included in the count.

# ZDSIDNM Function: z/OS

Returns individual data set names from the result of the ZDSLIST function, based on an index.

Category: External Files

## Syntax

**zdsidnm**(*variable name*, *index*);

### Required Arguments

***variable name***
specifies the result of a call to ZDSLIST.

***index***
specifies an index into the list of data set names stored by ZDSLIST. The index ranges from one to the number of names that were stored. It is obtained by the ZDSNUM function.

## Details

### Invoking ZDSIDNM

Use the following method to invoke the ZDSIDNM function:

```
length xidnm $256;
xidnm=zdsidnm(variable name, index);
```

## Example

```
length xdsn $4096;
xdsn = zdslist('catlg', 'userID.*.sas', '', '');
xnum = zdsnum(xdsn);
length xidnm $256;
do i = 1 to xnum;
   xidnm = zdsidnm(xdsn, i);
end;
```

The result of the ZDSIDNM function is a character string that contains a data set name and a member or entry list, if the list is generated by ZDSLIST.

# ZDSATTR Function: z/OS

Returns the attributes of a data set name or UFS filename.

Category: External Files

## Syntax

**zdsattr**(*variable name*, <*option*>);

### Required Argument

***variable name***
specifies a data set name or UFS filename that might have been obtained from ZDSLIST and ZDSIDNM.

### Optional Argument

***option***
specifies which of the File and Volume attributes are requested for sequential data sets or partitioned data sets. The specification can be entered as File, Vol, Vols, F, V, FV, VF, ALL, or null. ALL, or its equivalent FV, is the default. Invalid options are ignored.

Notes The option is ignored for migrated data sets, VSAM data sets, and UFS files.

ZDSATTR returns attributes for sequential data sets, partitioned data sets, VSAM data sets, and UFS files. It returns attributes for up to 20 volumes. The actual volume count is one of the attributes.

# Details

## Invoking ZDSATTR

Use the following method to invoke the ZDATTR function:

```
length xattr $4096;
xattr = zdsattr(variable name, option);
```

## Processing Invalid Data Sets

ZDSATTR issues a warning message, but does not generate an error, if it encounters an invalid data set name. This condition enables execution of the DATA step to proceed.

## Returned Information

The result of the ZDSATTR function is a character string that contains attributes, along with header and trailer information to improve output appearance if the results of ZDSYATT are displayed. The format of the data within the variable is subject to change, and should not be used other than to pass it to the ZDSXATT and ZDSYATT functions. The data returned is organized as a set of lines, most of which contain an attribute name and an attribute value. For more information about how to navigate the results of ZDSXATT and ZDSYATT, see “ZDSYATT Function: z/OS” on page 384.

## z/OS Data Set Basic Attributes

The following attributes are always stored for a z/OS data set, regardless of the option setting. The first column contains the attribute name, and the second column contains the format of the value stored by ZDSATTR.

***Table 21.4*** *z/OS Data Set Basic Attributes*

| Attribute Name | Value Format |
|---|---|
| Data Set Name | 44-character name |
| Total Volume Count | numeric |

## z/OS File Attributes

The following attributes are stored for a z/OS data set. The first column contains the attribute name, and the second column contains the format of the value stored by ZDSATTR.

***Table 21.5*** *z/OS File Attributes*

| Attribute Name | Value Format |
|---|---|
| Possible SAS Library | SASLIB=YES or SASLIB=NO |
| Creation Date | yyyy/mm/dd |
| Expiration date | yyyy/mm/dd or . (missing value) |
| Last Referenced Date | yyyy/mm/dd |
| Data Set Organization | PS, PO, DA, and so on, or ? if the organization is unknown |
| EATTR Option | YES or NO |
| Compressible | YES or NO |
| Data Class | name or . (missing value) |
| Management Class | name or . (missing value) |
| Storage Class | name or . (missing value) |
| Data Set Type | NONE, PDS, LIBRARY, and so on |
| Record Format | F, FB, FBA, V, and so on, or ? if the format is unknown |
| Logical Record Size | numeric or 0 if the logical record size is unknown |
| Blocksize | numeric or 0 if the blocksize is unknown |

In addition to the preceding attributes, the following attributes are stored by ZDSATTR if a partitioned data set is specified, whether the data set is a PDS or PDSE.

***Table 21.6*** *Additional File Attributes for PDS and PDSE*

| Attribute Name | Value Format |
|---|---|
| Maximum Directory Blocks | numeric or UNLIMITED for PDSE |
| Used Directory Blocks | numeric |

| Attribute Name | Value Format |
|---|---|
| Number of Members | numeric |

## SAS Libraries

ZDSATTR tests for the following conditions to determine whether a data set might be a SAS library.

DSORG = DA

DSORG = PS and RECFM = U

DSORG = PS and RECFM = FS, except in the case of certain file extensions

If these conditions exist, then ZDSATTR marks the Possible SAS Library attribute as SASLIB=YES and produces standard z/OS file and volume attributes. The SAS user can choose to interrogate the setting of this attribute and obtain SAS Library attributes with the invocation of other functions. For more information, see:

- "ATTRC Function" in *SAS Functions and CALL Routines: Reference*
- "ATTRN Function" in *SAS Functions and CALL Routines: Reference*
- The information about SASHELP views such as VLIBNAM and VMEMBER in "Accessing SAS Information By Using DICTIONARY Tables" in *SAS SQL Procedure User's Guide*

## z/OS Volume Attributes

When more than one volume is assigned to a z/OS data set, a Volume Summary with the following attributes is stored after the individual volume attributes. The first column contains the attribute name, and the second column contains the format of the value stored by ZDSATTR. When Unit appears in an attribute name, it is replaced by the value of the Unit of Allocation attribute.

***Table 21.7*** *z/OS Volume Attributes*

| Attribute Name | Value Format |
|---|---|
| Volume Serial | 6-character name |
| Device Type | IBM device code |
| Unit of Allocation | blocks, tracks, cylinders, bytes, kilobytes, or megabytes |
| Primary Allocation | numeric, measured in Units of Allocation |
| Secondary Allocation | numeric, measured in Units of Allocation |
| Allocated Extents | numeric |
| Allocated Unit | numeric, total space allocated (in Allocation Units) |

| Attribute Name | Value Format |
|---|---|
| Used Extents | numeric or not applicable for PDSE |
| Used Unit | numeric or not applicable for PDSE, total space used (in Allocation Units) |
| Volume Sequence No. | numeric |
| EAV Volume | YES or NO |

When more than one volume is assigned to a z/OS data set, a Volume Summary with the following attributes is stored after the individual volume attributes. The first column contains the attribute name, and the second column contains the format of the value stored by ZDSATTR. When Unit appears in an attribute name, it is replaced by the value of the Unit of Allocation attribute.

***Table 21.8*** *Volume Summary Attributes*

| Attribute Name | Value Format |
|---|---|
| Allocated Extents | numeric |
| Allocated Unit | numeric |
| Used Extents | numeric or not applicable for PDSE |
| Used Unit | numeric or not applicable for PDSE |

## VSAM Attributes

A VSAM cluster can have at least one associated data set, and possibly more. The associated data sets can include an INDEX data set, AIX data sets, and a PATH data set. These data set names are written as a group before the CLUSTER attributes are written.

**Note:** Attributes for associated data sets are not stored when ZDSATTR is called for a cluster. If you need to store these attributes, then you should include a separate call to ZDSATTR for each associated data set. If a naming convention is used for VSAM component names, it should be possible to call ZDSLIST with a filter that generates a list that contains both a cluster and all of its components. For example, the filter `"userID.example.vsam"` returns a list containing `userID.EXAMPLE.VSAM.DATA` and `userID.EXAMPLE.VSAM.INDEX`, as well as `userID.EXAMPLE.VSAM`.

## VSAM Data Set Basic Attributes

The following basic attributes are stored for a VSAM cluster or component. The first column contains the attribute name, and the second column contains the format of the value stored by ZDSATTR. The Associated Data Sets attributes appear only for a cluster, and the Total Volume Count attribute appears only for a component.

***Table 21.9*** *VSAM Data Set Basic Attributes*

| Attribute Name | Value Format |
|---|---|
| Data Set Name | 44-character name |
| User Catalog Name | 44-character name |
| Total Volume Count | numeric |
| Associated Data Sets | one or more 44-character names. The attribute name is null for associated data sets after the first one. |

For information about special considerations for processing the Associated Data Sets attribute of a VSAM data set, see "Navigating ZDSATTR Output for z/OS Data Sets" on page 385.

## VSAM Cluster Attributes

The following attributes are stored for a VSAM cluster. The first column contains the attribute name, and the second column contains the format of the value that is stored by ZDSATTR.

***Table 21.10*** *VSAM Cluster Attributes*

| Attribute Name | Value Format |
|---|---|
| Creation Date | yyyy/mm/dd |
| Expiration Date | yyyy/mm/dd or . (missing value) |
| Data Class | name or . (missing value) |
| Management Class | name or . (missing value) |
| Storage Class | name or . (missing value) |
| LOG value | NULL (non-RLS), or NONE, UNDO, or ALL (RLS) |
| Log Stream ID Specified | YES or NO |

| Attribute Name | Value Format |
|---|---|
| BWO value | NULL, TYPECICS, or TYPEIMS |

## VSAM Component Attributes

The following attributes are returned for a VSAM data or index component. The first column contains the attribute name, and the second column contains the format of the value stored by ZDSATTR.

***Table 21.11*** *VSAM Component Attributes*

| Attribute Name | Value Format |
|---|---|
| VSAM Data Set Type | KSDS, ESDS, RRDS, LDS, or VRRDS |
| Compressible | YES or NO, or . for INDEX components |
| EATTR option | YES or NO |
| Average LRECL | numeric |
| Maximum LRECL | numeric |
| Buffer Space | numeric |
| Free Space | numeric |
| CI Size | numeric |
| CI/CA | numeric |
| Extended Addressability | YES or NO |
| Extended Format | YES or NO |
| Key Length | numeric |
| Key Relative Position | numeric or . if not applicable |
| AIX Key Relative Pos. | numeric or . if not applicable |
| SHROPTNS | (numeric,numeric) |
| Stripe Count | numeric or . (missing value) |
| Unit of Allocation | blocks, tracks, cylinders, bytes, kilobytes, or megabytes |

| Attribute Name | Value Format |
|---|---|
| Primary Allocation | numeric, expressed in Allocation Units |
| Secondary Allocation | numeric, expressed in Allocation Units |
| Logical Records | numeric |
| Records Deleted | numeric |
| Records Inserted | numeric |
| Records Updated | numeric |
| Records Retrieved | numeric |
| VSAM Options | See the following information about Recovery and Writechk |
| Volume Serial | 6-character name |
| Device Type | IBM device code |
| Allocated Extents | numeric |
| Allocated Unit | numeric, total space allocated in Allocation Units |
| % Used | numeric |
| Physical Record Size | numeric |
| Volume Type | PRIME, CANDIDATE, or OVERFLOW |
| EAV Volume | YES or NO |

**Note:** To obtain all the VSAM options, such as Recovery, Writechk, and so on, for a VSAM component, Recovery, Writechk,it is necessary to call ZDSYATT once for each option. The first option has an attribute name of VSAM Options. The remaining options have a period in the attribute name part of the value returned, except for the last attribute. The last attribute has an attribute name of End VSAM Options. A list of nine VSAM options is displayed.

**Note:** Where Unit appears in an attribute name, it is replaced by the value of the Unit of Allocation attribute.

## Migrated Attributes

If ZDSATTR detects that a data set is migrated, then it stores attributes that are obtained from the HSM Migrated Control Data Set. For a migrated VSAM data set, the returned attributes are those that are relevant to the base cluster. Descriptive data for associated data sets is also displayed.

ZDSATTR stores the following attributes. The first column contains the attribute name, and the second column contains the format of the value stored by ZDSATTR.

***Table 21.12*** *Migrated Attributes*

| Attribute Name | Value Format |
|---|---|
| Data Set Name | 44-character name |
| Creation Date | yyyy/mm/dd |
| Migration Date | yyyy/mm/dd |
| Last Referenced Date | yyyy/mm/dd |
| Recalled Date | yyyy/mm/dd or . (missing value) |
| Migration Level | DISK or TAPE |
| Valid Migrated Data Set | YES or No |
| Number of Times Migrated | numeric |
| Reside in SDSP Data Set | YES or NO |
| Data Set Organization | PS, PO, DA, and so on, or ? if undefined |
| EATTR Option | YES or NO |
| Compressible | YES or NO |
| SMS Data Set | YES or NO |
| Data Class | name or . (missing value) |
| Management Class | name or . (missing value) |
| Storage Class | name or . (missing value) |
| Extended Format Data Set | YES or NO |
| Large Data Set | YES or NO |

| Attribute Name | Value Format |
|---|---|
| PDSE Data Set | YES or NO |
| Resource Owner | name or . (missing value) |
| Record Format | F, FB, FBA, V, and son, or ? if unknown |
| Logical Record Size | numeric or ? if unknown |
| Maximum Blocksize | numeric or ? if unknown |
| Migrated Volume Serial | 6-character name |
| Primary Volume Serial | 6-character name |
| User-Tracks Allocated | numeric |
| User-Data Set Size | numeric, in Data Set Size Units |
| User-D/Set Size Units | cylinders, tracks, blocks, bytes, kilobytes, or megabytes |
| Secondary Allocation | numeric |
| Secondary Request Type | cylinders, tracks, blocks, bytes, kilobytes, or megabytes |
| Migration Size in 2K Blocks | numeric, or ******** if Migration Level is not DISK |
| Migration Size in 16K Blocks | numeric, or ******** if Migration Level is not TAPE |

For associated VSAM data sets such as index and data components, ZDSATTR stores only the following attributes.

***Table 21.13*** *Stored Attributes for Associated VSAM Data Sets*

| Attribute Name | Value Format |
|---|---|
| Associated User Data Set | 44-character name of base cluster or AIX |
| Type of Object | Data, Index, Path, AIX, or Gen. Name |
| Associated Data Set Type | Cluster or AIX |

## UFS Attributes

The following attributes are stored for a UFS file or directory. The name of the file is stored before the attributes are stored. It is padded with blanks to a multiple of

72 bytes. The first column in the table contains the attribute name, and the second column contains the format of the value stored by ZDSATTR.

***Table 21.14*** *UFS Attributes*

| Attribute Name | Value Format |
|---|---|
| File Type | File, Directory, Named Pipe, and so on |
| Access Permissions | user, group, and other permissions, in the format used by the LS command |
| Number of Links | numeric |
| Owner Name | name |
| Group name | name |
| File Size | Numeric, in bytes for regular files. If the size is very large, it can be stored as a string of asterisks. |
| Status Change Date | Mmm dd yyyy |
| Last Access Date | Mmm dd yyyy |
| Last Modified Date | Mmm dd yyyy |

If the file that is being processed is a directory, and its entry names were stored because the ENT option was used, then the names of those entries can be retrieved with ZDSYATT. For information about navigating the results of ZDSATTR, see "Navigating ZDSATTR Output for UFS Files and Directories" on page 389.

## Example

```
length xdsn $4096;
xdsn = zdslist('catlg', 'userID.*.sas', '', '');
xnum = zdsnum(xdsn);
length xidnm $256;
length xattr $4096;
do I = 1 to xnum;
   xidnm = zdsidnm(xdsn, i);
   xattr = zdsattr(xidnm, 'ALL');
end;
```

# ZDSRATT Function: z/OS

Returns security attributes for a z/OS data set or UFS file or directory.

Category: External Files

## Syntax

**zdsratt**(*variable name*,<*option*>);

### Required Argument

***variable name***
specifies a data set name or UFS filename that might have been obtained from ZDSLIST and ZDSIDNM.

### Optional Argument

***option***
null or 'ALL'.

## Details

### Invoking ZDSRATT

Use the following method to invoke the ZDSRATT function:

```
length xratt $4096;
xratt = zdsratt(variable name, option);
```

### Processing Invalid Data Sets

ZDSRATT issues a warning message, but does not generate an error, if it encounters an invalid data set. This allows execution of the DATA step to proceed.

### Returned Information

The result of the ZDSRATT function is a character string that contains attributes, along with header and trailer information to improve output appearance if the results of ZDSYATT are displayed. The format of the data within the variable is subject to change, and should not be used except to pass it to the ZDSXATT and ZDSYATT functions. The returned data is organized as a set of lines, most of which contain an attribute name and an attribute value. For information about navigating the results of ZDSRATT and ZDSYATT, see "ZDSYATT Function: z/OS" on page 384.

## z/OS Security Attributes

For z/OS data sets, ZDSRATT stores the following attributes. The first column contains the attribute name, and the second column contains the format of the value stored by ZDSATTR.

***Table 21.15*** *z/OS Security Attributes*

| Attribute Name | Value Format |
|---|---|
| Data Set Name | 44-character name |
| Primary Volume Serial | 6-character name, non-VSAM only |
| Catalog Volume Serial | 6-character name, VSAM only |
| Data Set Type | VSAM or non-VSAM |
| Profile | discrete or generic |
| Owner | name |
| Create Date | yyyy/mm/dd or not applicable if generic |
| Last Referenced Date | yyyy/mm/dd or not applicable if generic |
| Last Changed Date | yyyy/mm/dd or not applicable if generic |
| Alter Count | numeric or not applicable if generic |
| Control Count | numeric or not applicable if generic |
| Update Count | numeric or not applicable if generic |
| Read Count | numeric or not applicable if generic |
| Universal Access | NONE, EXECUTE, READ, UPDATE, CONTROL, or ALTER |
| Auditing of Accesses | NONE, FAILING, SUCCESSFUL, or ALL |
| Audit Qualifier | NONE, READ, UPDATE, CONTROL, or ALTER |
| Level | numeric or NONE |
| Installation Data | string or NONE |
| Warning | YES or NO |
| Erase | YES or NO |

| Attribute Name | Value Format |
|---|---|
| Notify | user ID or NO USER |
| Creation Group | name |
| Security Level | numeric or NONE or not applicable for a requestor that is not the owner |
| Security Label | string or NONE or not applicable for a requestor that is not the owner |
| Your Access | NONE, READ, UPDATE, CONTROL, or ALTER |

ZDSRATT stores information about specific users with specific access rights to the data set. For information about the special considerations for processing this user ID and Access information, see "Navigating ZDSRATT Output for z/OS Data Sets" on page 390.

## UFS Security Attributes

For UNIX files and directories, ZDSRATT stores the following attributes. The first column contains the attribute name, and the second column contains the format of the value stored by ZDSATTR.

***Table 21.16*** *UFS Security Attributes*

| Attribute Name | Value Format |
|---|---|
| ACL Access Type | ACCESS or NONE |
| Owner | user ID |
| Group | owning group ID |
| User | base user permission string, such as, r-x |
| Group | base group permission string, such as r-x |
| Other | base other permission string, such as r-x |

If any ACL entries exist, ZDSRATT stores two attributes for each ACL entry, as indicated in the following table.

*Table 21.17 ZDSRATT Attributes for ACL Entries*

| Attribute Name | Value Format |
|---|---|
| User Name | user ID, present only for a user ACL entry |
| Group Name | group ID, present only for a group ACL entry |
| Permissions | permissions string, such as r-x |

For information about special considerations for accessing these ACL entry definitions, see "Navigating ZDSRATT Output for UFS Files" on page 391.

# ZDSXATT Function: z/OS

Returns the number of attributes retrieved by a previous ZDSATTR or ZDSRATT request.

Category: External Files

## Syntax

**zdsxatt**(*variable name*);

### Required Argument

***variable name***
specifies the result of a previous call to ZDSATTR or ZDSRATT.

## Details

### Invoking ZDSXATT

Use the following method to invoke the ZDSXATT function:

```
xattrn = zdsxatt(variable name);
```

### Processing Specifics

ZDSXATT validates that the argument is a character string that conforms to the format that was returned by ZDSATTR and ZDSRATT. ZDSXATT returns the number of lines of attribute and other information stored by ZDSATTR or ZDSRATT. These lines can be retrieved using the ZDSYATT function.

## Example

```
length xdsn $4096;
xdsn=zdslist('catlg', 'userID.sas.*', '', '');
xnum=zdsnum(xdsn);
length xidnm $256;
length xattr $4096;
do i = 1 to xnum;
  xidnm=zdsidnm(xdsn, i);
  xattr=zdsattr(xidnm);
  xattrn=zdsxatt(xattr);
  put @1 xattrn "lines of attribute information stored for data set " xidnm ".";
end;
```

The output format of the ZDSXATT function is a numeric variable that contains an attribute count.

# ZDSYATT Function: z/OS

Displays attribute information that is stored by ZDSATTR or ZDSRATT.

Category: External Files

## Syntax

**zdsyatt**(*variable name*, *index*);

### Required Arguments

***variable name***
specifies the result of a previous call to ZDSATTR or ZDSRATT.

***index***
represents an index into the ZDSATTR or ZDSRATT output. The upper bound for the index can be obtained using the ZDSXATT function.

## Details

### Invoking ZDSYATT

Use the following method to invoke the ZDSYATT function:

```
length xattrc $72;
xattrc=zdsyatt(variable name, indexj);
```

## The Structure of the ZDSATTR or ZDSRATT Return Value

The information returned by ZDSATTR and ZDSRATT is organized as a set of 72-character lines. A call to ZDSYATT returns the line from its first argument, and it is indexed by its second argument. Three distinct types of lines exist:

- a single attribute specification
- a portion of a multi-line attribute, which usually contains one or more possibly long UFS filenames
- a heading or footing line that might improve the readability of the output if each line were printed directly

An attribute line contains the attribute value in characters 1 through 44, and the attribute name in characters 45 through 69. A heading or footing line has blank spaces in the attribute name area, and the value area typically begins with two asterisks. For exceptions to these rules, see the following sections about navigating ZDSATTR and ZDSRATT output.

## Navigating ZDSATTR Output for z/OS Data Sets

For z/OS data sets that are not in a UFS directory, the first line of the ZDSATTR output is the data set name with the attribute name Data Set Name. For non-VSAM data sets, the output contains few unexpected results. For a multi-volume data set, the volume attributes are repeated for each volume. The attributes for the volumes are separated by a line with asterisks in both the attribute value and the attribute name. If more than one volume exists, then a Volume Summary section is written after the last volume. Note that the number of volumes can be obtained from the Total Volume Count attribute. Here is an example of the output created by using ZDSYATT to dump the ZDSATTR output for a three-volume, non-VSAM data set.

***Output 21.2*** *ZDSATTR Output for a Three-Volume, non-VSAM Data Set Using ZDSYATT*

```
userID.WXMVOL2.TEST2                          Data Set Name
3                                             Total Volume Count
** FILE ATTRIBUTES **
SASLIB=NO                                     Possible SAS Library
2013/10/22                                    Creation Date
.                                             Expiration Date
2013/10/22                                    Last Referenced Date
PS                                            Data Set Organization
NO                                            EATTR option
NO                                            Compressible
.                                             Data Class
.                                             Management Class
.                                             Storage Class
NONE                                          Data Set Type
FB                                            Record Format
80                                            Logical Record Size
27920                                         Blocksize
** END FILE ATTRIBUTES **
** VOLUME ATTRIBUTES **
USRD05                                        Volume Serial
3390                                          Device Type
Cylinders                                     Unit of Allocation
300                                           Primary Allocation
10                                            Secondary Allocation
16                                            Allocated Extents
450                                           Allocated Cylinders
16                                            Used Extents
450                                           Used Cylinders
1                                             Volume Sequence No.
NO                                            EAV Volume
************                                  **********
USRD01                                        Volume Serial
3390                                          Device Type
Cylinders                                     Unit of Allocation
0                                             Primary Allocation
10                                            Secondary Allocation
16                                            Allocated Extents
160                                           Allocated Cylinders
16                                            Used Extents
160                                           Used Cylinders
2                                             Volume Sequence No.
NO                                            EAV Volume
************                                  **********
USRD04                                        Volume Serial
3390                                          Device Type
Cylinders                                     Unit of Allocation
0                                             Primary Allocation
10                                            Secondary Allocation
6                                             Allocated Extents
60                                            Allocated Cylinders
6                                             Used Extents
59                                            Used Cylinders
3                                             Volume Sequence No.
NO                                            EAV Volume
************                                  **********
** END VOLUME ATTRIBUTES **
*** VOLUME SUMMARY ***
38                                            Allocated Extents
670                                           Allocated Cylinders
38                                            Used Extents
669                                           Used Cylinders
*** END VOLUME SUMMARY ***
```

The allocated and used space amount are expressed in Units of Allocation, which might differ for each data set. If an application needs to compare allocation amounts or find the total for the allocation amounts, it should first convert all values to a common unit such as Tracks.

For a VSAM cluster, the Associated Data Sets attribute requires special processing. One or more associated data set names might be present, with one per line, but only the first one has an attribute name. The first line following the last data set association can be recognized because it is a standard header line beginning with two asterisks. Here is an example of the output created by using ZDSYATT to dump the ZDSATTR output for a VSAM cluster.

***Output 21.3*** *ZDSATTR Output for a VSAM Cluster Using ZDSYATT*

```
userID.BUG2822.VSAM                          Data Set Name
SYS1.DEV.CATALOG                             User Catalog Name
userID.BUG2822.VSAM.DATA                     Associated Data Sets
userID.BUG2822.VSAM.INDEX
** VSAM CLUSTER ATTRIBUTES **
2014/02/26                                   Creation Date
.                                            Expiration Date
.                                            Data Class
.                                            Management Class
.                                            Storage Class
NULL                                         LOG Value
NO                                           Log Stream ID Specified
NULL                                         BWO Value
** END VSAM CLUSTER ATTRIBUTES **
```

For a VSAM index or data component, the VSAM Options attribute requires special processing. Multiple options are typically present, with one per line. The first of these lines contains an attribute name, VSAM Options, and the last contains an attribute name, End VSAM Options. Intermediate attribute names consist of a period. The attribute name End VSAM Options indicates the end of the list of options. Here is an example of the output created by using ZDSYATT to dump the ZDSATTR output for a VSAM index component.

***Output 21.4*** *ZDSATTR Output for a VSAM Index Component Using ZDSYATT*

```
userID.BUG2822.VSAM.INDEX                    Data Set Name
1                                            Total Volume Count
SYS1.DEV.CATALOG                             User Catalog Name
** VSAM ATTRIBUTES **
KSDS                                         VSAM Data Set Type
.                                            Compressible
YES                                          EATTR option
0                                            Average LRECL
505                                          Maximum LRECL
0                                            Buffer Space
24576                                        Free Space
512                                          CI Size
49                                           CI/CA
NO                                           Extended Addressability
NO                                           Extended Format
9                                            Key Length
0                                            Key Relative Position
.                                            AIX Key Relative Pos.
(1,3)                                        SHROPTNS
.                                            Stripe Count
Tracks                                       Unit of Allocation
1                                            Primary Allocation
1                                            Secondary Allocation
1                                            Logical Records
0                                            Records Deleted
0                                            Records Inserted
0                                            Records Updated
0                                            Records Retrieved
Recovery                                     VSAM Options
Unique                                       .
Reusable                                     .
Noerase                                      .
Nowritechk                                   .
Noimbed                                      .
Noreplicat                                   .
Nonspanned                                   .
.                                            End VSAM Options
USRD02                                       Volume Serial
3390                                         Device Type
1                                            Allocated Extents
1                                            Allocated Tracks
2                                            % Used
512                                          Physical Record Size
PRIME                                        Volume Type
NO                                           EAV Volume
************                                 **********
```

The ZDSATTR output for a migrated data set does not present any navigation difficulties. Here is an example of the output created by using ZDSYATT to dump the ZDSATTR output for a migrated data set.

***Output 21.5*** *ZDSATTR Output for a Migrated Data Set Using ZDSYATT*

```
userID.APROBE.IOFLIST                          Data Set Name
** MIGRATED DATA SET ATTRIBUTES **
2013/11/02                                     Creation Date
2013/11/22                                     Migration Date
2013/11/02                                     Last Referenced Date
.                                              Recalled Date
TAPE                                           Migration Level
YES                                            Valid Migrated Data Set
1                                              Number of Times Migrated
NO                                             Reside in SDSP Data Set
PS                                             Data Set Organization
NO                                             EATTR Option
NO                                             Compressible
NO                                             SMS Data Set
.                                              Data Class
.                                              Management Class
.                                              Storage Class
NO                                             Extended Format Data Set
NO                                             Large Data Set
NO                                             PDSE Data Set
.                                              Resource owner
VBA                                            Record Format
0                                              Logical Record Size
3600                                           Maximum Blocksize
MV0038                                         Migrated Volume Serial
USRD04                                         Primary Volume Serial
2                                              User - Tracks Allocated
33278                                          User - Data Set Size
Bytes                                          User - D/Set Size Units
20                                             Secondary Allocation
Tracks                                         Secondary Request Type
********                                       Mig. Size in 2K Blocks
2                                              Mig. Size in 16K Blocks
** END MIGRATED DATA SET ATTRIBUTES **
```

Here is an example of the output created by dumping the ZDSATTR output for a component of a migrated VSAM data set.

***Output 21.6*** *ZDSATTR Output for a Component of a Migrated VSAM Data Set*

```
userID.SOURCE.VSAM.DATA                        Data Set Name
** MIGRATED DATA SET ATTRIBUTES **
userID.SOURCE.VSAM                             Associated User Data Set
Data                                           Type of Object
Cluster                                        Associated Data Set Type
** END MIGRATED DATA SET ATTRIBUTES **
```

## Navigating ZDSATTR Output for UFS Files and Directories

The output of ZDSYATT for UFS files has two features that complicate navigation of the lines extracted by ZDSYATT. The first feature is that the first output lines contain the full pathname for the file. As the name can significantly exceed 72 characters, it is split into 72-character chunks, producing as many lines as necessary. No attribute name appears for this information. If the file is a directory, and if the source of the name is the output of ZDSLIST with the ENT option, then the names of its entries are listed in a single string. As with the input filename, this string is split into 72-byte chunks. Each chunk is retrievable by a single call to

ZDSYATT. These lines do not have an attribute name. However, they immediately follow a header line with the value portion of the header containing `** UNIX DIRECTORY ENTRY LIST **`.

Here is an example of the output created by using ZDSYATT to dump the ZDSATTR output for a UFS directory with a long name and a long list of associated entries.

***Output 21.7*** *ZDSATTR Output for a UFS Directory*

```
/u/userID/a12345678901234567890123456789012345678901234567890123456789012345678
90123456789012345678901234567890123456789012345678901234567890123456789
** UNIX FILE ATTRIBUTES **
Directory                                       File Type
drwxr-xr-x                                      Access Permissions
4                                               Number of Links
userID                                          Owner Name
CCD                                             Group Name
8192                                            File Size
Oct 23  2013                                    Status Change Date
Oct 25  2013                                    Last Access Date
Oct 23  2013                                    Last Modified Date
** END UNIX FILE ATTRIBUTES **
** UNIX DIRECTORY ENTRY LIST **
{subsub1,subsub2,subsub3,subsub4,subsub5,subsub6,subsub7,subsub8,subsub9
,subsuba}
** END DIRECTORY ENTRY LIST **
```

## Navigating ZDSRATT Output for z/OS Data Sets

The output of ZDSRATT for z/OS data sets has one feature that complicates navigation of the lines extracted by ZDSYATT. Information about permitted access for specific user IDs appears in lines that have no attribute name. These lines are preceded by a header line that does not begin, as all other header lines do, with "**". They instead contain the text `:User ID and Access:`. If the owner of the file is not the user running SAS, then the header is followed by a single line containing “N/A,” for not applicable. If the owner of the file is the user ID that is running SAS, then the header line is followed by a number of lines. Each line contains a user ID and an access level in its attribute value part.

Here is an example of the output created by using ZDSYATT to dump the ZDSRATT output for a z/OS data set that is owned by the user.

***Output 21.8*** *ZDSRATT Output for a z/OS Data Set That Is Owned by the User, Using ZDSYATT*

```
ownerID.PROGRESS.TEXT                          Data Set Name
USRD02                                         Primary Volume Serial
Non-VSAM                                       Data Set Type
** RACF ATTRIBUTES **
Generic                                        Profile
ownerID                                        Owner
2013/12/09                                     Create Date
N/A                                            Last Referenced Date
N/A                                            Last Changed Date
N/A                                            Alter Count
N/A                                            Control Count
N/A                                            Update Count
N/A                                            Read Count
NONE                                           Universal Access
NONE                                           Auditing of Accesses
N/A                                            Audit Qualifier
0                                              Level
NONE                                           Installation Data
NO                                             Warning
NO                                             Erase
ownerID                                        Notify
SAS                                            Creation Group
NONE                                           Security Level
NONE                                           Security Label
ALTER                                          Your Access
:User ID and Access:
ownerID     ALTER
userID1     READ
userID2     READ
userID3     READ
** END RACF ATTRIBUTES **
```

## Navigating ZDSRATT Output for UFS Files

The output of ZDSRATT for a UFS file resembles the output of ZDSATTR in structure. The lines retrieved by ZDSYATT begin with one or more lines containing 72-byte chunks of the pathname, and the number depends on the length of the pathname. If an ACL is defined for the filename, then the last lines retrieved by ZDSYATT are two lines for each user or group referenced in an ACL entry. One line contains the user ID or group ID, and one line contains the permitted access. These lines have names in the attribute name part of the lines. The list is terminated by the trailer line that begins with "**", and ends the ZDSRATT output. Also note that the attribute name Group appears twice in the output. The first occurrence refers to the group ID of the owner, and the second occurrence refers to the level of permitted access by members of that group.

Here is an example of the output created by using ZDSYATT to dump the ZDSRATT output for a UFS file with several defined ACL entries.

***Output 21.9*** *ZDSRATT Output for a UFS File with Several ACL Entries*

```
/u/ownerID/gotacl
** UNIX SYSTEM SERVICES ATTRIBUTES **
ACCESS                                  ACL Access Type
ownerID                                 Owner
CCD                                     Group
rwx                                     User
---                                     Group
---                                     Other
userID1                                 User Name
rw-                                     Permissions
userID2                                 User Name
r-x                                     Permissions
R@D                                     Group Name
--x                                     Permissions
** END USS ATTRIBUTES **
```

## Example

```
length xattr $4096;
length xdsn $4096;
length xidnm $256;
length xattrc $72;

xdsn = zdslist('catlg', 'userID.*.sas', '', '');
xnum = zdsnum(xdsn);
do i = 1 to xnum;
   xidnm = zdsidnm(xdsn, i);
   xattr = zdsattr(xidnm, 'ALL');
   xattrn = zdsxatt(xattr);
   do j = 1 to xattrn;
           xattrc=zdsyatt(xattr, j);
           put @1 xattrc;
   end;
end;
```

The result of ZDSYATT is a 72-byte character string. Each line of the output examples earlier in this section is an example of the result of a call to ZDSYATT.

## Examples of SAS Programs Interrogating the SASLIB Attribute

### Example 1: Retrieving Specific SAS Library Attributes

The following program retrieves z/OS attributes and checks for an attribute value of SASLIB=YES. If the check finds a value of YES, then the program assigns a libref, opens a specific member, and retrieves specific SAS library attributes.

***Example Code 21.1*** *Retrieving Specific SAS Library Attributes*

```
/*-----------------------------------------------------
  Test zDLA marker for possible SAS data library.
  Produce z/OS attribute list then specific data library attributes.
-----------------------------------------------------*/
%macro zdslint(dfilt,vfilt,optp);
 DATA _NULL_;
  file print;
```

```
  length xdsn $32000;
  length catgry dfilter optparm $256;
  catgry = 'CATLG';
  dfilter = &dfilt;
  vfilter = &vfilt;
  optparm = &optp;
  opentst = 'OPENTST';
  null = "";
  xdsn = zdslist(catgry, dfilter, vfilter, optparm);
  xnum = zdsnum(xdsn);
  length xidnm $4096;
  length xattr $4096;
  length xattrc $72;
  length xattrc_lib $8;
  length xsaslib $3;
  xsaslib = null;
  do i=1 to xnum;
    xidnm = zdsidnm(xdsn, i);
    xattr = zdsattr(xidnm, 'ALL');
    xattrn = zdsxatt(xattr);
    do j=1 to xattrn;
      xattrc = zdsyatt(xattr, j);
      put @1 xattrc;
/*-----------------------------------------------
Check the marker - SASLIB=YES.
-----------------------------------------------*/
      if xsaslib = null then do;
         xattrc_lib = substr(xattrc, 1, 8);
         if xattrc_lib = 'SASLIB=Y' then xsaslib = 'YES';
         else if xattrc_lib = 'SASLIB=N' then xsaslib = 'NO ';
      end;
    end;
/*-----------------------------------------------
If we found a possible data library, attempt to assign a libref,
open a specific member, and obtain character and numeric attributes.
-------------------------------------------------------------*/
    if xsaslib = 'YES' then do;
      rc = libname(opentst, xidnm ,, 'DISP=SHR');
      if rc ^= 0 then do;
        msg = SYSMSG();
        put "LIBNAME message: " msg;
        Goto EXIT;
      end;

      length libc memc mtypec typec $32;
      dsid=open('opentst.citiday','in');
      if dsid = 0 ihen do;
         put "OPEN message: open for member failed" ;
         Goto EXIT;
      end;

      libc=attrc(dsid,'lib');
      memc=attrc(dsid,'mem');
      mtypec=attrc(dsid,'mtype');
      typec=attrc(dsid,'type');
      crdt=attrn(dsid,'crdte');
```

```
      modt=attrn(dsid,'modte');
      nvars=attrn(dsid,'nvars');
      nobs=attrn(dsid,'nobs');
      nlobs=attrn(dsid,'nlobs');
      anyn=attrn(dsid,'any');
      lrecl=attrn(dsid,'lrecl');
      lrid=attrn(dsid,'lrid');

      if libc ^= "" then
        put "libref is " libc;
      if memc ^= "" then
        put "member name is " memc;
      if mtypec ^= "" then
        put "SAS data library member type is " mtypec;
      if typec ^= "" then
        put "SAS data set type is " typec;
      if crdt > 0 then
        put "data set creation date is " crdt datetime7.;
      if modt > 0 then
        put "data set modification date is " modt datetime7.;
      if nvars > 0 then
        put "number of variables in data set is " nvars;
      if nobs > 0 then
        put "number of physical observations is " nobs;
      if nlobs > 0 then
        put "number of logical observations is " nlobs;
      if anyn < 0 then
        put "data set has no observations or variables";
      else if anyn = 0 then
        put "data set has no observations";
      else if anyn = 1 then
        put "data set has observations and variables";
      if lrecl > 0 then
        put "logical record length is " lrecl;
      if lrid > 0 then
        put "record ID length is " lrid;
    end;
  end;

EXIT:
  run;

%mend zdslint;

%zdslint('site.v940.sa*', '', '')
quit;
```

## Example 2: Creating and Assigning a Libref

In the following program, the first DATA step retrieves z/OS attributes for data sets, and identifies which data sets are possible SAS libraries. The program then determines which of those data set names contain the string SASHELP. After making this determination, the program creates and assigns a libref for the data sets that contain the target string.

The second DATA step retrieves a value for the variable NUMX from the SAS data set that is written by the first DATA step. Then it uses this value to set the appropriate libref and view. This DATA step invokes the VLIBNAM view and retrieves the selected information from this view for each referenced libref.

The third DATA step performs similar processing for the VMEMBER view.

***Example Code 21.2*** *Creating and Assigning a Libref*

```
/* INVOKE ZDLA FUNCTIONS FROM ZDSLIST TO ZDSYATT - DISPLAY OF DATA
   SET ATTRIBUTES.
   THE PROGRAM CHECKS THE SASLIB ATTRIBUTE. IF THIS IS SET TO YES,
   AND THE DATA SET NAME CONTAINS THE STRING 'SASHELP', THEN A LIBREF
   IS ASSIGNED.
   IN SUBSEQUENT DATA STEPS, FOR EACH LIBREF ASSIGNED, THE PROGRAM
   DISPLAYS SELECTED ITEMS FROM SASHELP VIEWS VLIBNAM AND VMEMBER.
*/

%macro zdslint(dfilt,vfilt,optp);
 DATA DNAME;
  file print;
  length xdsn $32000;
  length catgry dfilter optparm $256;
  catgry = 'CATLG';
  dfilter = &dfilt;
  vfilter = &vfilt;
  optparm = &optp;
  numx = 1;
/* COMMENCE ZDLA INVOCATIONS */
  xdsn = zdslist(catgry, dfilter, vfilter, optparm);
  xnum = zdsnum(xdsn);
  length xidnm $44;
  length xattr $4096;
  length xattrc $72;
  length xattrc_lib $8;
  length xattrc_hlp $7;
  length xsaslib $3;
  length xnamesuf $1;
  retain numx;
  xsaslib = ' ';
  xattrsz = 38; /* SIZE OF ATTRIBUTE VALUE(45) LESS SASHELP(7) */
  do i=1 to xnum;
   xidnm = zdsidnm(xdsn, i);
   xattr = zdsattr(xidnm, 'ALL');
   xattrn = zdsxatt(xattr);
   do j=1 to xattrn;
     xattrc = zdsyatt(xattr, j);
     put @1 xattrc;
/* CHECK FOR SASLIB SPECIFICATION, AND SET XSASLIB VARIABLE */
     if xsaslib eq ' ' then do;
       xattrc_lib = substr(xattrc, 1, 8);
       if xattrc_lib eq 'SASLIB=Y' then do;
         xsaslib = 'NO ';
         do k = 1 to xattrsz while (xsaslib eq 'NO ');
           xattr_hlp = substr(xidnm, k, 7);
           if xattrc_hlp eq 'SASHELP' then
             xsaslib = 'YES';
```

```
        end;
      end;
      if xattrc_lib eq 'SASLIB=N' then xsaslib = 'NO ';
    end;
  end;
/* IF XSASLIB HAS BEEN SET TO YES:
   SET NUMERIC VARIABLE NUMX TO CHARACTER XNAMESUF.
   APPEND THE CHARACTER VALUE TO THE LIBREF NAME.
   INVOKE LIBNAME FUNCTION.
   RESET XSASLIB TO I VALUE.
*/
   if xsaslib eq 'YES' then do;
     output;
     xnamesuf = numx; numx = numx + 1;
     opentst = 'OPENTST'||xnamesuf;
     rc = LIBNAME(opentst, xidnm ,, 'DISP=SHR');
     if rc ne 0 then do;
       msg = SYSMSG();
       put "LIBNAME message: " msg;
     end;
   end;
   xsaslib = ' ';
  end;
run;

/*
  END OF ZDLA ATTRIBUTE DISPLAYS AND LIBNAME ASSIGNMENTS
  NEXT DATA STEP:
   SET DATA SET CREATED IN PREVIOUS DATA STEP AND OBTAIN VALUE OF NUMX.
   WITHIN DO LOOP - SET VLIBNAM VIEW ACCORDING TO LIBREF.
                    DISPLAY SELECTED VALUES.
*/
data _null_;
  file print;
  length oldlib $8;
  retain oldlib;
  set dname;
  do obsnum = 1 to last;
    if numx eq 1 then
      set opentst1.vlibnam nobs=last;
    else
      set opentst2.vlibnam nobs=last;
    if oldlib ne substr(libname,1,8) then do;
      put;
      put "libname = " libname;
      put "path = " path;
      oldlib = substr(libname,1,8);
    end;
    put "sysname = " sysname;
    put "sysvalue = " sysvalue;
  end;
run;

/*
   NEXT DATA STEP:
    SET DATA SET CREATED IN EARLIER DATA STEP AND OBTAIN VALUE OF NUMX.
```

```
    WITHIN DO LOOP - SET VMEMBER VIEW
                     CREATE LIBREF VALUE ACCORDING TO NUMX VALUE.
                     DISPLAY SELECTED VALUES.
*/
data _null_;
  file print;
  length xnamesuf $1;
  set dname;
  put;
  do obsnum = 1 to 100;
    if numx eq 1 then
      set opentst1.vmember;
    else
      set opentst2.vmember;
    xnamesuf = numx;
    opentst = 'OPENTST'||xnamesuf;
    openmem = opentst||'.'||memname;
    put openmem;
  end;
run;

%mend zdslint;

%zdslint('site.v940.sa*', '', '')
quit;
```

# 22

# Data Representation



## Representation of Numeric Variables

### Floating-Point Representation

SAS stores all numeric values in 8-byte floating-point representation. Using this representation enables SAS to store numbers of large magnitude and to perform computations that require many digits of precision to the right of the decimal point. Details about how floating-point numbers are represented and the factors that can affect your numeric calculations are provided in "Numeric Precision" in *SAS Programmer's Guide: Essentials* .

### Representation of Integers

When processing in a z/OS environment, you should also be aware of how SAS stores integers. Like other numeric values, SAS maintains integer variables in 8-byte hexadecimal floating-point representation. But under z/OS, outside of SAS, integer values are typically represented as 4-byte (fixed point) binary values using two's complement notation. SAS can read and write these values using informats and formats, but it does not process them internally in this form. SAS uses floating-point representation internally.

You can use the IB*w.d* informat and format to read and write the binary integer values used under z/OS. Each integer uses 4 bytes (32 bits) of storage space. Thus, the range of values that can be represented is from −2,147,483,648 to 2,147,483,647.

# Using the LENGTH Statement to Save Storage Space

When SAS writes a numeric variable to a SAS data set, it writes the number in IBM double-precision hexadecimal floating-point format (as described in "Numeric Precision" in *SAS Programmer's Guide: Essentials*). In this format, 8 bytes are required for storing a number in a SAS data set with full precision. However, you can use the LENGTH statement in the DATA step to specify that you want to store a particular numeric variable in fewer bytes.

Using the LENGTH statement can greatly reduce the amount of space that is required for storing your data. For example, if you were storing a series of test scores whose values could range from 0 to 100, you could use numeric variables with a length of 2 bytes. This value would save 6 bytes of storage per variable for each observation in your data set.

However, you must use the LENGTH statement cautiously in order to avoid losing significant data. One byte is always used to store the exponent and the sign. The remaining bytes are used for the mantissa. When you store a numeric variable in fewer than 8 bytes, the least significant digits of the mantissa are truncated. If the part of the mantissa that is truncated contains any nonzero digits, then precision is lost.

Use the LENGTH statement only for variables whose values are always integers. Fractional numbers lose precision if they are truncated. In addition, you must ensure that the values of your variable are always represented exactly in the number of bytes that you specify.

Use the following table to determine the upper bound of the range of contiguous integers that can be represented exactly in variables of various lengths in IBM Hexadecimal-Floating-Point (IBM HFP):

***Table 22.1*** *Variable Length and Largest Exact Integer Values in IBM HFP*

| Length in Bytes | Significant Digits Retained | Largest Integer Represented Exactly |
|---|---|---|
| 2 | 2 | 256 |
| 3 | 4 | 65,536 |
| 4 | 7 | 16,777,216 |

| Length in Bytes | Significant Digits Retained | Largest Integer Represented Exactly |
|---|---|---|
| 5 | 9 | 4,294,967,296 |
| 6 | 12 | 1,099,511,627,776 |
| 7 | 14 | 281,474,946,710,656 |
| 8 | 16 | 72,057,594,037,927,936 |

Use the following table to determine the upper bound of the range of contiguous integers that can be represented exactly in variables of various lengths for IEEE (also called binary floating-point), as used on most non-mainframe systems:

***Table 22.2*** *Variable Length and Largest Exact Integer Values for IEEE*

| Length in Bytes | Significant Digits Retained | Largest Integer Represented Exactly |
|---|---|---|
| 3 | 3 | 8,192 |
| 4 | 6 | 2,097,152 |
| 5 | 8 | 536,870,912 |
| 6 | 11 | 137,438,953,472 |
| 7 | 13 | 35,184,372,088,832 |
| 8 | 15 | 9,007,199,254,740,992 |

**Note:** Length 2 is supported for IBM HFP but not for IEEE. Therefore, the IEEE table does not contain an entry for length 2.

When you use the OUTREP option of the LIBNAME statement to create a SAS data set that is written in a data representation other than one that is native to SAS on z/OS, the information in the preceding table does not apply. The largest integer that can be represented exactly is generally smaller.

**Note:** No warning is issued when the length that you specify in the LENGTH statement results in truncated data.

For more information, see "LENGTH Statement: z/OS" on page 655.

# How Character Values Are Stored

Characters are stored in a computer using a “character encoding scheme” that maps the individual characters to binary integers. The two most commonly used single-byte character encoding schemes are ASCII and EBCDIC. IBM mainframe computers use the EBCDIC encoding, which contains representations for 256 characters. Each character has a unique representation, a binary integer from 0 to 256 (x'FF').

The previous paragraph contains a simplified overview of character encoding, ASCII, and EBCDIC. There are multiple forms of ASCII and multiple forms of EBCDIC. Often, these encodings are referred to as “code pages.” The different EBCDIC code pages generally represent common characters, like letters and numbers, with the same code. However, the code pages use different codes for less common characters.

The following table shows the EBCDIC code for commonly used characters. These representations are correct for all EBCDIC code pages.

***Table 22.3*** *EBCDIC Code: Commonly Used Characters*

| Hexadecimal | Character | Hexadecimal | Character | Hexadecimal | Character | Hexadecimal | Character |
|---|---|---|---|---|---|---|---|
| '40'x | space | '93' | l | 'C4' | D | 'E5' | V |
| '4B' | . | '94' | m | 'C5' | E | 'E6' | W |
| '4E' | + | '95' | n | 'C6' | F | 'E7' | X |
| '5C' | * | '96' | o | 'C7' | G | 'E8' | Y |
| '60' | - | '97' | p | 'C8' | H | 'E9' | Z |
| '61' | / | '98' | q | 'C9' | I | 'F0' | 0 |
| '6D' | _ | '99' | r | 'D1' | J | 'F1' | 1 |
| '81' | a | 'A2' | s | 'D2' | K | 'F2' | 2 |
| '82' | b | 'A3' | t | 'D3' | L | 'F3' | 3 |
| '83' | c | 'A4' | u | 'D4' | M | 'F4' | 4 |
| '84' | d | 'A5' | v | 'D5' | N | 'F5' | 5 |
| '85' | e | 'A6' | w | 'D6' | O | 'F6' | 6 |
| '86' | f | 'A7' | x | 'D7' | P | 'F7' | 7 |
| '87' | g | 'A8' | y | 'D8' | Q | 'F8' | 8 |
| '88' | h | 'A9' | z | 'D9' | R | 'F9' | 9 |
| '89' | i | 'C1' | A | 'E2' | S | | |
| '91' | j | 'C2' | B | 'E3' | T | | |
| '92' | k | 'C3' | C | 'E4' | U | | |

# 23

# The SASCBTBL Attribute Table and SAS MODULEx CALL Routines

# Overview of Load Libraries in SAS

## What Is a Load Library?

Load libraries contain executable programs that are written in any of several programming languages. Load libraries are a mechanism for storing useful routines that might be needed by multiple applications. When an application needs a routine that resides in a load module of an external load library, it loads the module, invokes the routine, and unloads the load module upon completion.

## Invoking Load Libraries from within SAS

SAS provides routines and functions that let you invoke these external routines from within SAS. You can access the load library routines from the DATA step, the IML procedure, and SCL code. You use the MODULE family of SAS CALL routines and functions (including MODULE, MODULEN, and MODULEC), as well as the SAS/IML functions and CALL routines (including MODULEI, MODULEIN, and MODULEIC), to invoke a routine that resides in a load library. This documentation refers to the MODULE family of CALL routines and functions generically as the CALL MODULE function.

For information about MODULE, MODULEN, and MODULEC, see the *SAS Functions and CALL Routines: Reference*. For information about the IML procedure, MODULEI, MODULEIN, and MODULEIC, see the *SAS/IML Studio: User's Guide* .

## Accessing an External Load Library

You can use the LOAD= parameter on the EXEC card in the JOB statement in batch mode to pass in the external load library for SAS to use.

Follow these steps to access an external load library routine:

1. Create a text file that describes the load library routine that you want to access, including the arguments that it expects and the values that it returns (if any). This attribute file must be in a special format, as described in "SASCBTBL Attribute Table" on page 407.
2. Use the FILENAME statement to assign the SASCBTBL fileref to the attribute file that you created.

3 In a DATA step or SCL code, use a CALL routine or function (MODULE, MODULEN, or MODULEC) to invoke the load library routine. The specific function that you use depends on the type of expected return value (none, numeric, or character). (You can also use MODULEI, MODULEIN, or MODULEIC within a PROC IML step.) The CALL MODULE functions are described in "CALL MODULE Routine: z/OS" on page 456.

**CAUTION**

**Only experienced programmers should access external routines in load libraries.** By accessing a function in a load library, you transfer processing control to the external function. If done improperly, or if the external function is not reliable, you might lose data, get unreliable results, or receive severe errors.

# SASCBTBL Attribute Table

## Introduction to the SASCBTBL Attribute Table

Because the CALL MODULE function invokes an external routine that SAS knows nothing about, you must supply information about the routine's arguments so that the CALL MODULE function can validate them and convert them, if necessary. For example, suppose you want to invoke a routine that requires an integer as an argument. Because SAS uses floating-point values for all of its numeric arguments, the floating-point value must be converted to an integer before you invoke the external routine. The CALL MODULE function looks for this attribute information in an attribute table that is referred to by the SASCBTBL fileref.

## What Is the SASCBTBL Attribute Table?

The attribute table is a sequential text file that contains descriptions of the routines that you can invoke with the CALL MODULE function. The table defines how the CALL MODULE function should interpret supplied arguments when it builds a parameter list to pass to the called routine.

The CALL MODULE function locates the table by opening the file that is referenced by the SASCBTBL fileref. If you do not define this fileref, the CALL MODULE function simply calls the requested load library routine without altering the arguments.

**CAUTION**

**Using the CALL MODULE function without defining an attribute table can cause SAS to crash, produce unexpected results, or result in severe errors.** You need to use an attribute table for all external functions that you want to invoke.

# Syntax of the Attribute Table

## Overview of the Attribute Table

The attribute table should contain the following items:

- a description in a ROUTINE statement for each load library routine that you intend to call
- descriptions in ARG statements for each argument that is associated with the routine that you intend to call

At any point in the attribute table file, you can create a comment using an asterisk (*) as the first non-blank character of a line or after the end of a statement (following the semicolon). You must end the comment with a semicolon.

## ROUTINE Statement

Here is the syntax of the ROUTINE statement:

**ROUTINE** *name* MINARG=*minarg* MAXARG=*maxarg* <RUNTIME=LE>

<CALLSEQ=BYVALUE|BYADDR>

<TRANSPOSE=YES|NO> <MODULE=*load-library-name*>

<RETURNS=DBLPTR | CHAR<*n*> | DOUBLE | LONG | PTR | SHORT | [U]INT32 | [U]INT64 | ULONG | USHORT>;

Here are descriptions of the ROUTINE statement attributes:

ROUTINE *name*
starts the ROUTINE statement. You need a ROUTINE statement for every load library function that you intend to call. The value for *name* must match the routine name that you specified in the *module* argument in the CALL MODULE function.

The *name* argument is case sensitive, and is required for the ROUTINE statement.

RUNTIME=LE
indicates that you are running LE COBOL routines.

MINARG=*minarg*
specifies the minimum number of arguments to expect for the load library routine. In most cases, this value is the same as the MAXARG value, but some routines do allow a varying number of arguments. This attribute is required.

MAXARG=*maxarg*
specifies the maximum number of arguments to expect for the load library routine. This attribute is required.

CALLSEQ=BYVALUE | BYADDR
indicates the calling sequence method used by the load library routine. Specify BYVALUE for call-by-value sequences and BYADDR for call-by-address sequences. The default value is BYADDR.

Fortran and COBOL use call-by-address sequences. The C language usually uses call-by-value sequences, although a specific routine might be implemented as call by address.

The CALL MODULE function does not require that all arguments use the same calling method. You can identify any exceptions by using the BYVALUE and BYADDR options in the ARG statement.

TRANSPOSE=YES | NO
specifies whether SAS transposes matrices that have both more than one row and more than one column before it calls the load library routine. This attribute applies only to routines called from within PROC IML with MODULEI, MODULEIN, and MODULEIC.

Use TRANSPOSE=YES when you use a CALL routine that is written in a language that does not use row-major order to store matrices. (For example, Fortran uses column-major order.)

For example, consider this matrix with three columns and two rows:

```
columns
                1  2  3
            ------------
      rows  1 | 10 11 12
            2 | 13 14 15
```

PROC IML stores this matrix in memory sequentially as 10, 11, 12, 13, 14, 15. However, Fortran routines expect this matrix as 10, 13, 11, 14, 12, 15.

The default value is NO.

RETURNS=DBLPTR | CHAR<*n*> | DOUBLE | LONG | PTR | SHORT | [U]INT32 | [U]INT64 | ULONG | USHORT
specifies the type of value that the load library routine returns. This value is converted as appropriate, depending on whether you use MODULEN (which returns a number) or MODULEC (which returns a character). Here are the possible return value types:

DBLPTR
is a pointer to a double-precision floating point number (instead of using a floating-point register). See the documentation for your load library routine to determine how it handles double-precision floating-point values.

CHAR<*n*>
is a pointer to a character string up to *n* bytes long. The string is expected to be null-terminated and is blank-padded or truncated as appropriate. If you do not specify *n*, the CALL MODULE function uses the maximum length of the receiving SAS character variable.

DOUBLE
is a double-precision floating-point number.

LONG
is a long integer.

PTR
is a character string being returned.

SHORT
is a short integer.

[U]INT32
is a 32-bit unsigned integer. (If INT32 is returned, it is a 32-bit signed integer.)

[U]INT64
is a 64-bit unsigned integer. (If INT64 is returned, it is a 64-bit signed integer.)

ULONG
is an unsigned long integer.

USHORT
is an unsigned short integer.

If you do not specify the RETURNS attribute, you should invoke the routine with only the MODULE and MODULEI CALL routines. Omitting the RETURNS attribute and invoking the routine with the MODULEN and MODULEIN functions or the MODULEC and MODULEIC functions produces unpredictable results.

## ARG Statement

The ROUTINE statement must be followed by as many ARG statements as you specified in the MAXARG= option. The ARG statements must appear in the order in which the arguments are specified within the CALL MODULE function.

Here is the syntax for each ARG statement:

**ARG** *argnum* NUM | CHAR <INPUT | OUTPUT | UPDATE> <NOTREQD | REQUIRED>
<BYADDR | BYVALUE> <FDSTART> <FORMAT=*format*>;

Here are the descriptions of the ARG statement attributes:

ARG *argnum*
defines the argument number. The *argnum* attribute is required. Define the arguments in ascending order, starting with the first routine argument (ARG 1).

NUM | CHAR
: defines the argument as numeric or character. This attribute is required.

  If you specify NUM here but pass the routine a character argument, the argument is converted using the standard numeric informat. If you specify CHAR here but pass the routine a numeric argument, the argument is converted using the BEST12. informat.

INPUT | OUTPUT | UPDATE
: indicates the argument is either input to the routine, an output argument, or both. If you specify INPUT, the argument is converted and passed to the load library routine. If you specify OUTPUT, the argument is not converted, but is updated with an outgoing value from the load library routine. If you specify UPDATE, the argument is converted, passed to the load library routine, and updated with an outgoing value from the routine.

  You can specify OUTPUT and UPDATE only with variable arguments (that is, no constants or expressions are allowed).

NOTREQD | REQUIRED
: indicates whether the argument is required. If you specify NOTREQD, then the CALL MODULE function can omit the argument. If other arguments follow the omitted argument, identify the omitted argument by including an extra comma as a placeholder. For example, to omit the second argument to routine `xyz`, you specify:

```
call module('xyz',1,,3);
```

**CAUTION**
**Be careful when using NOTREQD; the load library routine must not attempt to access the argument if it is not supplied in the call to MODULE. If the routine does attempt to access it, you might receive unexpected results or severe errors.**

  The REQUIRED attribute indicates that the argument is required and cannot be omitted. REQUIRED is the default value.

BYADDR | BYVALUE
: indicates whether the argument is passed by reference or by value.

  BYADDR is the default value unless CALLSEQ=BYVALUE was specified in the ROUTINE statement. In that case, BYVALUE is the default. Specify BYADDR when you are using a call-by-value routine that also has arguments to be passed by address.

FDSTART
: indicates that the argument begins a block of values that are grouped into a structure whose pointer is passed as a single argument. Note that all subsequent arguments are treated as part of that structure until the CALL MODULE function encounters another FDSTART argument.

FORMAT=*format*
: names the format that presents the argument to the load library routine. Any formats supplied by SAS, PROC FORMAT style formats, or SAS/TOOLKIT formats are valid. Note that this format must have a corresponding valid informat if you specified the UPDATE or OUTPUT attribute for the argument.

The FORMAT= attribute is not required, but is recommended because format specification is the primary purpose of the ARG statements in the attribute table.

**CAUTION**
**Using an incorrect format can produce invalid results, cause SAS to crash, or result in serious errors.**

# Importance of the Attribute Table

The CALL MODULE function relies heavily on the accuracy of the information in the attribute table. If this information is incorrect, unpredictable results can occur (including an abnormal termination).

Consider an example routine `xyz` that expects two arguments: an integer and a pointer. The integer is a code indicating what action takes place. For example, action 1 means that a 20-byte character string is written into the area that is pointed to by the second argument, the pointer.

Suppose you call `xyz` using the CALL MODULE function, but you indicate in the attribute table that the receiving character argument is only 10 characters long:

```
routine xyz minarg=2 maxarg=2;
arg 1 input num byvalue format=ib4.;
arg 2 output char format=$char10.;
```

Regardless of the value given by the LENGTH statement for the second argument to MODULE, MODULE passes a pointer to a 10-byte area to the `xyz` routine. If `xyz` writes 20 bytes at that location, the 10 bytes of memory following the string provided by MODULE are overwritten, causing unpredictable results:

```
data _null_;
    length x $20;
    call module('xyz',1,x);
run;
```

The call might work fine, depending on which 10 bytes were overwritten. However, overwriting can cause you to lose data or cause SAS to crash.

# Grouping SAS Variables as Structure Arguments

## Passing an Argument to a Structure

When calling external routines, a common need is to pass a pointer to a structure. Some parts of the structure might be used as input to the routine, and other parts might be replaced or filled in by the routine. Even though SAS does not have structures in its language, you can indicate to the CALL MODULE function that you want a particular set of arguments grouped into a single structure. You indicate this grouping by using the FDSTART option of the ARG statement to flag the argument that begins the structure in the attribute table. SAS gathers that argument and all the arguments that follow (until encountering another FDSTART option) into a single contiguous block. SAS then passes a pointer to the block as an argument to the load library routine.

# Invoking the CALL MODULE Routine

## Calling Conventions for the CALL MODULE Routine

Use the following syntax to invoke the CALL MODULE routine:

**CALL MODULE**(<*cntl*> ,*module*,*arg1*,*arg2*, ...;

*cntl*
specifies an optional control string. For more information, see "The Control String" on page 414.

module
specifies a character string that contains the name of the COBOL routine that is to be dynamically loaded. The string does not have to be in all uppercase. For information about where the module should be located so that it can be loaded, see the "Details" section of "CALL MODULE Routine: z/OS" on page 456.

*arg(n)*
specifies the arguments to be passed to the COBOL routine. For more information about supported attributes and their matching variable types, see "Using Constants and Expressions as Arguments to the CALL MODULE Function" on page 414.

For more information about the calling conventions, see "CALL MODULE Routine: z/OS" on page 456.

## The Control String

The control string begins with an asterisk (*). It can contain any number of options, each consisting of a single character, followed by an optional second character, depending on the options. The options are not case-sensitive. The allowed options are as follows:

E print error messages in the log.

I print parameter lists in the log.

A do not use table attributes, even if SASCBTBL is available.

Z do not invoke IGZERRE. For more information, see the IBM documentation for the z/OS operating system.

B copy arguments below the line. For more information, see the IBM documentation for the z/OS operating system.

T print attribute information in the log.

Sx use the separator character 'x' to delimit field definitions.

H print a brief help listing in the log.

For more information about the control string, see "CALL MODULE Routine: z/OS" on page 456.

# Using Constants and Expressions as Arguments to the CALL MODULE Function

You can pass any type of expression as an argument to the CALL MODULE function. The attribute table indicates whether the argument is for input, output, or update.

You can specify input arguments as constants and arithmetic expressions. However, because output and update arguments must be able to be modified and returned,

you can pass only a variable for them. If you specify a constant or expression where a value that can be updated is expected, SAS issues a warning message pointing out the error. Processing continues, but the CALL MODULE function cannot perform the update. That is, the value of the argument that you wanted to update is lost.

Consider these examples. Here is the attribute table:

```
* attribute table entry for ABC;
routine abc minarg=2 maxarg=2;
arg 1 input format=ib4.;
arg 2 output format=ib4.;
```

Here is the DATA step with the MODULE calls:

```
data _null_;
  x=5;
  /* passing a variable as the    */
  /*   second argument - OK       */
  call module('abc',1,x);

  /* passing a constant as the    */
  /*   second argument - INVALID  */
  call module('abc',1,2);

  /* passing an expression as the */
  /*   second argument - INVALID  */
  call module('abc',1,x+1);
run;
```

In the preceding example, the first call to MODULE is valid because `x` is updated by the value that the **abc** routine returns for the second argument. The second call to MODULE is invalid because a constant is passed. MODULE issues a warning indicating you have passed a constant, and passes a temporary area instead. The third call to MODULE is invalid because an arithmetic expression is passed. This action causes a temporary location from the DATA step to be used, and the returned value to be lost.

# Specifying Formats and Informats to Use with MODULE Arguments

## Using the FORMAT Attribute in the ARG Statement

You specify the SAS format and informat for each load library routine argument by specifying the FORMAT attribute in the ARG statement. The format indicates how numeric and character values should be passed to the load library routine and how they should be read back upon completion of the routine.

Usually, the format that you use corresponds to a variable type for a given programming language. The following sections describe the proper formats that correspond to different variable types in various programming languages.

# C Language Formats

***Table 23.1*** *C Language Formats*

| C Type | SAS Format and Informat for 32-Bit z/OS |
|---|---|
| double | RB8. |
| float | FLOAT4. |
| signed int | IB4. |
| signed short | IB2. |
| signed long | IB4. |
| char * | IB4. |
| unsigned int | PIB4. |
| unsigned short | PIB2. |
| unsigned long | PIB4. |
| char[*w*] | $CHAR*w*. or $CSTR*w*. |

**Note:** For more information, see "$CHARw. Format" in *SAS Formats and Informats: Reference* and "$CSTRw. Format" on page 419.

**Note:** For information about passing character data other than as pointers to character strings, see "$BYVALw. Format and Informat" on page 420.

# Fortran Language Formats

*Table 23.2* Fortran Language Formats

| Fortran Type | SAS Format and Informat |
|---|---|
| integer*2 | IB2. |
| integer*4 | IB4. |
| real*4 | RB4. |
| real*8 | RB8. |
| character*w | $CHARw. |

The CALL MODULE function can support Fortran character arguments only if they are not expected to be passed by a descriptor.

# PL/I Language Formats

*Table 23.3* PL/I Language Formats

| PL/I Type | SAS Format and Informat |
|---|---|
| FIXED BIN(15) | IB2. |
| FIXED BIN(31) | IB4. |
| FLOAT BIN(21) | RB4. |
| FLOAT BIN(31) | RB8. |
| CHARACTER(w) | $CHARw. |

The PL/I descriptions are added here for completeness. These descriptions do not guarantee that you are able to invoke PL/I routines.

# COBOL Language Formats

*Table 23.4* COBOL Language Formats

| COBOL Format | SAS Format and Informat | Description |
|---|---|---|
| PIC S*xxxx* BINARY | IB*w*. | integer binary |
| COMP-2 | RB8. | double-precision floating point |
| COMP-1 | RB4. | single-precision floating point |
| PIC *xxxx* or S*xxxx* | F*w*. | printable numeric |
| PIC *yyyy* | $CHAR*w*. | character |

*Table 23.5* COBOL Specifications and SAS Formats and Informats

| COBOL Format | SAS Format and Informat | Description |
|---|---|---|
| PIC S*xxxx* DISPLAY | ZD*w*. | zoned decimal |
| PIC S*xxxx* PACKED-DECIMAL | PD*w*. | packed decimal |

The following COBOL specifications do not have true native equivalents and are usable only in conjunction with the corresponding S370F*xxx* format and informat, which enables z/OS representations to be read and written in the UNIX environment. The specifications are provided here to assist with portability across platforms.

*Table 23.6* COBOL Specifications Used with the S370Fxxx Group of Formats and Informats

| COBOL Format | SAS Format and Informat | Description |
|---|---|---|
| PIC *xxxx* DISPLAY | S370FZDU*w*. | zoned decimal unsigned |
| PIC S*xxxx* DISPLAY SIGN LEADING | S370FZDL*w*. | zoned decimal leading sign |
| PIC S*xxxx* DISPLAY SIGN LEADING SEPARATE | S370FZDS*w*. | zoned decimal leading sign separate |
| PIC S*xxxx* DISPLAY SIGN TRAILING SEPARATE | S370FZDT*w*. | zoned decimal trailing sign separate |

| COBOL Format | SAS Format and Informat | Description |
|---|---|---|
| PIC *xxxx* BINARY | S370FIBU*w*. | integer binary unsigned |
| PIC *xxxx* PACKED-DECIMAL | S370FPDU*w*. | packed decimal unsigned |

# $CSTRw. Format

If you pass a character argument as a null-terminated string, use the $CSTR*w*. format. This format looks for the last non-blank character of your character argument and passes a copy of the string with a null terminator after the last non-blank character. For example, consider the following attribute table entry:

```
* attribute table entry;
routine abc minarg=1 maxarg=1;
arg 1 input char format=$cstr10.;
```

With this entry, you can use the following DATA step:

```
data _null_;
     rc = module('abc','my string');
     run;
```

The $CSTR format adds a null terminator to the character string `my string` before passing it to the `abc` routine. Adding a null terminator to the character string and then passing the string to the `abc` routine is equivalent to the following attribute entry:

```
* attribute table entry;
routine abc minarg=1 maxarg=1;
arg 1 input char format=$char10.;
```

The entry has the following DATA step:

```
data _null_;
     rc = module('abc','my string'||'00'x);
run;
```

The first example is easier to understand and easier to use when using variable or expression arguments.

The $CSTR informat converts a null-terminated string into a blank-padded string of the specified length. If the load library routine is supposed to update a character argument, use the $CSTR informat in the argument attribute.

# $BYVALw. Format and Informat

When you use a CALL MODULE function to pass a single character by value, the argument is automatically promoted to an integer. If you want to use a character expression in the MODULE call, you must use the special format or informat called $BYVAL*w*. The $BYVAL*w*. format or informat expects a single character and produces a numeric value, the size of which depends on *w*. For example, the $BYVAL2. format produces a short argument. The $BYVAL4. format produces a long argument. The $BYVAL8. format produces a double argument. Consider this example using the C language:

```
long xyz(a,b)
  long a; double b;
  {
  static char c = 'Y';
  if (a == 'X')
     return(1);
  else if (b == c)
     return(2);
  else return(3);
  }
```

In this example, the **xyz** routine expects two arguments, a long and a double. If the value of the long argument is **X**, the actual value of the long argument is 231 in decimal. This result happens because an EBCDIC X is stored as hexadecimal E7, and this value is promoted to a long argument, represented as 0x000000E7 (or 231 decimal). If the value of **a** is **X**, or 231, then a 1 is returned. If the second argument, a double, is **Y** (which is interpreted as 232), then 2 is returned.

If you want to pass characters as the arguments to **xyz**, then in the C language, you invoke them as follows:

```
x = xyz('X',(double)'Z');
y = xyz('Q',(double)'Y');
```

The characters are invoked in this way because the **x** and **Q** values are automatically promoted to integers (which are the same as long arguments for the sake of this example), and the integer values corresponding to **Z** and **Y** are cast to double arguments.

To call **xyz** using the MODULEN function, your attribute table must reflect the fact that you want to pass characters:

```
routine xyz minarg=2 maxarg=2 returns=long;
arg 1 input char byvalue format=$byval4.;
arg 2 input char byvalue format=$byval8.;
```

Note that the BYVALUE option must appear in the ARG statement as well. Otherwise, MODULEN assumes that you want to pass a pointer to the routine, instead of a value.

Here is the DATA step that invokes MODULEN and passes characters to it:

```
data _null_;
```

```
     x = modulen('xyz','X','Z');
     put x= ' (should be 1)';
     y = modulen('xyz','Q','Y');
     put y= ' (should be 2)';
run;
```

# Understanding MODULE Log Messages

If you specify `i` in the control string parameter to MODULE, SAS prints several informational messages to the log. You can use these messages to determine whether you have passed incorrect arguments or coded the attribute table incorrectly.

Consider this example that uses MODULEIN from within the IML procedure. It uses the MODULEIN function to invoke the `changi` routine (which is stored in theoretical TRYMOD). In the example, MODULEIN passes the constant 6 and the matrix x2, which is a 4x5 matrix to be converted to an integer matrix.

Here is the Assembly source code for `changi`:

```
NROWS    EQU   1
NCOLS    EQU   2
VALUE    EQU   3
MATRIX   EQU   4
I        EQU   5
CHANGI   CSECT
         USING *,15
         STM   14,12,12(13)           save registers
         LM    1,4,0(1)               get our arguments
ROWLP    DS    0H                     while(nrows > 0)
         LR    I,NCOLS                  for (i=ncols; i>0; i--)
COLLP    DS    0H
         L     0,0(MATRIX)                 get element
         AR    0,VALUE                     increment by constant
         ST    0,0(MATRIX)                 store it back
         AH    MATRIX,=H'4'                go to next element
         BCT   I,COLLP
         BCT   NROWS,ROWLP
         LM    14,12,12(13)           restore args
         BR    14                       and return
         LTORG
```

Here is the attribute table for `changi`:

```
routine changi minarg=4 maxarg=4;
arg 1 num input format=ib4. byvalue;
arg 2 num input format=ib4. byvalue;
arg 3 num input format=ib4. byvalue;
arg 4 num update format=ib4. byaddr;
```

The following IML step invokes MODULEIN:

```
proc iml;
```

```
use temp;
read all var{x y z} into testm;
print testm;
testm1 = testm;
value = modulein("*i",'changi',nrow(testm),ncol(testm),7,testm1);
print value testm1;
quit;
```

The `'*i'` control string causes the lines shown in the following output to be written in the log.

***Output 23.1*** *MODULEIN Output*

```
---PARM LIST FOR MODULEIN ROUTINE---
CHR PARM 1 21BF20B0 5C89 (*i)
CHR PARM 2 21BF20D0 838881958789 (changi)
NUM PARM 3 21BF2120 4120000000000000
NUM PARM 4 21BF2140 4130000000000000
NUM PARM 5 21BF2100 4170000000000000
NUM PARM 6 21BF2010 411000000000000041200000000000000413000
000000000041400000000000004150000000000000041600000000000000
---ROUTINE CHANGI LOADED AT ADDRESS 80019000 (AMODE 31 RMODE 24) (PARMLIST AT
000BB430)---
PARM 1 00000002      <CALL-BY-VALUE>
PARM 2 00000003      <CALL-BY-VALUE>
PARM 3 00000007      <CALL-BY-VALUE>
PARM 4 800BB040 00000001000000020000000300000004000000050000000 6
---VALUES UPON RETURN FROM CHANGI ROUTINE---
PARM 1 00000002      <CALL-BY-VALUE>
PARM 2 00000003      <CALL-BY-VALUE>
PARM 3 00000007      <CALL-BY-VALUE>
PARM 4 800BB040 000000080000000900000000A0000000B0000000C0000000D
---VALUES UPON RETURN FROM MODULEIN ROUTINE---
NUM PARM 3 21BF2120 4120000000000000
NUM PARM 4 21BF2140 4130000000000000
NUM PARM 5 21BF2100 4170000000000000
NUM PARM 6 21BF2010
418000000000000041900000000000041A000000000000041B0000000000000
41C000000000000041D0000000000000
```

The output is divided into four sections:

- The first section describes the arguments passed to MODULEIN.

  The CHR PARM *n* portion indicates that character parameter *n* was passed. In the example, 21BF20B0 is the actual address of the first character parameter to MODULEIN. The value at the address is hexadecimal 5C89, and the EBCDIC representation of that value ('*i') is in parentheses after the hexadecimal value. The second parameter is printed similarly. The hexadecimal equivalents are printed for only these first two arguments because other arguments might contain unreadable binary data.

  The remaining parameters appear with only hexadecimal representations of their values (NUM PARM 3 and NUM PARM 4 in the example).

  The third parameter to MODULEIN is numeric, and it is at address 21BF2120. The hexadecimal representation of the floating-point number 2 is shown. The sixth parameter is at address 21BF2120, which points to an area containing all the values for the 4x5 matrix. The `*i` option prints the entire argument. Be

careful if you use this option with large matrices, because the log might become quite large.

- The second section of the log lists the arguments that are to be passed to the requested routine and, in this case, changed. This section is important for determining whether the arguments are being passed to the routine correctly. The first line of this section contains the name of the routine and its address in memory. It also contains the address of the location of the parameter block that MODULEIN created.

  The log contains the status of each argument as it is passed. For example, the first parameter in the example is call-by-value (as indicated in the log). The fourth parameter is the address of the matrix. The log shows the address, along with the data to which it points.

  Note that all the values in the numeric parameters and in the matrix are long integers because the attribute table states that the format is IB4.
- In the third section, the log contains the argument values upon return from `changi`. The call-by-value argument is unchanged, but the other argument (the matrix) contains different values.
- The last section of the log output contains the values of the arguments as they are returned to the MODULEIN CALL routine.

The PRINT statements in the PROC IML step cause the lines shown in the following output to be written in the log.

```
              testm

          1          2          3
          4          5          6


value     testm1

      0          8          9         10
                11         12         13
```

# Examples of Accessing Load Executable Libraries

## COBOL Example

The following COBOL example creates a load module named TEST1 that is used in the following SAS example. The example program is passed two arguments, each of which is an 11-byte character buffer. The output buffer is first set to a value of `Z`. If

each of bytes 1 through 11 has a value of 1), then the output buffer is set to a value of A. The two arguments have been combined into one argument with `fdstart` in the ARG statement that describes the parameters in the attribute table.

```
DATA DIVISION.

LINKAGE SECTION.
01 WS-PARM-AREA.
  05 KEY-1A PIC X(1).
  05 KEY-1B PIC X(10).
  05 KEY-2A PIC X(1).
  05 KEY-2B PIC X(10).
****************************************************************
 PROCEDURE DIVISION USING WS-PARM-AREA.
     MOVE "Z" TO KEY-2A.
     MOVE "ZZZZZZZZZZ" TO KEY-2B.
     IF KEY-1B = "1111111111"
        THEN MOVE "AAAAAAAAAA" TO KEY-2B.
     IF KEY-1B = "1111111111"
        THEN MOVE "A" TO KEY-2A.
     GOBACK.

 END PROGRAM TEST1.
```

# Assembler Example

The following Assembler example creates a load module named TEST2 that is used in the following SAS example. The example has a single numeric argument that is updated in place by adding the value 123.

```
TEST2 CSECT
           USING *,15
           STM 14,12,12(13)
           L 1,0(1)
           LD 0,0(1)
           AD 0,=D'123'
           STD 0,0(1)
           LM 14,12,12(13)
           BR 14
           LTORG
           END
```

# SAS Example

The following SAS example creates a temporary data set named SASCBTBL, copies the ROUTINE and ARG statements into the data set, and calls the TEST1 and TEST2 load modules that the preceding COBOL and Assembler examples created.

```
filename sascbtbl temp;
data _null_; file sascbtbl;
     input; put _infile_; cards4;
```

```
routine test1 minarg=2 maxarg=2;
arg 1 char input format=$char11. fdstart;
arg 2 char output format=$char11.;
routine test2 minarg=1 maxarg=1;
arg 1 num update format=rb8. byaddr;
;;;;
data _null_;
     length fld_in fld_out $11;
     input fld_in @@;
     fld_out=' ';
     call module('test1', fld_in, fld_out);
     put fld_out= @;
     IF FLD_IN='11111111111' THEN PUT ' (SHOULD BE AAAAAAAAAAA)';
     ELSE PUT ' (SHOULD BE ZZZZZZZZZZZ)';
     cards;
11111111111 22222222222
     run;
data _null_;
     x = 12;
     call module('test2',x);
     put x= ' ( should be 135 , which is 12 + 123 )';
     run;
```

# Output

The preceding SAS example writes the following messages and output to the SAS log.

```
NOTE: Libref LIBRARY was successfully assigned as
follows:
      Engine:
V9
      Physical Name:
SDC.SAS9.E12W19.MXG.FMTLIB


1          filename sascbtbl
temp;
2          data _null_; file
sascbtbl;
3               input; put _infile_;
cards4;


NOTE: The file SASCBTBL
is:

Dsname=SYS12282.T134432.RA000.MODEXMPL.R0111551,

Unit=3390,Volume=SCRD01,Disp=NEW,Blksize=27920,

Lrecl=80,Recfm=FB,Creation=2012/10/08
```

```
NOTE: 5 records were written to the file
SASCBTBL.
NOTE: The DATA statement used 0.00 CPU seconds and
18342K.


NOTE: The address space has used a maximum of 920K below
      the line and 20276K above the line.




9          ;;;;

10         data
_null_;
11              length fld_in fld_out
$11;
12              input fld_in
@@;
13              fld_out='
';
14              call module('test1', fld_in,
fld_out);
15              put fld_out=
@;
16              IF FLD_IN='11111111111' THEN PUT ' (SHOULD BE
AAAAAAAAAAA)';
17              ELSE PUT ' (SHOULD BE
ZZZZZZZZZZZ)';
18
cards;


fld_out=AAAAAAAAAAA  (SHOULD BE
AAAAAAAAAAA)
fld_out=ZZZZZZZZZZZ  (SHOULD BE
ZZZZZZZZZZZ)
NOTE: SAS went to a new line when INPUT statement reached
past the end of a line.
NOTE: The DATA statement used 0.00 CPU seconds and
18391K.


NOTE: The address space has used a maximum of 1164K below
      the line and 20296K above the line.




20
run;
21         data
_null_;
```

```
22              x =
12;
23              call
module('test2',x);
24              put x= ' ( should be 135 , which is 12 +
123 )';
25
run;


x=135  ( should be 135 , which is 12 +
123 )
NOTE: The DATA statement used 0.00 CPU seconds and
18440K.


NOTE: The address space has used a maximum of 1164K below
      the line and 20344K above the line.



NOTE: The SAS session used 0.04 CPU seconds and
18440K.
```

PART 6

# Host-Specific Features of the SAS Language

# 24

# Data Set Options under z/OS



## Data Set Options in the z/OS Environment

Portable data set options are documented in *SAS Data Set Options: Reference*. This chapter provides detailed information about data set options that are specific to z/OS or that have aspects that are specific to z/OS. For a list of all of the SAS data set options that are available under z/OS, see "Summary of SAS Data Set Options in the z/OS Environment" on page 432.

Data set options are specified in parentheses following a data set name. The data set options apply only to that one data set.

# Summary of SAS Data Set Options in the z/OS Environment

The following table describes both the data set options specific to z/OS and the portable data set options.

The See column tells you where to look for more detailed information about an option, based on the following legend:

COMP
: See the description of the data set option in this chapter.

LR
: See *SAS Data Set Options: Reference*.

NLS
: See *SAS National Language Support (NLS): Reference Guide*

The Engines column lists the engines with which the option is valid, based on the following legend:

all V9, V8, V7, V6, DBI
: Applies to all disk and tape engines, including database interface (DBI) engines.

all V9, V8, V7, V6, V5
: Applies to all disk and tape engines except DBI engines.

V9TAPE, V8TAPE, V7TAPE, V6TAPE, V5TAPE
: Applies to all tape engines for the specified SAS versions; does not apply to disk or DBI engines.

V9, V8, V7, V6, V5
: Applies to all disk engines for the specified versions; does not apply to tape or DBI engines.

**Note:** For the purposes of the following table, V7, V8, and V9 are the same engine, and V7TAPE, V8TAPE, and V9TAPE are the same engine.

***Table 24.1*** *Summary Table of SAS Data Set Options*

| Data Set Option | Description | When Used | See | Engines |
|---|---|---|---|---|
| ALTER= | Specifies a password for a SAS file that prevents users from replacing or deleting the file, but permits Read and Write access. | output, update | COMP | all V9, V8, V7, V6 |

| Data Set Option | Description | When Used | See | Engines |
|---|---|---|---|---|
| BUFNO= | Specifies the number of buffers to be allocated for processing a SAS data set. | input, output, update | LR | all V9, V8, V7, V6 |
| | | input | LR | all V5 |
| BUFSIZE= | Specifies the size of a permanent buffer page for an output SAS data set. | output | COMP, LR | all V9, V8, V7, V6 |
| CNTLLEV= | Specifies the level of shared access to SAS data sets. | input, update | LR | V9, V8, V7, V6 |
| | | input | LR | V5 |
| COMPRESS= | Controls the compression of observations in a new output SAS data set. | output | LR | V9, V8, V7, V6, V9TAPE, V8TAPE, V7TAPE |
| DLDMGACTION= | Specifies the action to take when a SAS data set in a SAS library is detected as damaged. | input, output, update | LR | all V9, V8, V7, V6 |
| DROP= | Excludes variables from processing or from output SAS data sets. | input, output, update | LR | all V9, V8, V7, V6, DBI |
| | | input | LR | V5 |
| ENCODING= | Overrides the encoding for the input or output SAS data set. | input | NLS | V9, V8, V7, V9TAPE, V8TAPE, V7TAPE |
| ENCRYPT= | Specifies whether to encrypt an output SAS data set. | output | LR | all V8 |
| FILECLOSE= | Specifies how a tape is positioned when a SAS file on the tape is closed. | input, output | Comp, LR | V9TAPE, V6TAPE, V5TAPE |
| | | input | LR | V5TAPE |
| FILEDISP= | Specifies the initial disposition for a sequential-format SAS library. | input, output | COMP | V9TAPE, V8TAPE, V7TAPE, V6TAPE |
| | | input | COMP | V5TAPE |

| Data Set Option | Description | When Used | See | Engines |
|---|---|---|---|---|
| FIRSTOBS= | Specifies which observation SAS processes first. | input, update | LR | all V9, V8, V7, V6, DBI |
| GENMAX= | Requests generations for a SAS data set, and specifies the maximum number of versions. | output, update | LR | V9, V8, V7 |
| GENNUM= | Specifies a particular generation of a SAS data set. | input, output, update | LR | V9, V8, V7 |
| IDXNAME= | Specifies that SAS use a specific index to satisfy the conditions of a WHERE expression. | input, update | LR | V9, V8, V7, V6 |
| IDXWHERE= | Overrides the SAS decision about whether to use an index to satisfy the conditions of a WHERE expression. | input, update | LR | V9, V8, V7, V6 |
| IN= | Creates a variable that indicates whether the data set contributed data to the current observation. | input (with SET, MERGE, MODIFY, UPDATE statements only) | LR | all V9, V8, V7, V6, DBI |
| INDEX= | Defines an index for a new output SAS data set. | output | LR | V9, V8, V7, V6, V9TAPE, V8TAPE, V7TAPE |
| KEEP= | Specifies variables for processing or for writing to output SAS data sets. | input, output, update | LR | all V9, V8, V7, V6, DBI |
| | | input | LR | all V5 |
| LABEL= | Specifies a label for a SAS data set. | input, output, update | LR | all V9, V8, V7, V6, DBI |
| | | input | LR | all V5 |
| OBS= | Specifies the last observation of the data set to process. | input, update | LR | all V9, V8, V7, V6, DBI |
| OBSBUF= | Determines the size of the view buffer for processing a DATA step view. | input | LR | V9, V8, V7 |

| Data Set Option | Description | When Used | See | Engines |
|---|---|---|---|---|
| OUTREP= | Specifies an output format for an operating environment other than z/OS. | output | LR | V9, V8, V7, V9TAPE |
| POINTOBS= | Controls whether a compressed data set can be processed with random access (by observation number) rather than with sequential access only. | input | LR | V9, V8, V7 |
| PW= | Assigns a READ, WRITE, or ALTER password to a SAS file, and enables access to a password-protected file. | input, output, update | LR | all V9, V8, V7, V6 |
| | | input | LR | all V5 |
| PWREQ= | Specifies whether to display a dialog box for a SAS data set password. | input, output, update | LR | all V9, V8, V7, V6 |
| | | input | LR | all V5 |
| READ= | Assigns a password to a SAS file, and enables access to a read-protected SAS file. | input, output, update | LR | all V9, V8, V7, V6 |
| | | input | LR | V5 |
| RENAME= | Changes the name of a variable. | input, output, update | LR | all V9, V8, V7, V6, DBI |
| | | input | LR | V5 |
| REPEMPTY= | Specifies whether a new, empty data set can overwrite an existing SAS data set that has the same name. | output | LR | V9, V8 |
| REPLACE= | Specifies whether a new SAS data set that contains data can overwrite an existing data set that has the same name. | output | LR | all V9, V8, V7, V6, DBI |
| REUSE= | Specifies whether new observations can be written to freed space in compressed SAS data sets. | output | LR | V9, V8, V7, V6 |
| SORTEDBY= | Indicates how the SAS data set is currently sorted. | input, output update | LR | all V9, V8, V7, V6 |

| Data Set Option | Description | When Used | See | Engines |
|---|---|---|---|---|
| | | input | LR | all V5 |
| SPILL= | Specifies whether to create a spill file for non-sequential processing of a DATA step view. | output | LR | V9, V8, V7 |
| TOBSNO= | Specifies the number of observations to send in a client/server transfer. | input, output, update | LR | REMOTE |
| TYPE= | Specifies the data set type for a specially structured SAS data set. | input, output, update | LR | all V9, V8, V7, V6, DBI |
| | | input | LR | all V5 |
| WHERE= | Selects observations that meet the specified condition. | input, output, update | LR | all V9, V8, V7, V6, DBI |
| | | input | LR | all V5 |
| WHEREUP= | Specifies whether to evaluate added observations and modified observations against a WHERE clause. | input, output, update | LR | V9, V8, V7, V6 |
| | | input | LR | all V5 |
| WRITE= | Assigns a Write password to a SAS data set, and enables access to a write-protected SAS file. | output, update | LR | all V9, V8, V7, V6 |

# Dictionary

## ALTER= Data Set Option: z/OS

Specifies a password for a SAS file that prevents users from replacing or deleting the file, but permits Read and Write access.

Valid in: DATA step, PROC steps

Category: Data Set Control

z/OS specifics: All

See: "ALTER= Data Set Option" in *SAS Data Set Options: Reference*

# Syntax

**ALTER=***alter-password*

## Required Argument

***alter-password***
must be a valid SAS name. For more information, see "Rules for Words and Names in the SAS Language" in the *SAS Language Reference: Concepts*.

# Details

## About the Alter= Data Set Option

You can use this option to assign an *alter-password* to a SAS file or to access a read-protected, write-protected, or alter-protected SAS file. When replacing a SAS data set that is Alter protected, the new file inherits the Alter password. To change the Alter password for the new file, use the MODIFY statement in the DATASETS procedure.

The ALTER password is not honored for UFS libraries processed via the TAPE engine. Moreover, the ALTER password cannot be used to prevent members of a sequential access bound library from being deleted if those members follow a member that is being replaced. For more information, see "General Usage Notes" on page 58.

**Note:** A SAS password does not control access to a SAS file or a SAS library outside of SAS. You should use the operating environment-supplied utilities and file-system security controls in order to control access to SAS files outside of SAS. For example, a user with RACF access to the physical bound library could delete the entire library without using the ALTER password.

# See Also

- "Protecting Files" in *SAS Programmer's Guide: Essentials*
- "Manipulating Passwords" in *Base SAS Procedures Guide*

### Data Set Options

- "ENCRYPT= Data Set Option" in *SAS Data Set Options: Reference*
- "PW= Data Set Option" in *SAS Data Set Options: Reference*

- "READ= Data Set Option" in *SAS Data Set Options: Reference*
- "WRITE= Data Set Option" in *SAS Data Set Options: Reference*

# BUFSIZE= Data Set Option: z/OS

Specifies the size of a permanent buffer page for an output SAS data set.

| | |
|---|---|
| Valid in: | DATA step, PROC steps |
| Category: | Data Set Control |
| Default: | The value of the BUFSIZE= system option |
| Restriction: | Use with output data sets only |
| z/OS specifics: | Default value, valid values |
| See: | "BUFSIZE= Data Set Option" in *SAS Data Set Options: Reference* |

## Syntax

**BUFSIZE=**0 | *n* | *n*K

Note: You can also use the KB syntax notation.

### Required Arguments

**0**
specifies that SAS chooses the optimal page size of the data set based on the characteristics of the library and the type of data set.

***n* | *n*K**
specifies the permanent buffer size (page size) in bytes or kilobytes, respectively. For libraries other than UFS, the specified value is rounded up to the block size (BLKSIZE) of the library data set, because a block is the smallest unit of a data set that can be transferred in a single I/O operation.

## Details

The page size is the amount of data that can be transferred for a single I/O operation to one buffer. A page is the number of bytes of data that SAS moves between external storage and memory in one logical I/O operation.

On z/OS, when BUFSIZE=0, SAS usually sets the member page size for output SAS data sets equal to the number of blocks that would fit on one track of the z/OS disk device. This page size tends to favor sequential processing by assuming that the entire track is needed, and that it is read in multiple, consecutive blocks.

However, to improve performance for random (direct) access, the smallest possible buffer size is best. The minimum page size that you can specify depends on the type of library, as shown in the following table:

***Table 24.2*** *Minimum Page Sizes for SAS Libraries*

| Type of Library | Minimum Page Size |
|---|---|
| direct access bound library | BLKSIZE of library data set |
| UFS library | 4K |
| hiperspace library | 4K |

# FILECLOSE= Data Set Option: z/OS

Specifies how a tape is positioned when a SAS data set is closed.

Valid in: DATA step, PROC steps

Category: Miscellaneous

Default: Current setting of the TAPECLOSE system option

Engine: V5TAPE, V6TAPE, V9TAPE

See: "FILECLOSE= Data Set Option" in *SAS Data Set Options: Reference*

## Syntax

**FILECLOSE**=DISP | LEAVE | REREAD | REWIND | FREE

### Required Arguments

**DISP**
specifies that the operating system position the tape volume in accordance with the termination disposition specified via the DISP parameter when the library data set was allocated. If the disposition is PASS, the action described for FILECLOSE=LEAVE is performed. For other dispositions, the action described for FILECLOSE=REWIND is performed, and in some cases, the tape volume can be unloaded if necessary.

**LEAVE**
specifies that the operating system leave the tape volume positioned immediately following the end of the data set on the current volume when SAS closes the library data set. Specifying FILECLOSE=LEAVE is recommended if the subsequent data set on the tape volume is the next data set from that

volume that SAS processes. For more information about the LEAVE parameter, see the example in "Optimizing Performance" on page 60.

**REREAD**
specifies that the operating system rewind the tape volume to the start of the SAS library when SAS closes the library data set. Specifying FILECLOSE=REREAD is recommended if the library is to be processed by multiple SAS procedures or DATA steps in the same SAS session.

**REWIND**
specifies that the operating system rewind the tape volume to the beginning of the tape when SAS closes the library data set.

**FREE**
specifies that the operating system deallocate the tape volume when SAS closes the library data set. Specifying this option makes the tape volume available for use by other jobs in the system as soon as SAS has closed the library, rather than at the end of the SAS session. Do not specify FILECLOSE=FREE if the library data set is used in multiple SAS procedures or DATA steps in the same SAS session.

## Details

In general, SAS closes the library data set at the conclusion of the SAS procedure or DATA step that is processing the library. The FILECLOSE option has no effect on processing direct bound libraries or UFS libraries. Specifying FREE=CLOSE on the JCL DD statement for a library is honored only if FILECLOSE has a value of REWIND, DISP, or FREE. If FILECLOSE has a value of REREAD or LEAVE, then the FREE=CLOSE specification is ignored. For more information about FREE=CLOSE, see the IBM JCL Reference for the version of z/OS that your site is using.

**Note:** If the FILECLOSE data set option is specified, then it overrides the TAPLECLOSE system option.

## See Also

"TAPECLOSE= System Option: z/OS" on page 875

# FILEDISP= Data Set Option: z/OS

Specifies the initial disposition for a sequential access bound SAS library.

Valid in: DATA step, PROC steps

Default: OLD

Engine: V9TAPE, V8TAPE, V7TAPE, V6TAPE, V5TAPE

z/OS specifics: All

## Syntax

**FILEDISP=**NEW | OLD

### Required Arguments

**NEW**
specifies that the sequential library is to be considered empty. SAS therefore does not look for previously written members. The DATA step writes the new member at the beginning of the new (empty) library. Any members that existed in the library before the Write operation are lost. The FILEDISP=NEW option can be valid only during the first write to a sequential library for a given libref. For all subsequent writes to that libref, FILEDISP=NEW is ignored and FILEDISP=OLD is assumed.

**OLD**
specifies that the sequential library is not initially empty. SAS therefore writes members with names that do not already exist in the library at the end of the library. If the member being written has a name that already exists in the library, the existing member is overwritten, and any members that follow the overwritten member are lost.

## Details

A sequential library is a single SAS file that can contain one or more concatenated members.

To avoid inadvertent data loss, make sure that you specify FILEDISP=NEW only when writing to new (empty) sequential libraries. Also, when writing to an existing sequential library, make sure that the name of the member being written does not inadvertently correspond to the name of a member that already exists in the library.

# 25

# Formats under z/OS



## Formats in the z/OS Environment

In general, formats are completely portable. Only the formats that have aspects specific to z/OS are documented in this chapter. All portable formats are described in *SAS Formats and Informats: Reference*; that information is not repeated here. Instead, you are given details about how the format behaves in the z/OS environment, then you are referred to *SAS Formats and Informats: Reference* for additional information.

> **TIP** User-defined format names cannot end in a number. For more information, see "User-Defined Formats" in *SAS Formats and Informats: Reference* and "SAS Names" in *SAS Programmer's Guide: Essentials*.

# Considerations for Using Formats in the z/OS Environment

## EBCDIC and Character Data

The following character formats produce different results on different computing platforms, depending on which character-encoding the platform uses. Because z/OS uses EBCDIC character-encoding, all of the following formats convert data from EBCDIC.

These formats are not discussed in detail in this documentation because EBCDIC character-encoding is their only host-specific aspect.

$ASCII*w.*
: converts EBCDIC character data to ASCII character data.

$BINARY*w.*
: converts EBCDIC character data to binary representation, where each character is represented by eight binary characters.

$EBCDIC*w.*
: converts EBCDIC data to character data. Under z/OS, $EBCDIC*w.* and $CHAR*w.* are equivalent.

$HEX*w.*
: converts EBCDIC character data to hexadecimal representation.

$OCTAL*w.*
: converts EBCDIC character data to octal representation.

All the information that you need in order to use these formats under z/OS is in *SAS Formats and Informats: Reference*.

## Floating-Point Number Format and Portability

The manner in which z/OS stores floating-point numbers can affect your data. See *SAS Language Reference: Concepts* for details.

# Writing Binary Data

If a SAS program that writes binary data is run in only one operating environment, you can use the following native-mode formats.

**Note:** Native-mode formats use the byte-ordering system that is standard for the operating environment.

IB*w.d*
writes integer binary (fixed-point) values, including negative values, that are represented in two's complement notation.

IEEE*w.d*
writes real binary (floating-point) data in IEEE format.

PD*w.d*
writes data that is stored in IBM packed decimal format.

PIB*w.d*
writes positive integer binary (fixed-point) values.

RB*w.d*
writes real binary (floating-point) data in IBM hexadecimal floating-point format.

If you want to write SAS programs that can be run on multiple machines that use different byte-storage systems, use the following IBM 370 formats:

S370FF*w.d*
writes standard numeric data in IBM mainframe format.

S370FIB*w.d*
writes integer binary data in IBM mainframe format.

S370FIBU*w.d*
writes unsigned integer binary data in IBM mainframe format.

S370FPD*w.d*
writes packed decimal data in IBM mainframe format.

S370FPDU*w.d*
writes unsigned packed decimal data in IBM mainframe format.

S370FPIB*w.d*
writes positive integer binary data in IBM mainframe format.

S370FRB*w.d*
writes real binary data in IBM mainframe format.

S370FZD*w.d*
writes zoned decimal data in IBM mainframe format.

S370FZDL*w.d*
writes zoned decimal leading sign data in IBM mainframe format.

S370FZDS*w.d*
writes zoned decimal separate leading sign data in IBM mainframe format.

S370FZDT*w.d*
writes zoned decimal separate trailing sign data in IBM mainframe format.

S370FZDU*w.d*
writes unsigned zoned decimal data in IBM mainframe format.

These IBM z/Architecture formats enable you to write SAS programs that can be run in any SAS environment, regardless of the standard for storing numeric data. They also enhance your ability to port raw data between host operating environments.

For more information about the IBM z/Architecture formats, see *SAS Formats and Informats: Reference*.

# Dictionary

## IBw.d Format: z/OS

Writes values in integer binary (fixed-point) format.

| | |
|---|---|
| Category: | Numeric |
| Alignment: | Left |
| Default: | 4 |
| Ranges: | 1-8 bytes, 0-10 |
| z/OS specifics: | Two's complement big-endian notation |
| See: | "IBw.d Format" in *SAS Formats and Informats: Reference* |

### Details

On an IBM mainframe system, integer values are stored in two's complement notation.

If an overflow occurs, the value written is the largest value that fits into the output field; the value is positive, negative, or unsigned, as appropriate. If the format includes a *d* value, the number is multiplied by $10^d$.

The following table contains examples that illustrate the use of the IB*w.d* format under z/OS:

| Value | Format | Results (Hexadecimal) | Notes |
|---|---|---|---|
| -1234 | ib4. | '`FFFFFB2E`'x | |
| 12.34 | ib4. | '`0000000C`'x | |
| 123456789 | ib4. | '`075BCD15`'x | |
| 1234 | ib6.2 | '`00000001E208`'x | a *d* value of 2 causes the number to be multipled by $10^2$ |
| -1234 | ib6.2 | '`FFFFFFFE1DF8`'x | a *d* value of 2 causes the number to be multipled by $10^2$ |
| 1234 | ib1. | '`7F`'x | overflow occurred |
| -1234 | ib1. | '`80`'x | overflow occurred |

**Note:** In these examples, the Value column represents the value of the numeric variable. The Results column shows a hexadecimal representation of the bit pattern written by the corresponding format. (You cannot view this data in a text editor, unless you can view it in hexadecimal representation.)

## See Also

### Formats

- "S370FIBw.d Format" in *SAS Formats and Informats: Reference*
- "S370FPIBw.d Format" in *SAS Formats and Informats: Reference*

### Informats

- "IBw.d Informat: z/OS" on page 504

# PDw.d Format: z/OS

Writes values in IBM packed decimal format.

Category: Numeric

| | |
|---|---|
| Alignment: | Left |
| Default: | 1 |
| Ranges: | 1-16 bytes, 0-31 |
| z/OS specifics: | IBM packed decimal format |
| See: | "PDw.d Format" in *SAS Formats and Informats: Reference* |

## Details

In packed decimal format, each byte represents two decimal digits. An IBM packed decimal number consists of a sign and up to 31 digits, thus giving a range of $10^{31} - 1$ to $-10^{31} + 1$. The sign is written in the rightmost nibble. (A nibble is four bits or half a byte.) A hexadecimal C indicates a plus sign, and a hexadecimal D indicates a minus sign. The rest of the nibbles to the left of the sign nibble represent decimal digits. The hexadecimal values of these digit nibbles correspond to decimal values. Therefore, only values between '0'x and '9'x can be used in the digit positions.

If an overflow occurs, the value that is written is the largest value that fits into the output field. The value is positive.

If the format includes a d value, the number is multiplied by 10d.

The following table contains examples that illustrate packed decimal format:

| Value | Format | Results (Hexadecimal) | Notes |
|---|---|---|---|
| -1234 | pd3. | `'01234D'x` | |
| 1234 | pd2. | `'999C'x` | overflow occurred |
| 1234 | pd4. | `'0001234C'x` | |
| 1234 | pd4.2 | `'0123400C'x` | a *d* value of 2 causes the number to be multiplied by $10^2$ |

**Note:** In these examples, the Value column represents the value of the data, and the Results column shows a hexadecimal representation of the bit pattern written by the corresponding format. (You cannot view this data in a text editor, unless you can view it in hexadecimal representation.)

The PD*w.d* format writes missing numerical data as -0. When the PD*w.d* informat reads -0, the informat stores -0 as 0.

## See Also

### Formats

- "S370FPDw.d Format" in *SAS Formats and Informats: Reference*

### Informats

- "PDw.d Format" in *SAS Formats and Informats: Reference*
- "PDw.d Informat: z/OS" on page 505

# RBw.d Format: z/OS

Writes values in real binary (floating-point) format.

| | |
|---|---|
| Category: | Numeric |
| Alignment: | Left |
| Default: | 4 |
| Ranges: | 2-8 bytes, 0-10 |
| z/OS specifics: | IBM hexadecimal floating-point format |
| See: | "RBw.d Format" in *SAS Formats and Informats: Reference* |

## Details

The format of floating-point numbers is host-specific. For a description of the format that is used to store floating-point numbers under z/OS, see "Floating-Point Representation" on page 399.

If the format includes a *d* value, the number is multiplied by $10^d$.

The following table contains examples that illustrate how decimal numbers are written as floating-point numbers using the RB*w.d* format:

| Value | Format | Results (Hexadecimal) | Notes |
|---|---|---|---|
| 123 | rb8.1 | `'434CE00000000000'x` | a *d* value of 1 causes the number to be multiplied by $10^1$ |
| 123 | rb8.2 | `'44300C0000000000'x` | a *d* value of 2 causes the number to be multiplied by $10^2$ |

| Value | Format | Results (Hexadecimal) | Notes |
|---|---|---|---|
| -123 | rb8. | '`C27B000000000000`'x | |
| 1234 | rb8. | '`434D200000000000`'x | |
| 1234 | rb2. | '`434D`'x | truncation occurred |
| 12.25 | rb8. | '`41C4000000000000`'x | |

**Note:** In these examples, the Value column represents the value of the data, and the Results column shows a hexadecimal representation of the bit pattern written by the corresponding format. (You cannot view this data in a text editor, unless you can view it in hexadecimal representation.)

## See Also

### Formats

- "S370FRBw.d Format" in *SAS Formats and Informats: Reference*

### Informats

- "RBw.d Informat: z/OS" on page 506

# ZDw.d Format: z/OS

Writes zoned-decimal data.

Category: Numeric

Alignment: Left

Default: 1

Range: 1-32 bytes

z/OS specifics: IBM zoned decimal format

See: "ZDw.d Format" in *SAS Formats and Informats: Reference*

## Details

Like standard format, zoned decimal digits are represented as EBCDIC characters. Each digit requires one byte. The rightmost byte represents both the least

significant digit and the sign of the number. Digits to the left of the least significant digit are written as the EBCDIC characters 0 through 9. The character that is written for the least significant digit depends on the sign of the number. Negative numbers are represented as the EBCDIC printable hexadecimal characters D0 through D9 in the least significant digit position, and positive numbers are represented as hexadecimal C0 through C9. If the format includes a *d* value, the number is multiplied by $10^d$.

If an overflow occurs, the value that is written is the largest value that fits into the output field; the value is positive, negative, or unsigned, as appropriate.

The following table contains examples that illustrate the use of the zoned decimal format:

| Value | Format | Results (Hexadecimal) | Notes |
|---|---|---|---|
| 1234 | zd8. | `'F0F0F0F0F1F2F3C4'x` | |
| 123 | zd8.1 | `'F0F0F0F0F1F2F3C0'x` | a *d* value of 1 causes the number to be multiplied by $10^1$ |
| 123 | zd8.2 | `'F0F0F0F1F2F3F0C0'x` | a *d* value of 2 causes the number to be multiplied by $10^2$ |
| -123 | zd8. | `'F0F0F0F0F0F1F2D3'x` | |
| 0.000123 | zd8.6 | `F0F0F0F0F0F1F2C3` | a *d* value of 6 causes the number to be multiplied by $10^6$ |
| 0.00123 | zd8.6 | `'F0F0F0F0F1F2F3C0'x` | a *d* value of 6 causes the number to be multiplied by $10^6$ |
| 1E-6 | zd8.6 | `'F0F0F0F0F0F0F0C1'x` | a *d* value of 6 causes the number to be multiplied by $10^6$ |

**Note:** In these examples, the Value column represents the value of the data, and the Results column shows a hexadecimal representation of the bit pattern that is written by the corresponding format. (You cannot view this data in a text editor unless you view it in hexadecimal representation.) For a table of commonly used EBCDIC characters, see Table 22.3 on page 403.

## See Also

### Formats

- "S370FZDLw.d Format" in *SAS Formats and Informats: Reference*
- "S370FZDSw.d Format" in *SAS Formats and Informats: Reference*
- "S370FZDTw.d Format" in *SAS Formats and Informats: Reference*
- "S370FZDUw.d Format" in *SAS Formats and Informats: Reference*

### Informats

- "ZDBw.d Informat: z/OS" on page 509
- "ZDw.d Informat: z/OS" on page 507

# 26

# Functions and CALL Routines under z/OS

# Functions and CALL Routines under z/OS

Portable functions are documented in *SAS Functions and CALL Routines: Reference*. This chapter includes detailed information about the SAS functions and CALL routines that are specific to z/OS or that have aspects specific to z/OS.

# Dictionary

## ANYPUNCT Function: z/OS

Searches a string for a punctuation character and returns the first position at which that character is found.

Category: Character

z/OS specifics: *fileref*

See: "ANYPUNCT Function" in *SAS Functions and CALL Routines: Reference*

### Syntax

**ANYPUNCT**(*string* <,*start*> )

#### Required Argument

***string***
is the character constant, variable, or expression to search.

#### Optional Argument

***start***
is an optional integer that specifies the position at which the search should start and the direction in which to search.

## Details

The results of the ANYPUNCT function depend directly on the translation table that is in effect (see “TRANTAB= System Option” in the *SAS National Language Support (NLS): Reference Guide*) and indirectly on the ENCODING and LOCALE system options.

The ANYPUNCT function searches a string for the first occurrence of a punctuation character. If such a character is found, ANYPUNCT returns the position in the string of that character. If no such character is found, ANYPUNCT returns a value of 0.

If you use only one argument, ANYPUNCT begins the search at the beginning of the string. If you use two arguments, the absolute value of the second argument, *start*, specifies the position at which to begin the search. The direction in which to search is determined in the following way:

- If the value of *start* is positive, the search proceeds to the right.
- If the value of *start* is negative, the search proceeds to the left.
- If the value of *start* is less than the negative length of the string, the search begins at the end of the string.

ANYPUNCT returns a value of zero when

- the character that you are searching for is not found
- the value of *start* is greater than the length of the string
- the value of *start* = 0. Or, if the value is missing, `x=anypunct(x,.);`

**Note:** To use a current definition of the punctuation characters, specify an appropriate LOCALE option value (for example, **`LOCALE=ENGLISH`**).

## Comparisons

The ANYPUNCT function searches a character expression for a punctuation character. The NOTPUNCT function searches a character expression for a character that is not a punctuation character.

## Example

The following example uses the ANYPUNCT function to search a string for punctuation characters.

```
data _null_;
   string='Next = _n_ + 12E3;';
   j=0;
   do until(j=0);
      j=anypunct(string,j+1);
      if j=0 then put +3 "That's all";
      else do;
```

```
        c=substr(string,j,1);
        put +3 j= c=;
      end;
   end;
run;
```

The following lines are written to the SAS log:

```
j=6 c==
j=8 c=_
j=10 c=_
j=12 c=+
j=18 c=;
That's all
```

## See Also

"NOTPUNCT Function" in *SAS Functions and CALL Routines: Reference*

# CALL MODULE Routine: z/OS

Calls an external routine without any return code.

Category: External Routines

Restriction: When a SAS server is in a locked-down state, the CALL Module routine does not execute. For more information, see Chapter 10, "SAS Processing Restrictions for Servers in a Locked-Down State," on page 219.

z/OS specifics: ALL

See: "CALL MODULE Routine" in *SAS Functions and CALL Routines: Reference*

## Syntax

**CALL MODULE**(<*cntl*> ,*module*,*arg-1*,*arg-2*...,*arg-n*);

**CALL MODULEI** (<*cntl*> ,*modulearg-1*,*arg-2*...,*arg-n*);

### Required Arguments

***module***
specifies the name of the load module to load.

You can specify *module* as a SAS character expression instead of as a constant. Usually, you pass it as a constant.

***arg-1, arg-2, ...arg-n***
specifies the arguments to pass to the requested routine. Use the proper attributes for the arguments (that is, numeric arguments for numeric attributes and character arguments for character attributes).

**CAUTION**
**Be sure to use the correct arguments and attributes.** If you use incorrect arguments or attributes for a function, you might cause SAS to crash or produce unexpected results.

## Optional Argument

***cntl***
is an optional control string whose first character must be an asterisk (*), followed by any combination of the following characters:

I prints the hexadecimal representations of all arguments to the MODULE function and to the requested library routine before and after the library routine is called. You can use this option to help diagnose problems that are caused by incorrect arguments or attribute tables. If you specify the I option, the E option is implied.

E prints detailed error messages. Without the E option (or the I option, which supersedes it), the only error message that the MODULE function generates is "Invalid argument to function." This message is usually not enough information to determine the cause of the error.

A do not use table attributes, even if SASCBTBL is available.

Z do not invoke IGZERRE. For more information, see the IBM documentation for the z/OS operating system.

B copy arguments below the line. For more information, see the IBM documentation for the z/OS operating system.

T print attribute information in the log.

S*x* uses *x* as a separator character to separate field definitions. You can then specify *x* in the argument list as its own character argument to serve as a delimiter for a list of arguments that you want to group together as a single structure. Use this option only if you do not supply an entry in the SASCBTBL attribute table. If you do supply an entry for this module in the SASCBTBL attribute table, you should use the FDSTART option in the ARG statement in the table to separate structures.

H provides brief help information about the syntax of the MODULE routines, the attribute file format, and the suggested SAS formats and informats.

For example, the control string '*IS/' specifies that parameter lists be printed and that the string '/' is to be treated as a separator character in the argument list.

## Details

The following functions permit vector and matrix arguments. You can use them only within the IML procedure:

- CALL MODULEI
- MODULEIN
- MODULEIC

For more information, see the *SAS/IML Studio: User's Guide*.

The MODULE functions execute a routine *module* that resides in an external (outside SAS) library with the specified arguments *arg-1* through *arg-n*. In batch, the external library should be concatenated in the STEPLIB. In TSO, it should be specified on the LOAD option of the CLIST or REXX exec.

The MODULE call routine does not return a value, and the MODULEN and MODULEC functions return a numeric value *num* or a character value *char*, respectively. Which routine you use depends on the expected return value from the function that you want to execute.

MODULEI, MODULEIC, and MODULEIN are special versions of the MODULE functions that permit vector and matrix arguments. Their return values are still scalar. You can invoke these functions only from PROC IML.

Other than this name difference, the syntax for all six routines is the same.

The MODULE function builds a parameter list by using the information in *arg-1* to *arg-n* and by using a routine description and argument attribute table that you define in a separate file. Before you invoke the MODULE routine, you must define the fileref of SASCBTBL to point to this external file. You can name the file whatever you want when you create it.

In this way, you can use SAS variables and formats as arguments to the MODULE function. This specification ensures that these arguments are properly converted before being passed to the library routine.

## See Also

**Functions:**

- "MODULEC Function" in *SAS Functions and CALL Routines: Reference*
- "MODULEN Function" in *SAS Functions and CALL Routines: Reference*
- "MODULE Function: z/OS" on page 486
- "PEEKLONG Function: z/OS" on page 492

# CALL SLEEP Routine: z/OS

Suspends the execution of a program that invokes this call routine for a specified period of time.

Category: Special

z/OS specifics: Host call

See: "CALL SLEEP Routine" in *SAS Functions and CALL Routines: Reference*

## Syntax

**CALL SLEEP**(*time*);

### Required Argument

***time***
specifies the amount of time, in milliseconds (1/1,000 of a second), that you want to suspend execution of a DATA step and the SAS task that is running that DATA step.

## Details

CALL SLEEP puts the DATA step in which it is invoked into a nonactive wait state, using no CPU time and performing no input or output. If you are running multiple SAS tasks, each task can execute CALL SLEEP independently without affecting the other tasks.

**Note:**

- In batch mode, extended sleep periods can trigger automatic host session termination based on time-out values set at your site. Contact your host system administrator as necessary to determine the time-out values used at your site.
- If you are running the asynchronous RSUBMIT statement in a SAS/CONNECT session, specifying CALL SLEEP for a DATA step affects only that DATA step. It does not affect any other SAS tasks that you are running on the remote system.

# CALL SYSTEM Routine: z/OS

Executes a TSO command, emulated USS command, or MVS program.

Category: Special

Restriction: A TSO command executes successfully only in a TSO SAS session. In a non-TSO session, the command is disabled and the return code is set to 0.

z/OS specifics: The command must be a TSO command, emulated USS command, or MVS program.

See: "CALL SYSTEM Routine" in *SAS Functions and CALL Routines: Reference*

## Syntax

**CALL SYSTEM**(*command*);

### Required Argument

***command***
can be a system command enclosed in quotation marks, an expression whose value is a system command, or the name of a character variable whose value is a system command. Under z/OS, "system command" includes TSO commands, CLISTs, and REXX execs.

## Details

The CALL SYSTEM routine provides the same command interface and has the same syntax as the X statement. The CALL SYSTEM routine can be executed during a DATA step, but the X statement cannot. For information about the command interface, see "X Statement: z/OS" on page 681.

Under z/OS, CALL TSO is an alias for the CALL SYSTEM routine.

## Example

The following DATA step executes one of three CLISTs depending on the value of a variable named ACTION that is stored in an external file that is named USERID.TRANS.PROG:

```
data _null_;
infile 'userid.trans.prog';
/* action is assumed to have a value of */
/* 1, 2, or 3 */
/* create and initialize a 3-element array */
input action;
array programs{3} $ 11 c1-c3
("exec clist1" "exec clist2" "exec clist3");
call system(programs{action});
run;
```

In this example, the array elements are initialized with character expressions that consist of TSO commands for executing the three CLISTs. In the CALL SYSTEM

statement, an expression is used to pass one of these character expressions to the CALL SYSTEM routine. For example, if ACTION equals 2, then `PROGRAMS{2}`, which contains the `EXEC CLIST2` command, is passed to the CALL SYSTEM routine.

## See Also

### Statements

- “TSO Statement: z/OS” on page 679
- “X Statement: z/OS” on page 681

### Functions

- “SYSTEM Function: z/OS” on page 494
- “TSO Function: z/OS” on page 497

### Commands

- “TSO Command: z/OS” on page 285
- “X Command: z/OS” on page 288

### Macro Statements

- “Macro Statements” on page 514

# CALL TSO Routine: z/OS

Executes a TSO command, emulated USS command, or MVS program.

Category: Special

Restriction: A TSO command executes successfully only in a TSO SAS session. In a non-TSO session, the command is disabled and the return code is set to 0.

z/OS specifics: All

## Syntax

**CALL TSO**(*command*);

### Required Argument

**command**
can be a system command enclosed in quotation marks, an expression whose value is a system command, or the name of a character variable whose value is a

system command. Under z/OS, “system command” includes TSO commands, CLISTs, and REXX execs.

## Details

The TSO and SYSTEM CALL routines are identical, with one exception. Under an operating environment other than z/OS, the TSO CALL routine has no effect, whereas the SYSTEM CALL routine is always processed in any operating environment. For information about the command interface, see “X Statement: z/OS” on page 681.

## See Also

**CALL Routine**

- “CALL SYSTEM Routine: z/OS” on page 459

# CALL WTO Routine: z/OS

Sends a message to the system console.

z/OS specifics: All

## Syntax

**CALL WTO** (“*text-string*”);

### Required Argument

***text-string***
is the message that you want to send. It should be no longer than 125 characters.

## Details

WTO is a DATA step call routine that takes a character-string argument and sends it to a system console. The destination is controlled by the WTOUSERROUT=, WTOUSERDESC=, and WTOUSERMCSF= SAS system options. If WTOUSERROUT=0 (the default), then no message is sent.

## See Also

### Functions

- "WTO Function: z/OS" on page 498

### System Options

- "WTOUSERDESC= System Option: z/OS" on page 888
- "WTOUSERMCSF= System Option: z/OS" on page 889
- "WTOUSERROUT= System Option: z/OS" on page 891

# DINFO Function: z/OS

Returns information about a directory.

Category: External Files

z/OS specifics: *info-item*

See: "DINFO Function" in *SAS Functions and CALL Routines: Reference*

## Syntax

**DINFO**(*directory-id*, *info-item*)

### Required Arguments

***directory-id***
specifies the identifier that was assigned when the directory was opened, generally by the DOPEN function.

***info-item***
specifies the information item to be retrieved. DINFO returns a blank if the value of the **`info-item`** argument is invalid. The information available varies according to the operating environment. The **`info-item`** argument is a character value.

## Details

Directories that are opened with the DOPEN function are identified by a *directory-id* and have a number of associated information items. Use DOPTNAME to determine the names of the available system-dependent directory information items. Use DOPTNUM to determine the number of directory information items available.

The DINFO, DOPTNAME, and DOPTNUM functions support the following directory information items for UNIX File System (UFS) Directories under z/OS:

*Table 26.1 Directory Information Items for UFS Directories*

| Item | Item Identifier | Definition |
|---|---|---|
| 1 | Filename | Directory name |
| 2 | Access Permission | Read, Write, and Execute permissions for owner, group, and other |
| 3 | Number of Links | Number of links in the directory |
| 4 | Owner Name | User ID of the owner |
| 5 | Group Name | Name of the owner's access group |
| 6 | Filesize | File size |
| 7 | Last Modified | Date contents last modified |

The DINFO, DOPTNAME, and DOPTNUM functions support the following directory information items for PDSs under z/OS:

*Table 26.2 Directory Information Items for PDSs*

| Item | Item Identifier | Definition |
|---|---|---|
| 1 | Dsname | PDS name |
| 2 | Unit | Disk type |
| 3 | Volume | Volume on which data set resides |
| 4 | Disp | Disposition |
| 5 | Blksize | Block size |
| 6 | Lrecl | Record length |
| 7 | Recfm | Record format |

The DINFO, DOPTNAME, and DOPTNUM functions support the following directory information items for PDSEs under z/OS:

*Table 26.3* *Directory Information Items for PDSEs*

| Item | Item Identifier | Definition |
|---|---|---|
| 1 | Dsname | PDSE name |
| 2 | Dsntype | Directory type |
| 3 | Unit | Disk type |
| 4 | Volume | Volume on which data set resides |
| 5 | Disp | Disposition |
| 6 | Blksize | Block size |
| 7 | Lrecl | Record length |
| 8 | Recfm | Record format |

# Examples

## Example 1: UNIX File System (UFS) Directory Information

This example generates output that includes information item names and values for a UFS directory:

```
data _null_;
   length opt $100 optval $100;
   /* Allocate directory */
   rc=FILENAME('mydir', '/u/userid');
   /* Open directory */
   dirid=DOPEN('mydir');
   /* Get number of information items */
   infocnt=DOPTNUM(dirid);
   /* Retrieve information items and */
   /* print to log                   */
   put @1 'Information for a UNIX
      File System Directory:';
   do j=1 to infocnt;
      opt=DOPTNAME(dirid,j);
      optval=DINFO(dirid,upcase(opt));
      put @1 opt @20 optval;
   end;
   /* Close the directory */
   rc=DCLOSE(dirid);
   /* Deallocate the directory */
   rc=FILENAME('mydir');
run;
```

***Output 26.1*** *UFS Directory Information*

```
Information for a UNIX System
   Services Directory:
Directory Name          /u/userid
Access Permission  drwxr-xr-x
Number of Links    17
Owner Name         MYUSER
Group Name         GRP
Last Modified      Apr 26 07:18
Created            Jan 9 2007
NOTE: The DATA statement used 0.09
   CPU seconds and 5203K.
```

## Example 2: PDS Directory Information

This example generates information item names and values for a PDS:

```
data _null_;
   length opt $100 optval $100;
   /* Allocate directory */
   rc=FILENAME('mydir', 'userid.mail.text');
   /* Open directory */
   dirid=DOPEN('mydir');
   /* Get number of information items */
   infocnt=DOPTNUM(dirid);
   /* Retrieve information items and */
   /* print to log                   */
   put @1 'Information for a PDS:';
   do j=1 to infocnt;
      opt=DOPTNAME(dirid,j);
      optval=DINFO(dirid,upcase(opt));
      put @1 opt @20 optval;
   end;
   /* Close the directory */
   rc=DCLOSE(dirid);
   /* Deallocate the directory */
   rc=FILENAME('mydir');
run;
```

***Output 26.2*** *PDS Directory Information*

```
Information for a PDS:
Dsname             USERID.MAIL.TEXT
Unit               3380
Volume             ABC005
Disp               SHR
Blksize            6160
Lrecl              80
Recfm              FB
Creation           2005/10/03
NOTE: The DATA statement used 0.07
   CPU seconds and 5211K.
```

## Example 3: PDSE Directory Information

This example generates directory information for a PDSE:

```
data _null_;
   length opt $100 optval $100;
   /* Allocate directory */
   rc=FILENAME('mydir', 'userid.pdse.src');
   /* Open directory */
   dirid=DOPEN('mydir');
   /* Get number of information items */
   infocnt=DOPTNUM(dirid);
   /* Retrieve information items and */
   /* print to log                   */
   put @1 'Information for a PDSE:';
   do j=1 to infocnt;
      opt=DOPTNAME(dirid,j);
      optval=DINFO(dirid,upcase(opt));
      put @1 opt @20 optval;
   end;
   /* Close the directory */
   rc=DCLOSE(dirid);
   /* Deallocate the directory */
   rc=FILENAME('mydir');
run;
```

***Output 26.3*** *PDSE Directory Information*

```
Information for a PDSE:
Dsname              USERID.PDSE.SRC
Dsntype             PDSE
Unit                3380
Volume              ABC002
Disp                SHR
Blksize             260
Lrecl               254
Recfm               VB
Creation            2005/10/03
NOTE: The DATA statement used 0.08
   CPU seconds and 5203K.
```

## See Also

- “DOPEN Function: z/OS” on page 467
- “DOPTNAME Function: z/OS” on page 468
- “DOPTNUM Function: z/OS” on page 469

# DOPEN Function: z/OS

Opens a directory and returns a directory identifier value.

Category: External Files

z/OS specifics: File systems

See: "DOPEN Function" in *SAS Functions and CALL Routines: Reference*

## Syntax

**DOPEN**(*fileref*)

### Required Argument

***fileref***
specifies the fileref assigned to the directory. In a DATA step, *fileref* can be a character expression, a string enclosed in quotation marks, or a DATA step variable whose value contains the fileref. In a macro, *fileref* can be any expression.

## Details

DOPEN opens a directory and returns a directory identifier value (a number greater than 0) that is used to identify the open directory in other SAS external file access functions.

DOPEN applies to directory structures that are available in partitioned data sets (PDS, PDSE) and in UNIX System Services. For code examples, see "DINFO Function: z/OS" on page 463.

## See Also

- "DOPTNAME Function: z/OS" on page 468
- "DOPTNUM Function: z/OS" on page 469

# DOPTNAME Function: z/OS

Returns the name of a directory information item.

Category: External Files

z/OS specifics: *nval*

See: "DOPTNAME Function" in *SAS Functions and CALL Routines: Reference*

## Syntax

**DOPTNAME**(*directory-id*,*nval*)

### Required Arguments

***directory-id***
specifies the identifier that was assigned when the directory was opened, generally by the DOPEN function.

***nval***
specifies the number of a directory information item. For definitions of information item numbers and code examples, see "DINFO Function: z/OS" on page 463.

## Details

The DOPTNAME function returns the name of the specified information item number for a file that was previously opened with the DOPEN function.

For information about item numbers and definitions and code examples, see "DINFO Function: z/OS" on page 463.

## See Also

- "DOPEN Function: z/OS" on page 467
- "DOPTNUM Function: z/OS" on page 469

# DOPTNUM Function: z/OS

Returns the number of information items that are available for a directory.

Category: External Files

z/OS specifics: Return value

See: "DOPTNUM Function" in *SAS Functions and CALL Routines: Reference*

## Syntax

**DOPTNUM**(*directory-id*)

### Required Argument

***directory-id***
specifies the identifier that was assigned when the directory was opened, generally by the DOPEN function.

## Details

Currently, the number of information items that are available for a PDS directory is 7, for a PDSE directory is 8, and for a UNIX System Services directory is 7.

For code examples, see "DINFO Function: z/OS" on page 463.

## See Also

- "DOPEN Function: z/OS" on page 467
- "DOPTNAME Function: z/OS" on page 468

# DSNCATLGD Function: z/OS

Verifies the existence of an external file in the z/OS system catalog by its physical name.

Category: External Files

Restriction: If the SAS session in which you are specifying the FILEEXIST function is in a locked-down state, and the pathname specified in the function has not been added to the lockdown path list, then the function will fail and a file access error related to the locked-down data will not be generated in the SAS log unless you specify the SYSMSG function.

z/OS specifics: All

## Syntax

**DSNCATLGD**(*filename*)

### Required Argument

***filename***
specifies a physical filename of an external file. In a DATA step, *filename* can be a character expression, a character string in quotation marks, or a DATA step variable. In a macro, *filename* can be any expression.

Only native z/OS data set names can be specified; *filename* cannot specify a UFS path.

## Details

DSNCATLGD returns a value of 1 if the filename is found in the z/OS system catalog, and a value of 0 if the filename is not found in the catalog.

DSNCATLGD is similar to the FILEEXIST function, but there are some differences that make DSNCATLGD the preferred function to use in some circumstances. DSNCATLGD does not cause dynamic allocation to occur, which is useful for tape data sets because it does not require that a tape be mounted.

When a batch job is creating a new z/OS data set, DSNCATLGD does not return a value of 1 until the job step that creates the data set terminates. FILEEXIST uses dynamic allocation to verify that the data set exists. It returns a value of 1 anytime after the start of the batch job that is creating the data set.

**Note:** z/OS enters a dynamically allocated data set into the system catalog immediately at the time of the dynamic allocation request. All allocations made by TSO users are treated in this manner.

## See Also

"FILEEXIST Function: z/OS" on page 474

# FCLOSE Function: z/OS

Closes an external file, a directory, or a directory member.

Category: External Files

See: "FCLOSE Function" in *SAS Functions and CALL Routines: Reference*

## Syntax

**FCLOSE**(*file-id*)

### Required Argument

***file-id***
specifies the identifier that was assigned when the file was opened, generally by the FOPEN function.

## Details

Files opened with the FOPEN function are not closed automatically after processing. All files that are opened with FOPEN should be closed with FCLOSE. For code examples, see "FINFO Function: z/OS" on page 477.

## See Also

"FOPEN Function: z/OS" on page 481

# FDELETE Function: z/OS

Deletes an external file or an empty directory.

Category: External Files

z/OS specifics: *fileref*

See: "FDELETE Function" in *SAS Functions and CALL Routines: Reference*

## Syntax

**FDELETE** (*fileref*)

### Required Argument

***fileref***
identifies an external file. If *fileref* is a literal fileref name, it must be in quotation marks. If *fileref* is the name of a character variable whose value is a fileref name, it must not be in quotation marks. If *fileref* is used in the syntax for a macro, it must not be in quotation marks. The fileref must have been previously associated with a sequential file, a PDS, a PDSE, or a UNIX System Services file using a FILENAME statement or FILENAME function. The fileref cannot represent a concatenation of multiple files.

## Details

FDELETE returns 0 if the operation was successful, or a nonzero number if it was not successful. If the fileref that is specified with FDELETE is associated with a UNIX System Services directory, PDS, or PDSE, then that directory, PDS, or PDSE must be empty. In order to delete the directory or file, the user that calls FDELETE must also have the appropriate privileges.

## Example: Specifying Filerefs to Delete

Example of a literal fileref:

```
filename delfile 'myfile.test';
  data _null_;
  rc=fdelete('delfile');
  run;
```

Example of a variable whose value is a fileref name:

```
data _null_;
delref = 'delfile';
rc = fdelete(delref);
run;
```

# FEXIST Function: z/OS

Verifies the existence of an external file associated with a fileref.

Category: External Files

z/OS specifics: *fileref*

See: "FEXIST Function" in *SAS Functions and CALL Routines: Reference*

## Syntax

**FEXIST**(*fileref*)

### Required Argument

***fileref***
identifies an external file. If *fileref* is a literal fileref name, it must be in quotation marks. If *fileref* is the name of a character variable whose value is a fileref name, it must not be in quotation marks. Under z/OS, it can be a fileref or any valid ddname that has been previously associated with an external file with either a TSO ALLOCATE command or a JCL DD statement. In a DATA step, *fileref* can be a character expression, a string enclosed in quotation marks, or a DATA step variable whose value contains the fileref. In a macro, *fileref* can be any expression. If *fileref* is used in the syntax for a macro, it must not be in quotation marks. For information about the values returned by this function, see "FEXIST Function" in *SAS Functions and CALL Routines: Reference* in the *SAS Functions and CALL Routines: Reference*.

## Details

FEXIST returns 1 if the external file that is associated with fileref exists, and 0 if the file does not exist.

# FILEEXIST Function: z/OS

Verifies the existence of an external file by its physical name.

Category: External Files

Restriction: If the SAS session in which you are specifying the FILEEXIST function is in a locked-down state, and the pathname specified in the function has not been added to the lockdown path list, then the function will fail and a file access error related to the locked-down data will not be generated in the SAS log unless you specify the SYSMSG function.

z/OS specifics: *filename*

See: "FILEEXIST Function" in *SAS Functions and CALL Routines: Reference*

## Syntax

**FILEEXIST**(*filename*)

### Required Argument

***filename***
specifies a physical filename of an external file. In a DATA step, *filename* can be a character expression, a string in quotation marks, or a DATA step variable. In a macro, *filename* can be any expression.

The filename can be a native z/OS data set, or it can be a UFS file or directory.

## Details

FILEEXIST returns 1 if the external file exists, and 0 if the file does not exist. FILEEXIST can also verify the existence of a directory in USS.

# FILENAME Function: z/OS

Assigns or deassigns a fileref for an external file, a directory, or an output device.

Category: External Files

Restriction: If the SAS session in which you are specifying the FILEEXIST function is in a locked-down state, and the pathname specified in the function has not been added to the lockdown path list, then the function will fail and a file access error related to the locked-down data will not be generated in the SAS log unless you specify the SYSMSG function.

z/OS specifics: Host options, devices

See: "FILENAME Function" in *SAS Functions and CALL Routines: Reference*

# Syntax

**FILENAME**(*fileref*,*filename*<,*device* <,*host-options*> >)

## Required Arguments

***fileref***
in a DATA step, specifies the fileref to assign to an external file. In a DATA step, *fileref* can be a character expression, a string enclosed in quotation marks, or a DATA step variable whose value contains the fileref. If *fileref* is a literal fileref name, it must be in quotation marks. If *fileref* is the name of a character variable whose value is a fileref name, it must not be in quotation marks.

In a macro (for example, in the %SYSFUNC function), *fileref* is the name of a macro variable (without an ampersand) whose value contains the fileref to assign to the external file. In a macro, *fileref* can be any expression.

***filename***
specifies the external file. Specifying a blank *filename* (' ') deassigns the *fileref* that was previously assigned.

## Optional Arguments

***device***
specifies the type of device if the fileref points to an output device rather than to a physical file:

**DISK**
specifies a disk.

**DUMMY**
specifies that output to the file is discarded.

**PIPE**
specifies an unnamed pipe.

**PLOTTER**
specifies an unbuffered graphics output device.

**PRINTER**
specifies a printer or printer spool file.

**TERMINAL**
specifies the user's terminal.

**TAPE**
specifies a tape drive.

**TEMP**
creates a temporary file that exists only as long as the filename is assigned. The temporary file can be accessed only through the logical name and is available only while the logical name exists. If a physical pathname is specified, an error is returned. Files manipulated by the TEMP device can have the same attributes and behave identically to DISK files.

***host-options***
are host-specific options that can be specified in the FILENAME statement. These options can be categorized into several groups. For details, see the following sections:

- "FILENAME Statement: z/OS" on page 616
- "DCB Attribute Options" on page 628
- "SYSOUT Data Set Options for the FILENAME Statement" on page 634
- "Subsystem Options for the FILENAME Statement" on page 636
- "Options That Specify SMS Keywords" on page 632
- "Host-Specific Options for UNIX System Services Files" on page 613

You can specify host options in any order following the file specification and the optional *device* specification. When specifying more than one option, use a blank space to separate each option. Values for options can be specified with or without quotation marks. However, if a value contains one of the supported national characters ($, #, or @), the quotation marks are required.

## Details

FILENAME returns 0 if the operation was successful, and a nonzero number if it was not successful.

## See Also

"FILENAME Statement: z/OS" on page 616

# FILEREF Function: z/OS

Verifies that a fileref has been assigned for the current SAS session.

Category: External Files

z/OS specifics: *fileref*

See: "FILEREF Function" in *SAS Functions and CALL Routines: Reference*

## Syntax

**FILEREF**(*fileref*)

### Required Argument

***fileref***
specifies the fileref to be validated. Under z/OS, *fileref* can be a ddname that was assigned using the TSO ALLOCATE command or JCL DD statement. In a DATA step, *fileref* can be a character expression, a string enclosed in quotation marks, or a DATA step variable whose value contains the fileref. In a macro, *fileref* can be any expression. If *fileref* is a literal fileref name, it must be in quotation marks. If *fileref* is the name of a character variable whose value is a fileref name, it must not be in quotation marks. If *fileref* is used in the syntax for a macro, it must not be in quotation marks.

## Details

A negative return code indicates that the *fileref* exists, but the physical files associated with the *fileref* does not exist. A positive value indicates that the *fileref* is not assigned. A value of zero indicates that the *fileref* and the external file both exist.

# FINFO Function: z/OS

Returns the value of a file information item for an external file.

Category: External Files

z/OS specifics: *info-item*

See: "FINFO Function" in *SAS Functions and CALL Routines: Reference*

## Syntax

**FINFO**(*file-id*,*info-item*)

### Required Arguments

***file-id***
specifies the identifier that was assigned when the file was opened, generally by the FOPEN function.

***info-item***
specifies the number of the information item that is to be retrieved. The `info-item` argument is a character value.

## Details

FINFO returns the value of a system-dependent information item for an external file that was previously opened and assigned a file-id by the FOPEN function. FINFO returns a blank if the value given for info-item is invalid.

The FINFO, FOPTNAME, and FOPTNUM functions support the following information items for UNIX System Services (UFS):

***Table 26.4*** *Information Items for UFS Files*

| Item | Item Identifier | Definition |
|---|---|---|
| 1 | Filename | Filename |
| 2 | Access Permission | Read, Write, and Execute permissions for owner, group, and other |
| 3 | Number of Links | Number of links in the file |
| 4 | Owner Name | User ID of the owner |
| 5 | Group Name | Name of the owner's access group |
| 6 | File Size | File size |
| 7 | Last Modified | Date file last modified |
| 8 | Created | Date file created |

The FINFO, FOPTNAME, and FOPTNUM functions support the following information items for sequential files and members of PDSs and PDSEs

***Table 26.5*** *Information Items for Sequential Files and Members of PDSs and PDSEs*

| Item | Item Identifier | Definition |
|---|---|---|
| 1 | Dsname | Filename |
| 2 | Unit | Device type |
| 3 | Volume | Volume on which a data set resides |
| 4 | Disp | Disposition |
| 5 | Blksize | Block size |
| 6 | Lrecl | Record length |

| Item | Item Identifier | Definition |
|---|---|---|
| 7 | Recfm | Record format |
| 8 | Creation | Date file created |

# Examples

## Example 1: Sequential File Information

The following example generates output that shows the information items available for a sequential data set:

```
data _null_;
   length opt $100 optval $100;
   /* Allocate file  */
   rc=FILENAME('myfile',
      'userid.test.example');
   /* Open file */
   fid=FOPEN('myfile');
   /* Get number of information
      items */
   infocnt=FOPTNUM(fid);
   /* Retrieve information items
      and print to log  */
   put @1 'Information for a Sequential File:';
   do j=1 to infocnt;
      opt=FOPTNAME(fid,j);
      optval=FINFO(fid,upcase(opt));
      put @1 opt @20 optval;
   end;
   /* Close the file */
   rc=FCLOSE(fid);
   /* Deallocate the file */
   rc=FILENAME('myfile');
run;
```

***Output 26.4*** *Sequential File Information*

```
Information for a Sequential File:
Dsname             USERID.TEST.EXAMPLE
Unit               3390
Volume             ABC010
Disp               SHR
Blksize            23392
Lrecl              136
Recfm              FB
Creation           2007/11/20
NOTE: The DATA statement used 0.10
   CPU seconds and 5194K.
```

## Example 2: PDS, PDSE Member Information

This example shows the information items available for PDS and PDSE members:

```
data _null_;
  length opt $100 optval $100;
  /* Allocate file  */
  rc=FILENAME('myfile',
     'userid.test.data(oats)');
  /* Open file */
  fid=FOPEN('myfile');
  /* Get number of information
     items */
  infocnt=FOPTNUM(fid);
  /* Retrieve information items
        and print to log */
  put @1 'Information for a PDS Member:';
  do j=1 to infocnt;
    opt=FOPTNAME(fid,j);
    optval=FINFO(fid,upcase(opt));
    put @1 opt @20 optval;
  end;
  /* Close the file */
  rc=FCLOSE(fid);
  /* Deallocate the file */
  rc=FILENAME('myfile');
run;
```

***Output 26.5*** *PDS, PDSE Member Information*

```
Information for a PDS Member:
Dsname             USERID.TEST.DATA(OATS)
Unit               3380
Volume             ABC006
Disp               SHR
Blksize            1000
Lrecl              100
Recfm              FB
Creation           2007/11/05
NOTE: The DATA statement used 0.05
   CPU seconds and 5194K.
```

## Example 3: UNIX System Services File Information

This example shows the information items available for UNIX System Services files:

```
data _null_;
   length opt $100 optval $100;
   /* Allocate file  */
   rc=FILENAME('myfile',
      '/u/userid/one');
   /* Open file */
   fid=FOPEN('myfile');
   /* Get number of information
      items */
   infocnt=FOPTNUM(fid);
```

```
   /* Retrieve information items
      and print to log */
   put @1 'Information for a UNIX System Services File:';
   do j=1 to infocnt;
      opt=FOPTNAME(fid,j);
      optval=FINFO(fid,upcase(opt));
      put @1 opt @20 optval;
   end;
   /* Close the file */
   rc=FCLOSE(fid);
   /* Deallocate the file */
   rc=FILENAME('myfile');
run;
```

***Output 26.6*** *UNIX System Services File Information*

```
Information for a UNIX
   System Services File:
File Name           /u/userid/one
Access Permission   -rw-rw-rw-
Number of Links     1
Owner Name          USERID
Group Name          GRP
File Size           4
Last Modified       Apr 13 13:57
Created             Mar 16 09:55
NOTE: The DATA statement used
   0.07 CPU seconds and 5227K.
```

## See Also

- “FCLOSE Function: z/OS” on page 471
- “FOPEN Function: z/OS” on page 481
- “FOPTNAME Function: z/OS” on page 483
- “FOPTNUM Function: z/OS” on page 484

# FOPEN Function: z/OS

Opens an external file and returns a file identifier value.

Category: External Files

z/OS specifics: Files opened with FOPEN must be closed with FCLOSE

See: “FOPEN Function” in *SAS Functions and CALL Routines: Reference*

# Syntax

**FOPEN**(*fileref*<,*open-mode* <,*record-length* <,*record-format*> > >)

## Required Argument

***fileref***
specifies the fileref assigned to the external file.

## Optional Arguments

***open-mode***
specifies the type of access to the file:

**A**
APPEND mode allows writing new records after the current end of the file.

**I**
INPUT mode allows reading only (default).

**O**
OUTPUT mode defaults to the OPEN mode that is specified in the host option in the FILENAME statement or function. If no host option is specified, it allows writing new records at the beginning of the file.

**S**
Sequential input mode is used for pipes and other sequential devices such as hardware ports. Sequential input mode should be used for files that extend to multiple volumes.

**U**
UPDATE mode allows both reading and writing.

***record-length***
specifies the logical record length of the file. To use the existing record length for the file, specify a length of 0, or do not provide a value here.

***record-format***
specifies the record format of the file. To use the existing record format, do not specify a value here. Valid values are as follows:

**B**
data should be interpreted as binary data.

**D**
use default record format.

**E**
use editable record format.

**F**
file contains fixed length records.

**P**
file contains printer carriage control in host-dependent record format. For data sets with FBA or VBA record format, specify 'P' for the *record-format* argument.

V
file contains variable-length records.

## Details

FOPEN returns a 0 if the file could not be opened. Under z/OS, files that have been opened with FOPEN must be closed with FCLOSE at the end of a DATA step; files are not closed automatically after processing.

FOPEN can be used to open ddnames with instream data that are not already opened if you specify 'S' for the open-mode attribute.

The default Open mode for the FOPEN function is I, which means input but also implies random access. The I Open mode is acceptable for a single-volume file because the NOTE and POINT operations can be performed internally. However, the operating system does not support NOTE and POINT across multiple volumes in a file. If you use the I open-mode attribute to open an external file that extends to multiple volumes, SAS flags it as an error at OPEN time. The best way to get around this problem is to specify S as the open-mode attribute to FOPEN. The S open-mode attribute requests strictly sequential processing, and no conflict occurs.

For code examples, see "FINFO Function: z/OS" on page 477.

## See Also

- "FCLOSE Function: z/OS" on page 471
- "FOPTNAME Function: z/OS" on page 483
- "FOPTNUM Function: z/OS" on page 484

# FOPTNAME Function: z/OS

Returns the name of an information item for an external file.

Category: External Files

z/OS specifics: *info-item*

See: "FOPTNAME Function" in *SAS Functions and CALL Routines: Reference*

## Syntax

**FOPTNAME**(*file-id*,*nval*)

### Required Arguments

***file-id***
specifies the identifier that was assigned when the file was opened, generally by the FOPEN function.

***nval***
specifies the name of the file information item to be retrieved.

## Details

FOPTNAME returns a missing or null value if you specify an invalid argument.

For definitions of information item numbers and code examples, see "FINFO Function: z/OS" on page 477.

## See Also

- "FCLOSE Function: z/OS" on page 471
- "FOPEN Function: z/OS" on page 481
- "FOPTNUM Function: z/OS" on page 484

# FOPTNUM Function: z/OS

Returns the number of information items that are available for an external file.

Category: External Files

z/OS specifics: Return value

See: "FOPTNUM Function" in *SAS Functions and CALL Routines: Reference*

## Syntax

**FOPTNUM**(*file-id*)

### Required Argument

***file-id***
specifies the identifier that was assigned when the file was opened (generally by the FOPEN function).

## Details

Currently, the number of information items available for a sequential file, a PDS member, and a UNIX System Services file is 7.

For code examples, see "FINFO Function: z/OS" on page 477.

## See Also

- "FCLOSE Function: z/OS" on page 471
- "FOPEN Function: z/OS" on page 481
- "FOPTNAME Function: z/OS" on page 483

# KTRANSLATE Function: z/OS

Replaces specific characters in a character expression.

Category: DBCS

z/OS specifics: *to* or *from* pairs

See: "KTRANSLATE Function" in *SAS National Language Support (NLS): Reference Guide*

## Syntax

**KTRANSLATE**(*source*, *to-1*, *from-1*<*to-2*, *from-2* ...>)

## Details

In the z/OS environment, KTRANSLATE requires a *from* argument for each *to* argument. Also, there is no practical limit to the number of to or from pairs that you can specify.

KTRANSLATE differs from TRANSLATE in that it supports single-byte character set replacement by double-byte characters, or double-byte character set replacement for single-byte characters.

## See Also

"TRANSLATE Function: z/OS" on page 496

# MODULE Function: z/OS

Calls an external routine with a return code.

Category: External Routines

Restriction: When a SAS server is in a locked-down state, the CALL Module routine does not execute. For more information, see Chapter 10, "SAS Processing Restrictions for Servers in a Locked-Down State," on page 219.

z/OS specifics: ALL

See: "CALL MODULE Routine" in *SAS Functions and CALL Routines: Reference*

## Syntax

*num*=**MODULEN**(<*cntl*> ,*module*,*arg-1*,*arg-2*...,*arg-n*);

*char*=**MODULEC**(<*cntl*> ,*module*,*arg-1*...,*arg-2*,*arg-n*);

*num*=**MODULEIN**(<*cntl*> ,*module*,*arg-1*,*arg-2*...,*arg-n*)

*char*=**MODULEIC**(<*cntl*> ,*module*,*arg-1*,*arg-2*...,*arg-n*);

### Required Arguments

***module***
specifies the name of the load module to load.

You can specify *module* as a SAS character expression instead of as a constant. Usually, you pass it as a constant.

***arg-1, arg-2, ...arg-n***
specifies the arguments to pass to the requested routine. Use the proper attributes for the arguments (that is, numeric arguments for numeric attributes and character arguments for character attributes).

**CAUTION**
**Be sure to use the correct arguments and attributes.** If you use incorrect arguments or attributes for a function, you might cause SAS to crash or produce unexpected results.

### Optional Argument

***cntl***
is an optional control string whose first character must be an asterisk (*), followed by any combination of the following characters:

I prints the hexadecimal representations of all arguments to the MODULE function and to the requested library routine before and after the library routine is called. You can use this option to help diagnose problems that are caused by incorrect arguments or attribute tables. If you specify the I option, the E option is implied.

E prints detailed error messages. Without the E option (or the I option, which supersedes it), the only error message that the MODULE function generates is "Invalid argument to function." This message is usually not enough information to determine the cause of the error.

S*x* uses *x* as a separator character to separate field definitions. You can then specify *x* in the argument list as its own character argument to serve as a delimiter for a list of arguments that you want to group together as a single structure. Use this option only if you do not supply an entry in the SASCBTBL attribute table. If you do supply an entry for this module in the SASCBTBL attribute table, you should use the FDSTART option in the ARG statement in the table to separate structures.

H provides brief help information about the syntax of the MODULE routines, the attribute file format, and the suggested SAS formats and informats.

For example, the control string '*IS/' specifies that parameter lists be printed and that the string '/' is to be treated as a separator character in the argument list.

## Details

The following functions permit vector and matrix arguments. You can use them only within the IML procedure:

- MODULEIN
- MODULEIC

For more information, see the *SAS/IML Studio: User's Guide*.

The MODULE functions execute a routine *module* that resides in an external (outside SAS) library with the specified arguments *arg-1* through *arg-n*. In batch, the external library should be concatenated in the STEPLIB. In TSO, it should be specified on the LOAD option of the CLIST or REXX exec.

The MODULEN and MODULEC functions return a numeric value *num* or a character value *char*, respectively. Which routine you use depends on the expected return value from the function that you want to execute.

MODULEIC and MODULEIN are special versions of the MODULE functions that permit vector and matrix arguments. Their return values are still scalar. You can invoke these functions only from PROC IML.

Other than this name difference, the syntax for all six routines is the same.

The MODULE function builds a parameter list by using the information in *arg-1* to *arg-n* and by using a routine description and argument attribute table that you define in a separate file. Before you invoke the CALL MODULE routine, you must define the fileref of SASCBTBL to point to this external file. You can name the file whatever you want when you create it.

In this way, you can use SAS variables and formats as arguments to the MODULE function. This specification ensures that these arguments are properly converted before being passed to the library routine.

**CAUTION**
**Using the MODULE function without defining an attribute table can cause SAS to crash, produce unexpected results, or generate severe errors.** You need to use an attribute table for all external functions that you want to invoke.

## See Also

**CALL Routine**

- "CALL MODULE Routine: z/OS" on page 456

**Functions:**

- "MODULEC Function" in *SAS Functions and CALL Routines: Reference*
- "MODULEN Function" in *SAS Functions and CALL Routines: Reference*
- "PEEKLONG Function: z/OS" on page 492

# MOPEN Function: z/OS

Opens a file by directory ID and by member name, and returns either the file identifier or a 0.

Category: External Files

z/OS specifics: File systems, open-mode

See: "MOPEN Function" in *SAS Functions and CALL Routines: Reference*

## Syntax

**MOPEN**(*directory-id,member-name<,open-mode<,record-length<,record-format>>>*)

### Optional Argument

***open-mode***
specifies the type of access to the file.

**A**
APPEND mode allows writing new records after the current end of the file. The **A** option is valid only for UNIX System Services. An error is returned if you specify **A** for a PDS or PDSE member.

**O**
OUTPUT mode defaults to the OPEN mode specified in the operating environment option in the FILENAME statement or function. If no operating environment option is specified, it allows writing new records at the beginning of the file.

## Details

MOPEN returns the identifier for the file, or 0 if the file could not be opened.

MOPEN applies to members in partitioned data sets (PDS and PDSE) and UNIX file system (UFS) files. Under z/OS, MOPEN can open PDS and PDSE members for output only. It can open UFS files for output or append.

## See Also

"DOPEN Function: z/OS" on page 467

# PATHNAME Function: z/OS

Returns the physical name of a SAS library or of an external file or returns a blank.

Categories: SAS File I/O
External Files

z/OS specifics: *fileref*, *libref*

See: "PATHNAME Function" in *SAS Functions and CALL Routines: Reference*

## Syntax

**PATHNAME**((*fileref* | *libref*) <,*search-level*>)

### Required Arguments

***fileref***
specifies the fileref assigned to an external file. In a DATA step, *fileref* can be a character expression, a string enclosed in quotation marks, or a DATA step variable whose value contains the fileref. In a macro, *fileref* can be any expression that resolves to a macro variable. If *fileref* is used in the syntax for a macro, it must not be in quotation marks.

***libref***
specifies the libref assigned to a SAS library. In a DATA step, *libref* can be a character expression, a string enclosed in quotation marks, or a DATA step variable whose value contains the libref. In a macro, *libref* can be any expression.

### Optional Argument

***search-level***
specifies whether to search for a fileref or a libref. If *search-level* is omitted, PATHNAME searches for a fileref or libref with the specified name. You can use single or double quotation marks around the *fileref*, *libref*, and *search-level* elements of the PATHNAME statement.

**F**
specifies a search for a fileref.

**L**
specifies a search for a libref.

## Details

PATHNAME returns the physical name of an external file or a SAS library, or returns a blank if *fileref* or *libref* is invalid. When PATHNAME is applied to a concatenation, it returns a list of data set names enclosed in parentheses.

Under z/OS, you can also use any valid ddname that was previously allocated using a TSO ALLOCATE command or a JCL DD statement.

# PEEKCLONG Function: z/OS

Stores the contents of a memory address in a character variable.

Category: Special

Restriction: When a SAS server is in a locked-down state, the PEEKCLONG function does not execute. For more information, see Chapter 10, “SAS Processing Restrictions for Servers in a Locked-Down State,” on page 219.

See: “PEEKCLONG Function” in *SAS Functions and CALL Routines: Reference*

# Syntax

**PEEKCLONG**(*address*<,*length*>)

## Required Argument

***address***
specifies a character expression that is the memory address in binary.

## Optional Argument

***length***
specifies the length of the character data.

Default If no length is specified, the length of the target variable is used. If the function is used as part of an expression, the maximum length is returned.

Range 1 to 32,767

# Details

If you do not have access to the memory storage location that you are requesting, the PEEKCLONG function returns an “Invalid argument” error.

# Comparisons

The PEEKCLONG function stores the contents of a memory address in a *character* variable.

The PEEKLONG function stores the contents of a memory address in a *numeric* variable. It assumes that the input address refers to an integer in memory.

# Example: Copying Character Variables

The following example copies the contents of the first two bytes of the character variable X to the character variable Z:

```
data _null_;
   x='ABCDE';
   y=addrlong(x);
   z=peekclong(y,2);
   put z=;
run;
```

The output from the SAS log is: `z=AB`

## See Also

### Functions

- "PEEKLONG Function: z/OS" on page 492

# PEEKLONG Function: z/OS

Stores the contents of a memory address in a numeric variable.

Category: Special

Restriction: When a SAS server is in a locked-down state, the PEEKLONG Function does not execute. For more information, see Chapter 10, "SAS Processing Restrictions for Servers in a Locked-Down State," on page 219.

See: "PEEKLONG Function" in *SAS Functions and CALL Routines: Reference*

## Syntax

**PEEKLONG**(*address*<,*length*>)

### Required Argument

***address***
specifies a character expression that is the memory address in binary.

### Optional Argument

***length***
specifies the length of the numeric data.

Default 4

Range 1-4

## Details

If you do not have access to the memory storage location that you are requesting, the PEEKLONG function returns an "Invalid argument" error.

## Comparisons

The PEEKLONG function stores the contents of a memory address in a *numeric* variable. It assumes that the input address refers to an integer in memory.

The PEEKCLONG function stores the contents of a memory address in a *character* variable. It assumes that the input address refers to character data.

## Example: Copying the Contents of Numeric Variables

The following example copies the contents of the numeric variable Y to the numeric variable Z:

```
data _null_;
   length y $4;
   y=put(1,IB4.);
   addry=addrlong(y);
   z=peeklong(addry,4);
   put z=;
run;
```

The output from the SAS log is: `z=1`

## See Also

### Functions

- "PEEKCLONG Function: z/OS" on page 490

# SYSGET Function: z/OS

Returns the value of the specified operating-environment variable.

Category: Special

z/OS specifics: *operating-environment-variable*

See: "SYSGET Function" in *SAS Functions and CALL Routines: Reference*

## Syntax

**SYSGET**(*operating-environment-variable*)

### Required Argument

***operating-environment-variable***
is the name of a simulated environment variable.

## Details

z/OS does not have native environment variables, but SAS supports three types of simulated environment variables that can be accessed by SYSGET.

- variables that have been created through the SET system option
- variables that have been defined in a TKMVSENV file
- under TSO, variables in the calling REXX exec or CLIST

SYSGET searches for the specified *operating-environment-variable* in each of these three locations, in the order specified in the preceding list. If the specified variable is not found in any of the locations, then the error message `"NOTE: Invalid argument to the function SYSGET"` is generated and _ERROR_ is set to 1.

Names of TKMVSENV variables are case-sensitive, but names of SET variables, or REXX or CLIST variables, are not case-sensitive.

## Example: Returning Options from the SAS CLIST or REXX Exec

Under TSO, the following example returns the system options that are specified in the OPTIONS variable of the SAS CLIST or REXX exec and is printed to the specified log:

```
data _null_;
  optstr=sysget('OPTIONS');
  if _ERROR_ then put 'no options supplied';
  else put 'options supplied are:' optstr;
run;
```

## See Also

"SET= System Option: z/OS" on page 840

# SYSTEM Function: z/OS

Executes an operating environment command and returns the command return code.

Category: Special

Restriction: A TSO command executes successfully only in a TSO SAS session. In a non-TSO session, the command is disabled and the return code is set to 0.

z/OS specifics: The command must be a TSO command, emulated USS command, or MVS program.

See: "SYSTEM Function" in *SAS Functions and CALL Routines: Reference*

## Syntax

**SYSTEM**(*command*)

### Required Argument

***command***
can be a system command enclosed in quotation marks, an expression whose value is a system command, or the name of a character variable whose value is a system command. Under z/OS, the term system command refers to TSO commands, CLISTs, and REXX execs.

## Details

The SYSTEM function provides the same function and has the same syntax as the X statement, and it returns the command return code. For information about the command interface, see "X Statement: z/OS" on page 681.

## Example

In the following example, the SYSTEM function is used to allocate an external file:

```
data _null_;
   rc=system('alloc f(study) da(my.library)');
run;
```

For a fully qualified data set name, use the following statements:

```
data _null_;
   rc=system("alloc f(study) da('userid.my.library')");
run;
```

In the second example, notice that the command is enclosed in double quotation marks. When the TSO command includes quotation marks, it is best to enclose the command in double quotation marks. If you choose to use single quotation marks, then double each single quotation mark within the TSO command:

```
data _null_;
   rc=system('alloc f(study)da(''userid.my.library'')');
run;
```

## See Also

**Statements**

- “TSO Statement: z/OS” on page 679
- “X Statement: z/OS” on page 681

**CALL Routines**

- “CALL SYSTEM Routine: z/OS” on page 459
- “CALL TSO Routine: z/OS” on page 461

**Commands**

- “TSO Command: z/OS” on page 285
- “X Command: z/OS” on page 288

**Macro Statements**

- “Macro Statements” on page 514

# TRANSLATE Function: z/OS

Replaces specific characters in a character expression.

Category: Character

z/OS specifics: *to* or *from* pairs

See: “TRANSLATE Function” in *SAS Functions and CALL Routines: Reference*

## Syntax

**TRANSLATE**(*source*, *to-1*, *from-1*, <*to-n*, *from-2* ...>)

### Required Arguments

***source***
specifies the SAS expression that contains the original character value.

***to***
specifies the characters that you want TRANSLATE to use as substitutes.

***from***
specifies the characters that you want TRANSLATE to replace.

## Details

Under z/OS, you must specify pairs of *to* and *from* arguments. Also, there is no practical limit to the number of to or from pairs that you can specify.

TRANSLATE handles character replacement for single-byte character sets only. See KTRANSLATE to replace single-byte characters with double-byte characters, or to replace double-byte characters with single-byte characters.

## See Also

"KTRANSLATE Function: z/OS" on page 485

# TSO Function: z/OS

Issues an operating environment command during a SAS session and returns the system return code.

Restriction: A TSO command executes successfully only in a TSO SAS session. In a non-TSO session, the command is disabled and the return code is set to 0.

z/OS specifics: All

## Syntax

**TSO**(*command*)

### Required Argument

**command**
can be a system command enclosed in quotation marks, an expression whose value is a system command, or the name of a character variable whose value is a system command. Under z/OS, "system command" includes TSO commands, CLISTs, and REXX execs.

## Details

The SYSTEM and TSO functions are identical, with one exception: under an operating environment other than z/OS, the TSO function has no effect, whereas the SYSTEM function is always processed. For more information, see "SYSTEM Function: z/OS" on page 494. For information about the command interface, see "X Statement: z/OS" on page 681.

## See Also

"CALL TSO Routine: z/OS" on page 461

# WTO Function: z/OS

Sends a message to the system console.

z/OS specifics: All

## Syntax

**WTO**("*text-string*" | *var*)

### Required Arguments

***text-string***
is the message that you want to send. It should be no longer than 125 characters.

***var***
specifies a DATA step variable.

## Details

WTO is a DATA step function that takes a character-string argument and sends it to a system console. The destination is controlled by the WTOUSERROUT=, WTOUSERDESC=, and WTOUSERMCSF= SAS system options. If WTOUSERROUT=0 (the default), then no message is sent.

## See Also

- "WTOUSERDESC= System Option: z/OS" on page 888
- "WTOUSERMCSF= System Option: z/OS" on page 889
- "WTOUSERROUT= System Option: z/OS" on page 891

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# Informats under z/OS



## Informats in the z/OS Environment

In general, informats are completely portable. Only the informats that have aspects specific to z/OS are documented in this chapter.

All informats are described in *SAS Formats and Informats: Reference*; that information is not repeated here. Instead, you are given details about how the informat behaves under z/OS, and then you are referred to *SAS Formats and Informats: Reference* for more information.

# Considerations for Using Informats under z/OS

## EBCDIC and Character Data

The following character informats produce different results on different computing platforms, depending on which character encoding the platform uses. Because z/OS uses the EBCDIC character encoding, all of the following informats convert data to EBCDIC.

These informats are not discussed in detail in this documentation because the EBCDIC character encoding is their only host-specific aspect.

$ASCII*w.*
: converts ASCII-encoded character data to EBCDIC-encoded character data.

$BINARY*w.*
: converts binary values to EBCDIC-encoded character data.

$CHARZB*w.*
: reads character data and converts any byte that contains a binary zero to an EBCDIC blank.

$EBCDIC*w.*
: reads EBCDIC-encoded character data. Under z/OS, $EBCDIC and $CHAR are equivalent.

$HEX*w.*
: converts hexadecimal data to EBCDIC-encoded character data.

$OCTAL*w.*
: converts octal data to EBCDIC-encoded character data.

$PHEX*w.*
: converts packed hexadecimal data to EBCDIC-encoded character data.

All the information that you need in order to use these informats under z/OS is in *SAS Formats and Informats: Reference*.

## Floating-Point Number Format and Portability

The manner in which z/OS stores floating-point numbers can affect your data. For more information, see "Numeric Precision" in *SAS Programmer's Guide: Essentials*.

# Reading Binary Data

If a SAS program that reads and writes binary data is run on only one type of machine, you can use the native-mode informats in the following list.

**Note:** Native-mode means that these informats use the byte-ordering system that is standard for the machine.

IB*w.d*
reads integer binary (fixed-point) values, including negative values, that are represented in two's complement notation.

IEEE*w.d*
reads floating-point data that is stored in IEEE format

PD*w.d*
reads data that is stored in IBM packed decimal format.

PIB*w.d*
reads positive integer binary (fixed-point) values.

RB*w.d*
reads real binary (floating-point) data.

If you want to write SAS programs that can be run on multiple machines that use different byte-storage systems, use the following IBM 370 informats:

S370FF*w.d*
is used on other computer systems to read EBCDIC data.

S370FIB*w.d*
reads integer binary data.

S370FIBU*w.d*
reads unsigned integer binary data.

S370FPD*w.d*
reads packed decimal data.

S370FPDU*w.d*
reads unsigned packed decimal data.

S370FPIB*w.d*
reads positive integer binary data that is stored in IBMhexadecimal floating-point format.

S370FRB*w.d*
reads real binary data.

S370FZD*w.d*
reads zoned decimal data.

S370FZDL*w.d*
reads zoned decimal leading sign data.

S370FZDS*w.d*
reads zoned decimal separate leading sign data.

S370FZDT*w.d*
reads zoned decimal separate trailing sign data.

S370FZDU*w.d*
reads unsigned zoned decimal data.

These IBM 370 informats enable you to write SAS programs that can be run in any SAS environment, regardless of the standard for storing numeric data. They also enhance your ability to port raw data between host operating environments.

For more information about the IBM 370 informats, see *SAS Formats and Informats: Reference*.

# Date and Time Informats

Several informats are designed to read time and date stamps that have been written by the System Management Facility (SMF) or by the Resource Measurement Facility (RMF). SMF and RMF are standard features of the z/OS operating environment. They record information about each job that is processed. The following informats are used to read time and date stamps that are generated by SMF and RMF:

PDTIME*w.*
reads the packed decimal time of SMF and RMF records.

RMFDUR.
reads the duration values of RMF records.

RMFSTAMP*w.*
reads the time and date fields of RMF records.

SMFSTAMP*w.*
reads the time and date of SMF records.

TODSTAMP.
reads the 8-byte time-of-day stamp.

TU*w.*
reads timer unit values that are produced by IBM mainframe operating environments and converts the timer unit values to SAS time values.

In order to facilitate the portability of SAS programs, these informats can be used with any operating environment that is supported by SAS software. Therefore, they are documented in *SAS Formats and Informats: Reference*.

# Dictionary

## HEXw. Informat: z/OS

Converts hexadecimal character values to integer binary (fixed-point) or real binary (floating-point) values.

Category: Numeric

Default: 8

Range: 1-16 bytes

z/OS specifics: Interprets input as EBCDIC, IBM floating-point format

See: "HEXw. Informat" in *SAS Formats and Informats: Reference*

### Details

The format of floating-point numbers is host-specific. For a description of the IBM floating-point format that is used under z/OS, see Chapter 22, "Data Representation," on page 399.

The *w* value of the HEX informat specifies the field width of the input value. It also specifies whether the final value is an integer binary (fixed-point) value or a real binary (floating-point) value. When you specify a width value of 1 through 15, the input hexadecimal number represents an integer binary number. When you specify a width of 16, SAS interprets the input hexadecimal number as a representation of a floating-point number.

The following examples illustrate the use of the HEX*w.d* format:

| Data Line | Informat | Value | Notes |
|---|---|---|---|
| 433E800000000000 | HEX16. | 1000 | input is interpreted as floating point |
| 000100 | HEX6. | 256 | input is interpreted as integer |
| C1A0000000000000 | HEX16. | -10 | input is interpreted as floating point |

**Note:** In these examples, Data Line represents the bit pattern stored, which is the value seen when viewed in a text editor. Value is the number that is used by SAS after the data has been read using the corresponding informat.

## See Also

"Representation of Numeric Variables" on page 399

# IBw.d Informat: z/OS

Reads integer binary (fixed-point) values.

Category: Numeric

Default: 4

Ranges: 1-8 bytes, 0-10

z/OS specifics: Two's complement big-endian notation

See: "IBw.d Informat" in *SAS Formats and Informats: Reference*

## Details

On an IBM mainframe system, integer values are represented in two's complement notation. If the informat specification includes a *d* value, the result of the informat is divided by $10^d$.

The following examples illustrate the use of the IB*w.d* format:

| Data Line (Hexadecimal) | Informat | Value | Notes |
|---|---|---|---|
| FFFFFB2E | ib4. | -1234 | |
| 000000003034 | ib6.2 | 123.4 | a *d* value of 2 causes the number to be divided by $10^2$ |
| 00000001E208 | ib6.2 | 1234 | a *d* value of 2 causes the number to be divided by $10^2$ |

**Note:** In these examples, Data Line (Hexadecimal) represents the bit pattern that is stored. It is the value that you see when you view it in a text editor that displays

values in hexadecimal representation. Value is the number that is used by SAS after the data has been read using the corresponding informat.

## See Also

### Informats

- "S370FIBw.d Informat" in *SAS Formats and Informats: Reference*
- "S370FPIBw.d Informat" in *SAS Formats and Informats: Reference*

### Formats

- "IBw.d Format: z/OS" on page 446

# PDw.d Informat: z/OS

Reads IBM packed decimal data.

| | |
|---|---|
| Category: | Numeric |
| Default: | 1 |
| Ranges: | 1-16 bytes, 0-31 |
| z/OS specifics: | IBM packed decimal format |
| See: | "PDw.d Informat" in *SAS Formats and Informats: Reference* |

## Details

The *w* value specifies the number of bytes, not the number of digits. If the informat specification includes a *d* value, the result of the informat is divided by $10^d$.

In packed decimal format, each byte except for the last byte represents two decimal digits. (The last byte represents one digit and the sign.) An IBM packed decimal number consists of a sign and up to 31 digits, thus giving a range from $-10^{31} + 1$ to $10^{31} - 1$. The sign is written in the rightmost nibble. (A nibble is 4 bits or half a byte.) A hexadecimal C indicates a plus sign, and a hexadecimal D indicates a minus sign. The rest of the nibbles to the left of the sign nibble represent decimal digits. The hexadecimal values of these digit nibbles correspond to decimal values. Therefore, only values between '0'x and '9'x can be used in the digit positions.

Here are several examples of how data is read using the PD*w.d* informat:

| Data Line (Hexadecimal) | Informat | Value | Notes |
|---|---|---|---|
| 01234D | pd3. | -1234 | |
| 0123400C | pd4.2 | 1234 | the *d* value of 2 causes the number to be divided by $10^2$ |

**Note:** In these examples, Data Line (Hexadecimal) represents the bit pattern that is stored. It is the value that you see when you view it in a text editor that displays values in hexadecimal representation. Value is the number that is used by SAS after the data has been read using the corresponding informat.

The PD*w.d* format writes missing numerical data as -0. When the PD*w.d* informat reads -0, it stores it 0.

## See Also

### Informats

- "S370FPDw.d Informat" in *SAS Formats and Informats: Reference*

### Formats

- "PDw.d Format: z/OS" on page 447

# RBw.d Informat: z/OS

Reads real binary hexadecimal (floating-point) data.

| | |
|---|---|
| Category: | Numeric |
| Default: | 4 |
| Ranges: | 2- 8 bytes, 0-10 |
| z/OS specifics: | IBM hexadecimal floating-point format |
| See: | "RBw.d Informat" in *SAS Formats and Informats: Reference* |

## Details

The *w* value specifies the number of bytes, not the number of digits. If the informat specification includes a *d* value, the conversion result is divided by $10^d$.

The format of floating-point numbers is host-specific. For a description of the IBM floating-point format that is used under z/OS, see Chapter 22, "Data Representation," on page 399.

The following examples show how data that represent decimal numbers are read as floating-point numbers using the RB*w.d* informat:

| Data Line (Hexadecimal) | Informat | Value | Notes |
|---|---|---|---|
| 4214000000000000 | rb8.1 | 32 | a *d* value of 1 causes the number to be divided by $10^1$ |
| 4364000000000000 | rb8.2 | 16 | a *d* value of 2 causes the number to be divided by $10^2$ |
| c020000000000000 | rb8. | -0.125 | |
| 434b000000000000 | rb8. | 1200 | |
| 41C4000000000000 | rb8. | 12.25 | |

**Note:** In these examples, Data Line (Hexadecimal) represents the bit pattern that is stored. It is the value that you see when you view it in a text editor that displays values in hexadecimal representation. Value is the number that is used by SAS after the data has been read using the corresponding informat.

## See Also

### Informats

- "S370FRBw.d Informat" in *SAS Formats and Informats: Reference*

### Formats

- "RBw.d Format: z/OS" on page 449
- "Representation of Numeric Variables" on page 399

# ZDw.d Informat: z/OS

Reads zoned-decimal data.

Category: Numeric

Range: 1-32 bytes

z/OS specifics: IBM zoned decimal format

See: "ZDw.d Informat" in *SAS Formats and Informats: Reference*

## Details

Like numbers that are stored in standard format, zoned decimal digits require one byte of storage space. The low-order, or rightmost, byte represents both the least significant digit and the sign of the number. Digits to the left of the least significant digit are represented in EBCDIC code as 'F0'x through 'F9'x. The character that is printed for the least significant digit depends on the sign of the number. In EBCDIC code, negative numbers are represented as 'D0'x through 'D9'x in the least significant digit position; positive numbers are represented as 'C0'x through 'C9'x. If the informat specification includes a *d* value, the conversion result is divided by $10^d$.

The following examples illustrate the use of the ZD*w.d* informat:

| Data Line (Hexadecimal) | Informat | Value | Notes |
|---|---|---|---|
| F0F0F0F1F2F3F0C0 | zd8.2 | 123 | a *d* value of 2 causes the number to be divided by $10^2$ |
| F0F0F0F0F0F1F2D3 | zd8. | -123 | |
| F0F0F0F0F1F2F3C0 | zd8.6 | 0.00123 | a *d* value of 6 causes the number to be divided by $10^6$ |
| F0F0F0F0F0F0F0C1 | zd8.6 | 1E-6 | a *d* value of 6 causes the number to be divided by $10^6$ |

**Note:** In these examples, Data Line (Hexadecimal) represents the bit pattern that is stored. It is the value that you see when you view it in a text editor that displays values in hexadecimal representation. Value is the number that is used by SAS after the data has been read using the corresponding informat.

## Comparisons

On z/OS, the ZD*w.d* and the ZDV*w.d* informats do not perform validation, which means that non-numeric data is accepted as numeric data. For example, the character string ABC is interpreted as +123.

## See Also

### Informats

- "S370FZDw.d Informat" in *SAS Formats and Informats: Reference*
- "S370FZDLw.d Informat" in *SAS Formats and Informats: Reference*
- "S370FZDSw.d Informat" in *SAS Formats and Informats: Reference*
- "S370FZDTw.d Informat" in *SAS Formats and Informats: Reference*
- "S370FZDUw.d Informat" in *SAS Formats and Informats: Reference*
- "ZDBw.d Informat: z/OS" on page 509
- "ZDVw.d Informat" in *SAS Formats and Informats: Reference*

### Formats

- "ZDw.d Format: z/OS" on page 450

# ZDBw.d Informat: z/OS

Reads zoned decimal data in which zeros have been left blank.

Category: Numeric

Range: 1-32 bytes

z/OS specifics: Used on IBM 1410, 1401, and 1620

See: "S370FZDBw.d Informat" in *SAS Formats and Informats: Reference*

## Details

As previously described for the ZD*w.d* informat, each digit is represented as a single byte, and the low-order, or rightmost, byte represents both the sign and the least significant digit. The only difference between the two informats is the way in which zeros are represented. The ZDB*w.d* informat treats EBCDIC blanks ('40'x) as zeros. (EBCDIC zeros are also read as zeros.)

The following examples show how the ZDB*w.d* informat reads data:

| Data Line (Hexadecimal) | Informat | Value |
|---|---|---|
| 40404040F14040C0 | zdb8. | 1000 |
| 4040404040F1F2D3 | zdb8. | -123 |
| 4040404040F1F2C3 | zdb8. | 123 |

**Note:** In these examples, Data Line (Hexadecimal) represents the bit pattern that is stored. It is the value that you see when you view it in a text editor that displays values in hexadecimal representation. Value is the number that is used by SAS after the data has been read using the corresponding informat.

## See Also

### Informats

- “ZDw.d Informat: z/OS” on page 507

### Formats

- “ZDw.d Format: z/OS” on page 450

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# Macros under z/OS



## Macros in the z/OS Environment

Most features of the SAS macro facility are portable. These features are documented in the *SAS Macro Language: Reference*. This chapter discusses the aspects of the macro facility that are specific to the z/OS environment.

# Macro Variables

## Automatic Macro Variables That Have Host-Specific Values

The following macro variables that are automatically available have host-specific values under z/OS:

SYSCC
: contains the current SAS condition code that SAS translates into a meaningful return code for z/OS at the conclusion of the SAS session.

  **Note:** When the value of the ERRORCHECK= option is NORMAL, the return code is 0 even if an error exists in a LIBNAME or FILENAME statement, or in a SAS/SHARE LOCK statement. Also, the SAS job or session does not terminate when the %INCLUDE statement fails because of a nonexistent file. For more information, see "ERRORCHECK= System Option" in the *SAS System Options: Reference*.

SYSDEVIC
: contains the name of the current graphics device. The current graphics device is determined by the SAS option DEVICE=. For more information, see "DEVICE= System Option: z/OS" on page 723. Ask your on-site SAS support personnel which graphics devices are available at your site.

SYSENV
: is provided for compatibility with SAS software on other operating environments. Under z/OS, its value is FORE if you are running SAS under TSO. Otherwise, its value is BACK. You cannot change the value of this variable.

SYSJOBID
: contains the job name of the batch job that is currently executing, or the user ID that is associated with the current SAS session. SAS obtains this value from the TIOCNJOB field of the TIOT control block, except in the case of SAS/SESSION. With SAS/SESSION, SAS obtains the value from the User_id field that is returned by the Get_TP_Properties service of APPC/MVS. You cannot change the value of this variable.

  **Note:** Starting with SAS 9.4M8, SAS/Session is not available from SAS. If you have an existing installation of SAS/Session in your environment and plan to upgrade or migrate to SAS 9.4M8 or later, SAS recommends that you first uninstall SAS/Session.

SYSMAXLONG
: returns the maximum long integer value allowed by z/OS, which is 2,147,483,647.

SYSRC
: contains the return code from the most recent operating environment command that was issued from within a SAS session. The default value is 0.

SYSSCP
: contains the operating environment abbreviation OS. You cannot change the value of this variable.

SYSSCPL
: contains the operating environment name, z/OS. You cannot change the value of this macro variable.

# z/OS Global Macro Variables

The following global macro variables are automatically available under z/OS:

SYSDEXST
: contains the value that is returned by the DSNEXST statement. For more information, see "DSNEXST Statement: z/OS" on page 602. SYSDEXST has a value of 1 if the data set specified in the DSNEXST statement is currently available. It has a value of 0 if the data set is not currently available.

SYSJCTID
: contains the value of the JCTUSER field of the JCT control block as mapped by the IEFAJCTB macro. It is a 7-byte character value.

SYSJMRID
: contains the value of the JMRUSEID field of the JCT control block as mapped by the IEFAJMR macro. The value is a 7-byte character. This field is blank unless an installation exit or another program product populates it. This field is left blank by IBM for the installation to use.

SYSUID
: contains the value of the TSO user ID that is associated with the SAS session, regardless of whether the session is a batch job, a remote connect session, a SAS/SESSION connection, or a TSO session. SAS obtains this value from the ACEEUSRI field of the ACEE control block.

**Note:** Starting with SAS 9.4M8, SAS/Session is not available from SAS. If you have an existing installation of SAS/Session in your environment and plan to upgrade or migrate to SAS 9.4M8 or later, SAS recommends that you first uninstall SAS/Session.

The following four global macro variables can be used to help diagnose failures in dynamic allocation. Their values are updated each time SAS does a dynamic allocation as a result of a FILENAME or LIBNAME statement (or their equivalent DATA step or SCL functions). They are undefined until the first dynamic allocation is performed. These macro variables are as follows:

SYS99ERR
contains the error reason code that was returned in the SVC 99 request block.

SYS99INF
contains the information reason code that was returned in the SVC 99 request block.

SYS99MSG
contains the text of the message that is associated with the reason code.

SYS99R15
contains the return code that was returned in R15 from SVC 99.

**Note:** The %PUT statement can be used to display the contents of these variables in the SAS log–for example,

```
%put _global_;
```

# Names to Avoid When Defining Macro Variables

When you define macro variables, do not use names taken up by z/OS reserved words (see "Reserved z/OS Ddnames" on page 40), names of SAS files, or names beginning with &SYS. The prefix &SYS has been reserved for future use.

# Macro Statements

The following macro statements have behavior specific to z/OS:

%TSO
executes commands. It is similar to the TSO or X statements, except that it places the command return code in the automatic variable SYSRC. For more information, see "X Statement: z/OS" on page 681. You can use the %TSO statement either inside or outside a macro. The form of the statement is:

**%TSO** <*command*>;

You can use any TSO command or MVS program name, or any sequence of macro operations that generate a TSO command or MVS program name. If you omit the *command*, your SAS session is suspended and your z/OS session is placed in TSO submode. To return to the SAS session, enter either RETURN or END.

If you execute a %TSO statement on an operating environment other than z/OS, the statement is treated as a comment. In batch, the %TSO statement supports MVS programs but not TSO commands.

%SYSEXEC
executes commands . The form of the statement is:

**%SYSEXEC** <*command*>;

Under z/OS, the %SYSEXEC statement works exactly like the %TSO statement. The two statements are different only if you transport your SAS program to a different operating environment. Because %SYSEXEC statements are recognized on multiple operating environments, each operating environment expects commands that are appropriate for that operating environment.

# Macro Functions

The following macro functions have behavior specific to z/OS:

%SCAN
under z/OS and other systems that use an EBCDIC character encoding, if you specify no delimiters, SAS treats all of the following characters as delimiters:

blank . < ( + | & ! $ * ) ; ¬ - / , % ¦ ¢

%SYSGET
under TSO, %SYSGET returns values of variables from the REXX exec or CLIST with which SAS was invoked.

# Autocall Libraries

## Overview of Autocall Libraries

An autocall library contains files that define SAS macros. Under z/OS, an autocall library is a partitioned data set. Each autocall macro should be a separate member in a partitioned data set. SAS supplies some autocall macros in the system autocall library. You can also define autocall macros yourself in a user autocall library. In order to use the autocall facility, the SAS option MAUTOSOURCE must be in effect. (See *SAS System Options: Reference* for details about MAUTOSOURCE.)

# Specifying a User Autocall Library

## Overview of Specifying a User Autocall Library

You can designate a physical file, or a concatenation of physical files, as your user-written autocall library in any of the following ways:

- with the SASAUTOS= system option. You can designate one or more filerefs or data set names as your autocall library. For more information, see "SASAUTOS= System Option: z/OS" on page 833.
- with the SASAUTOS parameter of the SAS CLIST or SASRX exec (under TSO). In this case, SAS concatenates the user autocall library in front of the system autocall library, which is specified by the CLIST parameter MAUTS.
- with the SASAUTOS= parameter of the SAS cataloged procedure.

**Note:** SAS issues an error message if the specified autocall library does not exist.

## Example: Specifying an Autocall Library in Batch Mode

In batch mode, you can use the following JCL statements to specify an autocall library.

For a single autocall library, use this example:

```
//MYJOB    JOB account. ...
//         EXEC SAS,OPTIONS='MAUTOSOURCE'
//SASAUTOS DD DSN=MY.MACROS,DISP=SHR
```

For concatenated autocall libraries, the following technique handles any combination of libraries:

```
//MYJOB    JOB account ...
//         EXEC SAS,OPTIONS='MAUTOSOURCE SASAUTOS=(AUTOLIB1, AUTOLIB2,
//          SASAUTOS)'
//AUTOLIB1 DD DSN=MY.MACROS1,DISP=SHR
//AUTOLIB2 DD DSN=MY.MACROS2,DISP=SHR
//SASAUTOS DD DSN=default.autocall.library,DISP=SHR
```

**CAUTION**
**Defining a partitioned concatenation in your JCL is not recommended.**
Documented rules of the z/OS operating system govern partitioned concatenations.

These rules can cause the exclusion of numerous library combinations. For example, it is a rule violation to include a PDSE that does not have the same record format as the first library in the concatenation. This rule prevents a partitioned concatenation that begins with a fixed (unblocked) format library from containing a variable (blocked or unblocked) format PDSE, or a fixed block format PDSE. It also prevents a partitioned concatenation with both fixed and variable format PDSEs.

## Example: Specifying an Autocall Library under TSO

Under TSO, you can specify an autocall library either when you invoke SAS or during a SAS session.

When you invoke SAS:

single autocall library:

```
sas options('mautosource sasautos= "myid.macros"')
```

concatenated autocall library:

```
sas options('mautosource sasautos= ("myid.macros1","myid.macros2",sasautos)')
```

During a SAS session:

single autocall library:

```
options mautosource sasautos= 'myid.macros';
```

concatenated autocall library:

```
options mautosource sasautos= ('myid.macros1','myid.macros2', sasautos);
```

# Creating an Autocall Macro

To create an autocall macro:

1. Create a partitioned data set to function as an autocall library, or use an existing autocall library.
2. In the autocall library, create a member that contains the source statements for the macro. The member name must be the same as the name of the macro.

**Note:** The SAS macro facility enables you to include the underscore character in macro names. However, z/OS does not allow the underscore character in partitioned data set member names. To create an autocall member for a macro name that contains an underscore, use a number sign (#) in place of the underscore in the member name. For example, to create an autocall member for a macro named _SETUP_, name the member #SETUP#. However, invoke the macro by the macro name, as follows:

```
%_setup_
```

# Stored Compiled Macro Facility

## Overview of the Stored Compiled Macro Facility

The stored compiled macro facility gives you access to permanent SAS catalogs that contain compiled macros. In order for SAS to use stored compiled macros, the SAS option MSTORED must be in effect. In addition, you use the SAS option SASMSTORE= to specify the libref of a SAS library that contains a catalog of stored compiled SAS macros. For more information about these options, see *SAS System Options: Reference*.

Using stored compiled macros offers the following advantages over other methods of making macros available to your session:

- SAS does not have to compile a macro definition when a macro call is made.
- Session-compiled macros and the autocall facility are also available in the same session.

Because you cannot re-create the source statements from a compiled macro, you must save the original macro source statements.

**Note:** Catalogs of stored compiled macros cannot be concatenated.

If you do not want to use the stored compiled macro facility, you can make macros accessible to your SAS session or job by doing the following:

- placing all macro definitions in the program before calling them
- using a %INCLUDE statement to bring macro definitions into the program from external files

  **Note:** The %INCLUDE statement takes as arguments the same types of file specifications as the INCLUDE command. For more information, see "INCLUDE Command: z/OS" on page 283.

- using the autocall facility to search predefined source libraries for macro definitions

For more information

Your most efficient choice might be to use the stored compiled macro facility.

## Accessing Stored Compiled Macros

The following example illustrates how to create a stored compiled macro in one session and then use the macro in a later session.

```
/*  Create a Stored Compiled Macro      */
/*      in One Session                  */
libname mylib 'u.macro.mysecret' disp=old;
options mstored sasmstore=mylib;
%macro myfiles / store;
  filename file1 'mylib.first';
  filename file2 'mylib.second';
%mend;

/*  Use the Stored Compiled Macro       */
/*       in a Later Session             */
libname mylib 'u.macro.mysecret' disp=shr;
options mstored sasmstore=mylib;

%myfiles
data _null_;
   infile file1;
      *statements that read input file FILE1;
   file file2;
      *statements that write to output file FILE2;
run;
```

# Other Host-Specific Aspects of the Macro Facility

## Character Encoding for Evaluating Macro Characters

Under z/OS, the macro facility uses an EBCDIC character encoding for %EVAL and for the automatic evaluation of macro characters. For example,

```
%EVAL("A")
```

evaluates to the integer 193 (hexadecimal C1) because this value is the code point for the character A in the EBCDIC character set.

## SAS System Options Used by the Macro Facility

The following table lists the SAS options that are used by the macro facility and that have host-specific characteristics. It also tells you where to look for more information about these system options.

***Table 28.1*** *SAS Options Used by the Macro Facility That Have Host-Specific Aspects*

| System Option | Description | See ... |
|---|---|---|
| MSYMTABMAX= | specifies the maximum amount of memory available to all symbol tables (global and local combined). Under z/OS, the default value for this option is 1,048,576 bytes. | "MSYMTABMAX= System Option: z/OS" on page 820 and the *SAS System Options: Reference* |
| MVARSIZE= | specifies the maximum number of bytes for any macro variable stored in memory (0 <= *n* <= 32768). Under z/OS, the default setting for this option is 8,192. | "MVARSIZE= System Option: z/OS" on page 821 and the *SAS System Options: Reference* |
| SASAUTOS= | specifies the autocall library. | "Specifying a User Autocall Library" on page 516 and "SASAUTOS= System Option: z/OS" on page 833 |

## See Also

*SAS Macro Language: Reference*

# Dictionary

## %ISHCONV Macro Macro Statement: z/OS

Converts user-defined, item-store help to HTML help files.

Default: LATIN1

# Syntax

**%ISHCONV**(ishelp='*libref* ',
ishref=*libref-member*,
exphlp='*filename*',
htmdir='*pathname*',
<charenc='*encoding*'>);

## Required Arguments

**ishelp='*libref* '**
specifies the libref of the catalog in which the user-defined item-store help is located.

**ishref=*libref-member***
specifies the member of the libref that contains the item store. Note that unlike the other option values, the libref member name is not specified in single quotation marks.

**exphlp='*filename*'**
specifies the name of the target file in which %ISHCONV export places the exported data. This data is used as input in the DATA step to create the HTML structure of the user-defined help. This file is created if it does not currently exist.

**htmdir='*pathname*'**
specifies the pathname that contains the user-defined item store help that was exported with %ISHCONV. This name needs to be a valid UFS directory path. This path is created if it does not currently exist. Any parent directories that do not exist in this specification are also created.

## Optional Argument

**charenc='*encoding*'**
specifies the character encoding for HTML output files. If the CHARENC argument is omitted from the %ISHCONV macro, the default value of CHARENC is LATIN1. The encoding value must be valid for the SAS PUT statement.

# Details

The SAS %ISHCONV macro enables users of SAS 9.2 for z/OS to convert the contents of user-defined item store help to HTML format. After the item stores are converted to HTML, they can be used with the remote browser, which is the default Help system for SAS 9.2 for z/OS.

SAS accesses user-defined HTML help the same as it did item store files. SAS checks for help files that were created at customer locations, and uses those files before it uses files supplied by SAS. The HELPLOC system option indicates the order in which the browser is to use the Help files. It specifies that help files created by customers are to be used before the files that SAS provides. For more

information about how the HELPLOC option specifies the order in which to access files, see "HELPLOC= System Option: z/OS" on page 775.

When the %ISHCONV macro is run on the specified item-store help, the libref for the item-store help is opened. Then, the user-defined help is exported to the file that is specified in the macro call.

The file containing the exported data is then read, and the appropriate files are allocated and created with the base directory path that you specify for the **htmdir** parameter of the macro invocation. The files are converted to HTML and subdirectories are created as they are needed. The subdirectories are populated with files according to the exported item-store data.

After you have converted your item-store files to HTML, use the HELPLOC option when you start SAS to specify the location of your new user-defined help files:

```
HELP HELPLOC://dirname/filename
```

Replace **//dirname/filename** with your specific filepath information.

## Example: Coding the %ISHCONV Macro

The following example contains sample specifications for the parameters of the %ISHCONV macro. MYLIB is the user ID of the person who converts the item-store help files to HTML. ASCII is the default encoding.

ASCII Encoding (LATIN1)

```
%ishconv(ishelp='MYLIB.MYHELP',
         ishref=HELPDOC,
         exphlp='/home/mylib/ishconv_export_ascii',
         htmdir='/home/mylib/ishconv_dir_ascii');
```

EBCDIC Encoding (OPEN_ED-1047)

```
%ishconv(ishelp=MYLIB.MYHELP,
         ishref=HELPDOC,
         exphelp=/u/saswxg/ishconv_export_e1047,
         htmdir=/u/saswxg/ishconv_dir_e1047,
         charenc=open_ed-1047);
```

The following list contains explanations of the parameter specifications:

MYLIB.USERHELP
: the name of the catalog that contains the item store.

HELPDOC
: the name of the member that contains the user-defined help.

exphlp
: the filename reference in which the exported help contents are placed for parsing into HTML format.

htmdir
: the directory path in which the user-defined help resides in an HTML format.

## See Also

- “Converting Item Store Help to HTML Help” on page 230
- “HELPLOC= System Option: z/OS” on page 775

# 29

# Procedures under z/OS



## Procedures in the z/OS Environment

Portable procedures are documented in the *Base SAS Procedures Guide*. Only the procedures that are specific to z/OS or that have aspects specific to z/OS are documented in this chapter.

# Dictionary

## CATALOG Procedure Statement: z/OS

Manages entries in SAS catalogs.

z/OS specifics: FILE= option

See: "CATALOG Procedure" in *Base SAS Procedures Guide*

### Details

The FILE= option in the CONTENTS statement of the CATALOG procedure is the only portion of this procedure that is host specific. Under z/OS, if the value that you specify in the FILE= option has not been previously defined as a fileref (using a FILENAME statement, FILENAME function, TSO ALLOCATE command, or JCL DD statement), then SAS uses the value to construct the physical filename.

In the following example, if the SAS system option FILEPROMPT is in effect, a dialog box asks whether you want to allocate the external file whose fileref is SAMPLE. If you reply **Yes**, then SAS attempts to locate the external file. If the file was not previously allocated, then SAS allocates it. To construct the data set name, SAS inserts the value of the SYSPREF= system option in front of the FILE= value (in this case, SAMPLE), and it appends the name LIST to it. In this example, if the value of SYSPREF= is SASDEMO.V9, then SAS allocates a physical file that is named SASDEMO.V9.SAMPLE.LIST.

```
proc catalog catalog=profile;
   contents file=sample;
run;
```

## CIMPORT Procedure Statement: z/OS

Restores a transport file that was created by the CPORT procedure.

z/OS specifics: Options

See: "CIMPORT Procedure" in *Base SAS Procedures Guide*

## Details

The DISK option is the default for the CIMPORT procedure. Therefore, PROC CIMPORT defaults to reading from a file on disk instead of from a tape. If you want to read a file from tape, then specify the TAPE option.

When writing and reading files to and from tapes, you are not required to specify the DCB attributes in a SAS FILENAME statement or FILENAME function. However, it is recommended that you specify BLKSIZE=8000.

**Note:** SAS 9.1 and later releases support using the MIGRATE procedure to migrate a SAS library from a previous release. For more information, see the Migration focus area at **`support.sas.com`**.

## See Also

- *Moving and Accessing SAS Files*

**Procedures**

- "CPORT Procedure Statement: z/OS" on page 542
- "MIGRATE Procedure" in *Base SAS Procedures Guide*

# CONTENTS Procedure Statement: z/OS

Prints the description of the contents of one or more files from a SAS library.

z/OS specifics: Engine/host-dependent information, directory information

See: "CONTENTS Procedure" in *Base SAS Procedures Guide*
"Library Implementation Types for Base and Sequential Engines" on page 51

## Syntax

**PROC CONTENTS** <*options*>;

# Details

## Overview of PROC CONTENTS Output

Although most of the output that this procedure generates is the same on all operating environments, the Engine/Host Dependent Information is system-dependent and engine-dependent. The following SAS code creates two data sets, GRADES and MAJORS in your WORK library, and executes PROC CONTENTS to describe the MAJORS data set.

```
data grades (label='First Data Set');
   input student year state $ grade1 grade2;
   label year='Year of Birth';
   format grade1 4.1;
   datalines;
1000 2010 NC 85 87
1042 2011 MD 92 92
1095 2009 PA 78 72
1187 2010 MA 87 94
;
data majors(label='Second Data Set');
   input student $ year state $ grade1 grade2 major $;
   label state='Home State';
   format grade1 5.2;
   datalines;
1000 2010 NC 84 87 Math
1042 2011 MD 92 92 History
1095 2009 PA 79 73 Physics
1187 2010 MA 87 74 Dance
1204 2011 NC 82 96 French
;
proc contents data=majors;
run;
```

The following output shows sample PROC CONTENTS output, including the information that is specific to z/OS for the BASE engine:

***Output 29.1*** *CONTENTS Procedure Output, Including Engine/Host Dependent Information*

```
                          The SAS System                              1
                                                 15:58 Monday, October 10, 2016

                            The CONTENTS Procedure

Data Set Name        WORK.MAJORS                   Observations          5
Member Type          DATA                          Variables             6
Engine               V9                            Indexes               0
Created              10/10/2016 16:04:14           Observation Length    48
Last Modified        10/10/2016 16:04:14           Deleted Observations  0
Protection                                         Compressed            NO
Data Set Type                                      Sorted                NO
Label                Second Data Set
Data Representation  MVS_32
Encoding             open_ed-1047  Western
                     (OpenEdition)


                     Engine/Host Dependent Information

     Data Set Page Size          27648
     Number of Data Set Pages    1
     First Data Page             1
     Max Obs per Page            574
     Obs in First Data Page      5
     Number of Data Set Repairs  0
     ExtendObsCounter            YES
     Physical Name               SYS16284.T161005.RA000.USER01.R0134594
     Release Created             9.0401M4
     Release Last Modified       9.0401M4
     Created by                  USER01
     Last Modified by            USER01
     Subextents                  1
     Total Blocks Used           1
     Percent of Lib Allocation   < 0.1%


               Alphabetic List of Variables and Attributes

          #    Variable    Type    Len    Format    Label

          4    grade1      Num       8    5.2
          5    grade2      Num       8
          6    major       Char      8
          3    state       Char      8              Home State
          1    student     Char      8
          2    year        Num       8
```

The procedure output provides values for the physical characteristics of the SAS data set WORK.MAJORS. Here are the important values:

Observations
: is the number of nondeleted records in the data set.

Observation Length
: is the maximum record size in bytes.

Compressed
: has the value NO if records are not compressed. It has the value CHAR or BINARY if records are compressed.

Data Set Page Size
: is the number of bytes occupied by a single page of the member. For direct-access bound libraries, the page size is always an integral multiple of the library block size.

Number of Data Set Pages
: is the total number of pages in the data set.

First Data Page
: is the number of the page that contains the first data record. Header records are stored in front of data records.

Max Obs per Page
: is the maximum number of records that a page can hold.

Obs in First Data Page
: is the number of data records in the first data page.

Physical name
: is the physical name of the native MVS data set in which the library resides. No unique physical name exists for each member because all members reside in the SAS bound library, which in turn resides in a single MVS data set.

Created by
: is the name of the MVS job or TSO session under which the member was created.

Last Modified by
: is the name of the MVS job or TSO session under which the member was last modified.

Subextents
: is the number of distinct ranges of contiguous blocks required to store the member. It indicates the degree to which the member is fragmented within the library space map.

Total Blocks Used
: is the total number of blocks occupied by the member. It equals the number of member pages multiplied by the number of library blocks required to store a single page.

Percent of Lib Allocation
: is the percentage of the total library space that is occupied by this member. It is computed by dividing Total Blocks Used (see the preceding item) by Total Library Blocks (found in the Directory statistics).

PROC CONTENTS lists several host-specific library attributes in the `Directory` portion of its output. For example, to list the contents of the SASHELP library, submit the following statement.

```
proc contents data=sashelp._all_ directory;
run;
```

The following output shows the directory information that is produced for a direct access bound library. For more information, see “Direct Access Bound Libraries” on page 51.

***Output 29.2*** *Engine/Host Dependent Information*

```
                          The SAS System                              3
                                                 15:58 Monday, October 10, 2016

                       The CONTENTS Procedure

                         Directory

Libref                   SASHELP
Engine                   V9
Access                   READONLY
Physical Name            <physical name>.SASHELP
Unit                     DISK
Volume                   SMSD01
Disposition              SHR
Device                   3390
Blocksize                6144
Blocks per Track         8
Total Library Blocks     72824
Total Used Blocks        68153
Percent Used Blocks      93.5%
Total Free Blocks        4671
Highest Used Block       68153
Highest Formatted Block  68153
Members                  329
DSNTYPE                  BASIC
Data Representation      MVS_32
Channel Program Type     zHPF
```

To list the attributes of a different library, specify the appropriate libref in place of `sashelp` in the preceding code example. SAS lists different library attributes for different types of libraries. Many attributes correspond to information available via the SAS DSINFO window or the ISPF 3.2 window. However, SAS lists additional internal information for direct access bound libraries. These items are defined in this list.

Total Library Blocks
: is the total number of library blocks that can exist in the DASD space currently allocated to the library data set. This number includes the number of library blocks formatted on all volumes as well as the number of library blocks that could be formatted in the unused DASD space beyond the last formatted block. For more information, see the following list item for the Highest Formatted Block.

  This value does not take into account any DASD space that might exist on volumes that follow the volume that contains the highest formatted block.

  Except in the case of pre-allocated multi-volume libraries or multi-volume libraries that are allocated using SMS guaranteed space, Total Library Blocks corresponds to the amount of allocated space that is indicated by the DSINFO window or by ISPF 3.2.

Total Used Blocks
: is the total number of blocks that currently contain member data or information that is used by SAS to manage the internal structure of the library.

Percent Used Blocks
: is calculated as the Total Used Blocks divided by the Total Library Blocks, and expressed as a percentage.

Total Free Blocks
is calculated as the Total Library Blocks minus the Total Used Blocks.

This count includes formatted blocks that are not currently being used. It also includes blocks that could potentially be formatted in the allocated but unused space that is beyond the highest formatted block.

Highest Used Block
is the library relative block number of the last block in the library that is used to contain member data or internal structures.

Highest Formatted Block
is the number of the last library block that has been formatted. Additional DASD space beyond this block might be allocated to the library data set, but no blocks have ever been written beyond this point. Consequently, this statistic indicates the largest number of library blocks that were ever simultaneously in use since the library was created.

This value corresponds to the amount of used space indicated by the DSINFO window or by ISPF 3.2 after the library was closed.

DSNTYPE
is the type of MVS data set in which the library resides.

Only two values, BASIC and LARGE, are possible for a direct access bound library. BASIC data sets are limited to 64K tracks on each volume. Data sets specified with DSNTYPE=LARGE are not subject to that limit, but DSNTYPE=LARGE must be specified when the library is originally created.

Channel Program Type
Specifies the type of channel programs that are generated, either Channel Command Word (CCW) or High Performance FICON for IBM System z (zHPF).

**Note:** The same directory information that is generated by the DIRECTORY option in the PROC CONTENTS statement is also generated by the LIST option in the LIBNAME statement.

## PROC CONTENTS Output for a Sequential Access Bound Library

The following output shows the directory information that is produced for a sequential-bound library. For more information, see "Sequential Access Bound Libraries" on page 57.

***Output 29.3*** *PROC CONTENTS Output for a Sequential Access Bound Library, Part 1*

```
                          The SAS System                          1
                                                 15:58 Monday, October 10, 2016

                        The CONTENTS Procedure

                              Directory

          Libref                  SEQ
          Engine                  V9
          Access                  READONLY
          Physical Name           USER01.SAMPLE.SASLIB.V9SEQ
          Unit                    DISK
          Volume                  USRD05
          Disposition             SHR
          Device                  3390
          Blocksize               27648
          Blocks per Track        2
          Total Library Blocks    30
          Total Used Blocks       16
          Percent Used Blocks     53.3%
          Total Free Blocks       14
          Highest Used Block      16
          Highest Formatted Block 16
          Members                 2
          DSNTYPE                 BASIC
          Data Representation     MVS_32


                                  Number
                Member               of
  #  Name      Type    Pagesize   Pages  Created

  1  MEMBER01  DATA       27648       1  10/10/2016 16:04:14
  2  MEMBER02  DATA       27648       1  10/10/2016 16:04:14


                          The SAS System                          2
                                                 15:58 Monday, October 10, 2016

                        The CONTENTS Procedure

                                                          Release   Last
                                  Release   Created       Last      Modified
  #  Last Modified                Created   by            Modified  by

  1  10/10/2016 16:04:14          9.0401M4  USER01        9.0401M4  USER01
  2  10/10/2016 16:04:14          9.0401M4  USER01        9.0401M4  USER01
```

***Output 29.4*** *PROC CONTENTS Output for a Sequential Access Bound Library, Part 2*

```
                                The SAS System                       3
                                                    13:36 Thursday, May 7, 2015

                          The CONTENTS Procedure

  Data Set Name        SEQ.MEMBER01                  Observations          1
  Member Type          DATA                          Variables             1
  Engine               V9                            Indexes               0
  Created              10/10/2016 16:04:14           Observation Length    8
  Last Modified        10/10/2016 16:04:14           Deleted Observations  0
  Protection                                         Compressed            NO
  Data Set Type                                      Sorted                NO
  Label
  Data Representation  MVS_32
  Encoding             open_ed-1047  Western
                       (OpenEdition)


                       Engine/Host Dependent Information

              Data Set Page Size          27648
              Number of Data Set Pages    1
              First Data Page             1
              Max Obs per Page            3399
              Obs in First Data Page      1
              Number of Data Set Repairs  0
              ExtendObsCounter            YES
              Physical Name               USER01.SAMPLE.SASLIB.V9SEQ
              Release Created             9.0401M4
              Release Last Modified       9.0401M4
              Created by                  USER01
              Last Modified by            USER01
              Subextents                  1
              Total Blocks Used           1
              Percent of Lib Allocation   3.3%


                                The SAS System                              4
                                                    15:58 Monday, October 10,
2016
                             The CONTENTS Procedure

                    Alphabetic List of Variables and Attributes

                           #    Variable    Type    Len

                           1    x           Num       8
```

The physical characteristics of a SAS data set are defined with Output 29.19 on page 529. These two physical characteristics are different for sequential access bound libraries:

Physical Name
: specifies the physical name of the native MVS data set in which the library resides. No unique physical name exists for each member because all members reside in the SAS bound library, which in turn resides in a single MVS data set.

Created by
: specifies the name of the MVS job or TSO session under which the member was created.

Members of a sequential library cannot be modified in place because of the limitations of tape devices. Therefore, there are no modification statistics.

## PROC CONTENTS Output for a UFS Directory

On z/OS, SAS libraries can reside in a UNIX file system directory. Each member of the library is stored in a separate UNIX file within the directory.

The following output shows the directory information that is produced for a library in a UFS directory. For more information, see "UFS Libraries" on page 63.

***Output 29.5*** *PROC CONTENTS Output for a Library in a UFS Directory, Part 1*

```
                          The SAS System                     7
                                        15:58 Monday, October 10, 2016

                       The CONTENTS Procedure

                             Directory

                Libref                  UFS
                Engine                  V9
                Physical Name           /u/user01/sample
                Owner                   USER01
                Group                   PUB
                File Size               8192
                Device number (dev)     125865
                Dir serial number (ino) 55


                          Member
                #  Name      Type     Created

                1  MEMBER01  DATA    10/10/2016 16:04:14
                2  MEMBER02  DATA    10/10/2016 16:04:14

               #   Last Modified               Owner     Group

               1  10/10/2016 16:04:14          USER01    PUB
               2  10/10/2016 16:04:14          USER01    PUB

                                                 Dir
                                       Device    serial
                                       number    number
                    #  File Size       (dev)     (ino)

                    1  24576           125865    58
                    2  24576           125865    59


                          The SAS System                     8
                                        15:58 Monday, October 10, 2016

                       The CONTENTS Procedure

Data Set Name        UFS.MEMBER01                  Observations          1
Member Type          DATA                          Variables             1
Engine               V9                            Indexes               0
Created              10/10/2016 16:04:14           Observation Length    8
Last Modified        10/10/2016 16:04:14           Deleted Observations  0
Protection                                         Compressed            NO
Data Set Type                                      Sorted                NO
Label
Data Representation  MVS_32
Encoding             open_ed-1047  Western
                     (OpenEdition)
```

***Output 29.6*** *PROC CONTENTS Output for a Library in a UFS Directory, Part 2*

```
                    Engine/Host Dependent Information

        Data Set Page Size          16384
        Number of Data Set Pages    1
        First Data Page             1
        Max Obs per Page            2013
        Obs in First Data Page      1
        Number of Data Set Repairs  0
        ExtendObsCounter            YES
        Physical Name               /u/user01/sample/member01.sas7bdat
        Release Created             9.0401M4
        Release Last Modified       9.0401M4
        Created by                  USER01
        Last Modified by            USER01


                              The SAS System                              9
                                              15:58 Monday, October 10, 2016

                          The CONTENTS Procedure

                  Alphabetic List of Variables and Attributes

                         #    Variable    Type    Len

                         1    x           Num       8
```

The physical characteristics of a SAS data set are defined with Output 29.19 on page 529. These three physical characteristics are different for SAS libraries on UFS:

Physical Name
: specifies the fully qualified path or name for the UNIX file in which the member resides.

Created by
: specifies the name of the MVS job or TSO session under which the member was created. This information is available only for SAS files that were created by SAS on z/OS. It is omitted for files that SAS created on other host platforms.

Last Modified by
: specifies the name of the MVS job or TSO session under which the member was last modified. This information is available only for SAS files that were created by SAS on z/OS. It is omitted for files created by SAS on other host platforms.

# CONVERT Procedure Statement: z/OS

Converts BMDP and OSIRIS system files and SPSS export files to SAS data sets.

z/OS specifics: All

# Syntax

**PROC CONVERT** <*options*>;

# Details

## Overview of PROC CONVERT

PROC CONVERT produces one output SAS data set but no printed output. The new SAS data set contains the same information as the input system file; exceptions are noted in "How Variable Names Are Assigned" on page 539.

The procedure converts system files from these software applications:

- BMDP save files up to and including the most recent version of BMDP
- SPSS save files up to and including files that are created in SAS 9, along with SPSS-X and the SPSS portable file format that is created by using the SPSS EXPORT command. (If you create a system file in a later version of SPSS, then you need to use SPSS to resave the data in export format.)
- OSIRIS files up to and including OSIRIS IV (hierarchical file structures are not supported).

These software applications are products of other organizations. Therefore, changes that make the system files incompatible with the current version of PROC CONVERT might be made. SAS cannot be responsible for upgrading PROC CONVERT to support changes to other vendor's software applications. However, attempts to do so are made when necessary with each new version of SAS.

Information associated with each software application is given in "The BMDP, SPSS, and OSIRIS Engines" on page 968.

## PROC CONVERT Statement

**PROC CONVERT** <*options*> ;

*options* can be from the following list. Only one of the options that specify a system file (BMDP, OSIRIS, or SPSS) can be included. Usually, only the PROC CONVERT statement is used, although data set attributes can be controlled by specifying the DROP=, KEEP=, or RENAME= data set options with the OUT= option of this procedure. See *SAS Data Set Options: Reference* for more information about these data set options. You can also use LABEL and FORMAT statements following the PROC statement.

**BMDP=*fileref* <(CODE=*code-id* | CONTENT= *content-type*)>**
specifies the fileref of a BMDP save file. The first save file in the physical file is converted. If you have more than one save file in the data set, then you can use two additional options in parentheses after the libref or fileref. The CODE= option specifies the code of the save file that you want, and the CONTENT= option specifies the save file's content. For example, if a file CODE=JUDGES has a content type of DATA, you can use this statement:

```
proc convert bmdp=bmdpfile(code=judges
```

```
content=data);
```

**DICT=*fileref***
specifies the fileref of a physical file that contains the dictionary file for the OSIRIS data set. The DICT= option is required if you use the OSIRIS= option.

**FIRSTOBS=*n***
gives the number of the observation at which the conversion is to begin. This option enables you to skip over observations at the beginning of the BMDP, OSIRIS, or SPSS file.

**OBS=*n***
specifies the number of the last observation to be converted. This option enables you to exclude observations at the end of the file.

**OSIRIS=*fileref***
specifies a fileref for a physical file that contains an OSIRIS file. The DICT= option is required when you use the OSIRIS= option.

**OUT=*SAS-data-set***
names the SAS data set that are created to hold the converted data. If OUT= is omitted, SAS still creates a data set and automatically names it DATA*n*, just as if you omitted a data set name in a DATA statement. That is, if it is the first such data set in a job or session, then SAS names it DATA1; the second is DATA2, and so on. If you omit the OUT= option, or if you do not specify a two-level name in the OUT= option, then the converted data set is not permanently saved.

**SPSS=*fileref***
specifies a fileref for a physical file that contains an SPSS file. The SPSS file can be in any of three formats: SPSS Release 9 (or prior), SPSS-X format, or the portable file format from any operating environment that was created by using the SPSS EXPORT command.

## How Missing Values Are Handled

If a numeric variable in the input data set has no value or has a system missing value, PROC CONVERT assigns a missing value to it.

## How Variable Names Are Assigned

The following sections explain how names are assigned to the SAS variables that are created by the CONVERT procedure.

**CAUTION**
**Because some translation of variable names can occur (as indicated in the following sections), ensure that the translated names are unique.**

## Variable Names in BMDP Output

Variable names from the BMDP save file are used in the SAS data set, except that nontrailing blanks and all special characters are converted to underscores in the SAS variable names. The subscript in BMDP variable names, such as x(1), becomes part of the SAS variable name, but the parentheses are omitted (for example, X1).

Alphabetic BMDP variables become SAS character variables of length 4. Category records from BMDP are not accepted.

### Variable Names in OSIRIS Output

For single-response variables, the V1 through V9999 name becomes the SAS variable name. For multiple-response variables, the suffix R*n* is added to the variable name, when *n* is the response. For example, V25R1 would be the first response of the multiple response V25. If the variable after or including V1000 has 100 or more responses, then responses 99 are eliminated. Numeric variables that OSIRIS stores in character, fixed-point binary, or floating-point binary mode become SAS numeric variables. Alphabetic variables become SAS character variables; any alphabetic variable whose length is greater than 200 is truncated to 200. The OSIRIS variable description becomes a SAS variable label, and OSIRIS print format information is translated to the appropriate SAS format specification.

### Variable Names in SPSS Output

SPSS variable names and labels become variable names and labels without any changes. SPSS alphabetic variables become SAS character variables. SPSS blank values are converted to SAS missing values. SPSS print formats become SAS formats, and the SPSS default precision of no decimal places becomes part of the variables' formats. The SPSS DOCUMENT data is copied so that the CONTENTS procedure can display them. SPSS value labels are not copied.

## Examples

### Example 1: Converting a BMDP Save File

The following statements convert a BMDP save file and produce the temporary SAS data set TEMP, which contains the converted data.

```
filename ft04f001 'userid.bmdp.savefile';
proc convert bmdp=ft04f001 out=temp;
run;
title 'BMDP CONVERT Example';
proc contents;
run;
```

### Example 2: Converting an OSIRIS File

The following statements convert an OSIRIS file and produce the temporary SAS data set TEMP, which contains the converted data. Output 29.25 on page 541 shows the attributes of TEMP.

```
filename osiris 'userid.misc.cntl(osirdata)';
filename dict 'userid.misc.cntl(osirdict)';
proc convert osiris=osiris dict=dict out=temp;
run;
title 'OSIRIS CONVERT Example';
proc contents;
run;
```

The following output displays the results:

***Output 29.7*** *Converting an OSIRIS File*

```
                          OSIRIS CONVERT Example
                            The CONTENTS Procedure
Data Set Name: WORK.TEMP                           Observations:         20
Member Type:   DATA                                Variables:            9
Engine:        V9                                  Indexes:              0
Created:       9:46 Monday, April 27, 2005         Observation Length:   36
Last Modified: 9:46 Monday, April 27, 2005         Deleted Observations: 0
Protection:                                        Compressed:           NO
Data Set Type:                                     Sorted:               NO
Label:
                -----Engine/Host Dependent Information-----
      Data Set Page Size:         6144
      Number of Data Set Pages:   1
      First Data Page:            1
      Max Obs per Page:           135
      Obs in First Data Page:     20
      Number of Data Set Repairs: 0
      Physical Name:              SYS99117.T152416.RA000.USERID.R0121907
      Release Created:            8.0000B2
      Release Last Modified:      8.0000B2
      Created by:                 USERID
      Last Modified by:           USERID
      Subextents:                 1
      Total Blocks Used:          1
            -----Alphabetic List of Variables and Attributes-----
 #  Variable  Type  Len  Pos  Format  Label
 ------------------------------------------------------------------------
 1  V1        Num     4    0          INTERVIEW NUMBER         REF=   1 ID=
 2  V2        Num     4    4          INTERVIEWER NUMBER       REF=   2 ID=
 3  V3        Num     4    8          PRIMARY SAMPLING UNIT    REF=   3 ID=
 4  V4        Num     4   12          REGION                   REF=   4 ID=
 5  V5        Num     4   16          CHUNK AND SEGMENT        REF=   5 ID=
 6  V6        Num     4   20          LANGUAGE OF INTERVIEW    REF=   6 ID=
 7  V7        Num     4   24          LANGUAGE OF INTERVIEW    REF=1621 ID=
 8  V9        Num     4   28          LNGTH OF INTERVIEW       REF=1620 ID=
 9  V9        Num     4   32  12.4    WEIGHT                   REF=1700 ID=
```

## Example 3: Example of Converting an SPSS File

The following statements convert an SPSS Release 9 file and produce the temporary SAS data set TEMP, which contains the converted data. The output generated by PROC CONTENTS is similar in format to Output 29.25 on page 541.

```
filename spss 'userid.spssfile.num1';
proc convert spss=spss out=temp;
run;
title 'SPSSR9 CONVERT Example';
proc contents;
run;
```

# See Also

"The BMDP, SPSS, and OSIRIS Engines" on page 968

# CPORT Procedure Statement: z/OS

Writes SAS data sets and catalogs into a transport file.

z/OS specifics: Specification of transport file

See: "CPORT Procedure" in *Base SAS Procedures Guide*

## Details

The DISK option is the default for the CPORT procedure. Therefore, PROC CPORT defaults to writing to a file on disk instead of on a tape. If you want to write to a file on tape, specify the TAPE option or assign the fileref or ddname of SASCAT to a tape.

You are not required to define the logical name SASCAT to your tape, and you are not required to specify the full DCB attributes. However, the BLKSIZE= value must be an integral multiple of 80; a value of 8000 is recommended.

Here is an example of exporting all the SAS data sets and catalogs in a SAS library to a transport file on disk. Note that the FILENAME statement specifies BLKSIZE=8000.

```
libname oldlib 'SAS-data-library';
filename tranfile 'transport-file-name'
   blksize=8000 disp=(new,catlg);
proc cport library=oldlib file=tranfile;
run;
```

PROC CPORT writes a transport file to the physical file that is referenced by TRANFILE. The file contains all the data sets and catalogs in the SAS library OLDLIB.

**Note:** SAS 9.1 and later releases support using the MIGRATE procedure to migrate a SAS library from a previous release to a later release. For more information, see the Migration focus area at **support.sas.com**.

## See Also

- *Moving and Accessing SAS Files*

**Procedures**

- "CIMPORT Procedure Statement: z/OS" on page 526

# DATASETS Procedure Statement: z/OS

Manages SAS files; creates and deletes indexes and integrity constraints for SAS data sets.

z/OS specifics: Output generated by CONTENTS statement, library information

See: "DATEKEYS Procedure" in *Base SAS Procedures Guide*

## Details

Part of the DATASETS procedure output is system-dependent. The SAS library information that is displayed in the SAS log depends on the operating environment and the engine. In Output 29.26 on page 543, the SAS log shows the information that is generated by the DATASETS procedure for the V9 (BASE) engine under z/OS.

**Note:** The information that is produced for other engines varies slightly. For information about other engines, see "Compatibility Engines" on page 48.

***Output 29.8*** *SAS Library Information from the DATASETS Procedure*

```
                        -----Directory-----
Libref:                 WORK
Engine:                 V9
Physical Name:          SYS96053.T145204.RA000.USERID.R0000128
Unit:                   DISK
Volume:                 ANYVOL
Disposition:            NEW
Device:                 3380
Blocksize:              6144
Blocks per Track:       7
Total Library Blocks:   105
Total Used Blocks:      31
Total Free Blocks:      74
Highest Used Block:     44
Highest Formatted Block: 49
Members:                1

                   #  Name     Memtype  Indexes
                   ----------------------------
                   1  ORANGES  DATA
                   2  PROFILE  CATALOG
```

For explanations of the fields in this output, see "CONTENTS Procedure Statement: z/OS" on page 527.

## See Also

"CONTENTS Procedure Statement: z/OS" on page 527

# DBF Procedure Statement: z/OS

Converts a dBASE file to a SAS data set or a SAS data set to a dBASE file.

z/OS specifics: All

See: "DBF Procedure" in *SAS/ACCESS Interface to PC Files: Reference*

## Syntax

**PROC DBF** *options* ;

### Optional Arguments

The following options can be used in the PROC DBF statement:

**DB2 | DB3 | DB4 | DB5=*fileref***
specifies the fileref of a DBF file. The fileref can be allocated via a SAS FILENAME statement, a JCL DD statement (in batch mode), or a TSO ALLOC command (under TSO). For further information about fileref specification, see "Ways of Assigning External Files" on page 94. The DBF file can be stored as one of the following formats:

- a sequential data set (such as sasdemo.emp.dbf)
- a partitioned z/OS data set member (such as `sasdemo.dbf.pds(emp)`)
- a file in a hierarchical file system (such as `/u/sasdemo/emp.dbf`).

For further information about file naming requirements, see "Referring to External Files" on page 108.

If the fileref is allocated with a FILENAME statement, the statement might specify RECFM=N to identify the DBF file as binary. This specification is optional.

The DB*n* option must correspond to the version of dBASE with which the DBF file is compatible. Specify a DBF file with the DB*n* option, where *n* is 2, 3, 4, or 5. You can specify only one of these values.

**DATA=*<libref.>member***
names the input SAS data set, using 1–32 characters. Use this option if you are creating a DBF file from a SAS data set. If you use the DATA= option, do not use the OUT= option. If you omit the DATA= option, SAS creates an output SAS data set from the DBF file.

**OUT=*<libref.>member***
names the SAS data set that is created to hold the converted data, using 1–32 characters. Use this option only if you do not specify the DATA= option. If OUT= is omitted, SAS creates a temporary data set in the Work library. The name of the temporary data set is DATA1 [...DATA*n*]. If OUT= is omitted or if you do not

specify a two-level name in the OUT= option, the SAS data set that is created by PROC DBF remains available during your current SAS session (under the temporary data set name), but it is not permanently saved.

# Details

## Overview PROC DBF

You can use PROC DBF in the z/OS environment if your site has a license for SAS/ACCESS for PC File Formats.

The DBF procedure converts files in DBF format to SAS data sets that are compatible with the current SAS release. You can also use PROC DBF to convert SAS data sets to files in DBF format.

Before you convert a DBF file to a SAS file, you must first upload your DBF file from the Windows or UNIX environments to the z/OS environment, using a mechanism such as FTP (file transfer protocol). If you are licensed for SAS/CONNECT, you can use PROC UPLOAD:

```
filename out1 'sasdemo.emp.dbf';
proc upload infile='c:\employee\emp.dbf'
   outfile=out1 binary;
run;
```

In the z/OS environment, sequential data sets are recommended for use with DBF, with the following attributes:

- RECFM=FS
- DSORG=PS
- LRECL=6160
- BLKSIZE=6160

The following example illustrates the specification of attributes for a sequential data set:

```
sasdemo.emp.dbf = (DSORG=PS,RECFM=FS,LRECL=6160,BLKSIZE=6160)
```

PROC DBF produces one output file but no printed output. The output file contains the same information as the input file but in a different format.

The DBF procedure works with DBF files created by all the current versions and releases of dBASE (II, III, III PLUS, IV, and 5.0) and with most DBF files that are created by other software products.

## Converting DBF Fields to SAS Variables

When you convert a DBF file to a SAS data set, DBF numeric variables become SAS numeric variables. Similarly, DBF character variables become SAS character variables. Any DBF character variable of length greater than 254 is truncated to 254 in SAS. Logical fields become SAS character variables with a length of 1. Date fields become SAS date variables.

DBF fields whose data are stored in auxiliary files (Memo, General, binary, and OLE data types) are ignored in SAS.

If a DBF file has missing numeric or date fields, SAS fills those missing fields with a series of the digit 9 or with blanks, respectively.

When a dBASE II file is translated into a SAS data set, any colons in dBASE variable names are changed to underscores in SAS variable names. Conversely, when a SAS data set is translated into a dBASE file, any underscores in SAS variable names are changed to colons in dBASE field names.

### Converting SAS Variables to DBF Fields

In DBF files, numeric variables are stored in character form. When converting from a SAS data set to a DBF file, SAS numeric variables become DBF numeric variables with a total length of 16. A SAS numeric variable with a decimal value must be stored in a decimal format in order to be converted to a DBF numeric field with a decimal value. In other words, unless you associate the SAS numeric variable with an appropriate format in a SAS FORMAT statement, the corresponding DBF field does not have any value to the right of the decimal point. You can associate a format with the variable in a SAS data set when you create the data set or by using the DATASETS procedure. For more information, see "DATASETS Procedure Statement: z/OS" on page 543.

If the number of digits—including a possible decimal point—exceeds 16, a warning message is issued and the DBF numeric field is filled with a series of the digit 9. All SAS character variables become DBF fields of the same length. When converting from a SAS data set to a DBF file that is compatible with dBASE III or later, SAS date variables become DBF date fields. When converting to a dBASE II file, SAS date variables become dBASE II character fields in the form YYYYMMDD.

### Transferring Other Software Files to DBF Files

You might find it helpful to save another software vendor's file to a DBF file and then convert that file into a SAS data set. For example, you could save an Excel XLS file in DBF format, upload the file, and use PROC DBF to convert that file into a SAS data set. Or you could do the reverse; use PROC DBF to convert a SAS data set into a DBF file and then load that file into an Excel spreadsheet.

## Examples

### Example 1: Converting a dBASE IV File to a SAS Data Set

In this example, a dBASE IV file that is named SASDEMO.EMPLOYEE.DBF is converted to a SAS data set. A FILENAME statement specifies a fileref that names the dBASE IV file. The FILENAME statement must appear before the PROC DBF statement, as shown:

```
libname save 'sasdemo.employee.data';
filename dbfin 'sasdemo.employee.dbf';
proc dbf db4=dbfin out=save.employee;
run;
```

### Example 2: Converting a dBASE 5 File to a SAS Data Set

In this example, a dBASE 5 file is converted to a SAS data set.

```
libname demo 'sasdemo.employee.data';
filename dbfout 'sasdemo.newemp.dbf' recfm=n;
proc dbf db5=dbfout data=demo.employee;
run;
```

# FONTREG Procedure Statement: z/OS

Adds system fonts to the SAS registry.

z/OS specifics: Statement support for non-USS sites; font file requirements

See: "FONTREG Procedure" in *Base SAS Procedures Guide*

## Details

SAS distributes font files for use by the universal printer GIF driver as native z/OS files with the following characteristics:

- Data Set Organization (DSORG) = PS
- Record Format (RECFM) = FBS
- Logical Record Length (LRECL) = 1.

In this format, the FONTREG procedure requires the FONTFILE statement. All other statements for this procedure require a directory specification, which is incompatible with native z/OS files. Also, omitting all statements implies a directory search of the directory specified by the FONTSLOC= system option. The specification for the FONTSLOC= option for native z/OS files does not specify a directory.

The font files can be copied to the UNIX file system. Placing the font files in a UFS directory allows full functionality of the FONTREG procedure, with support for all statements. Also, if no statement is supplied, the specification of the FONTSLOC= system option for UFS allows for a directory specification.

## See Also

"FONTSLOC= System Option: z/OS" on page 767

# FORMAT Procedure Statement: z/OS

Creates user-defined formats and informats.

z/OS specifics: LIBRARY= option in the PROC FORMAT statement

Tip: User-defined format names cannot end in a number. For more information, see "User-Defined Formats" in *SAS Formats and Informats: Reference* and "SAS Names" in *SAS Programmer's Guide: Essentials*.

See: "PROC FORMAT Statement" in *Base SAS Procedures Guide*

## Details

To create a new format, specify a valid libref as the value of the LIBREF= option. Specifying a valid libref creates a new format in the SAS 9 style in the FORMATS catalog. The FORMATS catalog is stored in the SAS library that is identified by the LIBRARY= option.

In SAS 9, you can no longer write Version 5 formats to a load library by using a ddname as the value of the LIBRARY= option. You can read Version 5 formats, but you cannot write them.

# ITEMS Procedure Statement: z/OS

Builds, reads, and writes SAS item store files.

z/OS specifics: All

## Syntax

**PROC ITEMS** NAME=<*libref.*> *member*;

## Details

### Overview PROC ITEMS

An *item store* is a SAS data set that consists of independently accessible chunks of information. SAS uses item store files for online Help, where the SAS help browser accesses an item store in the Sashelp library. You can use the ITEMS procedure to

create, modify, and browse your own item store files, which you can then access through the SAS help browser.

The contents of an item store are divided into directories, subdirectories, and topics. The directory tree structure emulates the structure of UNIX System Services, so that a given Help topic is identified by a directory path (root_dir/sub_dir/item). This hierarchical structure allows the SAS help browser to support HTML links between Help topics.

The item store files that SAS uses for HTML help can be written only by users who have the appropriate privileges. Although SAS discourages rewrites of SAS help items, you can add items to the SAS help item store files, and you can develop new item store files of your own for any information that you want to make available through the SAS help browser. For information about writing your own HTML help, see "Using User-Defined Item Store Help Files" on page 228.

To access an item store, you must first allocate the library that contains the item store, unless the item store is a member of the Work library. After you allocate the library, you issue the PROC ITEMS NAME=*fileref* statement to access the item store in SAS. Once the item store is available in SAS, you can use the LIST, IMPORT, EXPORT, MERGE, and DELETE statements to control item store contents. SAS applies all of these statements to the item store name in the last PROC ITEMS NAME= statement.

For information about the HTML tags that are supported by the SAS help browser, see "Creating User-Defined Item Store Help Files" on page 229.

## HTC File Format

Item stores are physically stored in the operating environment as HTC files. An HTC file is a text file that lists help filenames one per line, preceded by five colons, as follows:

```
:::::<filename>.htm
```

Directories in the HTC file are identified by a line that begins with five colons and ends with a path specification:

```
:::::<dirname1>/<dirname2>/<filename>.htm
```

HTC files can be imported and exported in HTC file format. Importing an HTC file with the IMPORT statement creates the necessary directories and subdirectories. For example, if an HTC file that contains the preceding directory entry was imported into an item store with the IMPORT statement, then the directory and subdirectory would be created as needed. And, the file would be placed in the specified subdirectory. Any filename that lacks a path specification goes into the root directory or into the directory specified by the DIR= option, if it is specified in the IMPORT statement.

## Alternate Syntax for the DIR= and ITEM= Options

You can use the forward slash path character (/) to specify a path in the DIR= and ITEM= options in all of the statements that take those options. For example, the following two statements are equivalent:

```
LIST DIR='usr' ITEM='mail';
LIST ITEM='usr/mail';
```

Note that a full path, starting with the directory just beneath the item store's root directory (with no initial forward slash) is required for access to anything except items in the root directory or to item store files consisting of a single item.

Wildcards, using asterisks (*) as in UNIX, are not accepted in item store paths. Nor can you specify more than one path (a file concatenation) for each of the following statements.

## PROC ITEMS Statement

**PROC ITEMS** NAME=<*libref.*> *member*;

The following argument is required in the PROC ITEMS statement:

**NAME=**
If no libref is specified, the libref is assumed to be Work. If *libref.member* is specified, the libref must have been previously allocated. For more information about allocation, see "LIBNAME Statement: z/OS" on page 656.

## LIST Statement

**LIST** <*options*;>

The LIST statement writes a list of item names, a list of directory names, or both to the SAS log or to a specified file. Specifying no options writes a list of all items and directories to the SAS log.

The following options can be used in the LIST statement:

**DUMP=*fileref***
specifies the fileref that receives the listing. If DUMP= is not specified, the output goes to the SAS log.

**DIR='*dir-name*'**
specifies an item store directory whose item names you want to list. If you specify the DIR= option alone, you receive a listing of item names contained in that directory.

**ITEM='*item-name*'**
specifies that you want to list the contents of the named item in the named directory of the item store. If you specify an item without specifying a directory, you receive the contents of the item with the specified name in the root directory of the item store.

## IMPORT Statement

**IMPORT** FILEREF=*fileref* <*options*>;

The IMPORT statement imports a fileref into an item store. If the imported fileref contains items or directories that currently exist in the item store, the new items or directories overwrite (replace) the existing versions.

The following options can be used in the IMPORT statement:

**DIR='*dir-name*'**
specifies the item store directory that receives the imported fileref. If a directory is not specified, the fileref is imported into the root directory of the item store.

**ITEM='*item-name*'**
specifies the name of the item that receives the imported fileref. If an item is not specified, the imported fileref is assumed to be an HTC file.

## EXPORT Statement

**EXPORT** FILEREF=*fileref*<*options*>;

The EXPORT statement copies an item or item store to an external fileref in HTC format. If the fileref exists before the EXPORT statement, the new fileref overwrites (replaces) the previous version.

The following options can be used in the EXPORT statement:

**DIR='*dir-name*'**
specifies the item store directory that is the source of the export. If you do not specify a directory, the fileref receives the contents of the entire item store or the specified item from the root directory of the item store.

**ITEM='*item-name*'**
specifies an item for export. If you do not specify an item, the fileref receives the entire contents of the specified directory or item store, in HTC format.

## MERGE Statement

**MERGE** SOURCE=<*libref.*> *member*;

The MERGE statement merges the specified item store into the item store opened previously with PROC ITEMS.

A libref is required in the MERGE statement. If the two item store files have directories with the same name and path, the contents of the new directory replace the contents of the old directory. If you merge into the root directory, the entire item store is replaced. If you merge a new item into a directory, the new item is merged into the old directory. If the old directory contains an item of the same name, the new item replaces the old item.

## DELETE Statement

**DELETE** <*options*>;

The DELETE statement deletes all or part of the contents in an item store.

The following options can be used in the DELETE statement:

**DIR='*dir-name*'**
specifies the directory from which you want to delete. When DIR= is not specified, either the entire contents of the item store are deleted or the specified item is deleted from the item store's root directory.

**ITEM='*item-name*'**
deletes the specified item from the specified directory in the item store, or if a directory is not specified, from the root directory of the item store.

## See Also

"HELPLOC= System Option: z/OS" on page 775

# OPTIONS Procedure Statement: z/OS

Lists the current values of SAS system options.

z/OS specifics: Host options displayed, host-specific options of OPTIONS statement

See: "OPTIONS Procedure" in *SAS System Options: Reference*

## Syntax

**PROC OPTIONS**<*options*>;

### Optional Argument

***options***

**HOST**
**NOHOST**
displays only host options (HOST) or only portable options (NOHOST). PORTABLE is an alias for NOHOST.

## Details

**Note:** The previous syntax documentation is a simplified version of the OPTIONS procedure syntax. For the complete syntax and its explanation, see the OPTIONS procedure in *Base SAS Procedures Guide*.

Portable options are the same in all operating environments. To see a list of these options, submit

```
proc options portable;
run;
```

Certain portable options have aspects that are specific to z/OS. All portable options with z/OS aspects are documented in "System Options under z/OS" on page 685. All of the SAS options that are portable are documented in *SAS System Options: Reference*.

Other options are entirely specific to the z/OS environment. To see a list of these options, submit the following code:

```
proc options host;
run;
```

All options that are specific to z/OS are documented in "System Options under z/OS" on page 685.

The following options cause the OPTIONS procedure to list the system options that are specific to the following SAS software products or applications. Although the OPTIONS procedure still accepts the following one-word options, it is recommended that you use the associated GROUP= option instead:

**GROUP=ADABAS**
SAS/ACCESS interface to ADABAS

**GROUP=INSTALL**
system administrators

**GROUP=DB2**
SAS/ACCESS interface to DB2

**GROUP=DATACOM**
SAS/ACCESS interface to CA-DATACOM/DB

**GROUP=IDMS**
SAS/ACCESS interface to CA-IDMS

**GROUP=IMS**
SAS/ACCESS interface to IMS

**GROUP=ISPF**
SAS interface to ISPF (see "SAS Interface to ISPF" on page 293)

**GROUP=SORT**
sorts observations in a SAS data set

For more information about SAS system options that are associated with a particular SAS/ACCESS interface, see the documentation for that SAS/ACCESS interface.

## See Also

"Displaying System Option Settings" on page 22

# PDS Procedure Statement: z/OS

Lists, deletes, or renames members of a partitioned data set.

Restriction: When a SAS server is in the locked-down state, the PDS procedure is disabled. For more information, see Chapter 10, "SAS Processing Restrictions for Servers in a Locked-Down State," on page 219.

z/OS specifics: All

# Syntax

**PROC PDS** DDNAME=*file-specification* <*options*>;

**DELETE** *member-1* <*member-2* ...>;

**CHANGE** *old-name-1=new-name-1* <*old-name-2=new-name-2* ...>;

**EXCHANGE** *name-1=other-name-1* <*name-n =other-name-2* ...>;

# Details

## Overview PROC PDS

Partitioned data sets (PDS) are libraries that contain files called members. There are two types of partitioned data sets. One can contain source code, macros, cataloged procedures, and other data. The other, called a load library, can contain only load modules.

PROC PDS operates on the directory of a partitioned data set to list, delete, and rename members and aliases. (Partitioned data sets are not the same as SAS libraries.) When members are deleted or renamed, PROC PDS updates the directory of the partitioned data set. Also, unless NOLIST is specified, PROC PDS writes an updated listing of the PDS member names to the SAS log.

PROC PDS operates with full capabilities on both extended partitioned data sets (PDSEs) and standard partitioned data sets (PDSs).

## PROC PDS Statement

**PROC PDS** DDNAME=*file-specification* <*options*>;

**DDNAME=*file-specification***
specifies the physical filename (enclosed in quotation marks) or the fileref that is associated with the partitioned data set that you want to process. A fileref must have been previously assigned with a FILENAME statement, FILENAME function, a JCL DD statement, or a TSO ALLOCATE command. The DDNAME= argument is required.

The following options can appear in the PROC PDS statement:

**NOLIST**
suppresses the listing of the member names and aliases in the directory of the partitioned data set.

**KILL**
deletes all the members of the partitioned data set that is specified by DDNAME=.

**REFRESH | NOREFRESH**
specifies whether to update the directory information of the file that is being processed after each operation. The default, REFRESH, updates the directory information after each operation. Unless the operations that are being

performed by PROC PDS are dependent on each other, specify NOREFRESH for better performance.

**STRICT**
causes error messages to be generated and sets the return code to 8 if no members match the selection criteria. The default behavior is for note messages to be generated and for the return code to be set to 0 if no members match the selection criteria.

## DELETE Statement

**DELETE** *member-1 <member-2 ...>*;

If you want to delete a member or members from the PDS, specify the member names in a DELETE statement.

When a specification in the DELETE statement is followed by a colon (:), all members whose names begin with the characters preceding the colon are deleted. For example, when the following statement is executed, PROC PDS deletes all members whose names begin with the characters PRGM:

```
delete prgm:;
```

## CHANGE Statement

**CHANGE** *old-name-1=new-name-1 <old-name-2=new-name-2 ...>* ;

If you want to rename a member or members of the PDS, use the CHANGE statement. Specify the old name on the left side of the equal sign, and specify the new name on the right. For example, the following statements change the name of member TESTPGM to PRODPGM:

```
filename loadlib 'my.pgm.lib ';
proc pds ddname=loadlib;
   change testpgm=prodpgm;
run;
```

If multiple members have names that begin with the same sequence of characters and you want to change all of the names so that they begin with a different sequence, use a colon (:) after *old-name* and *new-name*. Here is an example:

```
change exam:=test:;
```

All of the members whose names began with the characters EXAM subsequently have names beginning with the characters TEST.

**Note:** If changing the name of a member would duplicate the name of an existing member, then the member is not renamed and a note is written to the SAS log.

It is not necessary for the lengths of the character sequences that precede the colon to match. For example, the following statement is valid:

```
change am:=morn:;
```

However, if a new name is too long, then a note is written to the SAS log and no change is made.

### EXCHANGE Statement

**EXCHANGE** *name-1=other-name-1 <name-2 =other-name-2 ...>*;

Use the EXCHANGE statement to switch the names of members of the partitioned data set. For example, after the following statements are executed, the member originally called A is named Z, and the member originally called Z is named A.

```
proc pds ddname='my.pgm.lib';
   exchange a=z;
run;
```

If multiple members have names that begin with the same sequence of characters and you want to exchange that sequence with the sequence from another group of data sets, use a colon (:) after *name* and *other-name*. For example, after the following statement is executed, all data sets whose names began with ABC subsequently begin with DEFG. In addition, all of the data sets whose names began with DEFG subsequently begin with ABC.

```
exchange abc:=defg:;
```

It is not necessary for the lengths of the sequences of characters that precede the colons to match. However, if a new name is too long, then a note is written to the SAS log and no change is made.

### Usage Note

Unlike other SAS procedures that deal with partitioned data sets (for example, PROC PDSCOPY and PROC SOURCE), PROC PDS does not make any distinction between a member name and an alias, other than to report which names in the PDS directory are aliases for which members. If an alias is renamed, it is still an alias. PROC PDS enables you to delete a member that has aliases in the PDS directory, but then other procedures (PROC PDSCOPY, for example) cannot process the aliases.

## Example: Deleting and Renaming Members with the PDS Procedure

This example writes the names of the members of USERID.MVS.OUTPUT to the SAS log and then generates a second listing showing the member changes and deletions that are specified by the second PROC step.

```
filename pdstest 'userid.mvs.output';
proc pds ddname=pdstest;
run;
proc pds ddname=pdstest;
   delete tempout tempout2;
   change mem=out1603;
run;
```

The following output displays the results:

***Output 29.9*** *Deleting and Renaming Members with the PDS Procedure*

```
1    filename pdstest 'userid.mvs.output';
2
3    proc pds ddname=pdstest;
4    run;
 SAS PROC PDS Version 9.00   04/27/99
   DSNAME=USERID.MVS.OUTPUT  VOL=SER=XXXXXX
   Members (aliases)
   MEM      OUT1601  OUT1602  TEMPOUT  TEMPOUT2
   Tracks Used        1.8
          Unused      1.2
          Total       3.0
   Extents              1
   Directory Blks      11
   Blocks Used          1
5
6    proc pds ddname=pdstest;
7       delete tempout tempout2;
8       change mem=out1603;
9    run;
   DSNAME=USERID.MVS.OUTPUT  VOL=SER=XXXXXX
   Members (aliases)
   MEM      OUT1601  OUT1602  OUT1603
   Tracks Used        1.8
          Unused      1.2
          Total       3.0
   Extents              1
   Directory Blks      11
   Blocks Used          1
```

# PDSCOPY Procedure Statement: z/OS

Copies partitioned data sets from disk to disk, disk to tape, tape to tape, or tape to disk.

Restriction: When a SAS server is in the locked-down state, the PDSCOPY procedure is disabled. For more information, see Chapter 10, "SAS Processing Restrictions for Servers in a Locked-Down State," on page 219.

z/OS specifics: All

## Syntax

**PROC PDSCOPY** INDD=*file-specification* OUTDD=*file-specification* <*options*>;

**EXCLUDE** *member-name-1* <. . . *member-name-2* ...>;

**SELECT** *member-name-1* <*member-name-2* ...>;

# Details

## Overview of PROC PDSCOPY

The PDSCOPY procedure can be used to copy an entire partitioned data set, or you can specify which members you want to copy. This procedure cannot be used to copy extended partitioned data sets (PDSEs). PROC PDSCOPY is useful for backing up source libraries and load module libraries to tape. If you use PROC PDSCOPY to copy a PDS to tape, then you must also use it if you want to copy that PDS back to disk. However, you can use either PROC PDSCOPY or other copy utilities to copy that tape to another tape.

When libraries are moved between disks that have different optimal block sizes, PROC PDSCOPY can be used to reblock the libraries. PROC PDSCOPY handles overlay programs and alias names. It also sets up the RLD count fields that are used by the FETCH program.

When a PDS contains load modules, it generally requires 13% to 18% less disk space after being copied by PROC PDSCOPY, because PROC PDSCOPY uses free space on a partially filled track to store records. The linkage editor constructs records that do not fit on a partially used track.

The PDSCOPY procedure does not copy scatter-loaded modules.

If errors are encountered during PDSCOPY processing, the return code for the job step is set to 8.

## PROC PDSCOPY Statement

## Syntax of the PROC PDSCOPY Statement

**PROC PDSCOPY** INDD=*file-specification* OUTDD=*file-specification* <*options*>;

## Required Arguments

**INDD=*file-specification***
specifies either the fileref or the physical filename (enclosed in quotation marks) of the library to copy.

**OUTDD=*file-specification***
specifies either the fileref or the physical filename (enclosed in quotation marks) of the output partitioned data set.

## Optional Arguments

Some of the options that can appear in the PROC PDSCOPY statement apply to both source libraries and load module libraries. Others apply only to load module libraries. The following options apply to both source libraries and load module libraries:

- ALIASMATCH=TTR
- BLKSIZE=

- INTAPE
- NEWMOD
- NOALIAS
- NOREPLACE
- OUTTAPE
- SHAREINPUT

The following options apply only to load module libraries:

- ALIASMATCH=BOTH | EITHER | NAME
- DC
- DCBS|NODCBS
- MAXBLOCK=
- NE
- NOTEST

All the options that can appear in the PROC PDSCOPY statement are discussed in this section. In the discussion, the term *member* refers to both source library members and to load modules. The term *module* refers only to load modules.

**ALIASMATCH=BOTH | EITHER | NAME | TTR**
specifies how to match aliases with main members to determine whether they represent the same member.

BOTH
specifies that both the TTR (relative track and record) values and the names must match in order for a main module to be considered a match.

EITHER
specifies that a match for either the TTR value or the name is sufficient to identify the main module that corresponds to an alias. If more than one main module directory entry matches, it is impossible to predict which one is used.

NAME
specifies that the main module name in the directory entry for the alias (at offset 36) is compared with main module names to find a match. The alias is assumed to represent the same module as the main module that has the matching name. When you specify ALIASMATCH=NAME, the TTR values do not need to match.

A situation in which names match even though TTR values do not match occurs when the main module is originally link edited specifying the alias names, and then link edited again without specifying them. In this case, the directory entries for the aliases still point to the old version of the module (that is, to a back-level version). Because of this situation, you should consider carefully whether to use the ALIASMATCH=NAME option or the NEWMOD option. ALIASMATCH=NAME updates the aliases to point to the current version of the main module rather than to the back-level version. The NEWMOD option causes the older version of the module to copy. Another

alternative is to use TTR matching and not to copy the aliases when they are, in fact, obsolete names.

**TTR**
specifies that TTR values are compared. TTR is the default. An alias is assumed to represent the main member that has the same TTR value. If the TTR values match, then the directory entry for the main member and the alias currently point to the same place in the data set.

For load modules, the most common situation in which TTR values might match, but names might not match, occurs when the main module was renamed (for example, by using ISPF option 3.1) after the aliases were created. The alias directory entries can still contain the old main module name.

Whichever method you use, unmatched aliases are not copied to the output file unless you specify the NEWMOD option. For more information, see "NEWMOD" on page 561. Matched aliases in the output file always point to the main module to which they were matched (that is, they have the same TTR values), even if the TTR values were different in the input file (which might occur if ALIASMATCH=NAME or ALIASMATCH=EITHER was used). When modules are matched using the TTR values (that is, when TTR or EITHER was specified), the main module name in alias directory entries is changed in the output file.

**BLKSIZE=*block-size***
specifies the maximum block size to use for reblocking the copied load modules on the output device. If the BLKSIZE= option is omitted, the default depends on the type of the output device and on the data set type:

- If output is to tape, the default is 32,760.
- If output is in tape (sequential) format on disk (that is, when the OUTTAPE option is used), the default is either the device track size or 32,760, whichever is less.
- If output is to disk, the default depends on the device type. However, it is never greater than 18K unless you use the MAXBLOCK= option. In addition, the default cannot exceed the device track size or 32,760, whichever is less. For more information, see "MAXBLOCK=*block-size* | MAXBLK=*block-size*" on page 561.
- Unless the NODCBS option (described later) is specified and the output data set is a partitioned data set on disk, the default value is reduced to the data set control block (DSCB) block size of the partitioned data set, if that is smaller.

For tape (sequential) format output, the specified block size cannot be less than 1.125 times the maximum input device block size, nor greater than 32,760. For disk output, the specified block size cannot be less than 1,024.

**DC**
specifies that load modules that are marked downward compatible (that is, modules that can be processed by linkage editors that were used before z/OS) are eligible for processing. After they are copied by PROC PDSCOPY, the load modules are not marked DC in their directory entry because PROC PDSCOPY does not produce downward compatible load modules nor does it preserve their

attributes. If you do not specify the DC option and you attempt to copy load modules marked DC, PROC PDSCOPY issues an error message.

**DCBS | NODCBS**
tells SAS whether to preserve the data control block (DCB) characteristics of the output partitioned data set on disk. If NODCBS is specified, the data control block (DCB) characteristics of the output partitioned data set on disk can be overridden. The default value is DCBS.

If the NODCBS option is specified, PROC PDSCOPY changes the DSCB (data set control block) block size of the output partitioned data set to the maximum permissible block size for the device. Otherwise, the maximum permissible value of the BLKSIZE= option is the current block size value from the DSCB, and the DSCB block size is not changed.

Using the NODCBS option might enable PROC PDSCOPY to block output load modules more efficiently. However, changing the DSCB block size could cause problems when the data set is moved, copied, or backed up by a program other than PROC PDSCOPY, particularly if your installation has more than one type of disk drive. Consult your systems staff before specifying NODCBS.

**INTAPE**
specifies that the INDD= library is in tape (sequential) format. The INTAPE option is assumed if a tape drive is allocated to the input data set.

**MAXBLOCK=*block-size* | MAXBLK=*block-size***
enables you to override the limitation of 18K on the block size of text records in the output library. (The value of BLKSIZE must be greater than or equal to the value of MAXBLOCK in order to get text records at MAXBLOCK size.) If the value of MAXBLOCK is not specified, then the maximum block size for text records is 18K; this block size is the largest text block that can be handled by the FETCH program in many operating environments. You can specify a block size greater than 18K for text records, but doing so might cause copied modules to ABEND with an ABEND code of 0C4 or 106-E when they are executed. You should use this parameter only if you are sure that your operating environment (or TP monitor) FETCH program supports text blocks that are larger than 18K. For example, CICS and z/OS FETCH programs support text blocks that are larger than 18K.

**NE**
specifies that the output library should not contain records that are used in the link editing process. Although programs in the output library are executable, they cannot be reprocessed by the linkage editor, nor can they be modified by the AMASPZAP program. Using the NE option can reduce the amount of disk space that is required for the output library.

**NEWMOD**
specifies that aliases that do not match a main member are to be copied as main members rather than being marked as aliases in the output file. The directory entry in the output file is reformatted to main member format. See the ALIASMATCH option for a description of how aliases are matched with main members. If you do not specify the NEWMOD option, unmatched aliases are not copied to the output file.

**NOALIAS | NOA**
prevents automatic copying of all aliases of each member that you have selected for copying. Any aliases that you want to copy must be named in the SELECT statement. If you select only an alias of a member, the member (that is, the main member name) is still automatically copied, along with the selected alias.

**NOREPLACE | NOR**
copies only members in the INDD= library that are not found in the OUTDD= library. That is, members or aliases that have the same name are not replaced.

**NOTEST**
deletes the symbol records produced by the assembler TEST option from the copied load modules. Using the NOTEST option can reduce the amount of disk space that is required for the output library by 10% to 20%.

**OUTTAPE**
specifies that the OUTDD= library is to be in tape (sequential) format. The OUTTAPE option is assumed if a tape drive is allocated to the output data set.

**SHAREINPUT | SHAREIN**
specifies that the INDD= library is to be shared with other jobs and TSO users. SHAREINPUT is the default for PDSCOPY when the INDD= library is enqueued for shared control (DISP=SHR). This value means that the INDD= library is shared with ISPF and the linkage editor rather than being enqueued exclusively. This sharing makes it possible for more than one person to use an INDD= library simultaneously. (The OUTDD= library is always enqueued for exclusive control against ISPF and the linkage editor. Therefore, it cannot be changed while PROC PDSCOPY is processing it.)

## EXCLUDE Statement

**EXCLUDE** *member-name-1* <*member-name-2 ...*>;

Use this statement if you want to exclude certain members from the copying operation. The EXCLUDE statement is useful if you want to copy more members than you want to exclude. All members that are not listed in EXCLUDE statements are copied. You can specify more than one member in an EXCLUDE statement, and you can specify as many EXCLUDE statements as necessary.

If you follow a specification in the EXCLUDE statement with a colon (:), then all members whose names begin with the characters preceding the colon are excluded.

**Note:** You cannot use both the SELECT statement and the EXCLUDE statement in one PROC PDSCOPY step.

## SELECT Statement

**SELECT** *member-name-1* <*member-name-2 ...*>;

Use this statement to specify the names of members to copy if you do not want to copy the entire library. You can specify more than one member in a SELECT statement, and you can specify as many SELECT statements as necessary.

If you follow a specification in the SELECT statement with a colon (:), then all members whose names begin with the characters preceding the colon are copied. In the following example all members whose names begin with the characters FCS are copied:

```
select fcs:;
```

**Note:** You cannot use both the SELECT statement and the EXCLUDE statement in one PROC PDSCOPY step.

## Output Data Set

The PDSCOPY procedure produces an output partitioned data set on disk or on tape. The output data set contains copies of the requested members of the input partitioned data set.

If you use PROC PDSCOPY to copy partitioned data sets that contain source members, then the RECFM and LRECL of the output data set must match the RECFM and LERECL of the input data set. If they differ, an error message is displayed. The BLKSIZE values for the input and output data sets do not have to be the same, however.

## Usage Notes

If a member that you specified in a SELECT statement does not exist, PROC PDSCOPY issues a warning message and continues processing.

PROC PDSCOPY enqueues the input and output data sets using the SPFEDIT and SPFDSN QNAMEs.

If a data set has a name that was assigned by using the FILENAME statement, the ENCODING value of the FILENAME statement is ignored when the data set is processed by PROC PDSCOPY.

## Output

The PDSCOPY procedure writes the following information to the SAS log:

- INPUT and OUTPUT, the data set names and volume serials of the input and output libraries
- MEMBER, a list of the members copied
- ALIAS, the members' aliases, if any
- whether the copied members replaced others members of the same name
- whether a selected member or alias was not copied and a note explaining why not.

If the output device is a disk, PROC PDSCOPY also writes the following information next to each member name:

- TRACKS, the size of the member, in tenths of tracks
- SIZE, the number of bytes in the member that was copied (in decimal notation).

## Example: Copying Members Using the PDSCOPY Procedure

The following example copies all members and aliases that start with the letters OUT. In this example, the alias must match the main member both by name and by TTR in order for the alias to be copied.

```
filename old 'userid.mvs.output' disp=shr;
filename new 'userid.mvs.output2' disp=old;
proc pdscopy indd=old outdd=new aliasmatch=both
      shareinput;
   select  out:;
run;
```

The following output displays the results:

***Output 29.10*** *PDSCOPY Procedure Example*

```
1    filename old 'userid.mvs.output' disp=shr;
2    filename new 'userid.mvs.output2' disp=shr;
3
4    proc pdscopy indd=old outdd=new aliasmatch=both shareinput;
5       select out:;
6    run;
     SAS PROC PDSCOPY Version 9.00   04/24/99
     INPUT  DSNAME=USERID.MVS.OUTPUT  VOL=SER=XXXXXX
     OUTPUT DSNAME=USERID.MVS.OUTPUT2  VOL=SER=XXXXXX
     MEMBER     TRACKS       SIZE
       ALIAS
     OUT1601     2.6        40019 replaced
     OUT1602    10.6       165519 replaced
     OUT1603    53.3       829081 replaced
     TRACKS USED    67.0
            UNUSED   8.0
            TOTAL   75.0
     EXTENTS         5
```

# PMENU Procedure Statement: z/OS

Defines menu facilities for windows that are created with SAS software.

z/OS specifics: Some portable statements are ignored.

See: "PMENU Procedure" in *Base SAS Procedures Guide*

## Details

The following statements and options are accepted without generating errors, but *with current device drivers* they have no effect under z/OS:

- ACCELERATE= option in the ITEM statement

- MNEMONIC= option in the ITEM statement
- HELP= option in the DIALOG statement.

# PRINT Procedure Statement: z/OS

Prints the observations in a SAS data set, using all or some of the variables.

See: "PRINT Procedure" in *Base SAS Procedures Guide*

## Syntax

**PRINT="*options*"**

## Details

PROC PRINT formats each page separately in memory. During formatting, PROC PRINT allocates memory to hold all of the data for all of the variables that are being printed on a page. If you are using observations with large variables, such as character strings of 32,000 bytes, your available memory allocation might not be adequate. If your memory allocation is not adequate, PROC PRINT terminates due to insufficient memory.

The amount of memory that PROC PRINT requires does not depend on the number of observations that the data set contains. It is based on filling an entire page, whether that many observations exist, or whether all of them are to be printed. The amount of required memory is calculated by multiplying the PAGESIZE by the LENGTH of the observation.

The following tips might help address this situation:

- Allocate a larger z/OS REGION size (and MEMSIZE) to provide more memory to PROC PRINT.
- Specify a smaller page size. Specifying a smaller page size reduces the number of observations that PROC PRINT must hold in memory at a given time.
- Print only the variables that you want to see instead of all of the variables for the data set. Specifying only the variables that you want to see reduces the number of variables that PROC PRINT must hold in memory for each observation.

**Note:** This allocation issue applies only to the LISTING output destination. HTML, RTF, PDF, and other output destinations do not have the same memory allocation issue.

# PRINTTO Procedure Statement: z/OS

Defines destinations for SAS procedure output and the SAS log.

z/OS specifics: UNIT= option; output destination

See: "PRINTTO Procedure" in *Base SAS Procedures Guide*

## Details

In the SAS CLIST, in the SASRX exec, and in the SAS cataloged procedure that are supplied by SAS, no filerefs of the form FT*nn*F001 are predefined for the UNIT= option. Ask your SAS Installation Representative whether ddnames of the form FT*nn*F001 are predefined for your site.

Under z/OS, the destination of the procedure output or the SAS log can be specified by either of the following:

***fileref***
sends the log or procedure output to a sequential data set or member of a partitioned data set that is identified by the fileref.

***'physical-filename'***
sends the log or procedure output to one of the following locations:

- a sequential data set
- a member of a partitioned data set
- an extended partitioned data set
- a file in a UNIX System Services hierarchical file system.

The following restrictions apply to PROC PRINTTO under z/OS:

- When writing log or procedure output files to a partitioned data set member, you must specify the NEW option; you cannot append data to a partitioned data set member.
- LOG files that are generated on z/OS and captured with PROC PRINTTO contain an ASA control character in column 1. If you are using the INPUT statement to read a LOG file that was generated on z/OS, you must account for this character if you use column input or column pointer controls.
- If you create a file to be used with the PRINTTO procedure and specify a record format that has no carriage-control characters, then the PROC PRINTTO output does not include carriage-control characters.
- In order to simultaneously route both the SAS log and procedure output files to partitioned data set members, the members must be in different partitioned data sets.

## See Also

"Directing Output to External Files with the PRINTTO Procedure" on page 145

# RELEASE Procedure Statement: z/OS

Releases unused space at the end of a disk data set.

Restriction: When a SAS server is in the locked-down state, the RELEASE procedure is disabled. For more information, see Chapter 10, "SAS Processing Restrictions for Servers in a Locked-Down State," on page 219.

z/OS specifics: All

## Syntax

**PROC RELEASE** DDNAME=*file-specification* <*options*>;

## Details

### Overview of PROC RELEASE

PROC RELEASE can be used with most sequential or partitioned data sets, not just with a SAS library that contains SAS data sets. However, PROC RELEASE is not supported for, and cannot be used to release unused space from, the following types of data sets:

- the SAS Work library
- extended partitioned data sets (PDSEs)
- ISAM or VSAM data sets
- multivolume SAS libraries
- multivolume data sets.

If you issue PROC RELEASE against any unsupported data set type other than a PDSE, SAS generates an error and writes an error message to the log. If you issue PROC RELEASE against a PDSE, SAS does not generate an error. SAS writes a note to the log that states that SAS did not release any unused space because the data set was a PDSE. The note also states that PROC RELEASE supports only sequential data sets and PDS data sets.

If you delete some members from a SAS library (using the DATASETS procedure, for example), you can use the RELEASE procedure to release the unused space at the end of the last member. You cannot use PROC RELEASE to release embedded space. That is, you can release only space that follows the "Highest Used Block," as indicated by the CONTENTS or DATASETS procedure.

In order to use PROC RELEASE on a SAS library, the library reference must be cleared. If a SAS library is allocated to the session with a LIBNAME statement, then SAS opens the library and keeps it open until the library reference is cleared. If the SAS library is allocated outside of SAS (for example, with a JCL DD statement or a TSO ALLOC command), then the library is not open until the first reference to the library is made in your SAS program. To clear the SAS library reference, issue a LIBNAME statement of the following form for each libref currently assigned to the library:

**LIBNAME** *libref* CLEAR;

Immediately after you issue the LIBNAME statement, issue a PROC RELEASE statement that specifies the library's name.

**PROC RELEASE** DDNAME="*file-specification*";

RUN;

Issue a new LIBNAME statement for the library after the RUN statement.

**LIBNAME** *libref 'physical-filename'*;

**Note:** If you do not issue a RUN statement after the PROC RELEASE statement, then the second LIBNAME statement is executed before the PROC RELEASE step is executed.

In the control language, you can release unused space by using specifications such as SPACE=(,,RLSE) in the DD statement (in batch mode), or you can use the RELEASE operand of the TSO ALLOCATE command. However, releasing unused space with PROC RELEASE offers several advantages over methods provided by the operating environment. For example, with PROC RELEASE, the user, not the operating environment, controls when unused space is released. This advantage is especially applicable to TSO users.

Another advantage of PROC RELEASE is that you can use PROC RELEASE options to specify exactly how many tracks you want to keep or release. There is no danger of erasing all or part of a data set because PROC RELEASE frees only unused space. PROC RELEASE returns unused space to the pool of available space on the disk volume. When it is released, the space is still available for allocation to the data set, provided a secondary space allocation is given for the data set in the control language or SAS statement, and provided all free space on the volume is not subsequently allocated to other data sets.

## PROC RELEASE Statement

**PROC RELEASE** DDNAME=*file-specification* <*options*> ;

**DDNAME=*file-specification***
specifies the ddname or the data set name of the data set whose unused space is to be released. A name that is not enclosed in quotation marks is treated as a ddname, and a quoted name is treated as a data set name. For data sets that were allocated by SAS, the ddname that is associated with the data set is usually the same as the fileref or libref that is specified in the first assignment of the data set. If a data set name is specified, PROC RELEASE dynamically allocates it.

***options***

specify how much unused space to keep or release, and specify the unit boundary on which the data set should end.

For extended format sequential data sets and data sets residing in Extended Addressing Space on Extended Address Volumes, PROC RELEASE can be used only to release all unused space. Therefore, for such data sets, no options can be specified on the PROC RELEASE invocation.

**TOTAL=*number* | TRACKS=*number***

specifies the total number of tracks that the data set should contain after unused space is released, that is, after PROC RELEASE has executed. For example, the following statement releases all but ten tracks for the data set that is referenced by the fileref SURVEY:

```
proc release ddname=survey total=10;
```

The procedure calculates the amount of space to release as follows:

amount of space allocated – (value of TOTAL= option) = amount of unused space released

If the value that you specify is smaller than the amount of used space in the data set, then SAS releases only the unused space at the end of the data set.

**UNUSED=*number***

specifies the number of tracks of unused space that the data set should contain after PROC RELEASE has executed. The procedure calculates the amount of unused space to release as follows:

```
amount of space allocated – (used space + value of UNUSED= option) =
amount of unused space released
```

If the value that you specify is greater than the amount of unused space at the end of the data set, then no space is released at the end of the data set.

**RELEASE=*number***

specifies how many tracks of unused space to release. If the value that you specify is greater than the amount of unused space at the end of the data set, then SAS releases all the unused space at the end of the data set.

**EXTENTS**
**EXTENT**
**EX**

tells SAS to release only the space that is allocated to completely unused secondary extents. After the procedure releases unused space from the data set, the size of the data set is the sum of the primary extent plus all used secondary extents.

If you do not specify one of these options in the PROC RELEASE statement, then all unused space at the end of the data set is released.

Use the following option to specify the unit boundary on which the data set should end:

**BOUNDARY=*type* | TYPE=*type***

specifies whether the data set ends on a track boundary or on a cylinder boundary.

After the total amount of space to be retained is calculated, this amount is rounded up to the next unit boundary. Any remaining space is then released. Remember that the total amount of space includes the space that is actually used and can also include unused space that was requested with other options. BOUNDARY=*type* then increases the amount of unused space that is retained in the data set by the portion of the unit that is needed in order to reach (or round up to) the next boundary. TYPE can be one of the following:

**DATASET**
**DSCB**
specifies that the data set ends on the next track or cylinder boundary depending on how space was originally allocated. If allocated in tracks, the total amount of space to be retained is calculated, and remaining unused tracks are released. If allocated in cylinders, the space to be retained is rounded up to the next cylinder boundary, and remaining unused space is released. This value is the default boundary type.

**CYLINDERS**
**CYLINDER**
**CYLS**
**CYL**
specifies that space to be retained is rounded to the next cylinder boundary before remaining unused space is released. This specification is effective only if the data set is currently allocated in multiples of cylinders.

**TRACKS**
**TRACK**
**TRKS**
**TRK**
specifies that unused tracks are to be released. Because the minimum unit of space that can be released is a track, the space to be retained is not rounded up.

**ALLOC**
**DD**
**JCL**
specifies that space to be retained is rounded to the next unit boundary (tracks or cylinders) depending on the allocation unit that was specified in the JCL statement, TSO ALLOCATE command, FILENAME or LIBNAME statement, or FILENAME or LIBNAME function that allocated the data set. For example, the following, in combination with BOUNDARY=DD, is equivalent to specifying BOUNDARY=CYL:

```
//DD2 DD DISP=OLD,DSN=MY.DATA,
//       SPACE=(CYL,2)
```

## Usage Notes

If the messages in the SAS log indicate that no space was released from the data set, check to see whether the data set is allocated to another job or to another user. When PROC RELEASE is invoked, the operating environment's disk space management function (DADSM) must be able to obtain exclusive control of the data set. If it cannot, then no indication that DADSM does not have control is

passed to SAS software, no space is released from the data set, and no error message is issued by SAS software.

In SAS 9.2 and later, the RELEASE procedure supports large sequential data sets, which might occupy more than 64K tracks on any of its volumes.

### Output

PROC RELEASE writes the following information to the SAS log:

- how many tracks were allocated to the data set before and after the procedure was executed
- how many tracks were used
- how many extents were used.

However, for extended format sequential data sets, PROC RELEASE reports only the number of tracks used after space was released.

## Example: Releasing Unused Secondary Extents

The following example releases the unused secondary extents for a physical file that is referenced by the fileref THISFILE:

```
filename thisfile 'my.pgm.lib';
proc release ddname=thisfile extents;
run;
```

## See Also

*IBMs MVS JCL Reference*

# SORT Procedure Statement: z/OS

Sorts observations in a SAS data set by one or more variables, and then stores the resulting sorted observations in a new SAS data set or replaces the original data set.

z/OS specifics: Available z/OS sort utilities and SORT procedure statement options; host-specific SAS system options

See: "SORT Procedure" in *Base SAS Procedures Guide*

# Details

## PROC SORT

You can direct the SORT procedure to use either the SAS sort program, which is available under z/OS and under all other operating environments, or a sort utility that is specific to z/OS. You can also use the SORTPGM= system option to choose the best sort program to use. For more information, see "SORTPGM= System Option: z/OS" on page 856.

The following SAS system options also affect any sorting that is done by SAS:

| | | |
|---|---|---|
| DYNALLOC | SORTDEVWARN | SORTSEQ= |
| FILSZ | SORTEQOP | SORTSHRB |
| SORT= | SORTLIB= | SORTSIZE= |
| SORTALTMSGF | SORTLIST | SORTSUMF |
| SORTBLKMODE | SORTMSG | SORTUADCON |
| SORTBLKREC | SORTMSG= | SORTUNIT= |
| SORTBUFMOD | SORTNAME= | SORTWKDD= |
| SORTCUT= | SORTOPTS | SORTWKNO= |
| SORTCUTP= | SORTPARM= | SORT31PL |
| SORTDEV= | SORTPGM= | |

The SORTSEQ=, and SORTSIZE= options are either portable or portable with host specifics. For information about these options, see *SAS System Options: Reference*.

You can see the values of the preceding options by submitting the following code:

```
proc options group=sort; run;
```

## PROC SORT Statement Options

The following host-specific sort options are available in the PROC SORT statement under z/OS in addition to the statement options that are available under all host operating environments. The list includes the portable EQUALS option because it has aspects that are specific to z/OS.

**DIAG**
passes the DIAG option to the sort utility. If the utility supports this option, then it produces additional diagnostic information if the sort fails.

**EQUALS**
passes the EQUALS option to the sort utility program if the sort utility supports it. SAS software defaults to EQUALS. If the SAS system option SORTEQOP is in effect, the EQUALS option is passed to the sort utility. Otherwise, EQUALS processing is simulated by adding an observation counter as the last key field.

**LEAVE=*n***
specifies how many bytes to leave unallocated in the region. Occasionally, the SORT procedure runs out of main storage. If main storage is exceeded, rerun the job and increase the LEAVE= value (which has a default value of 16000) by 30000.

**Note:** The LEAVE option applies only if SORTSIZE=SIZE is specified.

**LIST | L**
lists the control statements passed to the system sort. Not all sort utilities support the specification of the LIST option; they might require that it be specified when the sort utility is generated or installed. This option is the default action if the SAS system option SORTLIST is in effect. Also, this option overrides NOSORTLIST if it is in effect.

**MESSAGE | M**
prints a summary of the system sort utility's actions. This option is the default action if the SAS system option SORTMSG is in effect. Also, this option overrides NOSORTMSG if it is in effect. MESSAGE is useful if you run PROC SORT and the SAS log prints a message indicating that the sort did not work properly. Explanations of the message might be found in the IBM or vendor reference manual that describes your system sort utility.

**SORTSIZE=*n* | *n*K | *n*M | *n*G | MAX | SIZE**
specifies the maximum virtual storage that can be used by the system sort utility. If not specified, the default sort size is given by the SAS system option SORTSIZE=.

**SORTWKNO=*n***
specifies how many sort work files PROC SORT or the sort utility allocates. If a value is not specified, the default is given by the SAS system option SORTWKNO=. The range for SORTWKNO is 0-99.

**TECHNIQUE=*xxxx* | T=*xxxx***
specifies a four-character sort technique to be passed to the system sort utility. SAS does not check the validity of the specified value, so you must ensure that it is correct.

## Specifying the SORTSEQ= Option with a Host Sort Utility

The SORTSEQ= option enables you to specify the collating sequence for your sort. For more information, see "SORTSEQ= System Option: UNIX, Windows, and z/OS" in the *SAS National Language Support (NLS): Reference Guide*.

**CAUTION**
**If you are using a host sort utility to sort your data, then specifying the SORTSEQ= option might corrupt the character BY variables if the sort sequence translation table and its inverse are not one-to-one mappings.** In other words, for the sort to work the translation table must map each character to a unique weight, and the inverse table must map each weight to a unique character variable.

If your translation tables do not map one-to-one, then you can use one of the following methods to perform your sort:

- create a translation table that maps one-to-one. Once you create a translation table that maps one-to-one, you can easily create a corresponding inverse table using the TRANTAB procedure. If your table is not mapped one-to-one, then you receive the following note in the SAS log when you try to create an inverse table:

```
NOTE:  This table cannot be mapped one to one.
```

For more information, see “The TRANTAB Procedure” in the *SAS National Language Support (NLS): Reference Guide*.

- use the SAS sort. You can specify the SAS sort using the SORTPGM system option. For more information, see “SORTPGM= System Option: z/OS” on page 856.
- specify the collation order options of your host sort utility. See the documentation for your host sort utility for more information.
- create a view with a dummy BY variable. The following example contains a view with a dummy BY variable.

**Note:** After using one of these methods, you might need to perform subsequent BY processing using either the NOTSORTED option or the NOBYSORTED system option. For more information about the NOTSORTED option, see “BY Statement” in the *SAS DATA Step Statements: Reference*. For more information about the NOBYSORTED system option, see “BYSORTED System Option” in the *SAS System Options: Reference*.

## Example: Creating a View with a Dummy BY Variable

The following code is an example of creating a view using a dummy BY variable:

```
options sortpgm=host msglevel=i;
data one;
   input name $ age;
datalines;
anne 35
ALBERT 10
JUAN 90
janet 5
bridget 23
BRIAN 45
;
data oneview / view=oneview;
   set one;
   name1=upcase(name);
run;
proc sort data=oneview out=final(drop=name1);
   by name1;
run;
proc print data=final;
run;
```

The following output displays the results:

***Output 29.11*** *Creating a View with a Dummy BY Variable*

```
  The SAS System
Obs         name        age
 1          ALBERT       10
 2          anne         35
 3          BRIAN        45
 4          bridget      23
 5          janet         5
 6          JUAN         90
```

# SOURCE Procedure Statement: z/OS

Provides an easy way to back up and process source library data sets.

Restriction: When a SAS server is in the locked-down state, the SOURCE procedure is disabled. For more information, see Chapter 10, "SAS Processing Restrictions for Servers in a Locked-Down State," on page 219.

z/OS specifics: All

## Syntax

**PROC SOURCE** <*options* >;

**SELECT** *member-1* <*member-2* ...>;

**EXCLUDE** *member-1* <*member-2* ...>;

**FIRST** '*model-control-statement*';

**LAST** '*model-control-statement*';

**BEFORE** '*model-control-statement*' <*options*>;

**AFTER** '*model-control-statement*' <*options*>;

## Details

### Overview of PROC SOURCE

Use PROC SOURCE to read PDS or PDSE libraries and produce sequential output.

You can use the SOURCE procedure to perform the following tasks:

- write the contents of an entire library to the SAS log.
- process only the directory of a library in order to produce input for SAS software, for a utility, or for other programs.

- route the members of a library to other programs for processing. By default, PROC SOURCE generates records for the IBM utility, IEBUPDTE, which reloads an unloaded data set.
- create a sequential, or unloaded, version of the library's directory records.
- construct an unloaded data set from a library. The unloaded data set is suitable for reloading by IEBUPDTE or other source library maintenance utilities, including the ability to recognize and properly handle aliases.

Using the SOURCE procedure, a source library can be copied into a sequential tape or disk data set to create either a backup or a manually transportable copy of the source data. This copy is called an *unloaded data set*; it consists of 80-byte records that contain the source data and the control information that are needed to restore the source to its original organization. When an unloaded data set is restored by the proper utility to a device that supports the data in their original form, the data is reconstructed, or *loaded*.

The INDD and OUTDD data sets can have an LRECL that is greater than 80. The larger LRECL might be useful if you want to simply concatenate input data set members in the output data set with no BEFORE or AFTER records. If the INDD and OUTDD LRECL do not have the same LRECL value, then the value of the OUTTD LRECL must be equal to or greater than the value of the INDD LRECL. If the value of the OUTDD LRECL is less than the value of the INDD LRECL, then the records are truncated at the OUTDD LRECL. For example, when the INDD LRECL=128 and the OUTDD LRECL=80, records are truncated to 80 bytes and the 48 bytes of each record is lost in OUTDD.

An advantage of having an unloaded data set is that one or more members can be retrieved without reloading the entire library.

PROC SOURCE has several advantages over IBMs IEBPTPCH utility. With PROC SOURCE, you can perform the following tasks:

- list members in alphabetical order
- select members by specifying a wildcard or range
- list the number of records in each member
- list each member on a new page
- produce an unloaded version of the library that can be ported to some other host systems.

The *model-control-statements* in the FIRST, LAST, BEFORE, and AFTER statements are usually either utility or job control statements, depending on the destination given by the OUTDD= option in the PROC SOURCE statement.

## PROC SOURCE Statement

**PROC SOURCE** <*options* >;

The following options are used in the PROC SOURCE statement:

**DIRDD=*file-specification***
specifies either the fileref or physical filename of the output data set to which PROC SOURCE writes a sequential, unloaded form of the PDS directory. Each

directory record is written into one 80-byte record. Records are left-aligned and padded on the right with blanks. If specified, the fileref must match the reference name that was used in the FILENAME statement, FILENAME function, JCL DD statement, or TSO ALLOCATE command that allocated the output data set.

**INDD=*file-specification***
specifies the fileref or the physical filename of an input PDS that contains 80-byte fixed-length records. The fileref, if specified, must match the reference name that was specified in the FILENAME statement, FILENAME function, JCL DD statement, or TSO ALLOCATE command that allocated the input library. If the INDD= option is not specified, the default fileref is SOURCE.

If OUTDD is specified, then the RECFM of the INDD file must be either F or FB. The fileref cannot refer to a concatenation of data sets. If it does, then an error message is generated. If the member names in the INDD file are nonstandard, then specify FILEEXT=ASIS in an OPTIONS statement.

**MAXIOERROR=*n***
specifies the maximum number of I/O errors to allow before terminating. Normally, PROC SOURCE detects, issues a warning message about, and then ignores I/O errors that occur while reading the library members. When the number of errors specified by MAXIOERROR= has occurred, however, PROC SOURCE assumes that the library is unreadable and stops. The default MAXIOERROR= value is 50.

**NOALIAS**
treats aliases as main member names. Therefore, PROC SOURCE does not generate `./ ALIAS` cards or alias BEFORE and AFTER cards.

**NODATA**
specifies that you do not want to read the members in the input PDS. In other words, PROC SOURCE produces only control statements and a list of the member names; it does not produce the contents of the members. The list of member names includes any aliases. NODATA is particularly useful when you want to process only the directory of a library.

**NOPRINT**
specifies that you do not want to generate the list of member names and record counts. (These listings are produced even when the PRINT option is not specified.) The NOPRINT option is ignored when PRINT is specified.

**NOSUMMARY**
specifies that you do not want to generate the member summary. The NOSUMMARY option is ignored when the NODATA, NOPRINT, or PRINT option is specified.

**NOTSORTED**
causes PROC SOURCE to process PDS members in the order in which they either appear (in SELECT statements) or remain (after EXCLUDE statements).

Normally, PROC SOURCE processes (that is, unloads, writes to the SAS log, and so on) the PDS members in alphabetical order by member name.

**NULL**
specifies that null members (PDS members that contain no records, just an immediate end-of-file) should be processed. Such members occasionally appear

in source PDSs, but they are not normally unloaded because IEBUPDTE and most other PDS maintenance utilities do not create null members. If you are using a source library maintenance utility that can properly recognize and create a null member, then specify this option and provide the appropriate BEFORE (and possibly AFTER) statements.

**OUTDD=*file-specification***
specifies the fileref, PDS or PDSE member name, or UNIX System Services filename of the output file to which PROC SOURCE writes the unloaded (sequential) form of the input PDS and any records that FIRST, LAST, BEFORE, and AFTER statements generate. If specified, the fileref must match the reference name used in the FILENAME statement, FILENAME function, JCL DD statement, or TSO ALLOCATE command that allocated the data set. This option cannot be used when the INDD file contains variable-length records.

**PAGE**
begins the listing of the contents of each member on a new page.

**PRINT**
lists the contents of the entire PDS. The PRINT option is ignored when NODATA is specified.

## SELECT Statement

**SELECT** *member-1* <*member-2 ...*>;

When you use the SELECT statement, only the members that you specify are processed. You can specify more than one member in a SELECT statement, and you can use any number of SELECT statements.

Use a colon (:) to indicate that you want to select all members whose names begin with the characters that precede the colon. (See the following examples.)

You can include an alphabetic range of names in the SELECT statement by joining two names with a hyphen (-). The two hyphenated members and all members in between are processed. For example, if a library contains members called BROWN, GRAY, GREEN, RED, and YELLOW, and you want to process the first four members, use this SELECT statement:

```
select brown-red;
```

The colon (:) and hyphen (-) notation can be used together. For example, the following statement produces the same results as the previous SELECT statement:

```
select br:-gr: red;
```

## EXCLUDE Statement

**EXCLUDE** *member-1* <*member-2 ...*>;

When you use the EXCLUDE statement, all members except the ones that you specify are processed. You can use any number of EXCLUDE statements.

Use a colon (:) to indicate that you want to exclude all members whose names begin with the characters that precede the colon.

You can include an alphabetic range of names in the EXCLUDE statement by joining two names with a hyphen. The two hyphenated members and all members in between are excluded from processing. (See the SELECT examples in the SELECT statement description.)

The colon and hyphen notation can be used together.

Sometimes it is convenient to use SELECT and EXCLUDE statements together. For example, you can use the colon or hyphen notation in a SELECT statement to select many members, and then use the EXCLUDE statement to exclude a few of the selected members. Suppose there are 200 members called SMC1 through SMC200, and you want to copy all of them except SMC30 through SMC34. You could use these statements:

```
select smc:;
exclude smc30-smc34;
```

When you use both EXCLUDE and SELECT statements, the EXCLUDE statements should specify only members that are specified by the SELECT statements. However, excluding unspecified members has no effect other than to generate warning messages.

## FIRST Statement

**FIRST** '*model-control-statement*';

The FIRST statement generates initial control statements that invoke a utility program or that are needed only once. The specified *model-control-statement* is reproduced, left-aligned, on a record that precedes all members in the unloaded data set. You can use any number of FIRST statements. One FIRST statement can specify one model control statement. Each model control statement generates a record.

## LAST Statement

**LAST** '*model-control-statement*';

The LAST statement generates final control statements that terminate a utility program or that are needed only once. The specified *model-control-statement* is reproduced, left-aligned, on a record that follows all members in the unloaded data set. You can use any number of LAST statements. One LAST statement can specify one model control statement. Each model control statement generates a record.

## BEFORE Statement

**BEFORE** '*model-control-statement*' <*options*>;

The BEFORE statement generates a utility control statement before each member. You can use any number of BEFORE statements. One BEFORE statement can specify one model control statement. Each *model-control-statement* that you specify is reproduced, left-aligned, on a record that precedes each member in the unloaded data set.

By default, PROC SOURCE generates control statements for the IBM IEBUPDTE utility program before each member of an unloaded data set. You can use the BEFORE and AFTER statements to override the default and generate control statements for other utility programs. To prevent PROC SOURCE from generating these statements, use the BEFORE statement with no parameters.

Options for the BEFORE and AFTER statements are the same. A list of these options follows the description of the AFTER statement.

## AFTER Statement

**AFTER** '*model-control-statement*' <*options*>;

The AFTER statement generates a utility control statement after each member. You can use any number of AFTER statements. One AFTER statement can specify one model control statement. Each *model-control-statement* that you specify is reproduced, left-aligned, on a record that follows each member in the unloaded data set.

By default, PROC SOURCE generates control statements for the IBM IEBUPDTE utility program after each member of an unloaded data set. You can use the AFTER statement to override the default and generate control statements for other utility programs.

The following options are used in the BEFORE and AFTER statements:

**ALIAS**
tells SAS to produce a record containing the *model-control-statement* only for each defined alias. (The alias is placed into the record at the specified column, if any.)

***column number***
tells SAS to substitute the member name in records that are generated by BEFORE and AFTER statements in an 8-byte field beginning in this column. The beginning column can be any column from 1 to 73. Aliases, as well as main member names, are substituted. The name is left-aligned in the field unless the RIGHT option is specified, and it is padded on the right with blanks unless the NOBLANK option is specified.

**NOBLANK**
is meaningful only if *column number* is specified. When the member name is substituted in records that are generated by the BEFORE and AFTER statements, NOBLANK eliminates blanks between the end of the member and any text that follows. In the following record, a member name precedes the text; NOBLANK has *not* been specified:

```
name ,text text text
```

When NOBLANK is specified, the same record looks like this:

```
name,text text text
```

**RIGHT**
is meaningful only if *column number* is specified. When the member name is substituted in records that are generated by the BEFORE and AFTER statements, RIGHT causes the member name to be right-aligned in the specified field. By default, the name is left-aligned in an 8-byte field.

### Output

PROC SOURCE writes the following information to the SAS log:

- the contents of the entire PDS, if the PRINT option is specified
- a listing of the member names in the PDS (unless you specify NOPRINT)
- the number of records for each member (unless you specify NOPRINT or NODATA)
- a summary of the attributes and contents of the PDS.

Even when PRINT is not specified, some records can still be written to the log. The signal NAME: or ENTRY: or AUTHOR: beginning in column 5 of a record in the library starts the listing; the signal END beginning in column 5 stops it. If you do not want SAS to list this subset of records, specify the NOSUMMARY option.

## Examples

### Example 1: Printing Selected Members from a PDS

The following example writes to the SAS log the contents of the member ORANGES4 from the PDS USERID.TASTE.TEST:

```
proc source indd='userid.taste.test' print;
   select oranges4;
run;
```

The following output displays the log:

***Output 29.12*** *Selecting a Member from a Source Statement Library*

```
19   proc source indd='userid.taste.test' print;
20   select oranges4; run;
ORANGES4
data oranges;
   input variety $ flavor texture looks;
   total=flavor+texture+looks;
   datalines;
   navel 9 8 6
   temple 7 7 7
   valencia 8 9 9
   mandarin 5 7 8
   ;
proc sort data=oranges;
   by descending total;
proc print data=oranges;
   title 'Taste Test Result for Oranges';
17 - RECORDS
NOTE: INDD=SYS00158 data set is :
      Dsname=USERID.TASTE.TEST,
      Unit=3380,Volume=XXXXXX,Disp=SHR,Blksize=23055,
      Lrecl=259,Recfm=FB.
        3348      Members defined in source library.
           0      Aliases defined in source library.
           1      Members selected.
          17      Records read from source library.
```

## Example 2: Building and Submitting a Job to Assemble Programs

The following PROC SOURCE program builds and submits a job to compile assembler programs. It writes the output directly to the internal reader so that the compile job can be executed.

```
filename out sysout=a pgm=intrdr lrecl=80 recfm=f;
proc source indd='userid.asm.src' nodata outdd=out;
   first '//COMPILE JOB (0,ROOM),''DUMMY'',';
   first '// NOTIFY=,REGION=4M,TYPRUN=HOLD';
   first '/*JOBPARM FETCH';
   last  '//';
   before '//XXXXXXXX EXEC ASMHCL,' 3;
   before '// MAC2=''XXX.MACLIB'' ';
   before '//SYSIN DD DISP=SHR,';
   before '// DSN=USERID.ASM.SOURCE(XXXXXXXX)' 26 NOBLANK;
run;
```

The output that is written to the internal reader is shown in the following output example. Note that this output shows only the statements that are generated by PROC SOURCE, before they are executed.

***Output 29.13*** *Building and Submitting a Job to Assemble Programs*

```
//COMPILE JOB (0,ROOM),'DUMMY',
// NOTIFY=,REGION=4M,TYPRUN=HOLD
/*JOBPARM FETCH
//OUT1601  EXEC ASMHCL,
// MAC2='XXX.MACLIB'
//SYSIN DD DISP=SHR,
// DSN=USERID.ASM.SRC(OUT1601)
//OUT1602  EXEC ASMHCL,
// MAC2='XXX.MACLIB'
//SYSIN DD DISP=SHR,
// DSN=USERID.ASM.SRC(OUT1602)
//OUT1603  EXEC ASMHCL,
// MAC2='XXX.MACLIB'
//SYSIN DD DISP=SHR,
// DSN=USERID.ASM.SRC(OUT1603)
//
```

## Example 3: Producing Directory Records

The following PROC SOURCE program produces directory records. The subsequent DATA step extracts the ISPF statistics, if any are present.

```
filename indd 'userid.sas.src' disp=shr;
filename dirent '&temp';

proc source indd=indd nodata noprint dirdd=dirent;

data   test;

infile dirent eof=EXIT;
file print header=HDR;
retain TotEntries 0;
```

```
input  member $8. ttr pib3.  ind pib1. @;
TotEntries = ( TotEntries + 1);
halfwords = mod(ind,32);

if (halfwords = 15) or (halfwords = 20)
then do;
  input ver      pib1.    /*  1    Version               */
        mod      pib1.    /*  2    Modification          */
        flags    pib1.    /*  3    Flags                 */
        modifids pib1.    /*  4    Seconds last modified */
        ccreate  pib1.    /*  5    Creation Date         */
        create   pd3.     /*  6-8  "           "         */
        cchanged pib1.    /*  9-9  Last Modified Date    */
        changed  pd3.     /* 10-12 "           "         */
        hh       pk1.     /* 13    Hour                  */
        mm       pk1.     /* 14    Minute                */
        ccurrent pib2.    /* 15-16 Current Lines         */
        cinitial pib2.    /* 17-18 Initial Lines         */
        cmodifid pib2.    /* 19 20 Modified Lines        */
        userid   $char7.  /* 21-27 Userid                */
        depends  $char1.  /* 28    If bit 3/byte 3 = ON  */
        Ecurrent pib4.    /* 29-32 ON:  Current Lines    */
        Einitial pib4.    /* 33-36 ON:  Initial Lines    */
        Emodifid pib4. ;  /* 37-40 ON:  Modified Lines   */

  yyyydddc = (ccreate * 100000)  + 1900000 + create;
  jcreate  = datejul(yyyydddc);
  yyyydddx = (cchanged * 100000) + 1900000 + changed;;
  jchange  = datejul(yyyydddx);

  put @4   member   $char8.
      @15  jcreate  yymmdd10.
      @27  jchange  yymmdd10.
      @39  hh       z2.       @41 ':'
      @42  mm       z2.       @46 '|'
      @48  userid   $char8.   @57 '|'
      @58  ccurrent 9.0       @68 '|'
      @69  cinitial 9.0       @79 '|'
      @80  cmodifid 9.0       @90 '|'  @ ;
end;

 if (halfwords = 15)
 then do;
   put @92  "N/A"              @102 '|'
       @104 "N/A"              @114 '|'
       @116 "N/A"              @125 '|' ;
   put;
 end;

 if (halfwords = 20)
 then do;
   put @92  Ecurrent 9.0       @102 '|'
       @104 Einitial 9.0       @114 '|'
       @116 Emodifid 9.0       @125 '|' ;
   put;
 end;
```

```
    return;

    HDR:
    put @4   'Member   '  @15  'Created '   @27  'Changed '
        @39  'Time     '  @48  'Userid  '   @58  ' Current'
        @69  ' Initial'   @80  ' Modified'  @91  ' ECurrent '
        @103 ' EInitial' @114 ' EModified';
    put;
    return;

    EXIT:
    put "Directory Entries Processed: " TotEntries;
```

The following output displays the results:

***Output 29.14*** *Producing Directory Records*

```
   Member     Created     Changed     Time     Userid     Current    Initial    Modified   ECurrent    EInitial   EModified
   A          2006-04-21  2011-11-16  12:40  | SASCTG   |     144 |       1 |      143 | N/A       | N/A       | N/A       |
   ALASMEM6   2011-11-21  2011-11-21  15:08  | SASCTG   |       3 |       3 |        2 | N/A       | N/A       | N/A       |
   BIGMBR     2011-11-21  2011-11-21  14:25  | SASCTG   |   65535 |   65535 |        0 |    130700 |     65535 |         0|
   BIGONE     2011-11-21  2011-11-21  14:24  | SASCTG   |   32771 |   32771 |       17 | N/A       | N/A       | N/A       |
   BIGTWO     2011-11-21  2011-11-30  11:02  | SASCTG2  |   65535 |   65535 |    65535 |     65538 |     65535 |     65538|
   MLASMEM6   2006-04-21  2006-04-21  15:16  |,SASCTG,  |       1 |       1 |        0 | N/A       | N/A       | N/A       |
   ZLASMEM6   2011-11-16  2011-11-21  13:56  | SASCTG   |      19 |       1 |       18 | N/A       | N/A       | N/A       |
   ZM6        2006-04-21  2006-04-21  15:16  | SASCTG   |       1 |       1 |        0 | N/A       | N/A       | N/A       |
Directory Entries Processed: 10
```

## Example 4: Generating Control Cards for IEBCOPY

This example first produces control statements for the IBM utility program, IEBCOPY. Then IEBCOPY executes, copying selected members.

```
//IEBPDS JOB (0,ROOM),'USERID',
//  NOTIFY=
/*JOBPARM FETCH
//   EXEC SAS
//IN DD DSN=XXX.SUBLIB,DISP=SHR
//OUT DD DSN=&&TEMP,SPACE=(CYL,(1,2)),
//       DISP=(,PASS),UNIT=DISK
//SYSIN DD *
   proc source indd=in outdd=out nodata  noprint;
   select hc:;
   select lm:;
   select sasextrn;
   first ' COPY INDD=IN,OUTDD=NEWPDS';
   before '  SELECT MEMBER=XXXXXXXX -----------'
      17;
   before '       S      M=XXXXXXXX ***ALIAS***'
      17 ALIAS;
//S1     EXEC PGM=IEBCOPY
//SYSPRINT DD SYSOUT=A
//IN     DD DSN=XXX.SUBLIB,DISP=SHR
//NEWPDS DD DSN=&&NEW,SPACE=(CYL,(20,10,20)),
//          UNIT=DISK
//SYSUT1 DD UNIT=DISK,SPACE=(CYL,(2,3))
//SYSUT2 DD UNIT=DISK,SPACE=(CYL,(2,3))
//SYSUT3 DD UNIT=DISK,SPACE=(CYL,(2,3))
//SYSIN  DD DSN=&&TEMP,DISP=(OLD,DELETE)
```

The first output shows what is written to the SAS log after PROC SOURCE is run. The second output shows the IEBCOPY output.

The following output displays the log:

***Output 29.15*** *Producing Control Statements for the IEBCOPY Utility*

```
1             proc source indd=in outdd=out nodata  noprint;
2             select hc:;
3             select lm:;
4             select sasextrn;
5             first ' COPY INDD=IN,OUTDD=NEWPDS';
6             before '  SELECT MEMBER=XXXXXXXX -----------' 17;
7             before '       S      M=XXXXXXXX ***ALIAS***' 17 ALIAS;
NOTE: INDD=IN data set is :
      Dsname=USERID.DATASET,
      Unit=3380,Volume=XXXXXX,Disp=SHR,Blksize=6160,
      Lrecl=80,Recfm=FB.
NOTE: OUTDD=OUT data set is :
      Dsname=SYS96052.T131013.RA000.IEBPDS.TEMP,
      Unit=3390,Volume=,Disp=NEW,Blksize=27920,
      Lrecl=80,Recfm=FB.
           9      Members defined in source library.
           0      Aliases defined in source library.
           6      Members selected.
           0      Records read from source library.
```

***Output 29.16*** *IEBCOPY Output: Selected Members Copied*

```
                    IEBCOPY MESSAGES AND CONTROL STATEMENTS
 COPY INDD=IN,OUTDD=NEWPDS
  SELECT MEMBER=HCMEM1   -----------
  SELECT MEMBER=HCMEM2   -----------
  SELECT MEMBER=HCMEM3   -----------
  SELECT MEMBER=LMMEM1   -----------
  SELECT MEMBER=LMMEM2   -----------
  SELECT MEMBER=SASEXTRN -----------
         .
         .
         .
IEB167I FOLLOWING MEMBER(S) COPIED FROM INPUT DATA SET REFERENCED BY IN
IEB154I HCMEM1   HAS BEEN SUCCESSFULLY COPIED
IEB154I HCMEM2   HAS BEEN SUCCESSFULLY COPIED
IEB154I HCMEM3   HAS BEEN SUCCESSFULLY COPIED
IEB154I LMMEM1   HAS BEEN SUCCESSFULLY COPIED
IEB154I LMMEM2   HAS BEEN SUCCESSFULLY COPIED
IEB154I SASEXTRN HAS BEEN SUCCESSFULLY COPIED
IEB144I THERE ARE 239 UNUSED TRACKS IN OUTPUT DATA SET REFERENCED BY NEWPDS
IEB149I THERE ARE 8 UNUSED DIRECTORY BLOCKS IN OUTPUT DIRECTORY
IEB147I END OF JOB - 0 WAS HIGHEST SEVERITY CODE
```

## See Also

*IBMs DFSMSdfp Utilities*

# TAPECOPY Procedure Statement: z/OS

Copies an entire tape volume (tape or cartridge), or files from one or several tape volumes, to one output tape volume.

Restriction: When a SAS server is in the locked-down state, the TAPECOPY procedure is disabled. For more information, see Chapter 10, "SAS Processing Restrictions for Servers in a Locked-Down State," on page 219.

z/OS specifics: All

## Syntax

**PROC TAPECOPY** *options* ;

**INVOL** *options*;

**FILES** *file-number(s)*;

## Details

### Overview of PROC TAPECOPY

PROC TAPECOPY always begins writing at the beginning of the output tape volume; any files that previously existed on the output tape are destroyed.

**Note:** PROC TAPECOPY copies to a *single* output tape volume.

The TAPECOPY procedure can copy either standard labeled or nonlabeled tapes or cartridges. You can specify, within limits, whether the output tape is standard labeled (SL) or nonlabeled (NL). You cannot create an SL tape using an NL input tape because TAPECOPY cannot manufacture tape labels. Also, if LABEL=(,SL) was specified in a DD statement for an output tape volume, you cannot change that tape into a nonlabeled tape. PROC TAPECOPY does enable you to write over an existing volume label on a standard labeled tape if you specify LABEL=(,BLP) in the DD statement. (The BLP value indicates bypass label processing.)

The JCL DD statement parameter LABEL=(,BLP) must be authorized specifically by each computing installation. If your installation allows the BLP specification, then ANSI-labeled, nonstandard labeled, and standard user-labeled tapes can be treated as nonlabeled tape volumes. If the BLP specification is not authorized at your installation, then LABEL=(,BLP) is treated as LABEL=(,NL). PROC TAPECOPY works as you expect it to even if your tape is not labeled. Otherwise, the operating environment does not allow TAPECOPY to use the tape, thus preserving the label.

Throughout this description, references to specifying LABEL=(,BLP) assume that LABEL=(,BLP) is a valid specification at your installation.

**CAUTION**
**Record lengths cannot exceed 32K bytes.** PROC TAPECOPY copies up to 32K bytes of data per record, even if the length of the record exceeds 32K. No error message is generated.

## Input Tape DD Statement Requirements

In the DD statement that describes an input tape, you need to specify the UNIT, VOL=SER, DISP parameters, and usually either the LABEL or DSN parameter.

VOL=SER gives the volume serial of the first input tape. You can omit VOL=SER if the UNIT parameter specifies deferred mounting--for example, UNIT=(*tape*,,DEFER). If you specify deferred mounting, remember to use the INVOL= option in the PROC TAPECOPY statement or in an INVOL statement to specify the volume serial of the input tape. For details, see the information about the INVOL= option or "INVOL Statement" on page 590.

For a nonlabeled input tape, you must specify either LABEL=(,NL) or LABEL=(,BLP) in the DD statement. If you are unsure whether the input tape volume is labeled or nonlabeled, specify LABEL=(,BLP) in the input tape DD statement, if your installation allows it.

For a standard labeled input tape at an installation that does not allow LABEL=(,BLP), specify LABEL=(,SL) and the DSN parameter, giving the DSNAME of the first data set on the tape.

## Output Tape DD Statement Requirements

In the DD statement that describes the output tape, you usually need to specify only the UNIT, VOL=SER, and DISP parameters, and possibly the LABEL or DSN parameters.

VOL=SER gives the volume serial of the output tape. You can omit VOL=SER if the UNIT parameter specifies deferred mounting--for example, UNIT=(*tape*,,DEFER). If you specify deferred mounting, use the OUTVOL= option in the PROC TAPECOPY statement to specify the volume serial of the output tape. For more information, see "OUTVOL=*volume-serial*" on page 590.

You should usually specify DISP=(NEW,KEEP) for the output tape in the DD statement. At some installations, it might be necessary to specify DISP=(OLD,KEEP) along with the DSN parameter, giving the DSNAME of the first data set on the tape volume. The LABEL parameter should give the tape's label type as it is before the TAPECOPY procedure is executed, regardless of its label type after the copying operation.

## Output

The TAPECOPY procedure writes to the SAS log a listing of the input and output tape characteristics plus a summary of the files that were copied.

## PROC TAPECOPY Statement

**PROC TAPECOPY** *options* ;

The following options can appear in the PROC TAPECOPY statement:

**COPYVOLSER**
specifies that the output tape should have a standard label with the same volume serial as the first input tape. COPYVOLSER is effective only when both of the following conditions are true:

- The output tape volume is to be standard labeled--that is, LABEL=SL.
- The output tape DD statement specifies LABEL=(,NL) or LABEL=(,BLP).

Both of these conditions must be true because the PROC TAPECOPY statement LABEL= option specifies whether the output tape is standard labeled or nonlabeled *after* the copy operation. The output tape volume's DD statement LABEL= parameter specifies what the output tape's label status is *before* the copy operation.

If you specify COPYVOLSER and these conditions are not true, PROC TAPECOPY stops processing.

**DEN=*density***
specifies the density of the output tape. (The DEN= option should not be specified for cartridge tapes.) If the DEN= option appears in the PROC TAPECOPY statement, it overrides any DCB=DEN specification in the DD statement for the output tape volume. If you do not specify a density in the PROC TAPECOPY statement or in the DD statement, the operating environment writes the tape at its default density. The default density is usually the highest density at which the unit allocated to the output tape volume can record.

The following table shows the valid density values:

| Tape Density Value | Tape Volume Type |
|---|---|
| DEN=2 | 800 bpi |
| DEN=800 | |
| DEN=3 | 1600 bpi |
| DEN=1600 | |
| DEN=4 | 6250 bpi |
| DEN=6250 | |

**INDD=*ddname***
specifies the ddname that is referenced in the JCL DD statement for the first input tape volume. The default INDD= option value is VOLIN.

**INVOL=*volume-serial***
specifies the volume serial of the first input tape when deferred mounting is specified in the DD statement for the first input tape. The INVOL= option specification overrides the volume serial, if any, that was specified in the DD statement for the tape.

Specify the INVOL= option only if you are using deferred mounting.

**LABEL=SL | NL**
specifies whether the output tape volume is to be standard labeled (LABEL=SL) or nonlabeled (LABEL=NL).

**Note:** Be careful not to confuse the LABEL= option in the PROC TAPECOPY statement with the DD statement parameter LABEL=(,*specification*). The PROC TAPECOPY statement LABEL= option specifies whether the output tape is standard labeled or nonlabeled *after* the copy operation. The output tape volume's DD statement LABEL= parameter specifies what the output tape's label status is *before* the copy operation.

The DD statement for nonlabeled output tapes must specify either LABEL=(,NL) or LABEL=(,BLP). If the output tape has an existing label (before the copy operation) and the output tape is to be nonlabeled (after the copy operation), then the DD statement must specify LABEL=(,BLP).

The default LABEL= option value is NL when multiple input volumes are used and when the DD statements for any of them specify LABEL=(,NL). If there are multiple input tapes and LABEL=(,NL) is not specified for any of them, and if the first input tape volume is actually standard labeled, then the default LABEL= option value is SL. This default value applies even if the DD statement specifies LABEL=(,BLP) for the first tape; in this case, PROC TAPECOPY reads the tape volume's first record to determine the actual label type.

**NEWVOLSER=*new-volume-serial***
specifies a new volume serial for the output tape. NEWVOLSER is effective only if the output tape is standard labeled. If the output tape has an existing label, then the DD statement for the output tape must specify LABEL=(,BLP). Otherwise, PROC TAPECOPY stops processing and does not write over the label.

**NOFSNRESEQ | NFR**
specifies that file sequence numbers in the file labels should not be resequenced when a standard labeled output tape volume is being produced. PROC TAPECOPY usually resequences these numbers and updates the label in order to reflect both the ordinal position of the file on the output tape as it is copied and the actual density at which the output tape is written.

**NOLIST**
tells SAS not to write the tape characteristics and the summary of copied files to the SAS log. Even when you specify NOLIST, the SAS log contains a brief summary of PROC TAPECOPY's action; this summary is usually enough to verify proper functioning of PROC TAPECOPY if you are familiar with the contents of the input tapes.

**NORER**
tells SAS not to specify the "reduced error recovery for tape devices" feature of the operating environment for each input tape volume. When NORER is specified, some tapes of marginal quality can be read successfully by PROC TAPECOPY because the error recovery procedures are more extensive.

**OUTDD=*ddname***
specifies the ddname that is referenced in the JCL DD statement for the output tape. The default OUTDD= option value is VOLOUT.

**OUTVOL=*volume-serial***
specifies the volume serial of the output tape when deferred mounting is specified in the DD statement for the output tape. The OUTVOL= option specification overrides the volume serial, if any, that was specified in the DD statement for the tape.

Specify the OUTVOL= option only if you are using deferred mounting.

## INVOL Statement

**INVOL** *options*;

The INVOL statement defines an input tape volume from which some or all files are to be copied to the output tape volume. The INVOL statement is not necessary if you are using only one input tape nor for the first of several input tapes. (Use the INDD= and INVOL= options of the PROC TAPECOPY statement instead.) When you are using several input tapes, use an INVOL statement for each tape after the first input tape.

The following options can appear in the INVOL statement:

**DSN | DSNAME='*physical-filename*'**
specifies the data set name of the first file on the current input tape. You must use this option when both of the following conditions are true:

- The data set name specified in the DD statement is incorrect or missing.
- LABEL=(,SL) is specified (or implied by default) in the input tape volume DD statement.

You typically use this option when one of the following conditions is true:

- The DD statement for the input tape specifies deferred mounting.
- You are reusing a DD statement (and tape drive). That is, the fileref is the same but you want another standard labeled tape volume on the same unit. LABEL=(,SL) should be specified or implied by default, and the data set name cannot be the same as the data set name on the previous tape that was used with this fileref.

**INDD=*ddname***
specifies the ddname that is referenced in the JCL DD statement for the current input tape. The default INDD= option value is the ddname that is already in effect for the previous input tape volume, as specified in the PROC TAPECOPY statement or in the last INVOL statement.

**INVOL=*volume-serial***
specifies the volume serial of the current input tape. Use the INVOL= option when the JCL DD statement for the input tape specifies deferred mounting (as described in "PROC TAPECOPY Statement" on page 588), or when you are reusing a DD statement (and tape drive). That is, the ddname is the same, but you want a different tape volume on the same unit.

**NL**
specifies that the input tape is nonlabeled. If LABEL=(,SL) or LABEL=(,BLP) has been specified in the DD statement for the input tape and the tape is actually standard labeled, specifying the NL option causes the tape to be treated as if it were nonlabeled. In this case, any file numbers that are specified in FILES statements must be physical file numbers, not logical file numbers.

**NORER**
tells SAS not to specify the "reduced error recovery for tape devices" feature of the operating environment for the input tape volume. When this option is specified, some tapes of marginal quality can be read successfully by PROC TAPECOPY because the error recovery procedures are more extensive. If NORER is specified in the PROC TAPECOPY statement, then NORER is in effect for all input tape volumes and INVOL statements.

**SL**
specifies that the input tape is standard labeled. If you specify LABEL=(,BLP) in the DD statement for the input tape and specify SL in the INVOL statement, PROC TAPECOPY verifies that the tape is standard labeled. Do not specify SL unless the tape is actually standard labeled.

**Note:** If you do not specify NL or SL in the INVOL statement, the actual input tape label type determines whether PROC TAPECOPY treats the tape as nonlabeled or standard labeled, even when LABEL=(,BLP) is specified in the DD statement.

## FILES Statement

### Overview of the FILES Statement

**FILES** *file-number(s)*;

When you want to copy particular files from an input tape, use the FILES statement to specify which files you want to copy. Use as many FILES statements as you want. Give the physical file numbers for nonlabeled tapes or for labeled tapes that are being treated as nonlabeled. Give the logical file numbers for standard labeled tapes that are not being treated as nonlabeled, even when the output tape volume is to be nonlabeled (LABEL=NL). FILE is an alias for the FILES statement.

If you are using only one input tape, the FILES statements can directly follow the PROC TAPECOPY statement. When you use several input tape volumes, follow each INVOL statement with the associated FILES statement or statements.

### Specifying Individual Files

File numbers in a FILES statement can be specified in any order. For example, you might want to copy file 5 and then file 2 and then file 1, as in the following example:

```
proc tapecopy;
   files 5 2;
   files 1;
run;
```

### Specifying a Range

You can specify a range of files by putting a hyphen between two file numbers, as in the following example:

```
proc tapecopy;
   files 1-7;
run;
```

In a range, the second number must be greater than the first. The keyword EOV (end of volume) can be used as the last file in a range. PROC TAPECOPY copies all files on the input tape until the end of the volume (in most cases, a double tape mark). On a nonlabeled tape, you can copy files from the input tape beyond the double tape mark by specifying the physical file number, counting tape marks as usual. If another double tape mark exists on the input tape volume, you can then specify EOV in another range.

## Examples

### Example 1: Copying Standard Labeled to Standard Labeled

The following job copies a standard labeled tape (volume serial XXXXXX) to another standard labeled tape (volume serial YYYYYY).

```
//jobname  JOB
account,name
//  EXEC SAS
//VOLIN DD UNIT=TAPE,DISP=OLD,
//  VOL=SER=XXXXXX,LABEL=(,SL),
//  DSN=first-dsname-on-tape
//VOLOUT DD UNIT=TAPE,DISP=(,KEEP),
//  VOL=SER=YYYYYY,LABEL=(,SL)
//SYSIN DD *
   proc tapecopy;
   run;
/*
//
```

After PROC TAPECOPY executes, the output tape volume is labeled YYYYYY.

If LABEL=(,BLP) had been specified in the input tape DD statement (VOLIN), then it would not have been necessary to use the DSN= option. Because some installations do not permit the BLP label type specification, and because no volume

label checking is performed when it is specified, it is recommended that you specify (or allow to default) LABEL=(,SL).

The specification of LABEL=(,SL) in the output tape DD statement (VOLOUT) causes the operating environment to check the volume label when a tape volume is mounted on the tape drive. The operating environment ensures that a tape with volume serial YYYYYY is mounted. However, if the tape with external volume label YYYYYY is internally labeled something other than YYYYYY, PROC TAPECOPY fails. In this case, you must specify LABEL=(,BLP) or give the actual internal volume serial in the output tape DD statement. If the output tape is not labeled internally, you can specify LABEL=(,NL) or LABEL=(,BLP).

## Example 2: Copying Standard Labeled to Nonlabeled

The next job copies a standard labeled tape with volume serial TAPEIN to a nonlabeled tape, FCSTP1. After the job is executed, the output tape volume is still a nonlabeled tape, presumably with only an external volume label of FCSTP1. You must specify LABEL=NL in the PROC TAPECOPY statement. Otherwise, the procedure defaults to LABEL=SL because the first (and only) input tape volume is standard labeled.

```
//jobname  JOB
account,name
//  EXEC SAS
//VOLIN DD UNIT=TAPE,DISP=OLD,VOL=SER=TAPEIN,
//         LABEL=(,BLP)
//VOLOUT DD UNIT=TAPE,DISP=(,KEEP),VOL=SER=FCSTP1,
//         LABEL=(,NL)
//SYSIN DD *
   proc tapecopy label=nl;
   run;
/*
//
```

## Example 3: Copying Nonlabeled to Nonlabeled

The following job copies a nonlabeled tape with volume serial QDR123 to a nonlabeled, 1600 bpi tape, SLXATK:

```
//jobname  JOB
account,name
//  EXEC SAS
//INTAPE DD UNIT=TAPE,DISP=OLD,VOL=SER=QDR123,
//          LABEL=(,NL)
//OUTTAPE DD UNIT=2927-3,DISP=(,KEEP),
//           VOL=SER=SLXATK,LABEL=(,NL)
//SYSIN DD *
   proc tapecopy indd=intape outdd=outtape
        den=1600;
   run;
/*
//
```

## Example 4: Copying Multiple Files from One Input Tape

This next job copies the first seven files from the standard labeled input tape U02746 plus four files from the standard labeled input tape T13794 to an initially nonlabeled output tape with volume serial MINI01. After the procedure is executed, the output tape is standard labeled and has a volume serial of U02746, as specified by the COPYVOLSER option.

```
//jobname  JOB
account,name
//  EXEC SAS
//TAPI1 DD DISP=SHR,UNIT=TAPE,
//   VOL=SER=U02746,LABEL=(,SL),
//   DSN=first-file-dsname
//TAPI2 DD UNIT=(TAPE,,DEFER)
//OUTDDN DD DISP=(,KEEP),UNIT=TAPE,VOL=SER=MINI01,
//   LABEL=(,NL)
//SYSIN DD *
   proc tapecopy outdd=outddn indd=tapi1
        copyvolser;
      files 3 2 1;
      invol indd=tapi2 invol=t13794
         dsn='first-dsname-on-this-tape ';
      file 3;
      invol indd=tapi1;
      files 5-7 4;
      invol indd=tapi2;
      files 2 4 1;
   run;
/*
//
```

## Example 5: Copying Multiple Files from Multiple Input Tapes

The next job copies several files from several input tape volumes to one output tape volume:

```
//REARRNGE JOB account,name
//  EXEC SAS
//DEN2IN DD UNIT=(2927-4,,DEFER),LABEL=(,BLP)
//DEN3IN DD UNIT=(2927-3,,DEFER),LABEL=(,SL)
//TAPE1 DD UNIT=TAPE,DISP=SHR,VOL=SER=XR8475,
//   LABEL=(,BLP)
//TAPE2 DD UNIT=TAPE,DISP=OLD,VOL=SER=BKT023,
//  DSN=first-file-dsname
//OUTPUT DD UNIT=(3400-5,,DEFER),DISP=(,KEEP)
//SYSIN DD *
   proc tapecopy label=sl den=6250 nolist
        outdd=output outvol=histpe;
      invol indd=den2in invol=ptftp0;
      files 2-4 8-eov 7 6;
      invol indd=tape1;
      files 5 7 9-eov;
      invol indd=tape2;
      files 4 5 1;
      invol indd=den3in invol=s03768
         dsn='xrt.bkt120.g0081v00';
```

```
      files 1-6 22-34;
      invol invol=so3760 dsn='t.bkt120.g0023v00';
      files 4 5 6 9;
      invol indd=tape2;
      files 7-eov;
   run;
/*
//
```

# TAPELABEL Procedure Statement: z/OS

Writes the label information of an IBM standard-labeled tape volume to the SAS procedure output file.

Restriction: When a SAS server is in the locked-down state, the TAPELABEL procedure is disabled. For more information, see Chapter 10, "SAS Processing Restrictions for Servers in a Locked-Down State," on page 219.

z/OS specifics: All

## Syntax

**PROC TAPELABEL** <*options* >;

## Details

### Overview of PROC TAPELABEL

The procedure writes information from the tape label, including the data set name, DCB information, and data set history, to the SAS procedure output file.

A ddname must be allocated for each tape volume before that volume can be read by the TAPELABEL procedure. Multiple tape volumes can be read in one PROC TAPELABEL statement, using a list of ddnames in the DDNAME= option, as shown in the following list. At some installations, you might need to specify the data set name of the first file on the tape volume as the first entry in your list of ddnames. This specification is necessary if you cannot use LABEL=(,BLP), which is restricted at many sites.

### PROC TAPELABEL Statement

**PROC TAPELABEL** <*options* >;

The following options can be specified in the PROC TAPELABEL statement:

**DCBDEVT=128**
enables PROC TAPELABEL to process Fujitsu F6470 tape cartridges.

**DDNAME=(*ddname-1...ddname-n*)**
specifies the ddname of the tape volume that you want to process. More than one ddname can be specified. Use blank spaces to delimit the list. If you specify only one ddname, you can omit the parentheses.

If DDNAME= is omitted, the default ddname is TAPE.

**DUMP**
sends to output the first 80 bytes in the first 10 blocks of each data set on the tape.

**NOTRAP813**
tells the TAPELABEL procedure not to trap 813-04 abends. When you use LABEL=(,SL) to access an IBM standard labeled tape, this option prevents you from reading the tape unless you specify the data set name of the first file on the tape volume.

**PAGE**
begins the output for each tape volume on a new page.

## Output

For each file on a tape volume, TAPELABEL generates the following information:

- FILE NUMBER, the file sequence number
- DSNAME, the data set name
- RECFM, the record format
- LRECL, the logical record length
- BLKSIZE, the block size
- BLOCK COUNT, the number of blocks in the file (from the trailer label)
- EST FEET, the *estimated* length of the file in feet (assumes all blocks=BLKSIZE)
- CREATED, the file creation date
- EXPIRES, the file expiration date
- CREATED BY JOB NAME STEPNAME, the job name and the step name of the job that created the file
- TRTCH, the track recording technique
- DEN, the file recording density code
- PSWD, the file protection indicator
- UHL, the number of user header labels
- UTL, the number of user trailer labels.

TAPELABEL also lists the sum of the estimated file lengths.

**Note:** On an IBM standard tape label, only 17 characters are available for the data set name. If a longer name is specified in the JCL when the data set is created, only the rightmost 17 characters are used. PROC TAPELABEL displays what is stored in the tape's header label. Some tape management systems catalog data sets by the

full name specified in the JCL and therefore require you to specify the full name when you access the data set.

## Example: Generating Tape Label Information

The following job generates the label information for all files on the MVSV9 tape volume allocated to the ddname OURTAPE:

```
//jobname JOB acct,name
/*JOBPARM FETCH
//TLABEL   EXEC SAS
//OURTAPE  DD   UNIT=TAPE,DISP=OLD,VOL=SER=MVSV9
//SYSIN DD *
   proc tapelabel ddname=ourtape;
   run;
/*
//
```

The following output displays the results.

***Output 29.17*** *Output from the TAPELABEL Procedure*

```
                                                        The SAS System
                                                 TAPE LIST FOR DDNAME -  OURTAPE
 CONTENTS OF TAPE VOLUME -
OS390T                                                                  OWNER -
  FILE                                              BLOCK   EST       CUM
CREATED BY
  NUMBER DSNAME          RECFM  LRECL  BLKSIZE  COUNT   FEET   FEET CREATED   EXPIRES  JOB NAME
STEPNAME TRTCH DEN PSWD UHL UTL
    1  SAS.SASROOT         FB     80     6160    175      3.6    3.6 12MAR2005 0000000  E70S701 /
GO              5   NO   0   0
    2  SAS.V186.@P@BA$H    FB   6144     6144     77      1.6    5.2 12MAR2005 0000000  E70S701 /
GO              5   NO   0   0
    3  SAS.V186.EMO1CLR    U       0     6164    633     12.9   18.0 12MAR2005 0000000  E70S701 /
GO              5   NO   0   0
```

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# Statements under z/OS



## Statements in the z/OS Environment

Portable statements are documented in *SAS DATA Step Statements: Reference*. This chapter documents statements that are specific to z/OS or that have aspects that are specific to z/OS.

# Dictionary

## ABORT Statement: z/OS

Stops the execution of the current DATA step, SAS job, or SAS session.

Valid in: In a DATA step

z/OS specifics: Action of ABEND and RETURN, maximum value of *n*

See: "ABORT" in *SAS DATA Step Statements: Reference*

### Syntax

**ABORT** <ABEND | RETURN> <*n*> ;

#### Optional Arguments

The following options are used primarily in batch processing, although they can be used with any method of running SAS. These options have host-specific characteristics.

**ABEND**
causes normal z/OS abend processing to occur after the ABORT statement is issued.

**RETURN**
causes an immediate normal termination of the SAS system. The step return code (condition code) should be used to indicate the error. To pass a specific return code back to the operating environment, use the *n* option. You can then use this return code in your JCL to conditionally execute later steps in your z/OS job stream.

***n***
enables you to specify an ABEND code or a condition code that SAS returns to the operating environment when it stops executing. The value of *n* must be an integer. Under z/OS, the range of acceptable values is from 1 to 4095. If you do not specify a value for *n*, an ABORT ABEND statement returns a user abend 999 ('3E7'x); an ABORT RETURN statement returns condition code 20. ('3E7'x is the hexadecimal expression of 999.) If you issue the ABORT statement without specifying either ABEND or RETURN, and you do not specify a value for *n*, then the statement returns condition code 16.

## Details

You can use the ABORT statement to control the conditional execution of z/OS job steps. For example, depending on the result of the z/OS job step that executes your SAS program, you might need to either bypass or execute later steps. To enable this control, you can establish a variable in your SAS DATA step program that is set to a particular value whenever an error occurs. In the following example, we use a variable named ERRCODE that is set to 16 if an error occurs in the DATA step. You can choose any variable name and value that are required by your program. Then, use the following ABORT statement, coded in the THEN clause of an IF statement, to cause the z/OS job step to ABEND if ERRCODE=16:

```
if errcode=16 then abort return;
```

When the z/OS job step that is used to execute your SAS job ends (either normally or abnormally), the next z/OS job step is processed. You could then use the following EXEC statement to conditionally execute that job step if an ABEND occurs. If ERRCODE is not set to 16, then the ABORT statement is disabled, and because an ABEND did not occur the job step is bypassed.

```
//stepname EXEC
PGM=your-program,COND=ONLY
```

If a SAS session abends when it is processing an ABORT statement, then SAS uses the normal termination disposition when it deallocates any z/OS data set that SAS dynamically allocated during the session as a part of FILENAME or LIBNAME processing. For more information, see the description of the DISP option for "FILENAME Statement: z/OS" on page 616 or "LIBNAME Statement: z/OS" on page 656.

## See Also

*IBM MVS JCL Reference*

# ATTRIB Statement: z/OS

Associates a format, informat, label, length, or any combination of these attributes, with one or more variables.

| | |
|---|---|
| Valid in: | In a DATA step |
| z/OS specifics: | LENGTH= specification in *attribute-list* |
| See: | "ATTRIB" in *SAS DATA Step Statements: Reference* |

## Syntax

**ATTRIB** *variable-list-1 attribute-list-1* <*...variable-list-n attribute-list-n* > ;

## Details

LENGTH=<$> *length* is one of the attributes that can be specified in the *attribute-list*. The LENGTH= attribute specifies the length of variables in the *variable-list*. Under z/OS, numeric variables can range from 2 to 8 bytes in length, and character variables can range from 1 to 32,767 bytes in length.

# CARDS Statement: z/OS

Indicates that data lines follow.

Valid in: In a DATA step

z/OS specifics: Behavior

See: "CARDS" in *SAS DATA Step Statements: Reference*

## Details

The behavior of the CARDS statement is affected by the CARDIMAGE system option. For more information, see "CARDIMAGE System Option: z/OS" on page 716.

# DSNEXST Statement: z/OS

Checks to see whether the specified physical file exists and is available.

Valid in: Anywhere

z/OS specifics: all

## Syntax

**DSNEXST** '*physical-filename* ';

### Required Argument

***'physical-filename'***
is the name of a physical file. Quotation marks around the name are optional. However, the data set name must always be fully qualified. In this case, *physical-filename* cannot specify a UNIX System Services file.

When a SAS server is in a locked-down state, access to a permanent z/OS data set is limited to entries that are found in a lockdown list that is maintained by

the server administrator. Because the output is a Boolean macro variable, no distinction can be made between the file not being found and the file not being accessible. Therefore, when SAS is in the locked-down state, if the specified physical-name is not in the lockdown list, DSNEXST returns a value of false, as if the file did not exist. For more information, see Chapter 10, "SAS Processing Restrictions for Servers in a Locked-Down State," on page 219.

## Details

DSNEXST is a global statement. The first time the statement is issued, it performs one of the following actions:

- creates the macro variable &SYSDEXST and assigns a value of 1 to it if the data set exists and is available for allocation
- creates the macro variable &SYSDEXST and assigns a value of 0 to it if the data set does not exist.

**Note:** The DSNEXST statement causes SAS to perform a z/OS data set dynamic allocation. If the specified data set is on a removable volume, such as a tape, then it is mounted. Data sets that have been migrated by HSM (the z/OS Hierarchical Storage Manager) are recalled. To avoid these problems, use the DSNCATLGD function.

The following example allocates a data set differently depending on whether the data set already exists or not.

```
%macro mydsn;
   dsnexst 'my.data.set';
   filename myds 'my.data.set'
%if &sysdexst %then %do;
   disp=old;
   %end;
%else %do;
   disp=(new,catlg) space=(cyl,(1,1)) blksize=6160
      dsorg=ps recfm=fb lrecl=80 unit=disk
      volser='MYVOL';
   %end;
%mend mydsn;
%mydsn
```

The next example shows how you can submit some SAS statements if a data set already exists and bypass them if it does not.

```
%macro copylib;
   dsnexst 'my.data.library';
%if &sysdexst %then %do;
   libname mylib 'my.data.library' disp=shr;
   proc copy in=mylib out=work;
   run;
   %end;
%mend;
%copylib
```

In situations where there could be more than one user of the data set, the following example shows how you can use the &SYS99ERR automatic macro variable to distinguish between “data set does not exist” and “data set exists but is not available.”

```
%macro dsexist(loc);
  dsnexst &loc;
  %if &sysdexst=0 and &sys99err=1708
    %then %do;
    %put &loc does not exist;
    %end;
  %else %do;
    %put &loc exists;
    %end;
  %mend;
%dsexist(my.data.set)
```

## See Also

*SAS Macro Language: Reference*

# FILE Statement: z/OS

Specifies the current output file for PUT statements.

Valid in: In a DATA step

Restriction: The FILE statement cannot modify or override the device type that was set by an earlier FILENAME statement.

z/OS specifics: *file-specification, type, host-options*

See: “FILE” in *SAS DATA Step Statements: Reference*

## Syntax

**FILE** *file-specification* <PERMISSION='*permission-value*'><*type*> <ENCODING=*encoding-value*> <*options*>;

**FILE** LOG | PRINT <*options*>;

### Required Argument

***file-specification***
identifies a file in one of the following forms:

***fileref***
specifies a fileref or the allocated ddname of the file. A fileref can consist of up to eight letters, numbers, national characters ($, @, and #), and

underscores (_). The first character must be either a letter, a national character, or an underscore.

***fileref*(*member*)**
specifies a member of a partitioned data set, where the PDS or PDSE is specified by the assigned fileref or allocated ddname.

If you specify a fileref that is not allocated, then SAS attempts to construct a data set name with the following three qualifiers:

- the value of the SYSPREF= option (usually the user ID)
- the specified fileref
- DATA

If a file that has this constructed data set name is found, then SAS opens it and writes to it. If a file is not found, and the FILEPROMPT option is in effect, then you are asked if you want to create and catalog the file.

The value of the FILEEXT= system option can affect how SAS interprets PDS and PDSE member names. For more information, see "FILEEXT= System Option: z/OS" on page 746.

***'physical-filename'***
specifies a physical file, which can be a sequential file, a member of partitioned data set (PDS), a member of an extended partitioned data set (PDSE), or a UNIX System Services file, using the following syntax:

- a UNIX System Services file. For example:

```
'/u/userid/raw'
```

  or

```
'HFS:raw'
```

- a fully qualified data set name. For example:

```
'myid.raw.datax'
```

- a fully qualified data set name with a member in parentheses. For example:

```
'sas.raw.data(mem1)'
```

- a partially qualified data set name with a period preceding it. For example:

```
'.raw.data'
```

- a partially qualified data set name with a period preceding it and a member name in parentheses. For example:

```
'.raw.data(mem1)'
```

- a temporary data set name. For example:

```
'&mytemp'
```

The value of the FILEEXT= system option can affect how SAS interprets file specifications for PDS and PDSE files. For more information, see "FILEEXT= System Option: z/OS" on page 746.

For more information about partially qualified data set names, see Chapter 5, "Specifying Physical Files," on page 89. For information about encodings for z/OS resources such as data set names and UFS paths, see "PEEKLONG Function: z/OS" on page 492.

When a SAS server is in a locked-down state, access to a permanent z/OS data set or UFS file is limited to entries that are found in a lockdown list that is maintained by the server administrator. For more information, see Chapter 10, "SAS Processing Restrictions for Servers in a Locked-Down State," on page 219.

**LOG**
directs output to the SAS log file.

**PRINT**
directs output to the SAS procedure output file.

## Optional Arguments

**PERMISSION='*permission-value*'**
specifies permissions to set for the specified fileref. To specify more than one set of permission values, separate them with a comma within quotation marks.

**Note:** The PERMISSION option applies only to UFS files.

Provide the *permission-value* in the following format:

```
A::<trustee_type>::<permissions>
```

The 'A' indicates that these are access permissions. No other values are currently supported.

The trustee_type can take the following values:

u user

g group (group owner of the file)

o other (all other users)

The permission value takes the letters *r* (Read), *w* (Write), and *x* (Execute), in that order. If you do not want to grant one of these permissions, enter a '-' in its place (for example, *r-x* or *rw-*).

Suppose that you want to have Read, Write, and Execute permission for a fileref. You also want to specify Read and Execute permission for the group owner of the file. Finally, you want to allow all other users to have only Read permission for the file. You can specify these options as follows:

```
permission='A::u::rwx,A::g::r-x,A::o::r--'
```

Supply a permission value for all three trustee types. Any trustee type that you omit from the list of permission values is denied all access to the specified fileref. For example, suppose you used the following permission values:

```
permission='A::u::rwx,A::g::r-x'
```

In this case, only the owner and the group owner have access to the specified file. Any user other than the owner or group owner is denied all access to the file.

***type***
specifies the type of file. When you omit *type*, the default is a standard external file. Nonstandard (host-specific) file types that you can specify for z/OS are

DLI
for IMS-DL/I databases. For information about IMS-DL/I options for the FILE statement, see *SAS/ACCESS Interface to IMS: Reference*.

HFS
for UNIX System Services files. For more information, see "Accessing UNIX System Services Files" on page 129.

MVS
for z/OS data sets.

PIPE
for pipelines in UNIX System Services. See "Piping Data from SAS to a UNIX System Services Command" on page 137.

VSAM
for VSAM files. See "Accessing VSAM Data Sets" on page 128.

**ENCODING=*encoding-value***
specifies the encoding to use when writing to the output file. The value for ENCODING= indicates that the output file has a different encoding from the current session encoding. However, you can also specify the same encoding for the output file as the encoding of the current session. You must enclose the value in quotation marks if it contains a hyphen.

If you specify an encoding value different from the session encoding, SAS transcodes the data from the session encoding to the specified encoding when you write data to the output file. The default encoding is the session encoding, which is the value of the ENCODING= SAS system option.

For valid encoding values and more information about encoding, see "Encoding Values in SAS Language Elements" in the *SAS National Language Support (NLS): Reference Guide*.

***options***
are either portable or host-specific. For information about portable options that can be specified in the FILE statement, see the *SAS DATA Step Statements: Reference*.

You can specify portable options and host options in any order. When you specify more than one option, separate the options with a blank space.

The host options that you can specify depend on what type of file you are accessing. See the following sections for details:

- "Standard Host Options for the FILE Statement under z/OS" on page 608
- "Host Options for Retrieving Information about Data Sets" on page 610
- "Options That Specify SMS Keywords" on page 632

- "VSAM Options for the FILE and INFILE Statements under z/OS" on page 610
- "Host-Specific Options for UNIX System Services Files" on page 613


# Details

## Standard Host Options for the FILE Statement under z/OS

You can use the following options with all external files under z/OS:

**BLKSIZE=*value* | BLK=*value***
specifies the block size of the file. Block size is discussed in more detail in "DCB Option Descriptions" on page 628 and in "Overview of DCB Attributes" on page 630.

**BUFNO=*value***
specifies how many memory buffers to allocate for writing. If you specify BUFNO= in a FILE statement, it takes precedence over specifying it in a FILENAME statement. If you omit BUFNO= from the FILE statement, then specifying it in the FILENAME statement takes precedence. If you do not specify BUFNO= in a FILE statement or a FILENAME statement, SAS uses the value of the FILEBUFNO= system option. For information about using BUFNO or the FILEBUFNO system option, see "FILEBUFNO= System Option: z/OS" on page 742.

**CLOSE=*keyword***
indicates how a tape volume is positioned at the end of the DATA step. Values for *keyword* are

| | |
|---|---|
| REREAD | positions the tape at the logical beginning of the data set. |
| LEAVE | positions the tape at the logical end of the data set. |
| REWIND | rewinds the tape to the physical beginning of the volume. |
| FREE | dynamically deallocates the tape volume. |
| DISP | is implied by the control language. |

**CSRC**
specifies that you want to use CSRCESRV services (available with z/OS) to compress data on output. For example:

```
data _null_;
   file myfile csrc;
   put ... ;
run;
```

You cannot use this option with an external file that has a fixed-length record format.

**DCB=*fileref***
specifies the fileref of an external file that was referenced in an earlier FILE or INFILE statement in the same DATA step. SAS uses that file's RECFM=, LRECL=, and BLKSIZE= information for the current file.

**LINESIZE=*width***
works with LRECL to specify the maximum number of characters per line or record in print files, nonprint files, and the SAS log. Under z/OS, the range of acceptable values of LINESIZE= is 64 to 256. The default value of the LINESIZE= system option under z/OS is 132. This default applies only to print files (with carriage returns) or to the SAS log. For nonprint files (without carriage returns), the value of LRECL= is used in place of the default value for LINESIZE=.

**LRECL=*value***
specifies the logical record length of the file. The specified value depends on the access method and the device type. For more information, see the discussion of LRECL= in "DCB Option Descriptions" on page 628 and the IBM *MVS JCL Reference*.

**MOD**
writes the output lines following any existing lines in the file. This option overrides a disposition that was specified in JCL or under TSO. It is not valid if the specified file is a member of a partitioned data set (PDS).

**NOPROMPT**
specifies that if the file that you reference in the FILE statement is unavailable, a dialog box is not displayed, and an error is written to the SAS log.

**OLD**
writes the output lines at the beginning of the file, overwriting any existing data in the file. This option overrides a disposition that was specified in JCL or under TSO, and it is the default if no disposition is specified. Using OLD is necessary only if you used MOD for the file in an earlier FILE statement and you want to overwrite the file.

**PRINT | NOPRINT**
specifies whether carriage-control characters are placed in output files. Under z/OS, PRINT adds carriage-control characters to the beginning of all lines of output that are directed to print files and to the SAS log.

**RECFM=*record-format***
specifies the record format of the file. Valid values are

F specifies fixed-length records, unblocked.

V specifies variable-length records, unblocked.

FB specifies fixed-length records, blocked.

VB specifies variable-length records, blocked.

U specifies undefined-length records, unblocked.

The following values can be appended to the RECFM values:

A specifies that the first byte of each record is an ANSI printer-control character.

S if appended to V, specifies that the file contains spanned records; if appended to F, specifies that the file contains standard blocks.

The following value stands alone; no other values can be appended:

N indicates that the file is in binary format. The file is processed as a stream of bytes with no record boundaries, which includes the default value of LRECL. This record format is specific to SAS.

## Host Options for Retrieving Information about Data Sets

The following options are used in the FILE, FILENAME, and INFILE statements to retrieve information about a data set from the operating environment control blocks. SAS assigns values to the variables that are defined by these options when it opens the data set. It updates the values every time it opens a new data set in a concatenation. You can use these options with all standard external files under z/OS.

**DEVTYPE=*variable***
defines a character variable (minimum length 24) that SAS sets to the device type. SAS obtains the device type by using the z/OS operating environment DEVTYPE macro. For more information, see the IBM documentation for your operating environment.

**DSCB=*variable***
defines a character variable (minimum length 96) that SAS sets to the Data Set Control Block (DSCB) information from a non-VSAM data set. For more information, see the IBM documentation for your operating environment.

**JFCB=*variable***
defines a character variable (minimum length 176) that SAS sets to the Job File Control Block (JFCB). For more information, see the IBM documentation for your operating environment.

**UCBNAME=*variable***
defines a character variable (minimum length 3) that SAS sets to the unit name (device address), which is derived from information in the unit control block (UCB).

**VOLUME=*variable* | VOLUMES=*variable***
defines a character variable (with a minimum length of six characters) that SAS sets to the tape VOLSER or the disk volume serial number. In the case of a multivolume file, the VOLUME= variable contains the concatenated volume serial numbers up to the length of the variable or the first 30 volumes, whichever is less. The value in the VOLUME= variable contains the volume serial number of the first data set in the concatenation when the file is opened. This serial number changes if you open a subsequent data set in the concatenation.

## VSAM Options for the FILE and INFILE Statements under z/OS

You can use the following options for VSAM files in the FILE statement and in the INFILE statement. (Unless otherwise indicated, the option can be used in both.)

**BACKWARD | BKWD**
causes SAS to read the VSAM data set backward (INFILE only).

**BUFND=*value***
indicates how many data buffers to use for the VSAM data set.

**BUFNI=*value***
indicates how many index buffers to use for the VSAM data set.

**CONTROLINTERVAL | CTLINTV | CNV**
indicates that you want to read physical VSAM control interval records rather than logical records. This option is typically used for diagnostic purposes (INFILE only).

**ERASE=*variable***
defines a numeric SAS variable that you must set to 1 when you want to erase a VSAM record (INFILE only).

**FEEDBACK=*variable* | FDBK=*variable***
defines a numeric variable that SAS sets to the VSAM logical error code. This option is similar to the _FDBK_ automatic variable. When SAS sets the FEEDBACK variable, you must reset it to 0 in order to continue.

**GENKEY**
causes SAS to use the KEY= variable as the leading portion of a record's key. VSAM retrieves the first record whose key matches the generic key (INFILE only).

**KEY=*variable* | KEY=*(variable1 variable2 . . . )***
indicates that direct keyed access is being used to read records either from a KSDS or from an ESDS via an alternate index. Also, the variable contains the key value to be used in the retrieval of a record (input) or the writing of a record (output) (INFILE ONLY).

**KEYGE**
is used in conjunction with the KEY= option. KEYGE indicates that when KEY= is used in a retrieval request, SAS retrieves any record whose key is equal to or greater than the specified key. This option is useful when the exact key is not known (INFILE only).

**KEYLEN=*variable***
specifies a numeric SAS variable that, when used with GENKEY, specifies the length of the key that is to be compared to the keys in the file.

**KEYPOS=*variable***
indicates the numeric variable that SAS sets to the position of the VSAM key field. This option enables you to read keys without knowing the key position in advance. This variable is set to the column number (starting from 1).

**NORLS | NRLS**
specifies not to use record-level sharing (RLS) to open an RLS-eligible data set (INFILE only).

**Note:** This argument overrides the VSAMRLS system option.

**PASSWD=*value***
gives the appropriate password for a VSAM data set that has password protection.

**RBA=*variable***
specifies a numeric variable that you set to the relative byte address (RBA) of the data record that you want to read. The RBA= option indicates that

addressed direct access is being used; it is appropriate for KSDS and ESDS. If you specify the CONTROLINTERVAL option, you can use the RBA= option to access control records in an RRDS (INFILE only). This variable is set to zero when a path is defined over an alternate index.

**RC4STOP**
stops the DATA step from executing if a return code greater than 4 is returned by the operating environment when the VSAM data set is opened.

**RECORDS=*variable***
defines a numeric variable that SAS sets to the number of logical records in a VSAM data set that has been opened for input.

**RECORG=*record-organization***
specifies the organization of records in a new VSAM data set. Use this option only if SMS is active. Valid values are

KS specifies a VSAM key-sequenced data set.

ES specifies a VSAM entry-sequenced data set.

RR specifies a VSAM relative-record data set.

LS specifies a VSAM linear-space data set.

**RESET**
indicates that the VSAM file is reset to empty (no records) when it is opened. This option applies only to loading a VSAM data set that has been marked REUSE. You cannot use this option if the data set contains an alternate index.

**RLS**
specifies that this data set should be opened in RLS mode. If the data set is not RLS-eligible, the specification is ignored.

Note Overrides the NOVSAMRLS system option.

**RLSREAD=NRI | CR | CRE**
specifies the Read integrity level to be applied to this RLS data set.

Restriction Valid only for the INFILE statement.

Note Overrides any specification made with a DD statement or TSO ALLOC command.

**RRN=*variable***
defines a numeric variable that you set to the relative record number (RRN) of the record that you want to read or write. This option indicates that keyed direct access is being used; it is appropriate for RRDS only.

**SEQUENTIAL**
specifies sequential VSAM record retrieval when either the RBA= (for an ESDS) or the RRN= option (for an RRDS) is specified (INFILE only).

**SKIP**
indicates skip-sequential processing of VSAM files. Skip-sequential processing finds the first record whose value is the same as the value specified by the KEY= option; records are read sequentially thereafter (INFILE only).

**UPDATE=*variable***
defines a numeric SAS variable that indicates that not every record that it reads is to be updated. Use this option when you are updating records in a VSAM data set (INFILE only). When an INFILE statement and a FILE statement reference the same VSAM data set, records are retrieved for update by default.

In most cases when you retrieve a record for update, no user, including you, can access that particular record or any other records in the same control interval until you free the record by executing a PUT statement or an INPUT statement for the data set. The UPDATE= option avoids user lockout when only a few of many records read need to be updated. When you set the UPDATE= variable to a value of 1 before the INPUT statement, the record is retrieved for update. This value is the default if UPDATE= is not specified. If you set UPDATE=0 before the INPUT statement, the record is not retrieved for update.

**VSMDBUG=*nnnn***
indicates that a message should be written to the SAS log that indicates the filename, function requested, return code, and reason code after each VSAM system request (for example, GET, POINT, PUT) until the number specified by *nnnn* is exceeded.

Note The value of *nnnn* can be 1–9999.

## Host-Specific Options for UNIX System Services Files

The following table shows which host-specific options are recognized by the FILENAME, FILE, and INFILE statements for UNIX System Services files and pipes. No other options are recognized, including such options specific to z/OS as DISP, CLOSE, and DCB. Descriptions of the options follow the table.

***Table 30.1*** *Host-Specific Options for UNIX System Services Files and Pipes*

| Option | FILENAME | FILE | INFILE | %INCLUDE |
|---|---|---|---|---|
| BLKSIZE= | X | X | X | X |
| BOM | X | X | | |
| BOMFILE | X | X | | |
| FILEDATA= | X | X | X | |
| LRECL= | X | X | X | X |
| MOD | X | X | | |
| NOBOM | X | X | | |
| NOBOMFILE | X | X | | |
| OLD | X | X | | |
| RECFM= | X | X | X | X |

| Option | FILENAME | FILE | INFILE | %INCLUDE |
|---|---|---|---|---|
| TERMSTR= | X | X | X | |

**BLKSIZE=**
specifies the number of bytes that are physically read or written in an I/O operation. The default is 8K. The maximum is 1M.

**BOMFILE**
includes a Byte-Order Mark when a UNICODE-encoded file is created.

Alias BOM

**FILEDATA=BINARY | TEXT**
The FILEDATA= option specifies that the file being processed is expected to contain one of the following:

BINARY data without record separator character sequences.

TEXT data with records terminated by the EBCDIC newline character. The EBCDIC newline character is defined at code point **`x'15'`** and is typically represented as **`NL`** or **`\n`**.

**Note:** The FILEDATA= option is meant to be similar to the FILEDATA= parameter on the DD JCL statement, but is evaluated at run time by SAS. The JCL parameter is used by z/OS to set an attribute of the file when the file is created by the JCL

**LRECL=*value***
specifies the maximum number of characters in a line (unless the file has been opened with RECFM=N). The default is 255. Lines longer than *value* are truncated. *value* must be between 1 and 16,777,215, inclusive.

**MOD**
appends the output lines to the file. This option has no effect on a pipe.

**NOBOMFILE**
specifies that a Byte-Order Mark is not included when a UNICODE-encoded file is created.

Alias NOBOM

**OLD**
replaces the previous contents of the file. This option is the default. It has no effect on a pipe.

**RECFM=*record-format***
specifies the record format of the file. Valid values are

F specifies that all lines in the file have the length that is specified in the LRECL= option. In output files, lines that are shorter than the LRECL= value are padded on the right with blanks.

V | D specifies that the lines in the file are of variable length, ranging from one character to the number of characters specified by LRECL=. This option is the default.

P specifies that the file has variable-length records and is in print format.

N specifies that the file is in binary format. The file is treated as a byte stream. That is, line boundaries are not recognized.

**TERMSTR=NONE | NL | CR | LF | CRLF | LFCR | CRNL**

The TERMSTR= option specifies the type of record separator character sequences to use to terminate records in the file. TERMSTR= accepts the following parameters:

NONE Record terminators are not used. This parameter provides the same function as FILEDATA=BINARY.

NL The newline character (**`x'15'`**) is used as the record terminator. This parameter provides the same function as FILEDATA=TEXT.

CR The carriage return character (**`x'0D'`**) is used as the record terminator.

LF The line feed character (**`x'25'`**) is used as the record terminator.

CRLF The sequence CR followed by LF is used as the record terminator.

LFCR The sequence LF followed by CR is used as the record terminator.

CRNL The sequence CR followed by NL is used as the record terminator.

All of the previous specifications (x'15', x'0D', and x'25') assume that the files use an ENCODING= value whose short (12 byte) name is in the form **`open_ed-`***nnnn* and whose long (32 byte) name contains **`(OpenEdition)`** (for example, **`open_ed-1047`** or **`Western(OpenEdition)`**). These characters are automatically transcoded to or from the file's encoding if they are required by the ENCODING= or LOCALE= options.

The last occurrence of FILEDATA= or TERMSTR= takes precedence. Specification of one or the other of these options on a FILE or INFILE statement takes precedence over the specification in a related FILENAME statement. The full precedence order is as follows:

1. Specification of FILEDATA= or TERMSTR= on a FILE or INFILE statement.
2. Specification of FILEDATA= or TERMSTR= in a FILENAME statement.
3. Specification of FILEDATA= on a DD JCL statement when the file was created by that DD statement
4. Implied by the RECFM= option in effect for the file.

The RECFM= option in the FILENAME, FILE, and INFILE statement can imply the value assumed for the termination sequence. This implication is always overridden by the presence of a TERMSTR= or FILEDATA= option for the file. Here are the default values:

RECFM=V|D TERMSTR=NL is implied. (This option is the default.)

| | |
|---|---|
| RECFM=F | TERMSTR=NONE is implied. |
| RECFM=P | TERMSTR=NL implied, along with other formatting control characters. |
| RECFM=N | TERMSTR=NONE is implied. |

**Note:** The FILEDATA= parameter on the DD JCL statement is used only by z/OS when the file is being created by that JCL statement. For existing files, the FILEDATA= parameter is ignored by z/OS, and SAS is informed of its value at file creation time. Therefore, SAS cannot detect a change in the JCL. However, SAS honors the values of FILEDATA= or TERMSTR= that are specified in the FILENAME, INFILE, or FILE statements when you replace an existing file or read a file.

**CAUTION**

**The combination of RECFM= and TERMSTR= provides much flexibility for reading and writing many different file formats. It is possible to use these options in a way that can produce a file that might be difficult to process in the future. For example, a PRINT file can be created without record terminators, but this file would look strange when printed on a printer or viewed in an editor.**

For more information about these options, see "Writing to External Files" on page 110 and "Using the FILE Statement to Specify Data Set Attributes" on page 115.

## See Also

*SAS VSAM Processing for z/OS*

# FILENAME Statement: z/OS

Associates a SAS fileref with an external file.

| | |
|---|---|
| Valid in: | Anywhere |
| Restriction: | When a SAS server is in a locked-down state, access to a permanent z/OS data set or UFS file is limited to entries that are found in a lockdown list that is maintained by the server administrator. For more information, see Chapter 10, "SAS Processing Restrictions for Servers in a Locked-Down State," on page 219. |
| z/OS specifics: | *fileref, device-type, physical-filename, host-options* |
| Tip: | For information about the length limit of a fileref, see "SAS Name Literals" in *SAS Programmer's Guide: Essentials*. |
| See: | "FILENAME Statement" in *SAS Global Statements: Reference* |

# Syntax

**FILENAME** *fileref* <*device-type*> *'physical-filename'* <PERMISSION='*permission-value*'>
<*host-options*>;

**FILENAME** *fileref* <*device-type*> (*'physical–filename–1'* *'physical-filename-2'* ...)
<*host-options*>;

**FILENAME** *fileref* | _ALL_ CLEAR;

**FILENAME** *fileref* | _ALL_ LIST;

## Required Arguments

***fileref***
is a symbolic name for an external file. The fileref can consist of up to eight letters, numbers, national characters ($, @, #), and underscores (_). The first character must be either a letter, a national character, or an underscore.

***'physical-filename'* or (*'physical-filename-1'*... *'physical-filename-n'*)**
identifies an external file or a concatenation of external files. Enclose *physical-filename* in quotation marks. In a concatenation, enclose the entire group of concatenated file specifications in parentheses.

The physical file can be in one of the following formats:

- a sequential data set
- a member of a partitioned data set (PDS)
- a member of an extended partitioned data set (PDSE)
- a file in UNIX System Services (USS).

For information about files in USS directories, see "Accessing a Particular File in a UNIX System Services Directory" on page 135. *'physical-filename'* can be specified as

- a fully qualified data set name. For example:

```
'myid.raw.datax'
```

- a fully qualified data set name with a member in parentheses. For example:

```
'sas.raw.data(mem1)'
```

- a partially qualified data set name with a period preceding it. For example:

```
'.raw.data'
```

- a partially qualified data set name with a period preceding it and a member name in parentheses. For example:

```
'.raw.data(mem1)'
```

- for PDS members, a fully or partially qualified data set name with a wildcard name in parentheses. For example:

```
'.raw.data(mem*)'
```

```
'.raw.data(*mem1)'
```

```
'.raw.data(*)'
```

- a temporary data set name. For example:

```
'&mytemp'
```

- a UNIX System Services file. For example:

```
'/u/userid/raw'
```

or

```
'HFS:raw'
```

or

```
'/u/userid/test/data/*'
```

**Note:** The * wildcard character indicates a concatenation of UNIX System Services files. For more information about the use of the wildcard, see "Concatenating UNIX System Services Pathnames" on page 132.

SAS on z/OS does not support specifying physical files that have a member type of AUDIT. Specifying physical filenames such as the following returns an error:

- `filename mylib data='./saslib/memb01.sas7baud';`
- `filename mylib data='/u/user01/mylib/inventory.sas7baud'`

The value of the FILEEXT= system option can affect how SAS interprets physical file specifications for PDS and PDSE files. For more information, see "FILEEXT= System Option: z/OS" on page 746.

The value of the FILESYSTEM= system option can also affect how SAS interprets filenames. For more information, see "FILESYSTEM= System Option: z/OS" on page 761.

For more information about partially qualified data set names, see Chapter 5, "Specifying Physical Files," on page 89. For information about encodings for z/OS resources such as data set names and UFS paths, see "PEEKLONG Function: z/OS" on page 492.

**_ALL_**
specifies to clear or list all currently allocated filerefs.

**CLEAR**
specifies to deallocate the specified fileref, or to deallocate all currently allocated filerefs.

**LIST**
specifies to list the fileref name and physical name, or to list information about all currently allocated filerefs.

## Optional Arguments

**PERMISSION='*permission-value*'**
specifies permissions to set for the specified fileref. To specify more than one set of permission values, separate them with a comma within quotation marks.

**Note:** The PERMISSION option applies only to UFS files.

Provide the *permission-value* in the following format:

`A::<trustee_type>::<permissions>`

The 'A' indicates that these are access permissions. No other values are currently supported.

The trustee_type can take the following values:

u user

g group (group owner of the file)

o other (all other users)

The permission value takes the letters *r* (Read), *w* (Write), and *x* (Execute), in that order. If you do not want to grant one of these permissions, enter a '-' in its place (for example, *r-x* or *rw-*).

Suppose that you want to have Read, Write, and Execute permission for a fileref. You also want to specify Read and Execute permission for the group owner of the file. Finally, you want to allow all other users to have only Read permission for the file. You can specify these options as follows:

```
permission='A::u::rwx,A::g::r-x,A::o::r--'
```

Supply a permission value for all three trustee types. Any trustee type that you omit from the list of permission values is denied all access to the specified fileref. For example, suppose you used the following permission values:

```
permission='A::u::rwx,A::g::r-x'
```

In this case, only the owner and the group owner have access to the specified file. Any user other than the owner or group owner is denied all access to the file.

***device-type***
specifies a device type for the file.

You can specify *device-type* between the fileref and the file specification in the FILENAME statement. If you do not specify a device type value for a new file, SAS uses the current value of the SAS system option FILEDEV=.

*device type* can be one of the following:

**ACTIVEMQ**
specifies an access method that enables you to access an ActiveMQ messaging broker. For more information, see *Application Messaging with SAS*.

Interaction If the DATA step does not recognize the access method option, the DATA step passes the option to the access method for handling.

**CATALOG**
references a SAS catalog as a flat file. The external file is a valid two-, three-, or four- part SAS catalog name followed by any catalog options needed. See *SAS DATA Step Statements: Reference* for a description of catalog options.

**DATAURL**
specifies the access method that enables you to read data from the *data-url-spec*.

**DISK**
sends the input or output to a disk drive.

**DUMMY**
specifies a null input or output device. This value is especially useful in testing situations. Any output that would normally be sent to the external file is discarded.

**EMAIL**
enables you to send electronic mail programmatically from SAS.

**FTP**
reads or writes to a file from any machine on a network that is running an FTP server. The external file is the pathname of the external file on the remote machine followed by FTP options. Only one member of a z/OS PDS can be written to at a time. If you need to write to multiple members at the same time, a z/OS PDSE or a UNIX System Services directory should be used. For more information about using FTP with the FILENAME statement, see "Assigning Filerefs to Files on Other Systems (FTP and SOCKET Access Types)" on page 99.

**HFS**
specifies a UNIX System Services file.

**JMS**
specifies a Java Message Service (JMS) destination.

**MVS**
specifies an MVS data set.

**NOMVSTRANS**
suppresses the EBCDIC to ASCII translation that is internal to the Socket access method.

Restriction The NOMVSTRANS option is supported only for the SBCS (Single-Byte Character Set) version of SAS.

**PIPE**
specifies that SAS open a UNIX System Services pipeline for execution of UNIX System Services commands that are issued within the statement.

**PLOTTER**
sends the output to the default system plotter.

**PRINTER**
sends the output to the default system printer.

**SOCKET**
reads and writes information over a TCP/IP socket. The external file depends on whether the SAS application is a server application or a client application. In a client application, the external file is the name or IP address of the host and the TCP/IP port number to connect to, followed by any TCP/IP options. In server applications, it is the port number to create for listening, followed

by the SERVER keyword, and then any TCP/IP options. For more information, see "FILENAME Statement: SOCKET Access Method" in *SAS Global Statements: Reference* in the *SAS DATA Step Statements: Reference*.

The maximum number of directory or PDS members that you can have open at the same time is limited by the number of sockets that your FTP server can have open at one time. This limitation is restricted by the maximum number of connections created when the FTP server is installed.

You might want to limit the number of sockets that you have open at the same time to prevent potential degradation of your system's performance. The number of sockets that are open at the same time is proportional to the number of directory or PDS members open at the same time. When the job that you are running opens the maximum number of sockets that can be open at the same time, the results of the job can become unpredictable.

**TAPE**
sends the input or output to a tape drive.

**TEMP**
allocates a temporary data set. For more information, see "FILETEMPDIR System Option: z/OS" on page 762.

**TERMINAL**
reads the input from your terminal, or sends the output to your terminal.

**UPRINTER**
associates the fileref with the Universal Printing device. Any output generated to a fileref that is defined for this device type is formatted and sent to the default device that has been set up interactively through the Printer Setup dialog box. By default on z/OS, output is sent to a data set called <*prefix*>.sasprt.ps, where <*prefix*> is the value of the SYSPREF= system option. For more information about Universal Printing, see Chapter 9, "Universal Printing," on page 185 and .

**URL**
enables you to access remote files using the URL of the file. The external file is the name of the file that you want to read from or write to on a URL server. The URL must be in one of the following forms:

```
http://hostname/file
http://hostname:portno/file
```

For more information, see *SAS DATA Step Statements: Reference*.

**WebDAV**
specifies the access method that enables you to use WebDAV (Web Distributed Authoring and Versioning) to read from or write to a file from any host machine that you can connect to on a network with a WebDAV server running.

**ZIP**
specifies the access method that enables you to use ZIP files.

**Note:** The ZIP access method supports only UFS files.

***host-options***
are host-specific options that can be specified in the FILENAME statement. These options can be categorized into several groups. For details, see the following sections:

- "Standard File Options for the FILENAME Statement" on page 622
- "DCB Attribute Options" on page 628
- "SYSOUT Data Set Options for the FILENAME Statement" on page 634
- "Subsystem Options for the FILENAME Statement" on page 636
- "Options That Specify SMS Keywords" on page 632
- "Host-Specific Options for UNIX System Services Files" on page 613

You can specify these options in any order following '*physical-filename*'. When specifying more than one option, use a blank space to separate each option. Values for options can be specified with or without quotation marks. However, if a value contains one of the supported national characters ($, #, or @), the quotation marks are required.

**_ALL_**
specifies to clear or list all currently allocated filerefs.

**CLEAR**
specifies to deallocate the specified fileref, or to deallocate all currently allocated filerefs.

**LIST**
specifies to list the fileref name and physical name, or to list information about all currently allocated filerefs.

# Details

## Standard File Options for the FILENAME Statement

Standard file options provide information about a data set's disposition and physical attributes. The following standard options can be used with all external files under z/OS except for files that are in the Hierarchical File System of UNIX System Services. For more information, see "Host-Specific Options for UNIX System Services Files" on page 613.

**AVGREC=*multiplier***
AVGREC can be used only when the unit of space subparameter of the SPACE option is a number, which indicates an average record length. The multiplier value modifies the interpretation of the primary and secondary space subparameters of the SPACE option. The multiplier value can be any of the following:

U specifies that the primary and secondary space subparameters are to be interpreted as requests for sufficient space to contain the number of records that are to be allocated. The value specified with the unit of

the space subparameter of the SPACE option is also interpreted as the length of the records.

K specifies that the primary and secondary space subparameters are to be interpreted as a number of records multiplies by 1024. The value that is specified with the unit of the space subparameter of the SPACE option is also interpreted as the average length of the records.

M specifies that the primary and secondary space subparameters are to be interpreted as a number of records multiplied by 1024 times 1024 (1048576). The value that is specified with the unit of the space subparameter of the SPACE option is also interpreted as the average length of the records.

The following example specifies the AVGREC option with a value of K for file `avgrec`.

```
filename avgrec 'USERID.AVGREC.FILE' DISP=(NEW,CATLG,DELETE)
    SPACE=(800,(1,1)) AVGREC=K recfm=fb lrecl=80 blksize=27920;
```

**DISP=*status* | (*status*,<*normal-termination-disp*>,<*abnormal-termination-disp*>)**
specifies the status of the physical file at the beginning and ending of a job, as well as what to do if the job step terminates abnormally. If you specify only *status*, you can omit the parentheses.

***status***
specifies the status of the data set at the beginning of a job. Valid values are:

NEW creates a new data set.

OLD does not share the existing data set.

SHR shares the existing data set.

MOD if the data set exists, adds new records to the end. If the data set does not exist, it creates a new data set. MOD cannot be specified for a partitioned data set.

REP for non-PDS members, implies DISP=OLD if the data set exists and is cataloged. Otherwise, it implies DISP=NEW. For PDS members, it implies DISP=SHR if the PDS is cataloged. Otherwise, it implies DISP=NEW.

The default is SHR.

**Note:**

- You can also supply any of these values for status as a separate, individual keyword in the FILENAME statement rather than as a subparameter of the DISP= option.
- DISP=REP is ignored if a volume is specified in the FILENAME statement.

***normal-termination-disp***
specifies what to do with the data set when the fileref is cleared or when the job step that was using the data set terminates normally. Valid values are:

DELETE deletes the data set at the end of the step.

KEEP keeps the data set.

CATLG places the entry in the system catalog or user catalog.

UNCATLG deletes the entry from the system catalog or user catalog.

For a new data set, the default is CATLG. For an existing data set, the default is KEEP.

***abnormal-termination-disp***

specifies what to do if the job step terminates abnormally. The default is to take the action that is specified or implied by *normal-termination-disp*. Valid values are:

DELETE deletes the data set at the end of a job step.

KEEP keeps the data set.

CATLG places the entry in the system catalog or user catalog.

UNCATLG deletes the entry from the system catalog or user catalog.

**Note:** The conditional disposition for libraries and files is not honored for any abend that SAS or TSO (in the TSO environment) handles. It is not honored even if you specify the ERRORABEND option or the ABORT ABEND statement.

Here are some examples of the DISP parameter:

```
DISP=SHR
DISP=REP
DISP=(NEW,CATLG)
DISP=(OLD,UNCATLG,DELETE)
```

**EATTR=OPT | NO**

Specifies whether a sequential data set can have extended attribute DSCBs and can reside in extended addressing space (EAS). EATTR accepts the following values:

OPT specifies that the data set has extended attributes if it is created on an EAV.

NO specifies that the sequential data set cannot reside in EAS.

If the EATTR option is not specified, then the default value for the option can be supplied by the SMS data class that is specified or that is selected for the allocation. Otherwise, the default is NO.

**ENCODING=*encoding-value***

specifies the encoding to use when writing to an output file or reading from an input file. Typically, you would specify a value for ENCODING= that indicates that the file has a different encoding from the current session encoding. However, you can also specify the same encoding for the file as the encoding of the current session. You must enclose the value in quotation marks if it contains a hyphen.

If you specify an encoding value different from the session encoding, SAS performs the transcoding as the records are read. The default encoding is the session encoding, which is the value of the ENCODING= SAS system option.

**Note:** ENCODING is not supported for the PIPE, PRINTER, and UPRINTER access methods.

For valid encoding values, see "Overview to SAS Language Elements That Use Encoding Values" in *SAS National Language Support (NLS): Reference Guide* and "SBCS, DBCS, and Unicode Encoding Values for Transcoding Data" in *SAS National Language Support (NLS): Reference Guide*.

**SPACE=(*unit*,(*primary*,*secondary*,*directory*),RLSE,*type*,ROUND)**
is the amount of disk space to be provided for a data set that is being created.

***unit***
can be any of the following:

| | |
|---|---|
| TRK | allocates the space in tracks. |
| CYL | allocates the space in cylinders. |
| *blklen* | allocates space in blocks whose block length is *blklen* bytes. The system computes how many tracks are allocated. |

***primary***
specifies how many tracks, cylinders, or blocks to allocate.

***secondary***
specifies how many additional tracks, cylinders, or blocks to allocate if more space is needed. The system does not allocate additional space until it is needed.

***directory***
specifies how many 256-byte directory blocks are needed for the directory of a partitioned data set.

**RLSE**
causes unused space that was allocated to an output data set to be released when the data set is closed. Unused space is released only if the data set is opened for output and if the last operation was a Write operation.

***type***
can be any of the following:

| | |
|---|---|
| CONTIG | specifies to use contiguous space. |
| MXIG | specifies to use the maximum contiguous space. |
| ALX | specifies to use different areas of contiguous space. |

**Note:** You can also specify MXIG or ALX as a separate, individual keyword in the FILENAME statement rather than as a subparameter of the SPACE= option.

ROUND
specifies that the allocated space must be equal to an integral number of cylinders when the specified *unit* was a block length. If *unit* was specified as TRK or CYL, the system ignores ROUND.

Here are some examples of the SPACE parameter:

```
SPACE=(CYL,10)
   or SPACE=(CYL,(10,,10),,CONTIG)
SPACE=(1024,(100,50,20),RLSE,MXIG,ROUND)
```

If you do not specify SPACE, its values are taken from the SAS system options FILEUNIT=, FILESPPRI=, FILESPSEC=, and FILEDIRBLK=, in the following form:

```
SPACE=(FILEUNIT,(FILESPPRI, FILESPSEC,FILEDIRBLK))
```

The default specification is SPACE=(CYL,(1,1,6)) for partitioned data sets and SPACE=(CYL,(1,1)) for sequential data sets.

See *MVS JCL Reference* by IBM for complete information about how to use the SPACE= option.

**VOLSER=*value* | VOL=*value* | VOL=(*value-1, ..., value-n*)**
specifies the disk or tape volume serial number or numbers. Up to 30 volume serial numbers can be specified.

If you do not specify VOLSER=, its value is taken from the SAS system option FILEVOL=.

**VOLCOUNT=*nnn***
Where *nnn* is the maximum number of volumes that an output data set requires. The volume count is a decimal number from 1 through 200.

**VOLSEQ=*nnn***
Where *nnn* identifies which volume of an existing multivolume data set is to be used to begin processing the data set. The volume sequence number is a decimal number from 1 to 200.

**UNIT=*value* | UNIT=(*value,n*)**
specifies one of several devices. The *value* parameter must be enclosed in quotation marks if the unit name contains characters other than alphanumeric characters. The *n* parameter is a number from 1 to 59 that specifies the number of devices to be allocated for the data set. If `n` is the letter “p” or “P”, then all volumes for the data set are mounted in parallel.

If you specify a device type with UNIT=, the value overrides any device type specified in the FILENAME statement with the *device-type* option. Some valid values follow, but not all values are available at all sites. Ask your system administrator whether additional values are defined at your site.

- DISK
- DUMMY
- PLOTTER
- PRINTER
- SYSDA
- SYSALLDA

- TAPE
- TERMINAL

The default for UNIT= is the value of the FILEDEV= SAS system option.

A list of specific volume serial numbers in the FILENAME statement might result in the allocation of more devices to the data set than the number that is specified by *n*.

**LABEL=(*subparameter-list*)**
specifies the type and contents of the label of either a tape data set or a disk data set. It also specifies other information such as the retention period or expiration date for the data set. It is identical to the JCL LABEL= parameter. Here is a simple example:

```
label=(3,SL,,,EXPDT=2005/123)
```

This label specification indicates that the data set sequence number is 3, that it uses standard labels, and that it expires on the 123rd day of 2005. See the IBM *MVS JCL Reference* for complete information about how to use the LABEL= option, including which subparameters you can specify in *subparameter-list*.

**LOCKINTERNAL=**

AUTO
specifies the SAS system locking that is to be used for the file or files that are identified by a FILENAME statement. AUTO does not allow two applications within the same SAS session to have simultaneous Read and Write access to a file. If an application has Write access to a file, no other applications can have Read or Write access to it. If an application has Read access to a file, no other application can have Write access to it. Multiple applications can have simultaneous Read access to a file.

SHARED
specifies the SAS system locking that is to be used for the file or files that are identified by a FILENAME statement. SHARED does not allow two applications within the same SAS session to have simultaneous Write access to a file. SHARED allows one writer and multiple readers to have simultaneous access to a file.

**NOMOUNT**
specifies that the mount message is not issued for a volume that is not already online. The default action is to issue the mount message.

**NOPROMPT**
specifies that if the file that you reference in the FILENAME statement is unavailable, a dialog box is not displayed, and an error message is written to the SAS log.

**REUSE**
specifies that dynamic allocation reuse an existing allocation, if possible, to fulfill a new allocation request. By default, SAS requests that dynamic allocation create a unique allocation for this request. For more information about reusing an existing allocation, see the IBM document *z/OS Programming: Authorized Assembler Services*.

**WAIT=*n***
controls how many minutes SAS waits if the file that you reference in the FILENAME statement is unavailable. SAS tries to reacquire the reserved data set every 15 seconds. The value *n* specifies a length of time in minutes.

**Note:** This parameter only applies to native z/OS files and cannot be used with HFS/ZFS files.

## DCB Attribute Options

## DCB Option Descriptions

The following DCB options can be used in the FILENAME statement for all types of external files under z/OS. They cannot be used for files that are stored in the directory structure of UNIX System Services. For information about options that are available for UNIX System Services files, see "Host-Specific Options for UNIX System Services Files" on page 613. These options correspond to the DCB parameters that you would specify in a JCL DD statement. For additional information about DCB characteristics, see "Overview of DCB Attributes" on page 630.

**BLKSIZE=*value***
specifies the number of bytes in a block of records. A block is a group of records that SAS and the operating environment move as a unit when they read or write an external file. The term also refers to the space allocated for each group of records. You seldom need to calculate block size when you write an external file because SAS automatically selects the block size.

The values of the FILEBLKSIZE(*device-type*)= system option contain, for each model of disk that is currently available, the best block size for your installation for external, nonprint data sets on that type of disk. Some installations might provide different FILEBLKSIZE default values for batch processing than they do for interactive processing. Therefore, to see the values for the FILEBLKSIZE(*device-type*)= option, run the OPTIONS procedure both in a batch job and in a SAS session under TSO.

For print data sets, which by default have variable-length records, SAS uses a default block size of 264, with one record per block.

You can use the OPT value of the FILEBLKSIZE(*device-type*)= option to calculate the optimal block size for nonprint files (see "FILEBLKSIZE(device-type)= System Option: z/OS" on page 741). Or you can calculate the block size yourself:

- For fixed-length records, multiply the LRECL= value by the number of records that you want to put into the block.
- For variable-length records, multiply the LRECL= value by the number of records per block and add 4 bytes.

In each case, if you are writing the data set to disk, compare the block size to the track size for the disk. A block cannot be longer than one track of the disk device on which it is stored, and the operating environment does not split a block between tracks. Make sure that the block size does not leave a large

portion of the track unused. (If you are not sure, consult your computing center staff.) For information about determining the optimal block size for your data, see "Optimizing SAS I/O" on page 905.

The following maximum block sizes are supported:

- 262,144 bytes for 3590 tapes
- 65,535 bytes for 3480 and 3490e tapes
- 32,760 bytes for direct access devices

**BUFNO=*value***
specifies how many memory buffers to allocate for reading and writing. If you specify BUFNO= on a FILE or INFILE statement, it takes precedence over specifying it in a FILENAME statement. If you omit BUFNO= from the FILE or INFILE statement, then specifying it in the FILENAME statement takes precedence. If you do not specify BUFNO= in a FILE statement, INFILE statement, or FILENAME statement, SAS uses the value of the FILEBUFNO= system option. For information about using BUFNO or the FILEBUFNO system option, see "FILEBUFNO= System Option: z/OS" on page 742.

**DSORG=*organization***
can be any of the following:

DA specifies direct access.

PO specifies PDS, PDSE.

PS specifies sequential.

The following values for organization refer to physical files that contain location-dependent information: DAU, POU, PSU.

You do not need to include the DSORG= value when you create an external file of type PS or PO because the operating environment identifies a partitioned data set by the presence of a directory allocation in the SPACE= parameter. When you use a FILE statement to write data, SAS identifies a PDS or PDSE by the presence of a member name in the FILE statement. If no member name is present, SAS assumes that the data set is sequential.

**LRECL=*value***
specifies the logical record length (that is, the number of bytes in a record). SAS defaults to the size that is needed (for either print or nonprint files) when a file is opened.

Logical record length is affected by the record format. See RECFM=. When the record format is fixed (indicated by an F as part of the RECFM= value), all records have the same length, and that length is the value of the LRECL= value.

When the record format is variable (indicated by a V as part of the RECFM= value), records can have different lengths, and each record contains 4 bytes of length information in addition to its other data. Therefore, you must specify an LRECL= value that is 4 bytes longer than the longest record that you expect to write. If you do not know the length of the longest record to be put into a variable-format data set, choose a maximum value and add 4 to it to create an LRECL= value.

**OPTCD=*value***
specifies the optional services to be performed by the operating environment. For example, specifying W requests a validity check for Write operations on direct-access devices. For more information, see the appropriate IBM MVS JCL manual for your system.

Valid values are R, J, T, Z, A, Q, F, H, O, C, E, B, U, and W. You can specify more than one code by listing them with no blanks or commas between them (as with RECFM). A maximum of four characters is allowed.

**RECFM=*record-format***
specifies the record format of the file. Valid values are

F specifies fixed-length records, unblocked.

V specifies variable-length records, unblocked.

FB specifies fixed-length records, blocked.

VB specifies variable-length records, blocked.

U specifies undefined-length records, unblocked.

The following values can be appended to the RECFM= values:

A specifies that the first byte of each record is an ANSI printer-control character.

M specifies that the file is a machine control character file. SAS does not interpret machine-code control characters, nor does it create them in output files. See *MVS JCL Reference* by IBM for more information.

S specifies that the file contains spanned records (when appended to V), or that the file contains standard blocks (when appended to F).

The next format stands alone; no other values can be appended:

N indicates that the file is in binary format. The file is processed as a stream of bytes with no record boundaries, which includes the default value of LRECL. This record format is specific to SAS.

## Overview of DCB Attributes

DCB attributes and options are relevant to INFILE and FILE statements as well as to the FILENAME statement. This section provides some background information about DCB characteristics.

DCB attributes are those data set characteristics that describe the organization and format of the data set records. If you do not specify these attributes, SAS uses default values. This section discusses how and under what circumstances these attributes are changed or default values are used.

The discussion focuses on the RECFM, LRECL, and BLKSIZE file attributes. For more information, see the appropriate data administration guide for your system.

Values for these attributes are kept in each of the following operating environment control blocks:

Data Set Control Block (DSCB)
: is the description found in the VTOC of the disk device on which the physical file resides. They are the permanent characteristics of the data set. For tape devices, the data set label in the header of SL tapes contains this information.

Job File Control Block (JFCB)
: maps a physical file on a device to a logical name (ddname). Contains information from a JCL DD statement, TSO ALLOCATE command, SAS FILENAME statement, or SAS FILENAME function. These attributes are either temporary (for the duration of the allocation) or new (to be made permanent).

Data Control Block (DCB)
: describes the current state of an open data set. z/OS and its access methods (BSAM for SAS software) use the DCB to control how data is read or written. These attributes are temporary for input, but they become permanent for output.

For existing data sets, DCB attributes are almost never changed from the DSCB. These attributes can be overridden by a DD statement or TSO ALLOCATE command or by SAS FILENAME, FILE, or INFILE statement options. If a DCB option is specified in both places, the FILENAME, FILE, or INFILE option takes precedence.

When you open a data set, z/OS merges information from the DSCB (or data set label) and the JFCB to obtain the current DCB characteristics before entering the DCB open exit. SAS then merges its own information (FILENAME/FILE/INFILE statement options, data set device type, requested data set type, requested line size from LS=) and inspects the resulting DCB attributes. If the result is invalid for some reason, SAS terminates the Open operation and issues an appropriate message. Attributes can be considered invalid for any of the following reasons:

- For RECFM=V or VB, BLKSIZE is not at least 4 bytes greater than LRECL.
- For RECFM=F, LRECL equals neither 0 nor BLKSIZE.
- For RECFM=FB, BLKSIZE is not a multiple of LRECL.
- BLKSIZE or LRECL is greater than the z/OS maximum (32,760).
- LRECL is greater than BLKSIZE (except RECFM=VBS).
- RECFM is not consistent with the requested data set type.
- The requested data length cannot be contained in LRECL.

For any unspecified attributes, SAS uses default values that seem to fit existing attributes. For input files, the attributes are usually complete and consistent. For output files, it is best to specify the values for RECFM and LRECL. SAS fills in the value for BLKSIZE automatically based on the settings for the FILEBLKSIZE(device)= option.

If no permanent attributes are present (as is possible with a new data set), and if none are given by FILENAME/FILE/INFILE options, then SAS uses default values that are based on the device type and data set type.

The following table summarizes these default values:

*Table 30.2* Default Attribute Values

| Attribute | DISK | TAPE | PRINT/ SYSOUT | TERMINAL | DUMMY |
|---|---|---|---|---|---|
| RECFM | FB | FB | VBA | V | FB |
| LRECL | 80 | 80 | 260 | 261 | 80 |
| BLKSIZE | 1 | 2 | 264 | 265 | 1 |

1 The smaller of the SAS system option FILEBLKSIZE(*device-type*)= value and the output device maximum, rounded down to a multiple of the LRECL.

2 The smaller of the SAS system option FILEBLKSIZE(*device-type*)= value and 32,760, rounded down to a multiple of the LRECL.

If you specify a line size (LS=) parameter, SAS uses it to compute the LRECL and the BLKSIZE.

If you override permanent attributes on input, SAS uses the new values only for the duration of the INFILE processing; the permanent attributes of the data set are not changed. However, if you override the attributes on output, the new attributes become permanent for the data set, even if no records are physically written.

## Options That Specify SMS Keywords

Several options that specify SMS (Storage Management Subsystem) keywords can be specified in the FILENAME or FILE statement when you create an external file. All of these options are ignored for existing data sets; they apply only when you are creating a data set. If you do not specify any of these options when you create an SMS data set, the system defaults are used. The default values are site-dependent; see your system administrator for details. For more information about SMS data sets, see *MVS JCL Reference* by IBM.

**DATACLAS=*data-class-name***
specifies the data class for an SMS-managed data set. The name can have up to eight characters. This option applies only to new data sets; it is ignored for existing data sets. The data class is predefined and controls the DCB attributes for a data set.

The implementation of the DATACLAS= option is compatible with the SMS DATACLAS= JCL parameter. For complete information about this parameter, see *MVS JCL Reference*. Ask your system administrator for the data-class names that are used at your site.

**Note:** If your specified value for DATACLAS begins with national characters such as @, #, or $, then you need to enclose the value in single quotation marks as indicated in the following example:

```
LIBNAME WEEK 'physical.dataset.name'
     DISP=(NEW,CATLG,DELETE) DATACLAS='#DCLAS' MGMTCLAS='#MGMT';
```

**DSNTYPE=BASIC | LARGE | EXTREQ | EXTPREF | LIBRARY | PDS | NONE**
specifies the type of name for the data set. The DSNTYPE values BASIC, LARGE, EXTREQ, and EXTPREF are valid for z/OS V1R7 systems and later.

| | |
|---|---|
| BASIC | specifies that the system selects the BASIC format if the data set is sequential (DSORG=PS or PSU), or if DSORG is omitted from all sources and the data set is not VSAM. The data set cannot exceed 65535 tracks per volume. |
| LARGE | specifies that the system selects the LARGE format if the data set is sequential (DSORG=PS or PSU), or if DSORG is omitted from all sources and the data set is not VSAM. The data set can exceed 65535 tracks per volume. |
| EXTREQ | specifies that the data set is in the EXTENDED format if the data set is VSAM, sequential, or if DSORG is omitted from all sources. The assignment fails if the system cannot allocate an extended format data set. |
| EXTPREF | specifies that you prefer that the data set is in the EXTENDED format if the data set is VSAM, sequential, or if DSORG is omitted from all sources. If extended format is not possible, the system selects the BASIC format. |
| LIBRARY | specifies that the data set is a PDSE (DSORG=PO). |
| PDS | specifies that the data set is a PDS (DSORG=PO). |
| NONE | specifies that the default DSNTYPE of the system should be used when a new sequential file is allocated. |

The FILESEQDSNTYPE system option provides a default value for creation of sequential files when no DSNTYPE parameter is specified. For more information about this option, see "FILESEQDSNTYPE System Option: z/OS" on page 756.

**LIKE=*data-set-name***
allocates an external file that has the same attributes as an existing file. See *MVS JCL Reference* for more information.

**MGMTCLAS=*management-class-name***
specifies a management class for an SMS data set. The name can have up to eight characters. This option applies only to new data sets; it is ignored for existing data sets. The management class is predefined and controls how your data set is managed, such as how often it is backed up and how it is migrated.

The implementation of the MGMTCLAS= option is compatible with the SMS MGMTCLAS= JCL parameter. For complete information about this parameter, see *MVS JCL Reference*. Ask your system administrator for the management class names that are used at your site.

**Note:** If your specified value for MGMTCLAS begins with national characters such as @, #, or $, then you need to enclose the value in single quotation marks as indicated in the following example:

```
LIBNAME WEEK 'physical.dataset.name'
     DISP=(NEW,CATLG,DELETE) DATACLAS='#DCLAS' MGMTCLAS='#MGMT';
```

**RECORG=*record-organization***
specifies the organization of records in a new VSAM data set. Use this option only if SMS is active. Valid values are

KS specifies a VSAM key-sequenced data set.

ES specifies a VSAM entry-sequenced data set.

RR specifies a VSAM relative-record data set.

LS specifies a VSAM linear-space data set.

**STORCLAS=*storage-class-name***
specifies a storage class for an SMS data set. The name can have up to eight characters. This option applies only to new data sets; it is ignored for existing data sets. The storage class is predefined and controls which device your SMS data set is stored on, such as disk or tape.

The implementation of the STORCLAS= option is compatible with the SMS STORCLAS= JCL parameter. For full details about this parameter, see *MVS JCL Reference*. See your system administrator for storage class names at your site.

**Note:** If your specified value for STORCLAS begins with national characters such as @, #, or $, then you need to enclose the value in single quotation marks as indicated in the following example:

```
LIBNAME WEEK 'physical.dataset.name'
     DISP=(NEW,CATLG,DELETE) DATACLAS='#DCLAS' STORCLAS='#SCLAS';
```

## SYSOUT Data Set Options for the FILENAME Statement

The following options apply to data sets that are sent to a system output device (usually a printer). The default value is usually the value that was specified by your site at installation. For more information about print data sets, see "Writing to Print Data Sets" on page 117, as well as your IBM JCL reference.

**ALIGN**
tells the operator to check the alignment of the printer forms before printing the data set.

**BURST**
tells the operator that the printed output goes to a burster-trimmer-stacker machine, to be burst into separate sheets.

**CHAR1=**
specifies a one- to four-character name for character-arrangement table #1 (used in conjunction with the 3800 Printing Subsystem).

**CHAR2=**
specifies a one- to four-character name for character-arrangement table #2 (used in conjunction with the 3800 Printing Subsystem).

**CHAR3=**
specifies a one- to four-character name for character-arrangement table #3 (used in conjunction with the 3800 Printing Subsystem).

**CHAR4=**
specifies a one- to four-character name for character-arrangement table #4 (used in conjunction with the 3800 Printing Subsystem).

**CLOSE**
tells the operating environment to deallocate the data set when the DCB is closed.

**COPIES=**
specifies how many copies of the SYSOUT data set to print. The default is COPIES=1.

**DEST=**
specifies a destination for the SYSOUT data set. If DEST= is not defined, its value is taken from the SAS system option FILEDEST=.

**FCB=**
specifies the forms control buffer image that JES uses to control the printing of the SYSOUT data set.

**FLASH=**
specifies the forms-overlay frame to use when printing on a 3800 Printing Subsystem.

**FLASHC=**
specifies the number of copies on which to print the forms overlay frame.

**FOLD**
specifies that the print chain or print train for the universal character set is loaded in fold mode.

**FORMDEF=**
identifies a member that contains statements that tell the Print Services Facility from IBM how to print the SYSOUT data set on a page-mode printer. This option has no effect on SAS forms.

**FORMS=**
specifies the IBM form number. If FORMS= is not defined, its value is taken from the FILEFORMS= system option. This option has no effect on SAS forms.

**HOLD**
tells the system to hold the SYSOUT data set when it is deallocated until it is released by the system operator.

**ID=**
specifies the user ID for the SYSOUT destination.

**MODIFY=**
specifies a copy-modification module that tells JES how to print the SYSOUT data set on a 3800 Printing Subsystem.

**MODIFYT=*n***
specifies which of the CHAR*n* tables to use. For example, if *n* is 1, then the character-arrangement table that is identified by the CHAR1= option is used.

**OUTDES=**
specifies the output descriptor.

**OUTLIM=**
specifies a limit for the number of logical records in the SYSOUT data set.

**PAGEDEF=**
identifies a member that contains statements that tell the Print Services Facility how to format the page on a page-mode printer.

**PGM=**
specifies the SYSOUT program name.

When a SAS server is in a locked-down state, access to SYSOUT programs is limited to entries that are found in a lockdown list that is maintained by the server administrator. For more information, see Chapter 10, "SAS Processing Restrictions for Servers in a Locked-Down State," on page 219.

**PRMODE=**
specifies which process mode is required for printing the SYSOUT data set.

**SYSOUT=**
specifies the output class for the SYSOUT data set. If SYSOUT is not defined, its value is taken from the SAS system option FILESYSOUT=.

**UCS=**
specifies the Universal Character Set.

**UCSVER**
tells the operator to visually verify that the character set image is for the correct print chain or print train. The character set image is displayed on the printer before the data set is printed.

**VERIFY**
tells the operator to verify that the image displayed on the printer is for the correct FCB image.

## Subsystem Options for the FILENAME Statement

The following subsystem data set options are also available. For more information about subsystem data sets, see the appropriate IBM MVS JCL manual for your site.

**SUBSYS=**
specifies the name of the subsystem (up to four characters).

**PARM1=**
specifies a subsystem parameter (up to 67 characters).

**PARM2=**
specifies a subsystem parameter (up to 67 characters).

**PARM3=**
specifies a subsystem parameter (up to 67 characters).

**PARM4=**
specifies a subsystem parameter (up to 67 characters).

**PARM5=**
specifies a subsystem parameter (up to 67 characters).

## Host-Specific Options for UNIX System Services Files

The following table shows which host-specific options are recognized by the FILENAME, FILE, and INFILE statements for UNIX System Services files and pipes. No other options are recognized, including such options specific to z/OS as DISP, CLOSE, and DCB. Descriptions of the options follow the table.

***Table 30.3*** *Host-Specific Options for UNIX System Services Files and Pipes*

| Option | FILENAME | FILE | INFILE | %INCLUDE |
|---|---|---|---|---|
| BLKSIZE= | X | X | X | X |
| BOM | X | X | | |
| BOMFILE | X | X | | |
| LRECL= | X | X | X | X |
| MOD | X | X | | |
| NOBOM | X | X | | |
| NOBOMFILE | X | X | | |
| OLD | X | X | | |
| RECFM= | X | X | X | X |
| TERMSTR= | X | X | X | |

**BLKSIZE=**
specifies the number of bytes that are physically read or written in an I/O operation. The default is 8K. The maximum is 16M-1 or 16,777,215.

**BOMFILE**
includes a Byte-Order Mark when a UNICODE-encoded file is created.

Alias BOM

**FILEDATA=BINARY | TEXT**
The FILEDATA= option specifies that the file being processed is expected to contain one of the following:

BINARY data without record separator character sequences.

TEXT data with records terminated by the EBCDIC newline character. The EBCDIC newline character is defined at code point **`x'15'`** and is typically represented as **`NL`** or **`\n`**.

**Note:** The FILEDATA= option is meant to be similar to the FILEDATA= parameter on the DD JCL statement, but is evaluated at run time by SAS. The

JCL parameter is used by z/OS to set an attribute of the file when the file is created by the JCL

**LRECL=*value***
specifies the maximum number of characters in a line (unless the file has been opened with RECFM=N). The default is 255. Lines longer than *value* are truncated. *value* must be between 1 and 16,777,215, inclusive.

**MOD**
appends the output lines to the file. This option has no effect on a pipe.

**NOBOMFILE**
specifies that a Byte-Order Mark is not included when a UNICODE-encoded file is created.

Alias NOBOM

**OLD**
replaces the previous contents of the file. This option is the default. This option has no effect on a pipe.

**RECFM=*record-format***
specifies the record format of the file. Valid values are

F specifies that all lines in the file have the length that is specified in the LRECL= option. In output files, lines that are shorter than the LRECL= value are padded on the right with blanks.

V | D specifies that the lines in the file are of variable length, ranging from one character to the number of characters specified by LRECL=. This option is the default.

P specifies that the file has variable-length records and is in print format.

N specifies that the file is in binary format. The file is treated as a byte stream. That is, line boundaries are not recognized.

**TERMSTR=NONE | NL | CR | LF | CRLF | LFCR | CRNL**
The TERMSTR= option specifies the type of record separator character sequences to use to terminate records in the file. TERMSTR= accepts the following parameters:

NONE Record terminators are not used. This parameter provides the same function as FILEDATA=BINARY.

NL The newline character (**`x'15'`**) is used as the record terminator. This parameter provides the same function as FILEDATA=TEXT.

CR The carriage return character (**`x'0D'`**) is used as the record terminator.

LF The line feed character (**`x'25'`**) is used as the record terminator.

CRLF The sequence CR followed by LF is used as the record terminator.

LFCR The sequence LF followed by CR is used as the record terminator.

CRNL The sequence CR followed by NL is used as the record terminator.

All of the previous specifications (x'15', x'0D', and x'25') assume that the files use an ENCODING= value whose short (12 byte) name is in the form **open_ed-***nnnn* and whose long (32 byte) name contains **(OpenEdition)** (for example, **open_ed-1047** or **Western(OpenEdition)**). These characters are automatically transcoded to or from the file's encoding if they are required by the ENCODING= or LOCALE= options.

The last occurrence of FILEDATA= or TERMSTR= takes precedence. Specification of one or the other of these options on a FILE or INFILE statement takes precedence over the specification in a related FILENAME statement.

1 Specification of FILEDATA= or TERMSTR= on a FILE or INFILE statement.

2 Specification of FILEDATA= or TERMSTR= in a FILENAME statement.

3 Specification of FILEDATA= on a DD JCL statement when the file was created by that DD statement.

4 Implied by the RECFM= option in effect for the file.

The RECFM= option in the FILENAME, FILE, and INFILE statement can imply the value assumed for the termination sequence. This implication is always overridden by the presence of a TERMSTR= or FILEDATA= option for the file. Here are the default values:

**RECFM=V | D**
TERMSTR=NL is implied. (This option is the default.)

**RECFM=F**
TERMSTR=NONE is implied.

**RECFM=P**
TERMSTR=NL implied, along with other formatting control characters.

**RECFM=N**
TERMSTR=NONE is implied.

**Note:** The FILEDATA= parameter on the DD JCL statement is used only by z/OS when the file is being created by that JCL statement. For existing files, the FILEDATA= parameter is ignored by z/OS, and SAS is informed of its value at file creation time. Therefore, SAS cannot detect a change in the JCL. However, SAS honors the values of FILEDATA= or TERMSTR= that are specified in the FILENAME, INFILE, or FILE statements when you replace an existing file or read a file.

**CAUTION**
**The combination of RECFM=, FILEDATA=, and TERMSTR= provides much flexibility for reading and writing many different file formats. It is possible to use these options in a way that can produce a file that might be difficult to process in the future. For example, a PRINT file can be created without record terminators, but this file would look strange when printed on a printer or viewed in an editor.**

For more information about these options, see "Accessing UNIX System Services Files" on page 129, "Writing to External Files" on page 110, and "Using the FILE Statement to Specify Data Set Attributes" on page 115.

## See Also

- *z/OS V1R9.0 MVS JCL Reference*

### Functions

- "FILENAME Function: z/OS" on page 474

### Statements

- "FILENAME Statement" in *SAS Global Statements: Reference*

# FILENAME Statement: EMAIL (CSSMTP and SMTP) Access Method

Enables you to send electronic mail programmatically from SAS using the Simple Mail Transfer Protocol SMTP email interface.

Valid in: Anywhere

Category: Data Access

Restrictions: When SAS is in a locked-down state, the FILENAME statement EMAIL access method is not available. Your server administrator can enable this access method so that it is accessible in the locked-down state. For more information, see "SAS Processing Restrictions for Servers in a Locked-Down State" in *SAS Programmer's Guide: Essentials*.

z/OS V2R3 does not support the SMTPD email server. Specify CSSMTP to access an SMTP email server if you are using SAS on z/OS V2R3.

See: "FILENAME Statement: EMAIL (SMTP) Access Method" in *SAS Global Statements: Reference*

"EMAILSYS= System Option: z/OS" on page 736

"FILESPPRI= System Option: z/OS" on page 757

"FILESPSEC= System Option: z/OS" on page 758

## Syntax

**FILENAME** *fileref* EMAIL < '*address*' > < *email-options*>;

## Email Options

**LRECL=*lrecl***
specifies the record length of the data where *lrecl* is the logical record length of the data.

Default 256

Notes The record length for normal SMTP communications is 80 bytes. Make sure that the specified value for LRECL accommodates this length. Otherwise, the message might be corrupted.

If the recipient's email client does not support read-receipt requests or if the recipient does not allow these return requests, the sender does not receive a read-receipt notification when the recipient reads the email.

**PRESERVELRECL**
preserves spaces of fixed-length records in text files.

Default By default, SAS trims spaces from fixed-length records in text files that are sent as email attachments. Beginning in SAS 9.4M7, if PRESERVELRECL is specified, spaces are preserved for fixed-length records in text files.

Note This option can be set by the system administrator as a value in the SAS Registry. For more information about the SAS Registry, see "The SAS Registry File" on page 23.

**RECFM**
specifies the record format to use for the CSSMTP file.

Default variable format

**BLKSIZE=**
specifies the block size for the CSSMTP file.

Default 10 times the specified record length

**SYSOUT=**
specifies the destination for the CSSMTP file in the file system.

```
SYSOUT=A
```

Default printer A

**PGM=**
specifies the external writer program to attach to the CSSMTP file.

Default CSSMTP

**CONTENT_TYPE="*type/subtype*"**
specifies the content type of the message body.

**Note:** z/OS automatically transcodes EBCDIC to ASCII for all files that have the content type "TEXT/*". This transcoding includes files that do not have a specified content type.

Default "text/plain"

**DEBUG**
enables writing data about the creation of the email to a log in a temporary file. This log is not the log that is written to the final destination. The data lines follow the format used by SMTP, but all lines are prefaced with an S because the data is not received at the final destination.

**FROM='*from-address*'**
specifies the email address of the author of the message that is being sent. Specify this option when the person who is sending the message is not the author. You must enclose an address in quotation marks. You can specify only one email address. To specify the author's real name along with the address, enclose the address in angle brackets (< >). Here are examples:

```
from='martin@home.com'
from="Brad Martin <martin@home.com>"
```

Default The default value for FROM= is the email address of the user who is running SAS. Beginning in SAS 9.4M6, if the SENDER= option is specified, the default value for FROM= is the email address that is specified in the SENDER= option.

Range 1–255 characters

Requirement The FROM option is required if the EMAILFROM system option is set. For more information, see "EMAILFROM System Option" in *SAS System Options: Reference*.

Interaction Use the SENDER= option to specify a return email address that is different from the author-specified email address in the FROM= option.

See "SENDER='*sender-address*'" on page 642

**SENDER='*sender-address*'**
specifies the return email address for the message that is being sent. If a message cannot be delivered, a notification is sent to the sender email address. To specify the author's real name along with the address, enclose the address in angle brackets (< >). Here are examples:

```
sender='martin@home.com'
sender='Brad Martin <martin@home.com>'
```

Default The default value for SENDER= is the email address of the user who is running SAS. Beginning in SAS 9.4M6, if the FROM= option is specified, the default value for SENDER= is the email address that is specified in the FROM= option.

Range 1–255 characters

Interaction The SENDER= address can be different from the FROM= address, which allows for the message to be sent on behalf of the email address that is specified in the FROM= option.

See "FROM='*from-address*'" on page 642

# Details

## CSSMTP Usage Details

Communications Server Simple Mail Transfer Protocol (CSSMTP) is an interface that transports email across the internet much like SMTP. CSSMTP is supported only on z/OS hosts. It supports most of the functionality of SMTP.

## Configuring CSSMTP

Set EMAILSYS=CSSMTP on your MVS host to enable the CSSMTP interface. Your CSSMTP program must be running for the interface to work. CSSMTP does not work the same as SMTP because SAS does not have direct contact with an SMTP server. Instead, it writes a file that the CSSMTP program uses.

Because this email information is written to a file, errors can occur if you have not allocated adequate space. If you do not have adequate space for the file, set the FILESPPRI (primary space allocation) and FILESPSEC (secondary space allocation) system options to values that are large enough to resolve the problem.

**Note:** CSSMTP sends emails that are incomplete. Temporary files are used to verify that you have supplied valid values for the options before the email is written to the destination where CSSMTP accesses it. Because the server interaction does not occur within SAS, most errors are gathered by the CSSMTP program. SAS displays only blatant errors that occur when you send an email. Remember to check your logs to determine whether the email was sent correctly.

# Example: Using the SYSOUT and PGM Options

This example shows how to use the SYSOUT and PGM arguments.

```
options emailsys=cssmtp;

filename myemail EMAIL to=("userid1@sender.com" "userid2@dest.com")
from="Firstname Lastname myname@sender.com"
sender="myname@sender.com"
importance="HIGH"
expires="25 Dec 2016 23:00"
attach=("file.txt" "home.html" ct="text/html" lrecl=8000)
subject="Hello!"
sysout=A
pgm=CSSMTP
```

```
lrecl=80
blksize=80
recfm=FB;

data _null_;
  file myemail;
  put "Hello World!";
run;
```

# FOOTNOTE Statement: z/OS

Prints up to ten lines at the bottom of the procedure output.

Valid in: Anywhere

z/OS specifics: Maximum length of footnote

See: "FOOTNOTE Statement" in *SAS Global Statements: Reference*

## Syntax

**FOOTNOTE**<*n*> <'*text*' | "*text*"> ;

## Details

Under z/OS, the maximum footnote length is determined by the value of the LINESIZE= system option. The maximum value of LINESIZE= is 256. Footnotes longer than the value of LINESIZE= are truncated.

**Note:** No space is permitted between FOOTNOTE and the number *n*.

# %INCLUDE Statement: z/OS

Includes SAS statements and data lines.

Valid in: Anywhere

z/OS specifics: *file-specification*, JCLEXCL, options

See: "%INCLUDE Statement" in *SAS Global Statements: Reference*

# Syntax

**%INCLUDE** *source-1* <*source-2* ...>

</<SOURCE2> <S2=*length*> <S2V=*column*> <JCLEXCL>
<ENCODING='*encoding-value*'> <*host-options*>>;

## Required Arguments

The following list explains some of the components of the %INCLUDE statement. For complete syntax information, see "%INCLUDE Statement" in *SAS Global Statements: Reference*.

***source***
describes the location of the information that you want to access with the %INCLUDE statement. Here are the three possible sources:

***file-specification***
Under z/OS, this value can be a fileref or a physical filename enclosed in quotation marks. If you specify a fileref that is not allocated, then SAS attempts to construct a data set name with the following three qualifiers:

If you specify a physical filename and the SAS server is in a locked-down state, access to a permanent z/OS data set or UFS file is limited to entries that are found in a lockdown list that is maintained by the server administrator. For more information, see Chapter 10, "SAS Processing Restrictions for Servers in a Locked-Down State," on page 219.

- the value of the SYSPREF= option (usually the user ID)
- the specified fileref
- SAS

If a file that has this constructed data set name is found, then SAS opens it and reads it.

***internal-lines***
You can access lines that were entered earlier in the same SAS job or session. In order to use this technique in a line mode session, the SAS system option SPOOL must be in effect.

***keyboard-entry***
You can enter the statements or data lines directly from the terminal. Use an asterisk (*) to indicate that the statements are to come from the terminal.

**SOURCE2**
causes the SAS log to show the source statements that are being included in your SAS program. In other words, this option has the same effect as the SAS system option SOURCE2, except that it applies only to the records that you are currently including. Specifying SOURCE2 in the %INCLUDE statement works even if the NOSOURCE2 system option is in effect.

***S2=length***
specifies the length of the record to be used for input. Here are the possible values:

S sets S2 equal to the current setting of the SAS system option S=.

0 specifies to use the setting of the SAS system option SEQ= to determine whether the line contains a sequence field. If the line does contain a sequence field, SAS determines the line length by excluding the sequence field from the total length.

*n* indicates which columns SAS should scan and which columns, if any, contain sequence numbers that should be ignored. *n* specifies the column in which to start scanning (for variable-length records) or stop scanning (for fixed-length records).

If the source lines in an external file that you are including contain sequence numbers, then either delete them before including the SAS program in your SAS session, or specify S2=0. The maximum line length is 6K bytes.

**S2V=*column***
specifies which column to use to begin scanning text from secondary source files that have a variable record format. The default value is S2. Here are the possible values:

S2 specifies to use the value of the S2=system option to compute the column to begin scanning text that comes from a %INCLUDE statement, an autoexec file, or an autocall macro file.

S specifies to use the value of the S=system option to compute the column to begin scanning text that comes from a %INCLUDE statement, an autoexec file, or an autocall macro file.

*n* specifies to use the value of *n* to compute the column to begin scanning text that comes from a %INCLUDE statement, an autoexec file, or an autocall macro file. The value for *n* can range from 0 to 2147483647.

**JCLEXCL**
ignores any lines of JCL in the included source.

**ENCODING=*'encoding-value'***
specifies the encoding to use when reading from the specified source. The value for ENCODING= indicates that the specified source has a different encoding from the current session encoding.

For valid encoding values, see "Overview to SAS Language Elements That Use Encoding Values" in *SAS National Language Support (NLS): Reference Guide* and "SBCS, DBCS, and Unicode Encoding Values for Transcoding Data" in *SAS National Language Support (NLS): Reference Guide* .

***host-options***
consists of statement options that are valid under z/OS. The following options are available:

- BLKSIZE=*block-size*

  BLK=*block-size*
- LRECL=*record-length*
- RECFM=*record-format*

## See Also

- "DCB Attribute Options" on page 628
- "Host-Specific Options for UNIX System Services Files" on page 613

# INFILE Statement: z/OS

Specifies an external file to read with an INPUT statement.

Valid in: In a DATA step

Restriction: The INFILE statement cannot modify or override the device type that was set by an earlier FILENAME statement.

z/OS specifics: *file-specification*, *type*, *host-options*

See: "INFILE" in *SAS DATA Step Statements: Reference*

## Syntax

**INFILE** *file-specification* <*type*> <ENCODING=*encoding-value*> <*options*> ;

**INFILE** DATALINES | CARDS <*options*> ;

### Required Arguments

***file-specification***
identifies a file in one of the following forms:

***fileref***
specifies the assigned fileref or the allocated ddname of the file. A fileref must conform to the rules for ddnames. That is, it can consist of up to eight letters, numbers, or national characters ($, @, and #) and underscores (_). The first character must be either a letter or a national character.

***fileref*(*member*)**
specifies a member of a partitioned data set, where the PDS or PDSE is specified by the assigned fileref or allocated ddname.

If you specify a fileref that is not allocated, then SAS attempts to construct a data set name with the following three qualifiers:

- the value of the SYSPREF= option (usually the user ID)
- the specified fileref
- DATA

If a file that has this constructed data set name is found, then SAS opens it and reads it.

The value of the FILEEXT= system option can affect how SAS interprets PDS and PDSE member names. For more information, see "FILEEXT= System Option: z/OS" on page 746.

***'physical-filename'***
specifies a physical file, which can be a member of a partitioned data set (PDS), an extended partitioned data set (PDSE), or a UNIX System Services file, using the following syntax:

- a fully qualified data set name. For example:

```
'myid.raw.datax'
```

- a fully qualified data set name with a member in parentheses. For example:

```
'sas.raw.data(mem1)'
```

- a partially qualified data set name with a period preceding it. For example:

```
'.raw.data'
```

- a partially qualified data set name with a period preceding it and a member name in parentheses. For example:

```
'.raw.data(mem1)'
```

- for PDS members, a fully or partially qualified data set name with a wildcard name in parentheses. For example:
- a UNIX System Services file. For example:

  The * wildcard character indicates a concatenation of UNIX System Services files. For more information about the use of the wildcard, see "Concatenating UNIX System Services Pathnames" on page 132.

The value of the FILEEXT= system option can affect how SAS interprets file specifications for PDS and PDSE files. For more information, see "FILEEXT= System Option: z/OS" on page 746.

For more information about partially qualified data set names, see Chapter 5, "Specifying Physical Files," on page 89. For information about encodings for z/OS resources such as data set names and UFS paths, see "PEEKLONG Function: z/OS" on page 492.

When a SAS server is in a locked-down state, access to a permanent z/OS data set or UFS file is limited to entries that are found in a lockdown list that is maintained by the server administrator. For more information, see Chapter 10, "SAS Processing Restrictions for Servers in a Locked-Down State," on page 219.

**DATALINES | CARDS**
specifies that input data immediately follows a DATALINES or CARDS statement in your SAS program.

## Optional Arguments

***type***
specifies the type of file. When you omit *type*, the default is a standard external file. Nonstandard (host-specific) file types that you can specify for z/OS are

**DLI**
for IMS-DL/I databases. For information about IMS-DL/I options for the FILE statement, see *SAS/ACCESS Interface to IMS: Reference*.

**HFS**
for UNIX System Services. For information about files in the UNIX System Services, see "Accessing UNIX System Services Files" on page 129.

**MVS**
for z/OS data sets.

**PIPE**
opens a pipe to issue UNIX System Services commands from within the statement. For information about files in the UNIX System Services, see "Piping Data from SAS to a UNIX System Services Command" on page 137.

**IDMS**
for CA-IDMS files. For information about CA-IDMS options for the INFILE statement, see *SAS/ACCESS Interface to IMS: Reference*.

**VSAM**
for VSAM files. For information about VSAM files, see "Accessing Other File Types" on page 127.

**VTOC**
for a Volume Table of Contents (VTOC).

**ENCODING= *encoding-value***
specifies the encoding to use when reading from the input file. Typically, you would specify a value for ENCODING= that indicates that the input file has a different encoding from the current session encoding. However, you can also specify the same encoding for the input file as the encoding of the current session. You must enclose the value in quotation marks if it contains a hyphen.

If you specify an encoding value different from the session encoding, SAS transcodes the data from the session encoding to the specified encoding when you read data from the input file. The default encoding is the session encoding, which is the value of the ENCODING= SAS system option.

For valid encoding values, see "Overview to SAS Language Elements That Use Encoding Values" in *SAS National Language Support (NLS): Reference Guide* and "SBCS, DBCS, and Unicode Encoding Values for Transcoding Data" in *SAS National Language Support (NLS): Reference Guide* .

***options***
are either portable or host-specific. For information about portable options, see *SAS System Options: Reference*.

You can specify portable options and host options in any order. When you specify more than one option, separate the options with a blank space.

The *host-options* that you can specify depend on which type of external file is being accessed. See the following sections for details:

- "Standard Options for the INFILE Statement under z/OS" on page 650
- "Host Options for Retrieving Information about Data Sets" on page 652
- "VSAM Options for the FILE and INFILE Statements under z/OS" on page 610

- "VTOC Options for the INFILE Statement under z/OS" on page 652
- "Host-Specific Options for UNIX System Services Files" on page 613


# Details

## Standard Options for the INFILE Statement under z/OS

You can use the following standard options with all standard external files under z/OS.

**BLKSIZE=*value* | BLK=*value***
specifies the block size of the file. Block size is discussed in more detail in "DCB Attribute Options" on page 628.

**BUFNO=*value***
specifies how many memory buffers to allocate for reading. If you specify BUFNO= in an INFILE statement, it takes precedence over specifying it in a FILENAME statement. If you omit BUFNO= from the INFILE statement, then specifying it in the FILENAME statement takes precedence. If you do not specify BUFNO= in an INFILE statement or a FILENAME statement, SAS uses the value of the FILEBUFNO= system option. For information about using BUFNO or the FILEBUFNO system option, see "FILEBUFNO= System Option: z/OS" on page 742.

**CCHHR=*variable***
specifies a character variable to which the physical address (cylinder head record) of a record is returned. This applies to files on CKD disks only.

**CLOSE=*keyword***
indicates how a tape volume is positioned at the end of the DATA step. Values for *keyword* are

**REREAD**
positions the tape at the logical beginning of the data set.

**LEAVE**
positions the tape at the logical end of the data set.

**REWIND**
rewinds the tape to the physical beginning of the volume.

**FREE**
dynamically deallocates the tape volume.

**DISP**
is implied by the control language.

**CSRC**
specifies that you want to use CSRCESRV services (available with z/OS) to decompress data on input. For example:

```
data;
   infile myfile csrc;
   input;
run;
```

**DCB=*fileref***
specifies the fileref of an external file that was referenced in an earlier FILE or INFILE statement in the same DATA step. SAS uses that file's RECFM=, LRECL=, and BLKSIZE= information for the current file.

**LINESIZE=*width***
works with LRECL to specify the maximum number of characters per line or record in print files, nonprint files, and the SAS log. Under z/OS, the range of acceptable values of LINESIZE= is 64 to 256. The default value of the LINESIZE= system option under z/OS is 132. This default applies only to print files (with carriage returns) or to the SAS log. For nonprint files (without carriage returns), the value of LRECL= is used in place of the default value for LINESIZE=.

**LRECL=*value***
specifies the logical record length of the file. The specified value depends on the access method and the device type. For more information, see the discussion of LRECL= in "DCB Option Descriptions" on page 628 and in the *IBM MVS JCL Reference*.

**RECFM=*record-format***
specifies the record format of the file. Valid values are

**F**
specifies fixed-length records, unblocked.

**V**
specifies variable-length records, unblocked.

**FB**
specifies fixed-length records, blocked.

**VB**
specifies variable-length records, blocked.

**U**
specifies undefined-length records, unblocked.

The following values can be appended to the RECFM= values:

**A**
specifies that the first byte of each record is an ANSI printer-control character.

**M**
specifies that the file is a machine control character file. SAS does not interpret machine code control characters, nor does it create them in output files. See *MVS JCL Reference* by IBM for more information.

**S**
specifies that the file contains spanned records (V), or the file contains standard blocks (F).

The following value stands alone; no other values can be appended:

**N**
indicates that the file is in binary format. The file is processed as a stream of bytes with no record boundaries, which includes the default value of LRECL. This record format is specific to SAS.

## Host Options for Retrieving Information about Data Sets

For information about options that retrieve information about a data set from operating environment control blocks, see "Host Options for Retrieving Information about Data Sets" on page 610.

## VTOC Options for the INFILE Statement under z/OS

The following options are used only in INFILE statements that involve VTOC (Volume Table of Contents) access:

**CCHHR=*variable***
defines a SAS character variable of length 5 whose value is set to the CCHHR of the last VTOC record that was read by SAS. The returned value is in hexadecimal format; it can be printed by using the $HEX10. SAS format.

**CVAF**
tells SAS to use the Common VTOC Access Facility (CVAF) of the IBM program product Data Facility/Device Support (DF/DS) for indexed VTOCs. If the VTOC is not indexed, or if your installation does not have CVAF, this option is ignored.

**Note:**

- When you use CVAF and CCHHR=, values that are returned for Format-5 DSCB records are not valid, because indexed VTOCs do not have Format-5 DSCB records.
- When a SAS server is in the locked-down state, the VTOC access method is disabled. For more information, see Chapter 10, "SAS Processing Restrictions for Servers in a Locked-Down State," on page 219.

## Host-Specific Options for UNIX System Services Files

The following table shows which host-specific options are recognized by the FILENAME, FILE, and INFILE statements for UNIX System Services files and pipes. No other options are recognized, including such options specific to z/OS as DISP, CLOSE, and DCB. Descriptions of the options follow the table.

***Table 30.4*** *Host-Specific Options for UNIX System Services Files and Pipes*

| Option | FILENAME | FILE | INFILE | %INCLUDE |
|---|---|---|---|---|
| BLKSIZE= | X | X | X | X |
| FILEDATA= | X | X | X | |
| OLD | X | X | | |
| MOD | X | X | | |
| LRECL= | X | X | X | X |
| RECFM= | X | X | X | X |

| Option | FILENAME | FILE | INFILE | %INCLUDE |
|---|---|---|---|---|
| TERMSTR= | X | X | X | |

**BLKSIZE=**
specifies the number of bytes that are physically read or written in an I/O operation. The default is 8K. The maximum is 1M.

**FILEDATA=BINARY | TEXT**
The FILEDATA= option specifies that the file being processed is expected to contain one of the following:

BINARY
data without record separator character sequences.

TEXT
data with records terminated by the EBCDIC newline character. The EBCDIC newline character is defined at code point **x'15'** and is typically represented as **NL** or **\n**.

**Note:** The FILEDATA= option is meant to be similar to the FILEDATA= parameter on the DD JCL statement, but is evaluated at run time by SAS. The JCL parameter is used by z/OS to set an attribute of the file when the file is created by the JCL

**OLD**
replaces the previous contents of the file. This option is the default. This option has no effect on a pipe.

**MOD**
appends the output lines to the file. This option has no effect on a pipe.

**LRECL=*value***
specifies the maximum number of characters in a line (unless the file has been opened with RECFM=N). The default is 255. Lines longer than *value* are truncated. *value* must be between 1 and 65,535, inclusive.

**RECFM=*record-format***
specifies the record format of the file. Valid values are

F
specifies that all lines in the file have the length that is specified in the LRECL= option. In output files, lines that are shorter than the LRECL= value are padded on the right with blanks.

V
D
specifies that the lines in the file are of variable length, ranging from one character to the number of characters specified by LRECL=. This option is the default.

P
specifies that the file has variable-length records and is in print format.

**N**
specifies that the file is in binary format. The file is treated as a byte stream. That is, line boundaries are not recognized.

**TERMSTR=NONE | NL | CR | LF | CRLF | LFCR | CRNL**
The TERMSTR= option specifies the type of record separator character sequences to use to terminate records in the file. TERMSTR= accepts the following parameters:

**NONE**
Record terminators are not used. This parameter provides the same function as FILEDATA=BINARY.

**NL**
The newline character (**`x'15'`**) is used as the record terminator. This parameter provides the same function as FILEDATA=TEXT.

**CR**
The carriage return character (**`x'0D'`**) is used as the record terminator.

**LF**
The line feed character (**`x'25'`**) is used as the record terminator.

**CRLF**
The sequence CR followed by LF is used as the record terminator.

**LFCR**
The sequence LF followed by CR is used as the record terminator.

**CRNL**
The sequence CR followed by NL is used as the record terminator.

All of the previous specifications (x'15', x'0D', and x'25') assume that the files use an ENCODING= value whose short (12 byte) name is in the form **`open_ed-`***nnnn* and whose long (32 byte) name contains **`(OpenEdition)`** (for example, **`open_ed-1047`** or **`Western(OpenEdition)`**). These characters are automatically transcoded to or from the file's encoding if they are required by the ENCODING= or LOCALE= options.

The last occurrence of FILEDATA= or TERMSTR= takes precedence. Specification of one or the other of these options on a FILE or INFILE statement takes precedence over the specification in a related FILENAME statement.

The full precedence order is as follows:

1. Specification of FILEDATA= or TERMSTR= on a FILE or INFILE statement.
2. Specification of FILEDATA= or TERMSTR= in a FILENAME statement.
3. Specification of FILEDATA= on a DD JCL statement when the file was created by that DD statement.
4. Implied by the RECFM= option in effect for the file.

   The RECFM= option in the FILENAME, FILE, and INFILE statement can imply the value assumed for the termination sequence. This implication is always overridden by the presence of a TERMSTR= or FILEDATA= option for the file. Here are the default values:

**RECFM=V | D**
TERMSTR=NL is implied. (This option is the default.)

**RECFM=F**
TERMSTR=NONE is implied.

**RECFM=P**
TERMSTR=NL implied, along with other formatting control characters.

**RECFM=N**
TERMSTR=NONE is implied.

**Note:** The FILEDATA= parameter on the DD JCL statement is used only by z/OS when the file is being created by that JCL statement. For existing files, the FILEDATA= parameter is ignored by z/OS, and SAS is informed of its value at file creation time. Therefore, SAS cannot detect a change in the JCL. However, SAS honors the values of FILEDATA= or TERMSTR= that are specified in the FILENAME, INFILE, or FILE statements when you replace an existing file or read a file.

**CAUTION**
**The combination of RECFM= and TERMSTR= provides much flexibility for reading and writing many different file formats. It is possible to use these options in a way that can produce a file that might be difficult to process in the future. For example, a PRINT file can be created without record terminators, but this file would look strange when printed on a printer or viewed in an editor.**

## See Also

- "Accessing UNIX System Services Files" on page 129
- "Reading from External Files" on page 119
- "Using the FILE Statement to Specify Data Set Attributes" on page 115
- "Writing to External Files" on page 110

# LENGTH Statement: z/OS

Specifies how many bytes SAS uses to store a variable's value.

Valid in: In a DATA step

z/OS specifics: Length of numeric variables

See: "LENGTH" in *SAS DATA Step Statements: Reference*

## Syntax

**LENGTH** *variable(s)* <$> *length* ...<DEFAULT=*n* >;

### Required Arguments

This syntax is a simplified version of the LENGTH statement syntax. For more information, see "LENGTH" in *SAS DATA Step Statements: Reference*..

***length***
can range from 2 to 8 for numeric variables and from 1 to 32,767 for character variables. The minimum value for `length` for a numeric value might be greater than 2 when you create a SAS data set that is written in a data representation other than the native data representation for SAS on z/OS.

***n***
changes from 8 to *n* the default number of bytes that SAS uses for storing the values of newly created numeric variables. Under z/OS, *n* can range from 2 to 8.

## See Also

"Using the LENGTH Statement to Save Storage Space" on page 400

# LIBNAME Statement: z/OS

Assigns a SAS libref and an engine to a SAS library.

| | |
|---|---|
| Valid in: | Anywhere |
| Restriction: | When a SAS server is in a locked-down state, permanent SAS libraries cannot be accessed unless they are found in a lockdown list that is maintained by the server administrator. For more information, see Chapter 10, "SAS Processing Restrictions for Servers in a Locked-Down State," on page 219. |
| z/OS specifics: | *libref, engine, physical-filename, library-specification, engine/host-options* |
| Tip: | For information about the length limit of a libref, see "SAS Name Literals" in *SAS Programmer's Guide: Essentials*. |
| See: | "LIBNAME Statement" in *SAS Global Statements: Reference* |

## Syntax

**LIBNAME** *libref* <*engine*> <'<*file-system-prefix*> *physical-filename*'> <*engine/host-options*> ;

**LIBNAME** *libref* <*engine*> <(*library-specification-1*, *library-specification-2* ...)> <*engine/host-options*>;

**LIBNAME** *libref* | _ALL_ CLEAR;

**LIBNAME** *libref* | _ALL_ LIST;

# Details

## Overview of the LIBNAME Statement

The LIBNAME statement can be used to assign a SAS library, deassign a library assignment, or display a list of all library assignments. The LIBNAME function provides similar functionality. For more information, see the "LIBNAME Statement" in *SAS Global Statements: Reference*.

You can set the DLCREATEDIR system option to create the directory for the SAS library that is specified in the LIBNAME statement if that directory does not exist. For more information, see the "DLCREATEDIR System Option: z/OS" on page 724.

The first two preceding syntax diagrams are used for assigning SAS libraries. The last two are used for deassigning libraries and for listing library assignments. The following topics contain information about the specified LIBNAME statement forms:

- "LIBNAME Statement Forms for Assigning Libraries " on page 657
- "LIBNAME Statement Form for Deassigning Libraries" on page 661
- "LIBNAME Statement Form for Listing Library Assignments" on page 661

For more information, see the "LIBNAME Function" in *SAS Functions and CALL Routines: Reference*.

## LIBNAME Statement Forms for Assigning Libraries

The LIBNAME statement enables you to identify a library to SAS, specify which engine SAS should use to process the library, and identify the z/OS resources that are required to process the library. For a complete discussion of assigning libraries, see "Assigning SAS Libraries" on page 72. For direct or sequential access bound libraries, the LIBNAME statement can be used to specify the necessary options to allocate the library data set. For information about z/OS allocation as it relates to SAS libraries, see "Allocating the Library Data Set" on page 73.

**Note:** If an error is detected by SAS while it is processing a LIBNAME statement, then the SAS session return code is not affected unless the SAS system option ERRORCHECK=STRICT is specified.

The form of the LIBNAME statement that is used to assign a SAS library is described in the following list. For examples of assigning libraries, see "Example 1: Assigning an Existing Bound Library" on page 672.

**LIBNAME** *libref* <*engine*> <'<*file-system-prefix*> *physical-filename*'> <*engine/host-options*>;

**LIBNAME** *libref* <*engine*> <(*library-specification-1, library-specification-2 ...*)>

*<engine/host-options'>*;

***libref***
is a SAS name that can be used to refer to the library in subsequent SAS statements. The libref can be a maximum of eight characters. The first character must be a letter (A–Z) or an underscore. The remaining characters can be any of these characters or numerals 0–9.

If the specified libref is already assigned, SAS deassigns the libref before performing the specified assignment.

If the LIBNAME statement is specified with a non-blank, non-empty physical filename or with a list of library specifications, then the physical filename or list of library specifications identify the resources that are to be assigned. However, if the LIBNAME statement does not specify either a resource name or the HIPERSPACE option, then the libref must correspond to an externally defined logical name that refers to the resource that is to be assigned. The logical name can be a DDNAME that is allocated externally to a library data set. In that case, the externally allocated DDNAME must conform to the rules for the spelling of a libref. The logical name can also be an environment variable that is defined by an instance of the SET system option. For more information, see "Allocating the Library Data Set" on page 73 and "Assigning SAS Libraries Externally" on page 77.

**Note:** SAS 9.2 for z/OS supports libref names that begin with or contain underscores. For example, libref names with formats such as libref_name, _librefname, or _libref_name are now supported. Unlike filerefs, librefs cannot include the special characters $, @, and #.

***engine***
specifies which engine to use to access the SAS library.

For general information about these engines and other engines, see "SAS Engines" in *SAS Programmer's Guide: Essentials* .

It is generally necessary to specify the engine only when creating a library that is processed by an engine other than the default engine that is indicated by the ENGINE= system option or the SEQENGINE= system option. For more information, see "ENGINE= System Option: z/OS" on page 737 or the "SEQENGINE= System Option: z/OS" on page 839. For existing libraries, SAS can examine the format of the library to determine which engine to use. For complete details about how SAS selects an engine when an engine is not specified, see "How SAS Assigns an Engine" on page 81.

**Note:** The V5 and V5TAPE engine names can be specified in the LIBNAME statement. These engines are still supported for Read-Only access to existing libraries in those formats.

***physical-filename***
specifies the physical name of the library. The physical-filename syntax element and its enclosing quotation marks can be omitted entirely. A z/OS data set name or a UFS path can be specified for *physical-filename*. If a file system prefix was not specified to indicate whether the physical name refers to a z/OS data set or

a UFS path, SAS assumes that the physical name refers to a UFS path if any of the following conditions are true:

- The LIBNAME host option HFS is specified.
- The SAS system option FILESYSTEM=HFS is in effect.
- The physical name specified contains a slash (/) or a tilde (~).

If the physical filename does not refer to a UFS path and the HIPERSPACE option is specified, then SAS creates a new hiperspace library and the physical filename is disregarded. SAS assumes that the physical name refers to a z/OS data set in the following circumstances:

- The physical filename is not blank or empty and does not refer to a UFS path.
- The HIPERSPACE option is not specified.

If the physical filename is blank or empty and the HIPERSPACE option is not specified, then the libref must match an externally defined logical name that refers to the resource that is to be assigned. This specification is discussed in the description of the previous libref syntax element. In this case, SAS attempts to complete the assignment for the SAS library with which the logical name is associated. Specifying this form of the LIBNAME statement to assign an externally defined library ensures that the library exists in the SAS dictionary table, which can be accessed with the SAS view SASHELP.VLIBNAM. For more information, see "Assigning SAS Libraries Externally" on page 77.

The *physical-filename* and its *file-system-prefix*, can be specified in single quotation marks, as indicated in the syntax diagram, or they can be specified in double quotation marks instead.

For a library that resides in a z/OS data set, the physical name of the library data set can be specified in one of the following ways:

- a fully qualified data set name. For example:

```
'user934.mylib.saslib'
```

- a partially qualified data name. For example, if the value of the SYSPREF option is USER934, the following specification is equivalent to the preceding example:

```
'.mylib.saslib'
```

  For more information, see "SYSPREF= System Option: z/OS" on page 873.

- a temporary data set name specified as an ampersand (&), followed by one alphabetic character, and up to seven additional alphanumeric or special ($, #, or @) characters. For example:

```
'&tmp#lib1'
```

  This specification always creates a new temporary library, even if you have already specified the same temporary data set name in a previous LIBNAME statement. To assign an additional libref to a temporary library, specify the original libref, as shown in the following example:

```
libname t '&tmp#lib1';
libname x (t);
```

**Note:** Temporary libraries receive system-generated data set names in the following form, which is guaranteed to be unique across the sysplex:

```
SYSyyddd.Thhmmss.RA000.jjobname.Rggnnnn
```

For a library that resides in a UFS directory, the physical name of the library is the directory path. This path can be specified in the following ways:

- an absolute pathname:

```
'/u/userid/mylib'
```

  a pathname relative to the current working directory:

```
'./mylib'
```

  or

```
'HFS:mylib'
```

  The HFS prefix is needed when the SAS system option FILESYSTEM=MVS is in effect and the specified directory pathname does not contain a slash ( / ) to indicate a UFS file. For more information, see "FILESYSTEM= System Option: z/OS" on page 761.

- a pathname relative to the home directory of the user ID under which SAS is running:

```
'~/saslib';
```

  If the home directory of the user ID under which SAS is running is **/u/usera**, then this specification is equivalent to **'/u/usera/saslib'**.

  a pathname relative to the home directory of another user ID:

```
'~userb/saslib';
```

  If the home directory for `userb` is **'/u/userhome/userb'**, then the home directory is equivalent to **'/u/userhome/userb/saslib'**.

SAS on z/OS does not support specifying physical files that have a member type of AUDIT. Specifying physical filenames such as the following returns an error:

- `filename mylib data='./saslib/memb01.sas7baud';`
- `filename mylib data='/u/user01/mylib/inventory.sas7baud'`

For information about encodings for z/OS resources such as data set names and UFS paths, see "PEEKLONG Function: z/OS" on page 492.

***library-specification***

Specifies one of the following:

*'<file-system-prefix> physical-filename'*

*"<file-system-prefix> physical-filename"*

*libref*

*ddname*

*file-system-prefix* and *physical-filename* are described in the preceding list item. *libref* is described in the first list item, and refers to any SAS libref currently that

is assigned within the SAS session. *ddname* ddname refers to a z/OS ddname that is allocated to a single z/OS data set or UFS directory. This allocation must be established external to SAS in the job step or TSO session in which the SAS session is running. For more information about using a ddname, see "Allocating the Library Data Set" on page 73 and "Assigning SAS Libraries Externally" on page 77.

As noted in the syntax diagram, multiple library specifications can be specified in a single LIBNAME statement. In that case, the libref refers to a logical concatenation of the libraries. For more information, see "Library Concatenation" in *SAS Programmer's Guide: Essentials* . In addition, note that libraries of different implementation types (such as direct access bound and UFS) can be included within the concatenation.

***engine/host-options***

are options that govern processing of the SAS library. Each option is identified by a keyword, and most keywords assign a specific value to that option. You can specify one or more of these options using the following forms:

keyword=value | keyword

When you specify more than one option, use a blank space to separate each option.

There are two categories of options, engine options and host options. Engine options can vary from engine to engine but are the same for all operating environments. These options are documented as part of the syntax of the "LIBNAME Statement" in *SAS Global Statements: Reference*. The host options, which are documented in the following sections, apply exclusively to the z/OS environment. For convenience, the host options are divided into two groups, general options and options that govern the allocation of a library data set. Many host options apply only to certain library implementation types. For more information, see "Library Implementation Types for Base and Sequential Engines" on page 51.

## LIBNAME Statement Form for Deassigning Libraries

**LIBNAME** *libref* | _ALL_ CLEAR;

This form of the LIBNAME statement can be used to deassign an individual libref (specified by *libref*) or all library assignments (specified by _ALL_). However, library assignments, such as Work and Sashelp, that were established when the SAS session was initialized, and that are required for the session to continue, cannot be deassigned.

Deassigning an individual libref removes the individual library assignment that is associated with that libref. If the libref is the last remaining libref associated with the library, then the library is physically deassigned as well. When it physically deassigns bound libraries, SAS performs additional processing to release the library data set and the resources that are associated with processing it. For more information, see "Deassigning SAS Libraries" on page 83.

## LIBNAME Statement Form for Listing Library Assignments

**LIBNAME** *libref* | _ALL_ LIST;

This form of the LIBNAME statement can be used to list an individual library assignment that is associated with a specified libref or all library assignments (specified by _ALL_). LIBNAME LIST displays the physical name of the library, the engine assigned, and other information that is dependent upon the type of the library.

**Note:** Listing a bound library causes SAS to physically open the library data set if the library is not already open.

## General Host Options

**DLLBI=YES | NO**

specifies whether the default BLKSIZE for the sequential access bound library that is being assigned can exceed 32760 if the library resides on a tape device.

YES

specifies that the default BLKSIZE for SAS sequential access bound libraries on tape devices is the optimum value for the hardware. This value can exceed 32760.

NO

specifies that SAS uses a default BLKSIZE of 32760 for sequential access bound libraries that reside on tape devices.

If the BLKSIZE value is not explicitly specified on either the LIBNAME statement or the external allocation, then SAS must determine the block size to use when it processes a new sequential access bound library. If the library resides on a tape device, then the DLLBI LIBNAME option specifies whether the default BLKSIZE for the sequential access bound library can exceed 32760 for the library that is being assigned. BLKSIZE values greater than 32760 reduce elapsed time for tape devices and can also improve tape utilization.

The DLLBI LIBNAME option takes precedence over the SAS system option DLLBI. For more information, see "Controlling Library Block Size" on page 62.

**Note:**

- SAS 9.4M1 and earlier do not support library data sets that have a block size greater than 32760. If you intend to read the library with an earlier version of SAS, specify DLLBI=NO or allocate the library data set with a BLKSIZE value that does not exceed 32760.
- The DLLBI option is disregarded for all library implementation types other than the sequential access bound implementation type.
- The DLLBI option is honored only for the initial assignment of a sequential access bound library. If an additional assignment is made before the initial assignment is cleared, the value of DLLBI that is in effect for the initial assignment is used afterward regardless of the settings of the DLLBI LIBNAME option or the DLLBI SAS system option.

For more information, see:

- "DLLBI System Option: z/OS" on page 729
- "Example 5: Assigning an Engine and Requesting BLKSIZE > 32760 for an Externally Allocated Library" on page 673
- "Sequential Access Bound Libraries" on page 57
- "Optimizing Performance" on page 60

**DLTRUNCHK | NODLTRUNCHK**
overrides the system option DLTRUNCHK for this LIBNAME statement assignment only. This option applies only to direct access bound libraries. For more information, see "DLTRUNCHK System Option: z/OS" on page 732.

**HFS**
specifies that the library physical name refers to a UFS directory in the user's UFS working directory. For more information, see "UFS Libraries" on page 63.

It is not necessary to specify this option if the physical-filename in the LIBNAME statement contains a slash ( / ) or if the **`HFS: data-set-name`** syntax is used.

**HIPERSPACE**
specifies that SAS is to assign the libref to a newly created hiperspace library that is distinct from any other hiperspace library that is assigned within the SAS session. This hiperspace library, including any members created in it, exists only until the libref is de-assigned. The library is deleted when the libref is de-assigned. When assigning a hiperspace library, specify an empty string (two adjacent quotation marks) as the library physical filename because SAS itself generates a unique name for each hiperspace library. HIP is an alias for the HIPERSPACE option. For more information, see "Hiperspace Libraries" on page 66.

**Note:** For SAS 9.4M1 and earlier, the LIBNAME statement required a physical filename when assigning a hiperspace library. If the physical filename specifies a UFS path, SAS disregards the HIPERSPACE option and assigns the UFS library. Otherwise, SAS ignores the physical filename and assigns a hiperspace library.

**NOPROMPT**
for this assignment, specifies that no dialog box is displayed to prompt you to create the library, even if the system option FILEPROMPT is in effect and if the library does not already exist.

## Host Options for Allocating Library Data Sets

The host options in this category specify the parameters for allocating the library data set, or they control the allocation process itself. Therefore, these options apply only for library implementation types in which the library resides in a single z/OS data set: direct access bound libraries and sequential access bound libraries.

**AVGREC=*multiplier***
AVGREC can be used only when the unit of space subparameter of the SPACE option is a number, which indicates an average record length. The multiplier value modifies the interpretation of the primary and secondary space

subparameters of the SPACE option. The multiplier value can be any of the following:

U specifies that the primary and secondary space subparameters are to be interpreted as requests for sufficient space to contain the number of records that are to be allocated. The value specified with the unit of the space subparameter of the SPACE option is also interpreted as the length of the records.

K specifies that the primary and secondary space subparameters are to be interpreted as a number of records multiplies by 1024. The value that is specified with the unit of the space subparameter of the SPACE option is also interpreted as the average length of the records.

M specifies that the primary and secondary space subparameters are to be interpreted as a number of records multiplied by 1024 times 1024 (1048576). The value that is specified with the unit of the space subparameter of the SPACE option is also interpreted as the average length of the records.

The following example specifies the AVGREC option with a value of U for LIBNAME AVGREC.

```
LIBNAME AVGREC 'USERID.AVGREC.LIBN' DISP=(NEW,CATLG,DELETE)
    SPACE=(800,(1,1)) AVGREC=U;
```

**BLKSIZE=*n***

specifies the block size that SAS is to use when dynamically allocating the library data set. The BLKSIZE host option is ignored for libraries that are already externally allocated by a DD statement.

Valid values for BLKSIZE include 0 (zero) and any number from 4096 through 32760. SAS replaces specified block sizes of 1 through 4095 with the alternate value 4096. SAS replaces specified block sizes greater than 32760 with the maximum acceptable value of 32760. SAS writes a note to the log when it replaces a value that is specified for the block size.

**Note:** SAS rejects the LIBNAME statement if you specify a BLKSIZE that is greater than 262144. It writes an error to the log that the LIBNAME is not assigned because of an invalid value for the BLKSIZE option.

If the BLKSIZE option is omitted and SAS must dynamically allocate the library data set, then the block size associated with the allocation is zero unless the BLKALLOC option is specified. For more information, see “BLKALLOC System Option: z/OS” on page 711.

The value of the BLKSIZE host option for the LIBNAME statement is just one of many factors, which might influence the block size that SAS uses to process a library. Different rules apply for different library implementation types. For more information, see the following topics :

- “Controlling Library Block Size” on page 56 for Direct Access Bound Libraries
- “Controlling Library Block Size” on page 62 for Sequential Access Bound Libraries

**DATACLAS=*data-class-name***
specifies the data class for an SMS-managed data set. The name can have up to eight characters. This option applies only to new data sets; it is ignored for existing data sets. The data class is predefined and controls the DCB attributes for a data set.

The implementation of the DATACLAS= option is compatible with the SMS DATACLAS= JCL parameter. For complete information about this parameter, see *MVS JCL Reference* by IBM. Ask your system administrator which data-class names are used for SAS libraries at your site.

**Note:** If your specified value for DATACLAS begins with national characters such as @, #, or $, then you need to enclose the value in single quotation marks as indicated in the following example:

```
LIBNAME WEEK 'physical.dataset.name'
     DISP=(NEW,CATLG,DELETE) DATACLAS='#DCLAS' MGMTCLAS='#MGMT';
```

**DISP= status | (< *status* >,< *normal-termination-disp*>, < *abnormal-termination-disp*>)**
specifies the status of the data set at the beginning and ending of a job, as well as what to do if the job step terminates abnormally. If you are specifying only the *status*, you can omit the parentheses.

***status***
specifies the status of the physical file at the beginning of a job. Valid values are

NEW a new data set is to be created.

OLD the data set exists and is not to be shared.

SHR the data set exists and can be shared.

The default value for status is OLD except under the following conditions. Under these conditions, the default for *status* is SHR:

- The library data set is already externally allocated DISP=SHR.
- ACCESS=READONLY was specified in the LIBNAME statement.
- The library data was allocated DISP=SHR by SAS for an assignment that is still in effect, and the DLDISPCHG option specifies a value that prevents the allocation from being upgraded to OLD. For more information about changing the allocation of an existing library data set, see "DLDISPCHG System Option: z/OS" on page 725.

***normal-termination-disp***
specifies how the operating system handles the library data set when the final assignment for the library is cleared. If you omit the normal termination disposition value, the default value for new data sets is CATLG, and the default value for existing data sets is KEEP. If SAS uses this value, whether specified or supplied by default for *normal-termination-disp*, then the value is ignored if SAS uses an existing external allocation to assign the library data set. When this situation occurs, SAS displays a NOTE on the SAS log.

The following values are valid:

DELETE the data set is deleted at the end of the step.

KEEP the data set is to be kept.

CATLG the system should place an entry in the system catalog or user catalog.

UNCATLG the system is to delete the entry in the system catalog or user catalog.

***abnormal-termination-disp***
specifies how the operating system handles the library data set if the job step under which SAS is running terminates abnormally in such a way that SAS cannot handle the abend. However, under TSO, or if SAS can handle the abend, the data set is handled according to the *normal-termination-disposition*. The *normal-termination-disposition* is used if SAS abends as a result of the ERRORABEND option or the ABORT ABEND statement.

Valid values for *abnormal-termination-disposition* are the same as for *normal-termination-disposition*. If *abnormal-termination-disposition* is omitted, then the default value is the same as the value that is specified or supplied by default for *normal-termination-disposition*.

**Note:** If SAS uses an existing external allocation to assign the library data set, then the value that is specified or supplied by default for *abnormal-termination-disp* is ignored.

**DSKEYLBL=*label_name***
specifies the encryption key label to access a library that uses pervasive encryption.

Requirement The key label must point to an AES-256 bit encryption DATA key within the z/OS Integrated Cryptographic Service Facility (ICSF) key repository (CKDS). In addition, the user must have a minimum of READ access to the encryption key label name in the RACF CSFKEYS class. (See IBM's manual, IBM Data Set Encryption, for complete information on defining data set encryption labels.

Notes The DSKEYLBL= option is available beginning with SAS 9.4M8.

If the user does not have RACF access to the encryption key label, SAS generates an error, `Insufficient Access Authority`.

If a SAS library has been allocated for pervasive encryption support, the ISPF Data Set information panel shows `Data set encryption : YES`.

Examples The following LIBNAME statement accesses an existing library that has been allocated for pervasive encryption:

```
libname test BASE ".encrypt.saslib" DISP=MOD, DSKEYLBL=DSKEY1;
```

The following libname statement creates a new encrypted SAS bound library:

```
libname test BASE ".encrypt.saslib" DISP=(NEW,CATLG) UNIT=(RIO,1)
SPACE=(TRK,(5000,5000)) BLKSIZE=4096 DATACLAS=STD
```

```
MGMTCLAS=STD STORCLAS=STD DSNTYPE=BASIC
DSKEYLBL=DSKEY1;
```

For more information, see:

- "IBM z/OS Pervasive Encryption for Data Sets with SAS 9.4M8" in *Encryption in SAS*.
- "DLDSKEYLBL= System Option" on page 727
- IBM Data Set Encryption
- Getting Started with z/OS Data Set Encryption
- Using the z/OS data set encryption enhancements

**DSNTYPE=BASIC | LARGE | EXTREQ | EXTPREF | NONE**

specifies the type of data set that SAS should create for a new library data set that does not already exist.

BASIC
: specifies that SAS creates a regular format sequential data set that cannot use more than 64K tracks on any single volume.

LARGE
: specifies that SAS creates a regular format sequential data set that can use more than 64K tracks on any single volume.

EXTREQ
: specifies that SAS must create an extended format sequential data set. If the system cannot create an extended format data set, then the library assignment fails. This option value is intended for use with sequential access bound libraries on disk. See the LINEAR option in "General Host Options" on page 662. EXTREQ cannot be specified for direct access bound libraries that reside in DSORG=PS data sets.

EXTPREF
: specifies that SAS creates an extended format sequential data set, if possible. However, if extended format is not supported for the type of library that is being created, or if the operating system cannot create an extended format data set, then a regular format data set is created.

NONE
: causes SAS to not specify a DSNTYPE value when allocating the library data set. The type of data set that is created is determined by the system, and uses default values that are supplied by the SMS data class, and so on.

If DSNTYPE is not specified for a new library, then the value that is used for DSNTYPE depends on the engine that is assigned and the type of library that you are creating. SAS creates the new library according to the following rules, which are listed in order of precedence:

- SAS does not specify a DSNTYPE value when it allocates a library that resides in a temporary data set.
- If the specified engine is V6, SAS uses DSNTYPE=BASIC to provide compatibility with SAS 6, which does not support DSNTYPE=LARGE.

- When SAS creates a direct access bound library that resides in a DSORG=PS data set, it uses the value that you specify with the SAS system option DLDSNTYPE.
- When SAS creates a sequential access bound library that resides on disk, it uses the value that you specify with the SAS system option DLSEQDSNTYPE.

For more information about DLDSNTYPE and DLSEQDSNTYPE, see:

- "DLDSNTYPE System Option: z/OS" on page 726
- "DLSEQDSNTYPE System Option: z/OS" on page 731

**EATTR=OPT | NO**

For a SAS library in a z/OS data set, EATTR specifies whether the library data set, when created, is eligible to have extended attributes. In order to reside in the extended addressing space (EAS) of an extended address volume (EAV), a data set must have extended attributes. EATTR accepts the following values:

OPT specifies that the data set has extended attributes if it is created on an EAV.

NO specifies that the data set does not have extended attributes, even if it is created on an EAV.

If the EATTR option is not specified, then the default value for the option can be supplied by the SMS data class that is specified or selected for the allocation. Otherwise, the default is NO.

The EATTR option has no effect for UFS libraries, nor does it have any effect when assigning a library data set that already exists.

**EXTEND**

specifies that when SAS allocates this library, it allocates it with a volume count that is one greater than the current number of DASD volumes on which the library resides. With this option, a single-volume library can be converted to a multivolume library, and existing multivolume libraries can be extended to another volume.

**LABEL=(*subparameter-list*)**

enables you to specify for a tape or direct access data set the type and contents of the label of the tape or disk data set, as well as other information such as the retention period or expiration date for the data set.

The LABEL= option is identical to the JCL LABEL= parameter. For example:

```
label=(3,SL,,,EXPDT=2005/123)
```

This label specification indicates the data set sequence number is 3, that it uses standard labels, and that it expires on the 123rd day of 2005. See *MVS JCL Reference* by IBM for complete information about how to use the LABEL= option, including which subparameters you can specify in subparameter-list.

**LIKE='*physical-filename*'**

when allocating a new library, specifies that SAS sets the DCB attributes of the new library to the same values as those values in the specified data set.

**MGMTCLAS=*management-class-name***
specifies a management class for an SMS data set. The name can have up to eight characters. This option applies only to new data sets; it is ignored for existing data sets. The management class is predefined and controls how your data set is managed, such as how often it is backed up and how it is migrated.

The implementation of the MGMTCLAS= option is compatible with the SMS MGMTCLAS= JCL parameter. For complete information about this parameter, see z/OS JCL Reference by IBM. Ask your system administrator which management class names are used at your site.

**Note:** If your specified value for MGMTCLAS begins with national characters such as @, #, or $, then you need to enclose the value in single quotation marks as indicated in the following example:

```
LIBNAME WEEK 'physical.dataset.name'
     DISP=(NEW,CATLG,DELETE) DATACLAS='#DCLAS' MGMTCLAS='#MGMT';
```

**SPACE=(*unit*,(*primary*<,*secondary*>), <RLSE>,<*type*>,<ROUND> )**
specifies how much disk space to provide for a data set that is being created. The space can be requested in terms of tracks, cylinders, or blocks.

***unit***
can be any of the following:

| | |
|---|---|
| TRK | specifies that the space is to be allocated in tracks. |
| CYL | specifies that the space is to be allocated in cylinders. |
| blklen | specifies that the space is to be allocated in blocks whose block length is blklen bytes. The system computes how many tracks are allocated. |

***primary***
specifies how many tracks, cylinders, or blocks to allocate.

***secondary***
specifies how many additional tracks, cylinders, or blocks to allocate if more space is needed. The system does not allocate additional space until it is needed.

**RLSE**
causes unused space that was allocated to an output data set to be released when the data set is closed. Unused space is released only if the data set is opened for output, and if the last operation was a Write operation.

***type***
can be any of the following:

| | |
|---|---|
| CONTIG | specifies that the space to be allocated must be contiguous. |
| MXIG | specifies that the maximum contiguous space is required. |
| ALX | specifies that different areas of contiguous space are needed. |

ROUND
specifies that the allocated space must be equal to an integral number of cylinders when the unit specified was a block length. If unit was specified as TRK or CYL, the system ignores ROUND.

If SPACE is not defined, its values are taken from the SAS system options FILEUNIT=, FILESPPRI=, and FILESPSEC=, in the following form:

```
SPACE=(FILEUNIT,(FILESPPRI,FILESPSEC))
```

**STORCLAS=*storage-class-name***
specifies a storage class for an SMS data set. The name can have up to eight characters. This option applies only to new data sets; it is ignored for existing data sets. The storage class is predefined and controls which device your SMS data set is stored on, such as disk or tape.

The implementation of the STORCLAS= option is compatible with the SMS STORCLAS= JCL parameter. Ask your system administrator which storage class names are used at your site. For full details about this parameter, see *MVS JCL Reference* by IBM.

**Note:** If your specified value for STORCLAS begins with national characters such as @, #, or $, then you need to enclose the value in single quotation marks as indicated in the following example:

```
LIBNAME WEEK 'physical.dataset.name'
     DISP=(NEW,CATLG,DELETE) DATACLAS='#DCLAS' STORCLAS='#SCLAS';
```

**UNIT=*value* | (*value,n*) | (*value,P* )**
specifies that *value* is a generic device type name or a symbolic (esoteric) name for a group of devices. *value* must be enclosed in quotation marks if the generic device type name or group name contains characters other than alphanumeric characters. Contact your systems administrator to determine the appropriate generic device type or group name to specify.

*n* is the number of devices to be allocated for processing the library data set. A value from 1 to 59 can be specified. For multi-volume direct access bound libraries residing in non-SMS managed data sets, the device count can be specified to indicate the maximum number of volumes to which the data library can be extended during the current assignment.

For tape libraries, P requests that one device is allocated for each volume on which the data set resides.

For more information, see the IBM document *JCL Reference*.

**VOLCOUNT=*nnn***
specifies the maximum number of volumes on which a new library can reside. VOLCOUNT enables the creation of a multivolume tape library without the specification of a list of volumes with the VOLSER option. The value of VOLCOUNT is a decimal number from 1 through 255.

**VOLSER=*value* | (*value-1, ..., value-n*)**
specifies up to 30 volume serial numbers. If VOLSER= is not specified, its value is taken from the SAS system option FILEVOL=. For more information, see "FILEVOL= System Option: z/OS" on page 764. The VOLSER option does not

need to be specified for existing cataloged data sets unless your SAS job extends the library to additional volumes, and you want to specify the volumes (as opposed to allowing z/OS to select the volumes).

If the VOLSER option is specified, SAS supports option value specifications of 1 to 6 positions that consist of any combination of alphanumeric characters (A-Z, 0-9), national characters (#, $, @), or a hyphen. VOLSER values that contain a hyphen or any of the national characters must be enclosed in quotation marks. SAS writes an error to the log if an invalid VOLSER option value is specified.

**WAIT=*n***
specifies how long SAS software waits for a data set that is held by another job or user before the LIBNAME statement fails. The value *n* specifies a length of time in clock minutes. If the data set becomes free before n minutes expire, then the LIBNAME statement is processed as usual. The dynamic allocation request is retried internally every 15 seconds.

When you use the WAIT= option, you must also specify the engine name in the LIBNAME statement if you are accessing uncataloged libraries or libraries that do not reside on disk. Otherwise, you do not have to specify the engine name.

For batch jobs using WAIT=, also specify the FILEMSGS option, which causes a message to be written to the system log for each allocation attempt, thus allowing system operators to determine why the job is waiting. For more information, see "FILEMSGS System Option: z/OS" on page 753.

## Host Options for the XPORT, BMDP, OSIRIS, and SPSS Engines

The general form of the LIBNAME statement for the XPORT, BMDP, OSIRIS, and SPSS Engines is

**LIBNAME** *libref* <*engine* > <'*physical-filename*'> < *engine/host-options*> ;

**LIBNAME** *libref* <*engine*> <('*physical-filename-1*', ..., '*physical-filename-n*')>

**LIBNAME** *libref* | _ALL_ CLEAR;

**LIBNAME** *libref* | _ALL_ LIST;

***libref***
is a logical name by which the library is referenced during your SAS session. The libref must contain 1-8 characters and follow the rules for SAS names. To read, update, or create files that belong to a permanent SAS library, you must include the libref as the first part of a two-level SAS member name in your program statements, as follows:[1]

```
libref.member
```

*libref* could also be a ddname that was specified in a JCL DD statement or in a TSO ALLOCATE command. The first time the ddname of a SAS library is used in a SAS statement or procedure, SAS assigns it as a libref for the SAS library.

SAS 9 for z/OS supports libref names that begin with or contain underscores. For example, libref names with formats such as **`libref_name`**, **`_librefname`**, or **`_libref_name`** are now supported.

1. An exception is a SAS file in the USER library. In this case, you can use a one-level name. For more information about the USER library, see Chapter 3, "SAS Software Files," on page 25.

***engine***
tells SAS which engine to use for accessing the library. Valid engine names for z/OS include V9 (or its alias, BASE), V9TAPE, V8, V8TAPE, V7, V7TAPE, V6, V6TAPE, V5, V5TAPE, XPORT, REMOTE, BMDP, OSIRIS, SPD Engine Server, and SPSS. For more information, see "SAS Library Engines" on page 46. If you do not specify an engine, then SAS uses the procedures described in "How SAS Assigns an Engine" on page 81 to assign an engine for you. If the engine name that you supply does not match the actual format or attributes of the library, then any attempt to access the library fails.

***'physical-filename'***
is the z/OS operating environment data set name or the HFS directory name of the SAS library, enclosed in quotation marks. For more information, see Chapter 5, "Specifying Physical Files," on page 89. You can omit this argument if you are merely specifying the engine for a previously allocated ddname. Examples:

```
'userid.V9.library'
'MVS:userid.V9.library'
'HFS:/u/userid/V9/library'
'/u/userid/V9/library'
```

***('physical-filename-1', ..., 'physical-filename-n')***
is used to allocate an ordered concatenation of SAS libraries and associate that concatenation with a single libref. The concatenation can include direct-access bound libraries, UNIX System Services directories, and sequential libraries, as long as all of the libraries in the concatenation can be accessed with the specified engine.

When accessing a member of a concatenated series of libraries, SAS searches through the concatenation in the order which it was specified. SAS accesses the first member that matches the specified name. SAS does not access any members with the same name that are positioned after the first occurrence in the concatenation.

***engine/host options***
are options that apply to the SAS library. The host-specific options that are available depend on which engine you are using to access the library. For more information about SAS engine options, see "SAS Library Engines" on page 46. Specify as many options as you need. Separate them with a blank space. For a complete list of available options, see "LIBNAME Statement: z/OS" on page 656.

# Examples

## Example 1: Assigning an Existing Bound Library

The following LIBNAME statement associates the libref **mylib** with the existing library USER934.MYLIB.SASLIB. SAS examines the internal format of the library data set in order to select the appropriate engine. SAS would dynamically allocate the library for shared access if the library were not already assigned externally or internally.

```
libname mylib 'user934.mylib.saslib' disp=shr;
```

## Example 2: Assigning a UFS Library

The following LIBNAME statement associates the libref **hfslib** with the collection of UFS files residing in the directory **/u/user905/saslib**. This form of assignment does not use any host options and is, therefore, simple to port to or from other platforms.

```
libname UFSlib '/u/user905/saslib';
```

## Example 3: Assigning an Engine for an Externally Allocated Library

The following LIBNAME statement completes the assignment process for the externally assigned library CORP.PROD.PAYROLL.R200305 and specifies that the TAPE engine is used to process this library. It is necessary to specify the LIBNAME statement because the Base SAS engine is the default engine in this particular case.

```
//REGISTER  DD  DSN=CORP.PROD.PAYROLL.R200305,DISP=(NEW,CATLG),
//          UNIT=DISK,SPACE=(CYL,(5,5))
libname register TAPE;
```

## Example 4: Creating a New Bound Library

The following LIBNAME statement specifies the host options necessary to create and catalog a new multivolume, SMS-managed bound library:

```
libname new '.newproj.saslib' disp=(new,catlg)
   unit=(disk,2) space=(cyl,(50,20)) dataclas=sasstnd;
```

## Example 5: Assigning an Engine and Requesting BLKSIZE > 32760 for an Externally Allocated Library

The following LIBNAME statement completes the assignment process for the externally assigned library CORP.PROD.PAYROLL.MONTH, specifies DLLBI, and specifies that the TAPE engine is used to process this library. It is necessary to specify the LIBNAME statement to request the TAPE engine and a default BLKSIZE that is greater than 32760.

```
//REGISTER  DD  DSN=CORP.PROD.PAYROLL.MONTH,DISP=(NEW,CATLG),
//          UNIT=3590-1,LABEL=(1,SL),VOLUME=(PRIVATE,,,2)
libname register TAPE DLLBI=YES;
```

## Example 6: Concatenating a Personal Library to a Base Library

The following LIBNAME statements associate the libref **project** with the library concatenation in which a library containing modified members is concatenated in front of the base project library, which is accessed as read-only:

```
libname projbase '.project.base.saslib' disp=shr;
libname project ('.project.modified.saslib' projbase);
```

## See Also

- "Assigning SAS Libraries" on page 72
- "Deassigning SAS Libraries" on page 83
- "Listing Your Current Librefs" on page 82
- *SAS Programmer's Guide: Essentials*

### Functions

- "LIBNAME Function" in *SAS Functions and CALL Routines: Reference*

# OPTIONS Statement: z/OS

Changes the value of one or more SAS system options.

Valid in: Anywhere

z/OS specifics: *options*

See: "OPTIONS Statement" in *SAS Global Statements: Reference*

## Syntax

**OPTIONS** *options-1* <. . . *option-n* > ;

## Details

Some of the options that you can specify are host-specific. "System Options under z/OS" on page 685 contains information about all of the system options that are available in SAS under z/OS. Descriptions of the portable system options are provided in the *SAS System Options: Reference*.

Some system options can be changed only when you invoke SAS, not in an OPTIONS statement. "OPTIONS Statement" in *SAS Global Statements: Reference* contains information about where each system option can be specified.

## See Also

Chapter 1, "Invoking SAS in the z/OS Environment," on page 3

# SASFILE Statement: z/OS

Reduces I/O processing by holding the entire data set in memory.

Valid in: Anywhere

z/OS specifics: Performance considerations

See: "SASFILE Statement" in *SAS Global Statements: Reference*

## Syntax

**SASFILE** <*libref*.> *member-name*<.*member-type*> <(*password-options*)>
OPEN | LOAD | CLOSE;

### Arguments

***libref***
specifies a name that is associated with a SAS library. The libref must be a valid SAS name. The default libref is either User (if assigned) or Work (if User is not assigned).

Restriction The libref cannot represent a concatenation of SAS libraries that contain a library in sequential format.

***member-name***
specifies a valid SAS name that is a SAS data file that is a member of the SAS library associated with the libref.

Restriction The SAS data set must have been created with the V7, V8, or V9 Base SAS engine.

***member-type***
specifies the type of SAS file to be opened. Valid value is DATA, which is the default.

***password-options***
specifies one or more of the following password options:

**ENCRYPTKEY=*key-value***
enables the SASFILE statement to open a SAS data file that is encrypted with Advanced Encryption Standard (AES). If a SAS data file is encrypted with the AES algorithm, a key value is assigned to the file and must be specified in order to access the file. The key value can be up to 64 bytes long.

Interaction If you do not specify the ENCRYPTKEY= option for an AES-encrypted SAS data file, a dialog box prompts you to specify the key value.

See "SAS Data File Encryption" in *SAS Programmer's Guide: Essentials*

**READ=*password***
enables the SASFILE statement to open a read-protected file. The *password* must be a valid SAS name.

**WRITE=*password***
enables the SASFILE statement to use the WRITE password to open a file that is both read-protected and write-protected. The *password* must be a valid SAS name.

**ALTER=*password***
enables the SASFILE statement to use the ALTER password to open a file that is both read-protected and alter-protected. The *password* must be a valid SAS name.

**PW=*password***
enables the SASFILE statement to use the password to open a file that is assigned for all levels of protection. The *password* must be a valid SAS name.

Tip When SASFILE is executed, SAS checks whether the file is read-protected. Therefore, if the file is read-protected, you must include the READ= password in the SASFILE statement. If the file is either write-protected or alter-protected, you can use a WRITE=, ALTER=, or PW= password. However, the file is opened only in input (read) mode. For subsequent processing, you must specify the necessary password or passwords. See "Specifying Passwords with the SASFILE Statement" in *SAS Global Statements: Reference*.

**OPEN**
opens the file, allocates the buffers, but defers reading the data into memory until a procedure, statement, or application is executed.

**LOAD**
opens the file, allocates the buffers, and reads the data into memory.

**Note:** If the total number of allowed buffers is less than the number of buffers required for the file based on the number of data set pages and index file pages, SAS issues a warning about how many pages are read into memory.

**CLOSE**
frees the buffers and closes the file.

## Details

The SASFILE statement can greatly reduce both the elapsed time required for a SAS job to run and the CPU time for the job. However, in an environment where the various z/OS processes (batch jobs, TSO users, and started tasks) are competing for real (central) storage, the SAS data set might require more virtual storage than

is available. Unless steps are taken to manage memory usage, virtual storage paging delays can negate the benefits of using the SASFILE statement.

Using the SASFILE statement requires that the job step or TSO region size be increased sufficiently to allow a complete copy of the member to be stored in memory from the time SASFILE OPEN or LOAD is issued until SASFILE CLOSE is issued. SAS allocates virtual storage above the 16M line from the address space private region for buffers and associated control blocks for a SAS data set. The amount of storage that is required is approximately equal to the number of pages in the data set multiplied by the page size, provided that the file is not encrypted. The amount of storage required for an encrypted file is approximately double the amount required for a non-encrypted file. You can determine the number of pages in the data set and the size of those pages by running PROC CONTENTS against the data set. Therefore, your job's REGION value and the SAS MEMSIZE option must be set large enough to accommodate both your SASFILE data and any other memory that SAS requires for execution. However, if the overall environment is constrained for storage, or if a memory-intensive task is processing a heavy workload, the page frames that are occupied by the SAS data set buffers can be stolen, and virtual storage paging delays can occur.

When planning for SASFILE usage in your installation, first consider the importance of the workload that is requesting it. Weigh this importance against everything else in your workload (including work that is not related to your SAS work), and decide whether it is warranted. Use Workload Manager (WLM) to assign the appropriate importance level and velocity for all of your workload. The more important work automatically has higher priority for storage as it is needed.

For more information about Goal Mode, see the IBM documentation about WLM.

# SYSTASK LIST Statement: z/OS

Lists asynchronous tasks.

Valid in: Anywhere

z/OS specifics: All

## Syntax

**SYSTASK LIST** <_ALL_ | *taskname*> <STATE> ;

### Optional Arguments

**_ALL_**
specifies all active tasks in the system. A task is active if it is running, or if it has completed and has not been waited for using the WAITFOR statement on the remote host that submitted the task.

**STATE**
displays the status of the task, which can be Start Failed, Running, or Complete.

***taskname***
requests information for one remotely submitted task. If the task name contains a blank character, enclose *taskname* in quotation marks.

## Details

Task names can be listed with the SYSTASK LIST statement. These task names are assigned on other hosts and are supplied to the z/OS SAS session via RSUBMIT commands or statements in SAS/CONNECT software.

The preferred method for displaying any task (not just SAS/CONNECT processes) is to use the LISTTASK statement instead of SYSTASK LIST. For more information about LISTTASK, see "LISTTASK" in *SAS/CONNECT User's Guide*.

## See Also

- "WAITFOR Statement: z/OS" on page 680
- *SAS/CONNECT User's Guide*

# TITLE Statement: z/OS

Specifies title lines for SAS output.

Valid in: Anywhere

z/OS specifics: Maximum length of title

See: "TITLE Statement" in *SAS Global Statements: Reference*

## Syntax

**TITLE**<*n*> <'*text*' | "*text*"> ;

## Details

Under z/OS, the maximum title length is determined by the value of the LINESIZE= system option. The maximum value of LINESIZE= is 256. Titles longer than the value of LINESIZE= are truncated.

**Note:** No space is permitted between TITLE and the number *n*.

# TSO Statement: z/OS

Executes a TSO command, emulated USS command, or MVS program.

Valid in: Anywhere

Restriction: A TSO command executes successfully only in a TSO SAS session. In a non-TSO session, the command is disabled and the return code is set to 0.

z/OS specifics: All

## Syntax

**TSO** <*command*>;

### Optional Argument

***command***
is a TSO command, emulated USS command, or MVS program. For more information, see "X Statement: z/OS" on page 681.

## Details

### Overview of the TSO Statement

The TSO statement is an alias of the X statement. In other operating environments, the TSO statement has no effect, whereas the X statement is always processed.

## See Also

**Statements**

- "X Statement: z/OS" on page 681

**Functions**

- "SYSTEM Function: z/OS" on page 494
- "TSO Function: z/OS" on page 497

**CALL Routines**

- "CALL SYSTEM Routine: z/OS" on page 459
- "CALL TSO Routine: z/OS" on page 461

**Commands**

- “SAS Interface to REXX” on page 313
- “TSO Command: z/OS” on page 285

# WAITFOR Statement: z/OS

Suspends execution of the current SAS session until the specified tasks finish executing.

Valid in: Anywhere

z/OS specifics: All

## Syntax

**WAITFOR** <_ANY_ | _ALL_> *taskname-1* <*taskname-2* ...> <TIMEOUT=*seconds*>;

### Optional Arguments

***taskname***
specifies the name of the remotely submitted tasks that you want to complete execution before resuming execution of SAS. You cannot use wildcards to specify task names. Resumption of the SAS session depends first on the value of the TIMEOUT= option and second on the execution state of the specified tasks.

**_ANY_ | _ALL_**
suspends execution of the current SAS session until either one or all of the specified remote tasks finishes execution. The default setting is _ANY_, which means that as soon as one of the specified tasks completes execution, the WAITFOR statement also finishes execution. Note again that resumption of execution is primarily dependent on the TIMEOUT= option.

**TIMEOUT=*seconds***
specifies the maximum number of seconds that WAITFOR should suspend the current SAS session, regardless of the execution state of any or all specified tasks. The SAS session resumes execution at the end of the TIMEOUT= period even if specified tasks are still executing. If you do not specify the TIMEOUT= option and you do not specify any task names, WAITFOR suspends execution of the SAS session indefinitely. If you specify any task names and you do not specify a TIMEOUT= value, the SAS session resumes execution when the specified tasks complete execution. If you specify a TIMEOUT= value without specifying task names, the SAS suspends execution for the specified number of seconds.

## Details

Task names can be listed with the SYSTASK LIST statement. These task names are assigned on other hosts and are supplied to the z/OS SAS session via RSUBMIT commands or statements in SAS/CONNECT software.

The SYSRC macro variable contains the return code for the WAITFOR statement. If a WAITFOR statement cannot execute successfully, then the SYSRC macro variable is set to a nonzero value. For example, the WAITFOR statement might contain syntax errors. If the number of seconds specified with the TIMEOUT option elapses, then the WAITFOR statement finishes executing and the SYSRC macro variable is set to a nonzero value if any of the following occur:

- You specify a single task that does not finish executing.
- You specify more than one task and the _ANY_ option (which is the default setting), but none of the tasks finish executing.
- You specify more than one task and the _ALL_ option, and any one of the tasks does not finish executing.

## See Also

- *SAS/CONNECT User's Guide*
- "SYSTASK LIST Statement: z/OS" on page 677

# X Statement: z/OS

Executes a TSO command, emulated USS command, or MVS program.

| | |
|---|---|
| Valid in: | Anywhere |
| Restriction: | A TSO command executes successfully only in a TSO SAS session. In a non-TSO session, the command is disabled and the return code is set to 0. The NOXCMD option disables the X statement. |
| z/OS specifics: | The command must be a TSO command or simulated USS command, or an MVS program. |
| Note: | Under z/OS, the X and TSO statements are identical. In other operating environments, the TSO statement has no effect, whereas the X statement is always processed. |
| See: | "X Statement" in *SAS Global Statements: Reference* |

## Syntax

**X** <*command*> ;

**X TSO:**<*command*>;

**X XEQ:** pgmname <*parms*> ;

**X AEQ:** pgmname <*parms*> ;

**X WEQ:** pgmname <*parms*> ;

**X A*nn*:** pgmname <*parms*> ;

**X W*nn*:** pgmname <*parms*> ;

## Optional Argument

**command**

can be a system command (TSO command, CLIST, or REXX exec) or one of a set of emulated USS commands, enclosed in quotation marks, an expression whose value is a command, or the name of a character variable whose value is a command.

You cannot issue the TSO commands LOGON, LOGOFF, or TEST, and you cannot execute CLISTs that include the TSO ATTN statement. Nor can you issue authorized commands. However, you can use the TSOEXEC command to issue authorized commands, as in this example:

```
X TSOEXEC ALTDSD ...;
```

You can issue the following emulated shell commands: cd, env, pwd, and umask. The shell command names must be specified in lowercase. These commands emulate the basic function of the corresponding UNIX System Services shell commands. The emulated env command displays values that are set by TKMVSENV and by the SET option. These commands work in batch and under TSO.

It is not possible to directly issue UNIX System Services commands other than the four listed here with the X statement. However, there are two ways to issue them indirectly. You can use the PIPE access method of the FILENAME statement or function to invoke a USS command and send input to the command or read its output. For more information, see “Piping Data between SAS and UNIX System Services Commands” on page 136. You can use the IBM REXX exec SYS1.SBPXEXEC(OSHELL) to execute a USS command with BPXBATCH, for example:

```
x oshell ls;
```

To issue a TSO command that has the same name as one of the emulated-shell commands, such as a CLIST named CD, either enter the command using uppercase characters, or use the TSO: prefix, as in the following examples:

```
x CD option1 option2 ...;
x tso:cd option1 option2 ...;
```

# Details

## TSO Submode

In an interactive SAS session, you can specify the X statement (or TSO statement) with no arguments to enter TSO submode. Any commands that you issue in TSO submode are processed by TSO. They are not processed as SAS statements.

To return to the SAS session from TSO submode, issue RETURN, END, or EXIT. Any characters that follow the RETURN, END, or EXIT subcommand are ignored. An END command that occurs within a CLIST terminates the command procedure without ending the TSO submode.

## Command Execution

If you specify the X statement or the TSO statement with a command, then SAS executes the specified command immediately.

# Examples

## Example 1: SAS Macro

The following example SAS Macro enables you to determine whether the current SAS execution environment is TSO. If the environment is TSO, the macro invokes the TSO LISTA command. If the environment is not TSO, the macro sets SYSRC to 12.

```
%macro TSOONLY(mycmd);
%if "&sysscp" = "OS" and "&sysenv" = "FORE" %then %do;
%sysexec &mycmd;
%end;
%else %do;
%let sysrc=12;
%end;
%mend;
%let mycmd=lista sta sys hist;
%TSOONLY(&mycmd);
%put &sysrc;
```

## Example 2: MVS Program Execution: Synchronous

The X statement or TSO statement can also be used to execute an MVS program, rather than a TSO command. The statements work in batch and under TSO.

To execute an MVS program synchronously, prefix its name with `XEQ:`.

The following example attaches the program `mypgm`, passes it the argument `myparms`, and does not return until the program completes processing. All of the text between `mypgm` and the terminating semicolon are considered to be parameters.

```
X XEQ: mypgm myparms;
```

### Example 3: MVS Program Execution: Asynchronous

The X statement or TSO statement can also be used to execute an MVS program asynchronously. To start the execution of an MVS program, prefix its name with either AEQ: or A*nn*:, where *nn* is a two-digit number. To wait for the completion of the MVS program, issue a second X statement or TSO statement with only the prefix `WEQ:` or `W`*`nn`*`:`, where *nn* matches the same two digits used on the A*nn*: statement.

### Example 4: MVS Program Execution: Concurrent Asynchronous

The following example attaches two programs, executes some more SAS statements, and waits for each program to execute separately. To wait for a particular program to execute, issue an X W*nn*: statement where the value of *nn* is the same as the value of the *nn* in the corresponding X A*nn*: statement.

```
X A01: pgm1 parms1;
X A02: pgm2 parms2;
data x;x=1;run;
proc print;run;
X W02:;
X W01:;
```

## See Also

“TSO Statement: z/OS” on page 679

# 31

# System Options under z/OS

# System Options in the z/OS Environment

The *SAS System Options: Reference* contains information about system options that can be used in all operating environments. Only the Base SAS system options that are specific to z/OS or that have aspects specific to z/OS are documented in this chapter. However, some system options are specific to topics that are covered in other books. For example, system options that are related to security are documented in *Encryption in SAS*. For information about all Base SAS system options that are supported under z/OS, see *SAS System Options: Reference*.

- For information about system options that support a SAS product, such as SAS/ACCESS, SAS/CONNECT, or SAS/SHARE, see the documentation for that product.
- For information about using SAS system options under z/OS, see "SAS System Options" on page 19.
- For information about file specifications, see "Referring to External Files" on page 108 and "Ways of Assigning External Files" on page 94.
- Restricted options are system options whose values are determined by the site administrator and cannot be overridden. The site administrator can create a restricted options table that specifies the option values that are restricted when SAS starts. Any attempt to modify a system option that is listed in the restricted options table results in a message to the SAS log indicating that the system option has been restricted by the site administrator and cannot be updated. For information about restricted options, see "Restricted Options" in *SAS System Options: Reference*.
- If you include system options when you start SAS, and the value for the option contains blank spaces, then you need to place quotation marks around the value. The following example shows the correct format:

```
pgparm='string1 string2'
```

# Definition of System Options

System options are instructions that affect your SAS session. They control how SAS performs operations such as SAS initialization, hardware and software interfacing, and the input, processing, and output of jobs and SAS files.

# SAS System Options for z/OS by Category

| Category | Language Elements | Description |
|---|---|---|
| Communications: Email | EMAILSYS= System Option: z/OS (p. 736) | Specifies the email protocol to use for sending electronic mail. |
| Communications: Metadata | METAPROFILE= System Option: z/OS (p. 815) | Identifies the file that contains the SAS Metadata Server user profiles. |
| Communications: Networking and Encryption | DLDSKEYLBL= System Option (p. 727) | Specifies a default dataset pervasive encryption key label for accessing SAS libraries. |
| | SASSCRIPT System Option: z/OS (p. 837) | Specifies one or more storage locations of SAS/CONNECT script files. |
| DATA Step: WTO Function | WTOUSERDESC= System Option: z/OS (p. 888) | Specifies a WTO DATA step function descriptor code. |
| | WTOUSERMCSF= System Option: z/OS (p. 889) | Specifies WTO DATA step function MCS flags. |
| | WTOUSERROUT= System Option: z/OS (p. 891) | Specifies a WTO DATA step function routing code. |
| Environment Control: Display | CHARTYPE= System Option: z/OS (p. 718) | Specifies a character set or screen size to use for a device. |
| | FSBCOLOR System Option: z/OS (p. 768) | Specifies whether you can set background colors in SAS windows on vector graphics devices. |
| | FSBORDER= System Option: z/OS (p. 769) | Specifies what type of symbols are to be used in borders. |
| | FSDEVICE= System Option: z/OS (p. 769) | Specifies the full-screen device driver for your terminal. |
| | FSMODE= System Option: z/OS (p. 770) | Specifies the full-screen data stream type. |
| | GHFONT= System Option: z/OS (p. 773) | Specifies the default graphics hardware font. |
| | PFKEY= System Option: z/OS (p. 825) | Specifies which set of function keys to designate as the primary set of function keys. |

| Category | Language Elements | Description |
|---|---|---|
| | V6GUIMODE System Option: z/OS (p. 882) | Specifies whether SAS uses SAS 6 style SCL selection list windows. |
| Environment Control: Error Handling | ERRORABEND System Option: z/OS (p. 738) | Specifies whether SAS responds to errors by terminating. |
| | STAE System Option: z/OS (p. 865) | Enables or disables a system abend exit. |
| | STAX System Option: z/OS (p. 866) | Specifies whether to enable attention handling. |
| | STEPCHKPTLIB= System Option: z/OS (p. 867) | Specifies the libref of the library where checkpoint-restart data is saved. |
| Environment Control: Files | ALTLOG= System Option: z/OS (p. 703) | Specifies a destination for a copy of the SAS log. |
| | ALTPRINT= System Option: z/OS (p. 704) | Specifies the destination for the copies of the output files from SAS procedures. |
| | APPEND= System Option: z/OS (p. 705) | Appends the specified value to the existing value at the end of the specified system option. |
| | APPLETLOC= System Option: z/OS (p. 707) | Specifies the location of Java applets. |
| | AUTOEXEC= System Option: z/OS (p. 710) | Specifies the SAS autoexec file. |
| | CONFIG= System Option: z/OS (p. 722) | Specifies the configuration file that is used when initializing or overriding the values of SAS system options. |
| | HELPLOC= System Option: z/OS (p. 775) | Specifies the location of the text and index files for the facility that is used to view SAS Help and Documentation. |
| | INSERT= System Option: z/OS (p. 783) | Inserts the specified value at the beginning of the specified system option. |
| | LOG= System Option: z/OS (p. 804) | Specifies a destination for a copy of the SAS log when running in batch mode. |
| | MSG= System Option: z/OS (p. 817) | Specifies the library that contains the SAS messages. |
| | MSGCASE System Option: z/OS (p. 818) | Specifies whether notes, warnings, and error messages that are generated by SAS are displayed in uppercase characters. |
| | MSGSIZE= System Option: z/OS (p. 819) | Specifies the size of the message cache. |
| | PRINT= System Option: z/OS (p. 828) | Specifies a destination for SAS output when running in batch mode. |

| Category | Language Elements | Description |
|---|---|---|
| | SASAUTOS= System Option: z/OS (p. 833) | Specifies the location of the autocall library. |
| | SASHELP= System Option: z/OS (p. 835) | Specifies the location of the Sashelp SAS library. |
| | SASLIB= System Option: z/OS (p. 836) | Specifies the ddname for an alternate load library. |
| | SASUSER= System Option: z/OS (p. 838) | Specifies the location of an external SAS library that contains the user Profile catalog. |
| | SET= System Option: z/OS (p. 840) | Defines an environment variable. |
| | SYSIN= System Option: z/OS (p. 871) | Specifies the location of the primary SAS input data stream. |
| | USER= System Option: z/OS (p. 877) | Specifies the location of the default SAS library. |
| | WORK= System Option: z/OS (p. 887) | Specifies the location of the SAS Work library. |
| | WORKTERM System Option: z/OS (p. 888) | Specifies whether SAS erases WORK files at the termination of a SAS session. |
| Environment Control: Help | HELPHOST System Option: z/OS (p. 774) | Specifies the name of the computer where the remote help browser is running. |
| | HELPTOC System Option: z/OS (p. 776) | Specifies the table of contents files for the online SAS Help and Documentation. |
| Environment Control: Initialization and Operation | CLIST System Option: z/OS (p. 721) | Specifies that SAS obtains its input from a CLIST. |
| Files: External Files | ASYNCHIO System Option: z/OS (p. 709) | Specifies whether asynchronous I/O is enabled. |
| | CAPSOUT System Option: z/OS (p. 715) | Specifies that all output is to be converted to uppercase. |
| | DSRESV System Option: z/OS (p. 733) | Requests exclusive use of shared disk volumes when accessing partitioned data sets on shared disk volumes. |
| | FILEAUTHDEFER System Option: z/OS (p. 739) | Controls whether SAS performs file authorization checking for z/OS data sets or defers authorization checking to z/OS system services such as OPEN. |
| | FILEBLKSIZE(device-type)= System Option: z/OS (p. 741) | Specifies the default block size for external files. |

| Category | Language Elements | Description |
|---|---|---|
| | FILEBUFNO= System Option: z/OS (p. 742) | Specifies how many memory buffers to allocate for reading and writing. |
| | FILECC System Option: z/OS (p. 743) | Specifies whether to treat data in column 1 of a printer file as carriage-control data when reading the file. |
| | FILEDEST= System Option: z/OS (p. 744) | Specifies the default printer destination. |
| | FILEDEV= System Option: z/OS (p. 744) | Specifies the device name used for allocating new physical files. |
| | FILEDIRBLK= System Option: z/OS (p. 745) | Specifies the number of default directory blocks to allocate for new partitioned data sets. |
| | FILEEXT= System Option: z/OS (p. 746) | Specifies how to handle file extensions when accessing members of partitioned data sets. |
| | FILELBI System Option: z/OS (p. 749) | Controls the use of the z/OS Large Block Interface support for BSAM and QSAM files, as well as files on tapes that have standard labels. |
| | FILELOCKS= System Option: z/OS (p. 750) | Specifies the default SAS file locking that is to be used for external files (both UFS and native MVS). Also specifies the operating system file locking to be used for UFS files (both SAS files and external files). |
| | FILEMOUNT System Option: z/OS (p. 752) | Specifies whether an off-line volume is to be mounted. |
| | FILEMSGS System Option: z/OS (p. 753) | Controls whether you receive expanded dynamic allocation error messages when you are assigning a physical file. |
| | FILENULL System Option: z/OS (p. 753) | Specifies whether zero-length records are written to external files. |
| | FILEPROMPT System Option: z/OS (p. 754) | Controls whether you are prompted if you reference a data set that does not exist. |
| | FILEREUSE System Option: z/OS (p. 755) | Specifies whether to reuse an existing allocation for a file that is being allocated to a temporary ddname. |
| | FILESEQDSNTYPE System Option: z/OS (p. 756) | Specifies the default value that is assigned to DSNTYPE when it is not specified with a FILENAME statement, a DD statement, or a TSO ALLOC command. |
| | FILESPPRI= System Option: z/OS (p. 757) | Specifies the default primary space allocation for new physical files. |
| | FILESPSEC= System Option: z/OS (p. 758) | Specifies the default secondary space allocation for new physical files. |
| | FILESTAT System Option: z/OS (p. 758) | Specifies whether ISPF statistics are written. |

| Category | Language Elements | Description |
|---|---|---|
| | FILESYSTEM= System Option: z/OS (p. 761) | Specifies the default file system used when the filename is ambiguous. |
| | FILETEMPDIR System Option: z/OS (p. 762) | Specifies the parent directory for FILENAME TEMPFILE. |
| | FILEUNIT= System Option: z/OS (p. 763) | Specifies the default unit of allocation for new physical files. |
| | FILEVOL= System Option: z/OS (p. 764) | Specifies which VOLSER to use for new physical files. |
| | LRECL= System Option: z/OS (p. 810) | Specifies the default logical record length to use for reading and writing external files. |
| | PGMPARM= System Option: z/OS (p. 827) | Specifies the parameter that is passed to the external program specified by the SYSINP= option. |
| | SYSINP= System Option: z/OS (p. 872) | Specifies the name of an external program that provides SAS input statements. |
| | SYSPREF= System Option: z/OS (p. 873) | Specifies a prefix for partially qualified physical filenames. |
| | S99NOMIG System Option: z/OS (p. 875) | Tells SAS whether to recall a migrated data set. |
| Files: SAS Files | ALIGNSASIOFILES System Option: z/OS (p. 702) | Aligns output data on a page boundary for SAS data sets written to UFS libraries. |
| | ASYNCHIO System Option: z/OS (p. 709) | Specifies whether asynchronous I/O is enabled. |
| | BLKALLOC System Option: z/OS (p. 711) | Causes SAS to set LRECL and BLKSIZE values for a SAS library when it is allocated rather than when it is first accessed. |
| | BLKSIZE= System Option: z/OS (p. 712) | Specifies the default block size for SAS libraries. |
| | BLKSIZE(device-type)= System Option: z/OS (p. 714) | Specifies the default starting point for block size calculations for new direct access bound libraries that reside in DSORG=PS data sets. |
| | CATCACHE= System Option: z/OS (p. 717) | Specifies the number of SAS catalogs to keep open. |
| | CLIENTWORK System Option: z/OS (p. 719) | Specifies dynamic allocation options for creating client work libraries in a SAS server environment. |
| | DLCREATEDIR System Option: z/OS (p. 724) | Creates a directory for a SAS library that is specified in a LIBNAME statement if the directory does not exist. |

| Category | Language Elements | Description |
|---|---|---|
| | DLDISPCHG System Option: z/OS (p. 725) | Controls changes in allocation disposition for an existing library data set. |
| | DLDSNTYPE System Option: z/OS (p. 726) | Specifies the default value of the DSNTYPE LIBNAME option for direct access bound libraries in DSORG=PS data sets. |
| | DLEXCPCOUNT System Option: z/OS (p. 728) | Reports number of EXCPs to direct access bound SAS libraries. |
| | DLLBI System Option: z/OS (p. 729) | Specifies whether the default BLKSIZE for the sequential access bound library that is being assigned can exceed 32760 if the library resides on a tape device. |
| | DLMSGLEVEL= System Option: z/OS (p. 730) | Specifies the level of messages to generate for SAS libraries. |
| | DLSEQDSNTYPE System Option: z/OS (p. 731) | Specifies the default value of the DSNTYPE LIBNAME option for sequential-access bound libraries on disk. |
| | DLTRUNCHK System Option: z/OS (p. 732) | Enables checking for SAS library truncation. |
| | FILEAUTHDEFER System Option: z/OS (p. 739) | Controls whether SAS performs file authorization checking for z/OS data sets or defers authorization checking to z/OS system services such as OPEN. |
| | FILEDEV= System Option: z/OS (p. 744) | Specifies the device name used for allocating new physical files. |
| | FILELOCKS= System Option: z/OS (p. 750) | Specifies the default SAS file locking that is to be used for external files (both UFS and native MVS). Also specifies the operating system file locking to be used for UFS files (both SAS files and external files). |
| | FILEMSGS System Option: z/OS (p. 753) | Controls whether you receive expanded dynamic allocation error messages when you are assigning a physical file. |
| | FILEPROMPT System Option: z/OS (p. 754) | Controls whether you are prompted if you reference a data set that does not exist. |
| | FILESPPRI= System Option: z/OS (p. 757) | Specifies the default primary space allocation for new physical files. |
| | FILESPSEC= System Option: z/OS (p. 758) | Specifies the default secondary space allocation for new physical files. |
| | FILESYNC= System Option: z/OS (p. 759) | Specifies when operating system buffers that contain contents of permanent SAS files are written to disk. |
| | FILEUNIT= System Option: z/OS (p. 763) | Specifies the default unit of allocation for new physical files. |
| | FILEVOL= System Option: z/OS (p. 764) | Specifies which VOLSER to use for new physical files. |

| Category | Language Elements | Description |
|---|---|---|
| | HSLXTNTS= System Option: z/OS (p. 779) | Specifies the size of each physical hiperspace that is created for a SAS library. |
| | HSMAXPGS= System Option: z/OS (p. 780) | Specifies the maximum number of hiperspace pages allowed in a SAS session. |
| | HSMAXSPC= System Option: z/OS (p. 781) | Specifies the maximum number of hiperspaces allowed in a SAS session. |
| | HSWORK System Option: z/OS (p. 782) | Tells SAS to place the Work library in a hiperspace. |
| | SEQENGINE= System Option: z/OS (p. 839) | Specifies the default engine to use when assigning sequential access SAS libraries. |
| | SYNCHIO System Option: z/OS (p. 870) | Specifies whether synchronous I/O is enabled. |
| | S99NOMIG System Option: z/OS (p. 875) | Tells SAS whether to recall a migrated data set. |
| | TAPECLOSE= System Option: z/OS (p. 875) | Specifies how sequential access bound libraries on tape are handled when SAS closes the library data set. |
| | UTILLOC= System Option: z/OS (p. 877) | Specifies location of certain types of temporary utility files. |
| | VALIDMEMNAME= System Option: z/OS (p. 883) | Specifies the rules for naming SAS data sets, data views, and item stores. |
| Graphics: Driver Settings | DEVICE= System Option: z/OS (p. 723) | Specifies a device driver for graphics output for SAS/GRAPH software. |
| Host Interfaces: ISPF | ISPCAPS System Option: z/OS (p. 784) | Specifies whether to convert to uppercase printable ISPF parameters that are used in CALL ISPEXEC and CALL ISPLINK. |
| | ISPCHARF System Option: z/OS (p. 785) | Specifies whether the values of SAS character variables are converted using their automatically specified informats or formats each time they are used as ISPF variables. |
| | ISPCSR= System Option: z/OS (p. 786) | Tells SAS to set an ISPF variable to the name of a variable whose value is found to be invalid. |
| | ISPEXECV= System Option: z/OS (p. 787) | Specifies the name of an ISPF variable that passes its value to an ISPF service. |
| | ISPMISS= System Option: z/OS (p. 788) | Specifies the value assigned to SAS character variables defined to ISPF when the associated ISPF variable has a length of zero. |
| | ISPMSG= System Option: z/OS (p. 789) | Tells SAS to set an ISPF variable to a message ID when a variable is found to be invalid. |

| Category | Language Elements | Description |
|---|---|---|
| | ISPNOTES System Option: z/OS (p. 789) | Specifies whether ISPF error messages are to be written to the SAS log. |
| | ISPNZTRC System Option: z/OS (p. 790) | Specifies whether nonzero ISPF service return codes are to be written to the SAS log. |
| | ISPPT System Option: z/OS (p. 791) | Specifies whether ISPF parameter value pointers and lengths are to be written to the SAS log. |
| | ISPTRACE System Option: z/OS (p. 792) | Specifies whether the parameter lists and service return codes are to be written to the SAS log. |
| | ISPVDEFA System Option: z/OS (p. 793) | Specifies whether all current SAS variables are to be identified to ISPF via the SAS VDEFINE user exit. |
| | ISPVDLT System Option: z/OS (p. 794) | Specifies whether VDELETE is executed before each SAS variable is identified to ISPF via VDEFINE. |
| | ISPVDTRC System Option: z/OS (p. 795) | Specifies whether to trace every VDEFINE for SAS variables. |
| | ISPVIMSG= System Option: z/OS (p. 796) | Specifies the ISPF message ID that is to be set by the SAS VDEFINE user exit when the informat for a variable returns a nonzero return code. |
| | ISPVRMSG= System Option: z/OS (p. 796) | Specifies the ISPF message ID that is to be set by the SAS VDEFINE user exit when a variable has a null value. |
| | ISPVTMSG= System Option: z/OS (p. 797) | Specifies the ISPF message ID that is to be displayed by the SAS VDEFINE user exit when the ISPVTRAP option is in effect. |
| | ISPVTNAM= System Option: z/OS (p. 798) | Restricts the information that is displayed by the ISPVTRAP option to the specified variable only. |
| | ISPVTPNL= System Option: z/OS (p. 799) | Specifies the name of the ISPF panel that is to be displayed by the SAS VDEFINE user exit when the ISPVTRAP option is in effect. |
| | ISPVTRAP System Option: z/OS (p. 799) | Specifies whether the SAS VDEFINE user exit writes information to the SAS log (for debugging purposes) each time it is entered. |
| | ISPVTVARS= System Option: z/OS (p. 800) | Specifies the prefix for the ISPF variables to be set by the SAS VDEFINE user exit when the ISPVTRAP option is in effect. |
| Host Interfaces: REXX | REXXLOC= System Option: z/OS (p. 831) | Specifies the ddname of the REXX library to be searched when the REXXMAC option is in effect. |
| | REXXMAC System Option: z/OS (p. 832) | Enables or disables the REXX interface. |
| Input Control: Data Processing | CARDIMAGE System Option: z/OS (p. 716) | Processes SAS source and data lines as 80-byte records. |

| Category | Language Elements | Description |
|---|---|---|
| | XCMD System Option: z/OS (p. 892) | Specifies whether the X command is valid in the SAS session. |
| Log and Procedure Output Control: ODS Printing | FILEFORMS= System Option: z/OS (p. 748) | Specifies the default SYSOUT form for a print file. |
| | FILESYSOUT= System Option: z/OS (p. 760) | Specifies the default SYSOUT CLASS for a printer file. |
| | FONTRENDERING= System Option: z/OS (p. 765) | Specifies whether SAS/GRAPH devices that are based on the SASGDGIF, SASGDTIF, and SASGDIMG modules render fonts by using the operating system or by using the FreeType engine. |
| | SYSPRINT= System Option: z/OS (p. 874) | Specifies the handling of output that is directed to the default print file. |
| Log and Procedure Output Control: Procedure Output | PRINTINIT System Option: z/OS (p. 828) | Initializes the procedure output file. |
| Log and Procedure Output Control: SAS Log | ECHO= System Option: z/OS (p. 735) | Specifies a message to be echoed to the SAS log while initializing SAS. |
| | FULLSTATS System Option: z/OS (p. 771) | Specifies whether to write all available system performance statistics to the SAS log. |
| | HOSTINFOLONG System Option: z/OS (p. 778) | Specifies to print additional operating environment information in the SAS log when SAS starts. |
| | ISPNOTES System Option: z/OS (p. 789) | Specifies whether ISPF error messages are to be written to the SAS log. |
| | ISPNZTRC System Option: z/OS (p. 790) | Specifies whether nonzero ISPF service return codes are to be written to the SAS log. |
| | ISPPT System Option: z/OS (p. 791) | Specifies whether ISPF parameter value pointers and lengths are to be written to the SAS log. |
| | ISPTRACE System Option: z/OS (p. 792) | Specifies whether the parameter lists and service return codes are to be written to the SAS log. |
| | ISPVDTRC System Option: z/OS (p. 795) | Specifies whether to trace every VDEFINE for SAS variables. |
| | ISPVTRAP System Option: z/OS (p. 799) | Specifies whether the SAS VDEFINE user exit writes information to the SAS log (for debugging purposes) each time it is entered. |
| | LINESIZE= System Option: z/OS (p. 803) | Specifies the line size for the SAS Log and SAS procedure output. |

| Category | Language Elements | Description |
|---|---|---|
| | LOGPARM= System Option: z/OS (p. 805) | Controls when SAS log files are opened, closed, and, in conjunction with the LOG= system option, how they are named. |
| | OPLIST System Option: z/OS (p. 822) | Specifies whether the settings of the SAS system options are written to the SAS log. |
| | STATS System Option: z/OS (p. 865) | Specifies whether statistics are to be written to the SAS log. |
| | VERBOSE System Option: z/OS (p. 886) | Specifies whether SAS writes the start-up system option settings to the SAS log. |
| Log and Procedure Output Control: SAS Log and Procedure Output | PAGEBREAKINITIAL System Option: z/OS (p. 822) | Inserts an initial page break in SAS log and procedure output files. |
| | PAGESIZE= System Option: z/OS (p. 823) | Specifies the number of lines that compose a page of SAS output. |
| Macro: SAS Macro | MSYMTABMAX= System Option: z/OS (p. 820) | Specifies the maximum amount of memory available to the macro variable symbol tables. |
| | MVARSIZE= System Option: z/OS (p. 821) | Specifies the maximum size for macro variables that are stored in memory. |
| | SASAUTOS= System Option: z/OS (p. 833) | Specifies the location of the autocall library. |
| Sort: Procedure Options | DYNALLOC System Option: z/OS (p. 734) | Controls whether SAS or the host sort utility allocates sort work data sets. |
| | FILSZ System Option: z/OS (p. 764) | Specifies that the host sort utility supports the FILSZ parameter. |
| | SORT= System Option: z/OS (p. 841) | Specifies the minimum size of all allocated sort work data sets. |
| | SORTALTMSGF System Option: z/OS (p. 842) | Enables sorting with alternate message flags. |
| | SORTBLKMODE System Option: z/OS (p. 843) | Enables block mode sorting. |
| | SORTBLKREC System Option: z/OS (p. 844) | Enables control of SORTBLKMODE buffers. |
| | SORTBUFMOD System Option: z/OS (p. 844) | Enables modification of the sort utility output buffer. |
| | SORTCUT= System Option: z/OS (p. 845) | Specifies the size of the data in observations above which the host sort is likely to perform more efficiently than the internal sort. |

| Category | Language Elements | Description |
|---|---|---|
| | SORTCUTP= System Option: z/OS (p. 846) | Specifies the size of the data in bytes above which the host sort is likely to perform more efficiently than the internal sort. SORTCUTP is used only when SORTCUT=0. |
| | SORTDEV= System Option: z/OS (p. 848) | Specifies the unit device name if SAS dynamically allocates the sort work file. |
| | SORTDEVWARN System Option: z/OS (p. 849) | Enables device type warnings. |
| | SORTEQOP System Option: z/OS (p. 850) | Specifies whether the host sort utility supports the EQUALS option. |
| | SORTLIB= System Option: z/OS (p. 850) | Specifies the name of the sort library. |
| | SORTLIST System Option: z/OS (p. 851) | Enables passing of the LIST parameter to the host sort utility. |
| | SORTMSG System Option: z/OS (p. 852) | Controls the class of messages to be written by the host sort utility. |
| | SORTMSG= System Option: z/OS (p. 853) | Specifies the ddname to be dynamically allocated for the message print file of the host sort utility. |
| | SORTNAME= System Option: z/OS (p. 853) | Specifies the name of the host sort utility. |
| | SORTOPTS System Option: z/OS (p. 854) | Specifies whether the host sort utility supports the OPTIONS statement. |
| | SORTPARM= System Option: z/OS (p. 855) | Specifies parameters for the host sort utility. |
| | SORTPGM= System Option: z/OS (p. 856) | Specifies which sort utility SAS uses, the SAS sort utility or the host sort utility. |
| | SORTSHRB System Option: z/OS (p. 857) | Specifies whether the host sort interface can modify data in buffers. |
| | SORTSIZE= System Option: z/OS (p. 858) | Specifies the SIZE parameter that SAS is to pass to the sort utility. |
| | SORTSUMF System Option: z/OS (p. 859) | Specifies whether the host sort utility supports the SUM FIELDS=NONE control statement. |
| | SORTUADCON System Option: z/OS (p. 860) | Specifies whether the host sort utility supports passing a user address constant to the E15/E35 exits. |
| | SORTUNIT= System Option: z/OS (p. 861) | Specifies the unit of allocation for sort work files. |
| | SORTWKDD= System Option: z/OS (p. 862) | Specifies the prefix of sort work data sets. |

| Category | Language Elements | Description |
|---|---|---|
| | SORTWKNO= System Option: z/OS (p. 863) | Specifies how many sort work data sets to allocate. |
| | SORT31PL System Option: z/OS (p. 864) | Controls what type of parameter list is used to invoke the host sort utility. |
| System Administration: Memory | MEMLEAVE= System Option: z/OS (p. 811) | Specifies the amount of memory in the user's region that is reserved exclusively for the use of the operating environment. |
| | MEMRPT System Option: z/OS (p. 813) | Specifies whether memory usage statistics are to be written to the SAS log for each step. |
| | MEMSIZE= System Option: z/OS (p. 814) | Specifies the limit on the total amount of memory that can be used by a SAS session. |
| | MINSTG System Option: z/OS (p. 816) | Tells SAS whether to minimize its use of storage. |
| | MSGSIZE= System Option: z/OS (p. 819) | Specifies the size of the message cache. |
| | PROCLEAVE= System Option: z/OS (p. 829) | Specifies an amount of memory that is to be held in reserve, and that is to be made available only when memory allocation would otherwise fail. |
| | REALMEMSIZE= System Option: z/OS (p. 830) | Specifies the amount of real memory SAS can expect to allocate. |
| | SORTSIZE= System Option: z/OS (p. 858) | Specifies the SIZE parameter that SAS is to pass to the sort utility. |
| | SYSLEAVE= System Option: z/OS (p. 872) | Specifies how much memory to leave unallocated to ensure that SAS software tasks are able to terminate successfully. |
| System Administration: Performance | ARMAGENT= System Option: z/OS (p. 708) | Specifies another vendor's ARM agent, which is an executable module that contains a vendor's implementation of the ARM API. |
| | FULLSTATS System Option: z/OS (p. 771) | Specifies whether to write all available system performance statistics to the SAS log. |
| | STATS System Option: z/OS (p. 865) | Specifies whether statistics are to be written to the SAS log. |
| | STIMER System Option: z/OS (p. 868) | Specifies whether to write a subset of system performance statistics to the SAS log. |
| | SVC11SCREEN System Option: z/OS (p. 869) | Specifies whether to enable SVC 11 screening to obtain host date and time information. |

# Dictionary

## ALIGNSASIOFILES System Option: z/OS

Aligns output data on a page boundary for SAS data sets written to UFS libraries.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation |
| Category: | Files: SAS Files |
| PROC OPTIONS GROUP= | SASFILES |
| Default: | NOSASALIGNIOFILES |

### Syntax

**ALIGNSASIOFILES** | **NOALIGNSASIOFILES**

#### Syntax Description

**ALIGNSASIOFILES**
specifies to align output data on page boundary.

**NOALIGNSASIOFILES**
specifies to write output data using standard SAS practices.

### Details

A SAS data set in a UFS library consists of a header that is followed by one or more pages of data. The ALIGNSASIOFILES system option forces the header to be the same size as the data pages so that the data pages are aligned to boundaries that are whole-number multiples of the member page size. Although aligning the pages provides no performance benefit on z/OS, SAS data sets with aligned pages can be processed more efficiently by SAS on other platforms. Therefore, when creating SAS data sets in a non-native data representation for use on another host platform (by using the OUTREP option of the LIBNAME statement), specify ALIGNSASIOFILES.

The ALIGNSASIOFILES option has no effect on the creation or processing of members in direct access bound libraries or sequential access bound libraries because they have a different physical organization that the SAS files in UFS libraries.

You can use the BUFSIZE= system option or the BUFSIZE= data set option to set the page size.

## See Also

- "Techniques for Optimizing I/O" in *SAS Programmer's Guide: Essentials*

**Data Set Options:**

- "BUFSIZE= Data Set Option: z/OS" on page 438

**System Options:**

- "BUFSIZE= System Option" in *SAS System Options: Reference*

# ALTLOG= System Option: z/OS

Specifies a destination for a copy of the SAS log.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation |
| Category: | Environment Control: Files |
| PROC OPTIONS GROUP= | ENVFILES |
| Default: | None |
| z/OS specifics: | *file-specification* |

## Syntax

**ALTLOG**=<*file-specification*>

**NOALTLOG**

### Optional Argument

***file-specification***
identifies an external file. Under z/OS, it can be a valid ddname, a physical filename, or the name of a file stored in the directory structure of the UNIX file system. The ddname must have been previously associated with an external file using either a TSO ALLOCATE command or a JCL DD statement.

## Details

The ALTLOG= system option specifies a destination to which a copy of the SAS log is written. Use the ALTLOG= option to capture the log output for printing.

The NOALTLOG option specifies that the SAS log is not copied.

When SAS is started with the OBJECTSERVER and NOTERMINAL system options and no log is specified, SAS discards all log and alternate log messages.

Using directives in the value of the ALTLOG system option enables you to control when logs are open and closed and how they are named, based on real-time events, such as time, month, day of week, and so on. For a list of directives see the "LOGPARM= System Option: z/OS" on page 805.

## See Also

- "Directing Output to an External File at SAS Invocation" on page 146
- "The SAS Log" in *SAS Programmer's Guide: Essentials*

**System Options**

- "ALTPRINT= System Option: z/OS" on page 704

# ALTPRINT= System Option: z/OS

Specifies the destination for the copies of the output files from SAS procedures.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation |
| Category: | Environment Control: Files |
| PROC OPTIONS GROUP= | ENVFILES |
| Default: | None |
| z/OS specifics: | *file-specification* |

## Syntax

**ALTPRINT=**<*file-specification*>

**NOALTPRINT**

### Optional Argument

***file-specification***
identifies an external file. Under z/OS, it can be a valid ddname, a physical filename, or the name of a file stored in the directory structure of the UNIX file system. The ddname must have been previously associated with an external file using either a TSO ALLOCATE command or a JCL DD statement.

## Details

Use the ALTPRINT= option to capture procedure output for printing.

The NOALTPRINT option causes any previous ALTPRINT specifications to be ignored.

## See Also

- "Directing Output to a Printer" on page 150

**System Options**

- "ALTLOG= System Option: z/OS" on page 703

# APPEND= System Option: z/OS

Appends the specified value to the existing value at the end of the specified system option.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Category: | Environment Control: Files |
| PROC OPTIONS GROUP= | ENVFILES |
| Default: | None |
| z/OS specifics: | SAS invocation syntax |

## Syntax

**APPEND=**(*system-option*=*appended-value*)

### Required Arguments

***system-option***
can be AUTOEXEC, CMPLIB, FMTSEARCH, HELPLOC, MAPS, MSG, SASAUTOS, SASHELP, or SASSCRIPT.

**Note:** You can submit `proc options listinsertappend;` to produce a complete list of options that can be appended.

***appended-value***
is the new value that you want to append to the current value of **system-option**.

## Details

If you specify a SAS system option more than once, then the last specification of the option is the one that SAS uses. You must use the APPEND system option if you want to add additional values to the end of the value that is already specified for the following options:

| | | |
|---|---|---|
| AUTOEXEC | HELPLOC | SASAUTOS |
| CMPLIB | MAPS | SASHELP |
| FMTSEARCH | MSG | SASSCRIPT |

For example, if your configuration file contains the following option specification:

```
sasautos='prefix.prod.sasautos'
```

and you enter the following SASRX command,

```
sasrx -sasautos 'prefix.more.sasautos'
```

then the only location where SAS looks for autocall macros is **'prefix.more.sasautos'**. The output of PROC OPTIONS shows **'prefix.more.sasautos'** as the value of the SASAUTOS option.

If you want SAS to look in both locations for autocall macros, then you must use the following APPEND option:

```
sasrx -append=(sasautos='prefix.more.sasautos')
```

PROC OPTIONS then shows the following value for the SASAUTOS option:

```
('prefix.prod.sasautos' 'prefix.more.sasautos')
```

If the original value of **system-option** or **appended-value** is enclosed in parentheses, then the resulting option value is merged into one pair of parentheses. For example,

```
SASAUTOS=(.a.sasautos .b.sasautos)
APPEND=(sasautos=(.c.sasautos .d.sasautos))
```

sets the value of the SASAUTOS option to

```
(.a.sasautos .b.sasautos .c.sasautos .d.sasautos)
```

## See Also

- "Changing an Option Value By Using the INSERT and APPEND System Options" in *SAS System Options: Reference*
- "PEEKLONG Function: z/OS" on page 492

**System Options**

- "CMPLIB= System Option" in *SAS System Options: Reference*
- "INSERT= System Option: z/OS" on page 783
- Appendix 3, "Encoding for z/OS Resource Names," on page 939

# APPLETLOC= System Option: z/OS

Specifies the location of Java applets.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options |
| Category: | Environment Control: Files |
| PROC OPTIONS GROUP= | ENVFILES |

## Syntax

**APPLETLOC=**"*base-URL*"

### Syntax Description

***"base-URL"***
specifies the address where the SAS Java applets are located. The maximum address length is 256 characters.

## Details

The APPLETLOC= system option specifies the base location (typically a URL) of Java applets. These applets are typically accessed from an intranet server or a local CD-ROM.

## Example

```
APPLETLOC="http://server.abc.com:server.abc.port/SAS/applets"
```

# ARMAGENT= System Option: z/OS

Specifies another vendor's ARM agent, which is an executable module that contains a vendor's implementation of the ARM API.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options |
| Category: | System Administration: Performance |
| PROC OPTIONS GROUP= | PERFORMANCE |
| Default: | None |
| Restriction: | After you enable the ARM subsystem, you cannot specify a different ARM agent using ARMAGENT=. |
| z/OS specifics: | Length of module name |
| See: | "ARMAGENT= System Option" in *SAS Interface to Application Response Measurement (ARM): Reference* |

## Syntax

**ARMAGENT=***module*

### Required Argument

***module***
is the name of the module that contains an ARM agent, which is a program module that contains a vendor's implementation of the ARM API. The maximum length for the module name in z/OS environments is eight characters.

## Details

An ARM agent is an executable module that contains a vendor's implementation of the ARM API. The ARM agent is a set of executable routines that are called from an application. The ARM agent and SAS run concurrently. The SAS application passes transaction information to the ARM agent, which collects and manages the writing of the ARM records to the ARM log. SAS, as well as other vendors, provide an ARM agent.

By default, SAS uses the SAS ARM agent. Use ARMAGENT= to specify another vendor's ARM agent in order to monitor both the internal SAS processing transactions (using ARMSUBSYS=) as well as for user-defined transactions (using ARM macros).

## See Also

*SAS Interface to Application Response Measurement (ARM): Reference*

# ASYNCHIO System Option: z/OS

Specifies whether asynchronous I/O is enabled.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation |
| Categories: | Files: External Files<br>Files: SAS Files |
| PROC OPTIONS GROUP= | EXTFILES<br>SASFILES |
| Default: | ASYNCHIO |

## Syntax

**ASYNCHIO** | **NOASYNCHIO**

### Required Arguments

**ASYNCHIO**
allows other logical SAS tasks to execute (if any are ready) while the I/O is being done, which improves system performance.

**NOASYNCHIO**
causes I/O to wait for completion.

## Details

### Overview of ASYNCHIO System Option

The ASYNCHIO system option is the mirror alias of the system option NOSYNCHIO. NOASYNCHIO is equivalent to SYNCHIO.

### Asynchronous I/O or Task Switching

The Base SAS engine and other engines are able to process several tasks concurrently. For example, you can enter statements into the Program Editor at the same time that PROC SORT is processing a large file. The reason that this is possible is that the engine enables task switching.

Task switching is possible because the engine architecture supports the ability to start one task before another task is finished, or to handle work asynchronously. This ability provides greater efficiencies during processing and often results in faster processing time. The ASYNCHIO system option controls this activity.

# AUTOEXEC= System Option: z/OS

Specifies the SAS autoexec file.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation |
| Category: | Environment Control: Files |
| PROC OPTIONS GROUP= | ENVFILES |
| Default: | None |
| z/OS specifics: | *file-specification* |

## Syntax

**AUTOEXEC=**(*file-specification1*<*file-specification-2 ...*>) | NOAUTOEXEC

### Required Arguments

***file-specification***
identifies an external file. Under z/OS, it can be a single ddname, a single MVS data set name, or a single UFS filename. If a ddname is used, it must have been previously associated with an external file using either a TSO ALLOCATE command or a JCL DD statement. Under TSO, file-specification can also be a list of MVS data set names that are enclosed in parentheses. For batch mode, use a SASEXEC DD statement instead of the AUTOEXEC option for multiple autoexec files.

**NOAUTOEXEC**
disables AUTOEXEC, as if the *file-specification* was blank.

## Details

The autoexec file contains SAS statements that are executed automatically when you invoke SAS. The autoexec file can contain any SAS statements. For example, you can include LIBNAME statements for SAS libraries that you access routinely in SAS sessions.

During initialization, if AUTOEXEC= is not explicitly specified, SAS checks to see whether the SASEXEC ddname has been allocated. If so, SAS initializes AUTOEXEC= to SASEXEC. Otherwise, SAS sets the SASEXEC ddname to null.

You can use the APPEND= and INSERT= system options to add additional file specifications if all of the files are UFS files. For more information, see the APPEND= and INSERT= system options. INSERT adds files to be executed before the autoexec file, and APPEND adds files to be executed after the autoexec file.

## See Also

- "Autoexec Files" on page 14

**System Options**

- "APPEND= System Option: z/OS" on page 705
- "INSERT= System Option: z/OS" on page 783

# BLKALLOC System Option: z/OS

Causes SAS to set LRECL and BLKSIZE values for a SAS library when it is allocated rather than when it is first accessed.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS Systems Options window |
| Category: | Files: SAS Files |
| PROC OPTIONS GROUP= | SASFILES |
| Default: | NOBLKALLOC |
| z/OS specifics: | All |

## Syntax

**BLKALLOC | NOBLKALLOC**

## Details

The BLKALLOC option causes LIBNAME statement processing to use a nonzero block size value when allocating a direct access or sequential access bound library. The block size value is derived from one of the following sources, which are listed in order of precedence:

1. the value specified with the BLKSIZE host option of the LIBNAME statement
2. the value specified with the BLKSIZE system option

3 the value specified with the BLKSIZE(OTHER) system option

4 6144.

The block size value is set only if both of following conditions are met:

- The library is not already allocated either externally or internally to SAS.
- DISP=NEW is specified.

The purpose of BLKALLOC is to ensure that the library data set is allocated with a default nonzero block size value, even if the library is not accessed by SAS in the current session, and therefore not initialized. The block size value thus set is saved in the data set label (format-1 DSCB in VTOC). If such a library is accessed in a later SAS session, it is treated as a preallocated, but uninitialized, library.

**Note:** The BLKALLOC option has no effect for libraries that were already allocated, either externally or internally to SAS.

## See Also

- "Direct Access Bound Libraries" on page 51
- "Sequential Access Bound Libraries" on page 57

**Statements**

- "LIBNAME Statement: z/OS" on page 656

# BLKSIZE= System Option: z/OS

Specifies the default block size for SAS libraries.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Category: | Files: SAS Files |
| PROC OPTIONS GROUP= | SASFILES |
| Default: | 0 |
| z/OS specifics: | All |

## Syntax

**BLKSIZE=***n* | *n*K | *hex*X | MIN | MAX

### Required Arguments

***n* | *n*K**
specifies the block size in multiples of 1 (bytes) or 1,024 (kilobytes). You can specify decimal values for the number of kilobytes. For example, a value of 8 specifies a block size of 8 bytes, and a value of .782K specifies a block size of 801 bytes.

***hex*X**
specifies the block size as a hexadecimal value. You must specify the value beginning with a number (0–9), followed by hexadecimal characters (0–9, A–F), and then followed by an X. For example, the value 2dx sets the block size to 45 bytes and a value of 0a0x sets the block size to 160 bytes.

**MIN**
sets the default block size to 0.

If BLKSIZE=0 is specified, SAS uses the value of the appropriate BLKSIZE(device) option. If a nonzero value is specified for BLKSIZE, then SAS uses the value specified for all device types.

**MAX**
sets the default block size to 32,760.

## Details

The BLKSIZE= option sets the physical block size of the library when you create a SAS library. After the library is created, the block size is set.

The default value of zero indicates that SAS uses the value of the appropriate BLKSIZE(*device-type*)= option. When a nonzero value is specified for BLKSIZE=, this value takes precedence over any value specified with the BLKSIZE(*device-type*)= option.

**Note:** Because of the constraints on the block size for direct access bound libraries, SAS uses a lower value than the value that is specified in some situations for direct access bound libraries. For more information, see “Controlling Library Block Size” on page 56.

## See Also

- “Direct Access Bound Libraries” on page 51
- “Sequential Access Bound Libraries” on page 57

# BLKSIZE(device-type)= System Option: z/OS

Specifies the default starting point for block size calculations for new direct access bound libraries that reside in DSORG=PS data sets.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Category: | Files: SAS Files |
| PROC OPTIONS GROUP= | SASFILES |
| Default: | Varies by device type |
| z/OS specifics: | All |

## Syntax

**BLKSIZE**(*device-type*)=*value*

### Required Arguments

***device-type***
specifies any valid specific device type number (such as 3380 or 3390), DASD, DISK, or OTHER.

**DISK or DASD**
indicates that the specified value is to be used as the default block size for all types of disk devices.

**OTHER**
specifies the value that SAS uses to allocate a library when the BLKALLOC option is specified and the BLKSIZE host option was not specified in the LIBNAME statement or LIBNAME function. For more information, see "BLKSIZE= System Option: z/OS" on page 712.

***value***
specifies the default block size. Here are the valid values:

***number***
specifies the block size that SAS is to use for the device.

**OPT**
specifies that SAS is to choose the most efficient block size for the device and the type of library.

**MAX or FULL**
specifies that SAS is to use the maximum permitted block size for the device or 32760, whichever is lower.

**HALF, THIRD, FOURTH, or FIFTH**
specifies that SAS is to use the largest value that results in obtaining two, three, four, and five blocks per track, respectively.

## Details

The following example tells SAS to choose optimum block size values for all disk devices except 3380s, for which one-third track blocking is requested:

```
options blksize(disk)=opt
        blksize(3380)=third;
```

For all DASD devices currently supported on z/OS, the default value of BLKSIZE(*device-type*) is HALF. This value corresponds to the largest efficient block size that is supported by SAS and standard access methods.

When the library BLKSIZE is not specified by other means, such as with the library data set allocation or the BLKSIZE system option, SAS uses the block size value specified for the BLKSIZE(*device-type*) as a starting point for determining the block size. Constraints on the block size for direct access bound libraries might cause SAS to use a lower value than the specified value in some situations for direct access bound libraries. For more information, see "Controlling Library Block Size" on page 56.

**Note:** The BLKSIZE(*device*) option has no influence over the block size for sequential access bound libraries.

## See Also

"Optimizing SAS I/O" on page 905

# CAPSOUT System Option: z/OS

Specifies that all output is to be converted to uppercase.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Category: | Files: External Files |
| PROC OPTIONS GROUP= | EXTFILES |
| Default: | NOCAPSOUT |
| z/OS specifics: | All |

## Syntax

**CAPSOUT | NOCAPSOUT**

## Details

CAPSOUT applies only to native z/OS files. It does not apply to files in UFS directories. The CAPSOUT setting takes effect when a file is opened. Changing the setting does not affect files that are already open.

# CARDIMAGE System Option: z/OS

Processes SAS source and data lines as 80-byte records.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement |
| Category: | Input Control: Data Processing |
| PROC OPTIONS GROUP= | INPUTCONTROL |
| Default: | NOCARDIMAGE |
| z/OS specifics: | Default value |
| See: | "CARDIMAGE System Option" in *SAS System Options: Reference* |

## Syntax

**CARDIMAGE | NOCARDIMAGE**

## Details

The default setting on z/OS is NOCARDIMAGE.

**Note:** The default setting of CARDIMAGE for SAS 9.3 and earlier was CARDIMAGE.

# CATCACHE= System Option: z/OS

Specifies the number of SAS catalogs to keep open.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation |
| Category: | Files: SAS Files |
| PROC OPTIONS GROUP= | SASFILES |
| Default: | 0 |
| z/OS specifics: | All |
| See: | "CATCACHE= System Option" in *SAS System Options: Reference* |

## Syntax

**CATCACHE=***n* | *hex*X | MIN | MAX

### Required Arguments

***n***
specifies any integer greater than or equal to 0 in terms of bytes. If *n* > 0, SAS places up to that number of open-file descriptors in cache memory instead of closing the catalogs.

***hex*X**
specifies the number of open-file descriptors that are kept in cache memory as a hexadecimal number. You must specify the value beginning with a number (0–9), followed by hexadecimal characters (0–9, A–F), and then followed by an X. For example, the value 2dx sets the number of catalogs to keep open to 45 catalogs.

**MIN**
sets the number of open-file descriptors that are kept in cache memory to 0.

**MAX**
sets the number of open-file descriptors that are kept in cache memory to the largest, signed, 4-byte integer that is representable in your operating environment. The recommended maximum setting for this option is 10.

## Details

By using the CATCACHE= system option to specify the number of SAS catalogs to keep open, you can avoid the repeated opening and closing the same catalogs.

**Note:** If MINSTG is in effect, then SAS sets the value of CATCACHE to 0.

## See Also

"Optimizing System Performance" in *SAS Language Reference: Concepts*

# CHARTYPE= System Option: z/OS

Specifies a character set or screen size to use for a device.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation |
| Category: | Environment Control: Display |
| PROC OPTIONS GROUP= | ENVDISPLAY |
| Default: | 0 |
| z/OS specifics: | All |

## Syntax

**CHARTYPE=***cell-size* | *screen-size*

### Required Arguments

***cell-size***
specifies the character set number for an IBM 3290 terminal. Values are 1 for a 6 x 12 cell and 2 for a 9 x 16 cell.

***screen-size***
specifies the screen size for other Extended-Data-Stream (EDS) terminals. Values are 1 for a primary screen size and 2 for an alternate screen size.

## Details

For an IBM 3290 terminal, the CHARTYPE= option specifies which character cell size to use. For other EDS terminals, it specifies which screen size to use. This option corresponds to the CHARTYPE option in SAS/GRAPH.

The default value, 0, indicates that the CHARTYPE= option is not applicable to the terminal that you are using.

## See Also

"Improving Screen Resolution on an IBM 3290 Terminal" on page 260

# CLIENTWORK System Option: z/OS

Specifies dynamic allocation options for creating client work libraries in a SAS server environment.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation |
| Category: | Files: SAS Files |
| PROC OPTIONS GROUP= | SASFILES |
| Default: | null |
| z/OS specifics: | All |

## Syntax

**CLIENTWORK=**"*operand ...* <*operand ...*>"

### Required Argument

The required operands can be one of the following TSO ALLOCATE command operands:

***operand***
can be one of the following operands. You must specify all of these operands.

- UNIT(*device type*)
- TRACKS, CYL, BLOCK()
- SPACE(*primary*<,*secondary*>)

### Optional Argument

The optional operands can be one of the following TSO ALLOCATE commands:

***operand***
can be any of the following operands. You can specify one or more of these operands.

- UCOUNT(<*number of devices*>)
- VOL(volser<,volser...>)
- STORCLAS(storage class
- MGMTCLAS(management class)
- DATACLAS(data class)
- DSNTYPE(LARGE)

## Details

The CLIENTWORK option specifies the data set dynamic allocation options that a SAS server attempts to use when it creates a temporary work library for a client session. The CLIENTWORK option is used only when the server's Work library resides in a direct access bound library. The CLIENTWORK option has no effect when the server's Work library resides in a UFS directory. For more information, see "Work Library and Other Utility Files" on page 26.

The operands in the preceding list have the same syntax and meaning as when they are specified on the TSO ALLOCATE command. For more information, see the IBM documentation about the ALLOCATE command. However, the CLIENTWORK option does not depend on TSO services. CLIENTWORK can be specified in any execution environment supported by SAS, including batch, started task, and USS shell.

If the server's Work library resides in a direct access bound library, the SAS server dynamically allocates a temporary MVS data set for each client that connects to the server. If CLIENTWORK is specified, then its operands are used to determine the allocation. This data set contains the work library for the client. It is created with a unique system-generated name.

If any of the following three conditions are true, then the SAS server reverts to the behavior that is described for the case in which CLIENTWORK is null:

- CLIENTWORK is not specified.
- CLIENTWORK is specified with a value of NULL.
- The CLIENTWORK operands refer to resources (for example, a non-existent SMS data class) that are not defined on the z/OS system.

If the value that is specified for CLIENTWORK is null, then the size of the client Work library is governed by the values of the following SAS system options that are in effect for the initialization of the SAS server:

FILESPPRI
: primary space allocation

FILESPSEC
: secondary space allocation

FILEUNIT
: unit of space

**Note:**

- The CLIENTWORK option provides the advantage of enabling a SAS server to create client work libraries that can span multiple volumes.
- The temporary data sets that are created for client work libraries must be regular-format sequential data sets. Extended-format sequential data sets are not supported. Therefore, for the DATACLAS operand, do not specify a data class with a data set name type of extended.
- The processing for the CLIENTWORK option is identical to that for the UTILLOC option with the exception that the ALLOC command name is not

specified as part of CLIENTWORK. For more information, see "UTILLOC= System Option: z/OS" on page 877.

# CLIST System Option: z/OS

Specifies that SAS obtains its input from a CLIST.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation |
| Category: | Environment Control: Initialization and Operation |
| PROC OPTIONS GROUP= | EXECMODES |
| Default: | NOCLIST |
| z/OS specifics: | All |

## Syntax

**CLIST | NOCLIST**

## Details

The CLIST option controls whether SAS obtains its input from the terminal directly (NOCLIST specified or defaulted) or indirectly (CLIST specified) when running interactively under TSO. When the CLIST option is specified and SAS is executed from a CLIST, any statements following the SASCP command in the CLIST are executed by SAS. Any of those statements that resolve as commands are executed as SAS statements. If the end of the CLIST is reached, then SAS continues to read statements from the REXX stack until it is empty. SAS then reads from the terminal. An ENDSAS statement in any of these three input locations terminates the session. To take advantage of this feature, you should provide your own CLIST in place of the one that is shipped with SAS.

The CLIST option can also be used when SAS is executed from a REXX exec. In this case, there is no support for reading statements from the REXX code, but statements are read from the REXX stack and then from the terminal. Thus, you can use the REXX exec that is shipped with SAS.

When the CLIST option is specified, the NODMS option is automatically set.

The following example shows how a user-written REXX exec can use the CLIST option to submit statements to a SAS session that is started from the REXX exec that SAS supplies:

```
queue "data_null_;"
queue "put 'Use QUEUE to provide input when using the CLIST option';"
```

```
queue "run;"
queue "endsas;"
'SASRX -clist'
```

# CONFIG= System Option: z/OS

Specifies the configuration file that is used when initializing or overriding the values of SAS system options.

| | |
|---|---|
| Valid in: | SAS invocation |
| Category: | Environment Control: Files |
| PROC OPTIONS GROUP= | ENVFILES |
| Default: | CONFIG |
| z/OS specifics: | All |

## Syntax

**CONFIG=***file-specification*

### Required Argument

***file-specification***
The value of the CONFIG= option can be any valid ddname, a data set name, a PDS member name, a UFS filename, or a list in parentheses that contains any combination of these types of file designations.

## Details

The configuration file can contain any of the SAS system options, including the CONFIG= option.

**Note:** Typically, CONFIG= is not directly specified as a command-line option, but indirectly with SASRX, SAS CLIST, or batch PROC parameters.

## See Also

"Configuration Files" on page 11

# DEVICE= System Option: z/OS

Specifies a device driver for graphics output for SAS/GRAPH software.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Category: | Graphics: Driver Settings |
| PROC OPTIONS GROUP= | GRAPHICS |
| Default: | none |
| z/OS specifics: | *device-driver-name* |

## Syntax

**DEVICE=***device-driver-name*

### Required Argument

***device-driver-name***
specifies the name of a terminal device driver.

## Details

To see a list of device drivers that are available, use the GDEVICE procedure. If you are in the windowing environment, submit the following statements:

```
proc gdevice catalog=sashelp.devices;
run;
```

If you are running in interactive line mode, noninteractive mode, or batch mode, submit the following statements:

```
proc gdevice catalog=sashelp.devices nofs;
list _all_;
run;
```

## See Also

"DEVICE= System Option" in *SAS/GRAPH: Reference*

# DLCREATEDIR System Option: z/OS

Creates a directory for a SAS library that is specified in a LIBNAME statement if the directory does not exist.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Category: | Files: SAS Files |
| PROC OPTIONS GROUP= | SASFILES |
| Default: | DLCREATEDIR |
| Restriction: | If the path specified in the LIBNAME statement contains multiple components, SAS creates only the final component in the path. If any intermediate components of the path do not exist, SAS does not assign the specified path. For example, when the code `libname mytestdir 'c:\mysasprograms\test'` executes, and c:\mysasprograms exists, SAS creates the test directory. If c:\mysasprograms does not exist, SAS does not create the test directory. |
| z/OS specifics: | All |

## Syntax

**DLCREATEDIR | NODLCREATEDIR**

## Details

When the DLCREATEDIR system option is specified, and a UFS directory that does not exist is specified in a LIBNAME statement or function, then SAS creates the directory.

**Note:** The following restrictions apply if DLCREATEDIR is specified on z/OS:

- The FILEPROMPT system option is ignored.
- The NOPROMPT option of the LIBNAME statement is ignored when a library is being assigned.

## See Also

- "FILEPROMPT System Option: z/OS" on page 754

- "HFS, UFS, and zFS Terminology" on page 8
- The NOPROMPT option of the "LIBNAME Statement: z/OS" on page 656

# DLDISPCHG System Option: z/OS

Controls changes in allocation disposition for an existing library data set.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation |
| Category: | Files: SAS Files |
| PROC OPTIONS GROUP= | SASFILES |
| Default: | COMPAT91 |
| z/OS specifics: | All |

## Syntax

**DLDISPCHG=**AUTO | BYREQUEST | COMPAT91 | NONE

### Required Arguments

When SAS is assigning a SAS library that the SAS job has already allocated as DISP=SHR, the DLDISPCHG option controls whether SAS re-allocates a library as DISP=OLD.

**AUTO**
SAS determines whether to upgrade an existing DISP=SHR allocation based on all available information. This information includes the level of authorization with which the client user ID (if applicable) and the SAS session itself have to access the library. AUTO is recommended for SAS/SHARE servers.

**BYREQUEST**
SAS upgrades an existing DISP=SHR allocation only if it is explicitly requested by DISP=OLD on the library assignment. BYREQUEST is recommended for single user SAS sessions.

**COMPAT91**
SAS applies the same rules as specified in SAS Release 9.1.3 when upgrading an existing DISP=SHR allocation. COMPAT91 is the default.

**NONE**
SAS does not upgrade an existing DISP=SHR allocation under any circumstances.

# DLDSNTYPE System Option: z/OS

Specifies the default value of the DSNTYPE LIBNAME option for direct access bound libraries in DSORG=PS data sets.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, Options statement, SAS System Options window |
| Category: | Files: SAS Files |
| PROC OPTIONS GROUP= | SASFILES |
| Default: | NONE |
| z/OS specifics: | All |

## Syntax

**DLDSNTYPE=** BASIC | LARGE | NONE

### Required Arguments

**BASIC**
specifies a regular-format sequential data set that cannot exceed 64K tracks per volume.

**LARGE**
specifies a regular-format sequential data set that can exceed 64K tracks per volume.

**NONE**
causes SAS to not specify a DSNTYPE value when allocating the library data set. The type of data set that is created is determined by the system, which uses the default values that are supplied by the SMS data class.

## Details

Use the DLDSNTYPE option to specify the default value of the DSNTYPE LIBNAME option that is to be used when you create direct access bound libraries that reside in DSORG=PS data sets.

**Note:** This option is ignored when you create V6 libraries.

The value that you specify for DLDSNTYPE can be overridden by the DSNTYPE LIBNAME option.

## See Also

- "DLSEQDSNTYPE System Option: z/OS" on page 731
- DLDSNTYPE under "Host Options for Allocating Library Data Sets" on page 663

# DLDSKEYLBL= System Option

Specifies a default dataset pervasive encryption key label for accessing SAS libraries.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Category: | Communications: Networking and Encryption |
| PROC OPTIONS GROUP= | COMMUNICATIONS |
| Requirement: | The key label must point to an AES-256 bit encryption DATA key within the z/OS Integrated Cryptographic Service Facility (ICSF) key repository (CKDS). In addition, the user must have a minimum of READ access to the encryption key label name in the RACF CSFKEYS class. (See IBM's manual, IBM Data Set Encryption, for complete information on defining data set encryption labels. |
| Notes: | The DLDSKEYLBL= system option is available beginning with SAS 9.4M8.<br>If the user does not have RACF access to the encryption key label, SAS generates an error, `Insufficient Access Authority`.<br>If a SAS library has been allocated for pervasive encryption support, the ISPF Data Set information panel shows `Data set encryption : YES`. |

## Syntax

DLDSKEYLBL=*label_name*

## Details

The DSKEYLBL= LIBNAME option overrides the DLDSKEYLBL= system option for the library specified in the LIBNAME statement.

For more information, see:

- "IBM z/OS Pervasive Encryption for Data Sets with SAS 9.4M8" in *Encryption in SAS*.
- DSKEYLBL= LIBNAME option on page 666
- IBM Data Set Encryption
- Getting Started with z/OS Data Set Encryption

- Using the z/OS data set encryption enhancements

# DLEXCPCOUNT System Option: z/OS

Reports number of EXCPs to direct access bound SAS libraries.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation |
| Category: | Files: SAS Files |
| PROC OPTIONS GROUP= | SASFILES |
| Default: | NODLEXCPCOUNT |
| z/OS specifics: | All |

## Syntax

**DLEXCPCOUNT** | **NODLEXCPCOUNT**

### Required Arguments

**DLEXCPCOUNT**
reports the EXCPs (Execute Channel Program calls) that SAS performs on direct access bound libraries and the number of blocks that were transferred in these EXCPs.

**NODLEXCPCOUNT**
does not report the number of EXCPs that SAS performs on direct access bound libraries and the number of blocks that were transferred in these EXCPs.

## Details

Specifying DLEXCPCOUNT causes SAS to generate a message that reports the number of blocks that are processed. It also reports the corresponding number of EXCPs that are issued to each SAS library since the library was opened. This message is produced when the library is closed. The message is written to the z/OS system log as a WTO message. The message is also written to the SAS log except when the library is closed during termination of the SAS session. The message text output is in this form:

```
SAS processed <number> blocks and performed <number> EXCPs on
library 'data set name'
```

**Note:** A library is opened the first time it is referenced in a SAS session. It is closed when the last libref that is assigned to the library is cleared. If the library is still open at the end of a SAS session, the library is closed as part of SAS termination.

The values of BUFSIZE= and BUFNO=, specified as data set options or SAS system options, have a direct effect on the number of EXCPs performed. Increasing the value of BUFSIZE= increases page size and reduces the number of EXCPs required. Specifying a larger value for BUFNO= causes more blocks to be read with a single EXCP under certain circumstances, thus reducing the total EXCP count.

# DLLBI System Option: z/OS

Specifies whether the default BLKSIZE for the sequential access bound library that is being assigned can exceed 32760 if the library resides on a tape device.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Category: | Files: SAS Files |
| PROC OPTIONS GROUP= | SASFILES |
| Default: | NODLLBI |
| Restriction: | The DLLBI= LIBNAME statement option takes precedence over the DLLBI system option. |
| z/OS specifics: | ALL |

## Syntax

**DLLBI** | **NODLLBI**

## Details

The DLLBI system option specifies the default behavior for the DLLBI LIBNAME option.

Specifying the DLLBI system option causes each assignment of a sequential access library to be processed as if the LIBNAME option DLLBI=YES is specified, unless it is overridden by the DLLBI LIBNAME option.

Specifying NODLLBI causes each assignment of a sequential access library to be processed as if the LIBNAME option DLLBI=NO is specified, unless it is overridden by the DLLBI LIBNAME option.

**Note:** Setting DLLBI causes the block size to exceed 32760 for sequential access bound libraries on tape devices. SAS 9.4M1 and earlier do not support library block sizes that are greater than 32760. Do not specify DLLBI if you need to read newly created libraries with SAS 9.4M1 or earlier.

## See Also

- "LIBNAME Statement: z/OS" on page 656
- "Sequential Access Bound Libraries" on page 57

# DLMSGLEVEL= System Option: z/OS

Specifies the level of messages to generate for SAS libraries.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Category: | Files: SAS Files |
| PROC OPTIONS GROUP= | SASFILES |
| Default: | ERROR |
| z/OS specifics: | All |

## Syntax

**DLMSGLEVEL=**ERROR | WARN | INFO | DIAG

### Required Arguments

**ERROR**
causes a message to be written to the SAS log when an error occurs during processing of a SAS library. This value is the default.

**WARN**
causes a message to be written to the SAS log when SAS detects an abnormal or unusual situation during processing of a SAS library, yet is able to continue processing.

**INFO**
causes a message to be written to the SAS log that details processing for certain types of libraries. This setting can be requested by SAS Technical Support for high-level problem diagnosis.

**DIAG**
causes SAS to produce SNAP dumps of key internal control blocks when processing certain types of libraries. In order to receive the dumps, it is necessary to allocate the SASSNAP ddname to a SYSOUT data set or to a sequential data set. This setting would be requested by SAS Technical Support for detailed problem diagnosis.

Each setting also implies all the preceding settings in the list. For example, DLMSGLEVEL=INFO would cause SAS to also produce the messages that would be generated for WARN and ERROR.

# DLSEQDSNTYPE System Option: z/OS

Specifies the default value of the DSNTYPE LIBNAME option for sequential-access bound libraries on disk.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, Options statement, SAS System Options Window |
| Category: | Files: SAS Files |
| PROC OPTIONS GROUP= | SASFILES |
| Default: | NONE |
| z/OS specifics: | All |

## Syntax

**DLSEQDSNTYPE=**BASIC | LARGE | EXTREQ | EXTPREF | NONE

### Required Arguments

**BASIC**
specifies a regular-format sequential data set that cannot exceed 64K tracks per volume.

**LARGE**
specifies a regular-format sequential data set that can exceed 64K tracks per volume.

**EXTREQ**
specifies that an extended-format sequential data set is required. The library assignment fails if the system cannot create an extended-format data set.

**EXTPREF**
specifies that an extended-format sequential data set is preferred. This library resides in an extended format data set if that format is available. Otherwise, a regular format data set is created.

**NONE**
causes SAS to not specify a DSNTYPE value when allocating the library data set. The type of data set that is created is determined by the system, which uses default values that are supplied by the SMS data class, and so on.

## Details

Use DLSEQDSNTYPE to specify the default value of the DSNTYPE LIBNAME option, which can be specified in LIBNAME statements when creating new sequential-access bound libraries on disk.

## See Also

- "DLDSNTYPE System Option: z/OS" on page 726
- DSNTYPE under "Host Options for Allocating Library Data Sets" on page 663

# DLTRUNCHK System Option: z/OS

Enables checking for SAS library truncation.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Category: | Files: SAS Files |
| PROC OPTIONS GROUP= | SASFILES |
| Default: | DLTRUNCHK |
| z/OS specifics: | All |

## Syntax

**DLTRUNCHK | NODLTRUNCHK**

## Details

### Overview of DLTRUNCHK

The first time a SAS direct access bound library is accessed after it is assigned, SAS compares the external count of library blocks from the z/OS data set label with the

count of library blocks maintained by SAS within the library itself. If the external count is less, SAS considers the library to be truncated. How SAS processes a truncated library depends on the setting of the DLTRUNCHK option:

- If the DLTRUNCHK option is in effect, then SAS issues an error message and does not process the library in any manner. The SAS session return code is 8 or higher.
- If NODLTRUNCHK is in effect, then SAS issues a warning message. It also allows Read access to the library so that its contents can be copied, to the extent possible, to a new library data set. The SAS session return code is 4 or higher.

SAS does not allow Write access to a truncated library regardless of the DLTRUNCHK setting.

### Usage Notes

- The setting of the DLTRUNCHK option of the LIBNAME statement takes precedence over the setting of the DLTRUNCHK system option.
- Depending on the type of damage a library data set has received, recovery of some data from a truncated library might be possible. For assistance with this problem, contact SAS Technical Support.

## DSRESV System Option: z/OS

Requests exclusive use of shared disk volumes when accessing partitioned data sets on shared disk volumes.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Category: | Files: External Files |
| PROC OPTIONS GROUP= | EXTFILES |
| Default: | NODSRESV |
| z/OS specifics: | All |

### Syntax

**DSRESV** | **NODSRESV**

### Required Arguments

**DSRESV**
reserves the device, which prevents other processors from accessing the volume on which the partitioned data set resides.

**NODSRESV**
enqueues the resources that are defined by the operating environment.

## Details

The DSRESV option controls whether certain SAS utility procedures, such as PDSCOPY, issue the RESERVE macro instruction when they access partitioned data sets on shared disk volumes.

# DYNALLOC System Option: z/OS

Controls whether SAS or the host sort utility allocates sort work data sets.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Category: | Sort: Procedure Options |
| PROC OPTIONS GROUP= | SORT |
| Alias: | DYN |
| Default: | NODYNALLOC |
| z/OS specifics: | All |

## Syntax

**DYNALLOC** | **NODYNALLOC**

### Required Arguments

**DYNALLOC**
specifies that the host sort utility supports dynamic allocation of any necessary work files. Therefore, SAS does not attempt to allocate them.

**NODYNALLOC**
specifies that SAS allocates sort work files. This specification might be necessary if the host sort utility does not support allocation. Some sort programs do not reallocate previously allocated work files even if the space requirements are greater.

## Details

The host sort is used if the number of observations that are to be sorted is unknown.

## See Also

- “SORT= System Option: z/OS” on page 841
- “SORTDEV= System Option: z/OS” on page 848
- “SORTUNIT= System Option: z/OS” on page 861
- “SORTWKDD= System Option: z/OS” on page 862
- “SORTWKNO= System Option: z/OS” on page 863

# ECHO= System Option: z/OS

Specifies a message to be echoed to the SAS log while initializing SAS.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation |
| Category: | Log and Procedure Output Control: SAS Log |
| PROC OPTIONS GROUP= | LOGCONTROL |
| Default: | none |
| z/OS specifics: | All |

## Syntax

**ECHO=** "*message*"

### Required Argument

***"message"***

specifies the text of the message to be echoed to the SAS log. The text must be enclosed in single or double quotation marks if the message is more than one word. Otherwise, quotation marks are not needed.

## Details

You can specify multiple ECHO options. The strings are displayed in the order in which SAS encounters them. For information about how that order is determined, see "Precedence for Option Specifications" on page 23.

## Example: Specifying an ECHO Option

For example, you can specify the following:

```
echo="SAS under z/OS
      is initializing."
```

The message appears in the log as SAS initializes.

# EMAILSYS= System Option: z/OS

Specifies the email protocol to use for sending electronic mail.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Category: | Communications: Email |
| PROC OPTIONS GROUP= | EMAIL |
| Default: | SMTP |
| Restriction: | z/OS V2R3 does not support the SMTPD email server. Specify CSSMTP to access an SMTP email server if you are using SAS on z/OS V2R3. |
| z/OS specifics: | *interface* |
| See: | "Sending Email from within SAS Software" on page 169 |

## Syntax

**EMAILSYS=** *interface*

### Required Argument

***interface***

**SMTP**
enables you to send electronic mail programmatically from SAS using the Simple Mail Transfer Protocol (SMTP) email interface.

**CSSMTP**
is an interface that transports email across the internet much like SMTP. Communications Server Simple Mail Transfer Protocol (CSSMTP) is supported only on z/OS hosts. It supports most of the functionality of SMTP.

## Details

The EMAILSYS= system option is supported for compatibility with other hosts. For more information about SMTP, see "The SMTP E-Mail Interface" in *SAS Language Reference: Concepts*.

# ENGINE= System Option: z/OS

Specifies the default engine to use when assigning direct access SAS libraries.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation |
| PROC OPTIONS GROUP= | SASFILES |
| Default: | BASE |
| z/OS specifics: | Valid values for *engine-name* |
| See: | "ENGINE= System Option" in *SAS System Options: Reference* |

## Syntax

**ENGINE=***engine-name*

### Required Argument

***engine-name***
For information about SAS engines, see "SAS Library Engines" on page 46.

## Details

When you assign a SAS library that is not currently assigned within the SAS session, if the engine is not specified on the assignment request, then SAS has to determine which engine to use to process the library. If the library already exists, and if its engine format can be determined, then SAS uses the newest engine that is compatible with the format of the library. Otherwise, if the engine format of the library cannot be determined, then SAS selects an engine to use by default. If the assignment request specifies a device or type of library that supports random

access, then SAS uses the engine that is specified by the ENGINE system option. Otherwise, SAS uses the engine that is specified by the SEQENGINE option.

The ENGINE option supplies the default value when the library assignment specification refers to one of the following conditions:

- a z/OS data set on disk that is not cataloged
- an empty z/OS disk data set with DSORG=PS specified and for which RECFM=U is not specified.
- A UFS directory that contains members of multiple engine formats that are different

## See Also

- "How SAS Assigns an Engine" on page 81
- "SAS Engines" in *SAS Programmer's Guide: Essentials*

**System Options**

- "SEQENGINE= System Option: z/OS" on page 839

# ERRORABEND System Option: z/OS

Specifies whether SAS responds to errors by terminating.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Category: | Environment Control: Error Handling |
| PROC OPTIONS GROUP= | ERRORHANDLING |
| Alias: | ERRABEND \| NOERRABEND |

## Syntax

**ERRORABEND** | **NOERRORABEND**

### Required Arguments

**ERRORABEND**

specifies that SAS terminates for most errors (including syntax errors and file not found errors) that normally cause it to issue an error message, set OBS=0, and go into syntax-check mode (if syntax checking is enabled). SAS also

terminates if an error occurs in any global statement other than the LIBNAME and FILENAME statements.

Use the ERRORABEND system option with SAS production programs, which presumably should not encounter any errors. If errors are encountered and ERRORABEND is in effect, SAS brings the errors to your attention immediately by terminating. ERRORABEND does not affect how SAS handles notes such as invalid data messages.

**NOERRORABEND**
specifies that SAS handle errors normally, that is, issue an error message, set OBS=0, and go into syntax-check mode (if syntax checking is enabled).

## Details

If a SAS session abends when it is processing an ABORT statement, then SAS uses the normal termination disposition when it deallocates any z/OS data set that SAS dynamically allocated during the session as a part of FILENAME or LIBNAME processing. For more information, see the description of the DISP option for "FILENAME Statement: z/OS" on page 616 or "LIBNAME Statement: z/OS" on page 656.

## See Also

- *SAS Global Statements: Reference*

**System options**

- "ERRORBYABEND System Option" in *SAS System Options: Reference*
- "ERRORCHECK= System Option" in *SAS System Options: Reference*

# FILEAUTHDEFER System Option: z/OS

Controls whether SAS performs file authorization checking for z/OS data sets or defers authorization checking to z/OS system services such as OPEN.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Categories: | Files: External Files<br>Files: SAS Files |
| PROC OPTIONS GROUP= | EXTFILES<br>SASFILES |
| Default: | NOFILEAUTHDEFER |

z/OS specifics: All

## Syntax

**FILEAUTHDEFER** | **NOFILEAUTHDEFER**

### Required Arguments

**FILEAUTHDEFER**
specifies that SAS does not attempt to perform file authorization checking for z/OS data sets before invoking z/OS system services such as OPEN. FILEAUTHDEFER enables the site's authorization system to record failed access attempts in its audit log.

**NOFILEAUTHDEFER**
specifies that SAS does not attempt to open a z/OS data set without first verifying that the user is authorized to access the file in the manner requested. NOFILEAUTHDEFER prevents security system messages (such as ICH408I) and S913 abends from being issued.

## Details

If the user ID under which the session or server is running is not authorized to access a z/OS data set in the manner requested (either read or update), by default SAS then produces an explanatory message in the SAS log. SAS does not attempt to open the data set if the user ID does not have the proper authorization. However, the auditing requirements for some installations cause unauthorized access attempts to be sent to the log for that site's authorization facility. An attempt to open the data set must actually occur before a message is sent to the log of the authorization facility. Specify FILEAUTHDEFER for unauthorized access attempts to be logged with the authorization facility at your site.

The FILEAUTHDEFER option controls the checking of file authorization for external files and SAS libraries. However, it applies only to files or libraries that reside in z/OS data sets. FILEAUTHDEFER does not apply to the processing of UFS files.

FILEAUTHDEFER does not control the authorization checking for z/OS data sets that a SAS server accesses on behalf of a client. Such third-party authorization checking is performed regardless of the FILEAUTHDEFER setting, and access failures are intercepted by SAS rather than resulting in abends or system errors. Nonetheless, FILEAUTHDEFER governs attempts by a SAS server to access a data set in a manner not authorized for the ID under which the server is running. However, the unauthorized access is logged as having been attempted by the server ID, not the client ID.

# FILEBLKSIZE(device-type)= System Option: z/OS

Specifies the default block size for external files.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Category: | Files: External Files |
| PROC OPTIONS GROUP= | EXTFILES |
| Default: | Varies by device type |
| z/OS specifics: | All |

## Syntax

**FILEBLKSIZE**(*device-type*)=*value*

### Required Arguments

***device-type***
specifies any valid specific device number, as well as DASD, DISK, OTHER, SYSOUT, TAPE, and TERM.

**DASD or DISK**
indicates that the specified value is to be used as the default block size for all types of tape devices.

**OTHER**
specifies the value that SAS uses when it is unable to determine the exact device type.

**SYSOUT**
sets values for SYSOUT data sets.

**TAPE**
sets values for the 3400, 3480, 3490E, and 3590 device types.

**TERM**
sets values for data sets that are directed to the terminal.

***value***
specifies the default block size. Valid values are

***number***
specifies the block size that SAS is to use for the device.

**OPT**
tells SAS to choose an optimum block size for the device.

**MAX or FULL**
tells SAS to use the maximum permitted block size for the device.

**HALF, THIRD, FOURTH, or FIFTH**
instructs SAS to use the largest value that results in obtaining two, three, four, and five blocks per track, respectively (if a disk device), or the maximum permitted block size divided by two, three, four, and five, respectively (if not a disk device).

**MIN**
specifies the same as FIFTH above.

## Details

The minimum value for FILEBLKSIZE(*device-type*)= is 5; the maximum value is device dependent and can be obtained by using the DEFINE option in the PROC OPTIONS statement. For example:

```
proc options option=fileblksize(3390) define;
run;
```

# FILEBUFNO= System Option: z/OS

Specifies how many memory buffers to allocate for reading and writing.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Category: | Files: External Files |
| PROC OPTIONS GROUP= | EXTFILES |
| Default: | 5 |
| See: | Appendix 1, “Optimizing Performance,” on page 903 |

## Syntax

**FILEBUFNO**=*n*

### Required Arguments

**FILEBUFNO**
specifies the default value of the number of buffers to allocate for reading and writing.

***n***
specifies the default value of FILEBUFNO.

## Details

The FILEBUFNO system option specifies the default value of the number of buffers to allocate for reading and writing. The default value of FILEBUFNO is 5. The value specified for FILEBUFNO is used by the FILE, FILENAME, and INFILE statements.

These conditions determine whether the value specified for the FILEBUFNO system option or the BUFNO argument is used.

- If BUFNO is not specified on the FILE, FILENAME, or INFILE statements, the value specified for FILEBUFNO is used.
- If the BUFNO argument is specified in the FILENAME statement, it overrides the value specified for FILEBUFNO.
- If the BUFNO argument is specified on the FILE or INFILE statements, it overrides the values that are specified for the FILEBUFNO system option and the BUFNO argument in the FILENAME statement.

## See Also


- "FILE Statement: z/OS" on page 604
- "FILENAME Statement: z/OS" on page 616
- "INFILE Statement: z/OS" on page 647


# FILECC System Option: z/OS

Specifies whether to treat data in column 1 of a printer file as carriage-control data when reading the file.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Category: | Files: External Files |
| PROC OPTIONS GROUP= | EXTFILES |
| Default: | NOFILECC |
| z/OS specifics: | All |

## Syntax

**FILECC** | **NOFILECC**

### Required Arguments

**FILECC**
specifies that data in column 1 of a printer file should be treated as carriage-control data.

**NOFILECC**
indicates that data in column 1 of a printer file should be treated as data.

# FILEDEST= System Option: z/OS

Specifies the default printer destination.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Category: | Files: External Files |
| PROC OPTIONS GROUP= | EXTFILES |
| Default: | None |
| z/OS specifics: | All |

## Syntax

**FILEDEST=***printer-destination*

## Details

The FILEDEST= system option specifies the default destination to be used for printer data sets when the DEST= option is omitted. This situation can occur when the FILENAME statement or FILENAME function does not have a DEST= value or when the form being used does not have a DEST= value.

## See Also

"SYSOUT Data Set Options for the FILENAME Statement" on page 634

# FILEDEV= System Option: z/OS

Specifies the device name used for allocating new physical files.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Categories: | Files: External Files<br>Files: SAS Files |
| PROC OPTIONS GROUP= | EXTFILES<br>SASFILES |
| Default: | SYSDA |
| z/OS specifics: | All |

## Syntax

**FILEDEV=***device-name*

## Details

FILEDEV= specifies the device name to be used when dynamically allocating a new physical file if *device-type* or UNIT= is not specified in the FILENAME statement or FILENAME function, or if UNIT= is not specified in the LIBNAME statement or LIBNAME function. Device names are site-specific.

# FILEDIRBLK= System Option: z/OS

Specifies the number of default directory blocks to allocate for new partitioned data sets.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Category: | Files: External Files |
| PROC OPTIONS GROUP= | EXTFILES |
| Default: | 6 |
| z/OS specifics: | All |

## Syntax

**FILEDIRBLK=***n*

## Details

The FILEDIRBLK= system option specifies how many directory blocks to allocate for a new partitioned data set when the SPACE= option is omitted from the FILENAME statement or FILENAME function.

## See Also

- “FILESPPRI= System Option: z/OS” on page 757
- “FILESPSEC= System Option: z/OS” on page 758
- “FILEUNIT= System Option: z/OS” on page 763

# FILEEXT= System Option: z/OS

Specifies how to handle file extensions when accessing members of partitioned data sets.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Category: | Files: External Files |
| PROC OPTIONS GROUP= | EXTFILES |
| Default: | IGNORE |
| z/OS specifics: | All |

## Syntax

**FILEEXT=**VERIFY | IGNORE | INVALID | ASIS

### Required Arguments

**VERIFY**
verifies that the part of the name after the period corresponds to the last level of the partitioned data set name.

**IGNORE**
ignores the part of the name after the period and specifies that only the part before the period is to be used.

**INVALID**
disallows any member name with an extension.

**ASIS**
accepts the member name as it is. These member names must conform to the naming conventions of partitioned data sets.

## Details

For compatibility with SAS on other platforms, the FILEEXT= system option enables you to write portable SAS programs that run on systems that either support or do not support file extensions.

Portable SAS programs can access external files with file extensions when you run those programs in environments such as Windows and UNIX. When you run those programs in z/OS, and when the program accesses members in partitioned data sets, the value of FILEEXT= determines how the file extensions are interpreted.

Member names in partitioned data sets must consist of one to eight alphanumeric characters starting with a letter or with one of the following national characters: $, #, @. A member name extension is an optional part of the member name that follows a period.

SAS on z/OS does not support specifying physical files that have a member type of AUDIT. Specifying physical filenames such as the following returns an error:

- `filename mylib data='./saslib/memb01.sas7baud';`
- `filename mylib data='/u/user01/mylib/inventory.sas7baud'`

## Examples

### Example 1: Specifying FILEEXT=VERIFY

In this example, SAS verifies that the part of the name that follows the period corresponds to the last level of the partitioned data set name. If it does not, an error message is written to the SAS log:

```
options fileext=verify;
   /* allocate a PDS */
filename out2 'myid.fileext.sas' disp=old;
data _null_;
      /* the member name is 'versas'*/
   file out2(versas.sas);
        put 'text';
run;
```

### Example 2: Specifying FILEEXT=IGNORE

Using the IGNORE value causes the extension, if present, to be ignored:

```
options fileext=ignore;
   /* allocate a PDS */
filename out2 'myid.fileext.testsrc' disp=old;
 data _null_;
```

```
      /* the member name is 'dotnd' */
   file out2(dotnd.some);
   put 'text';
run;
```

### Example 3: Specifying FILEEXT=ASIS

With the ASIS parameter, the member name is accepted as-is:

```
options fileext=asis;
   /* allocate a PDS */
filename out2 'myid.fileext.testsrc' disp=old;
data _null_;
      /* the member name is 'mem.as' */
   file out2(mem.as);
   put 'text';
run;
```

# FILEFORMS= System Option: z/OS

Specifies the default SYSOUT form for a print file.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Category: | Log and Procedure Output Control: ODS Printing |
| PROC OPTIONS GROUP= | LISTCONTROL |
| Default: | none |
| z/OS specifics: | All |

## Syntax

**FILEFORMS=***operating-environment-form*

## Details

The FILEFORMS= system option specifies a default operating environment form using one to four characters. The default form is used when a printer file is dynamically allocated if FORMS= is not specified in the FILENAME statement or FILENAME function.

## Comparisons

The FILEFORMS= option specifies operating environment forms, whereas the portable FORMS= system option specifies the name of the default form that is used by the SAS FORM subsystem. For information about the FORM subsystem and about the FORMS= system option, see "Using the PRINT Command and the FORM Subsystem" on page 154 and "FORMS= System Option" in *SAS System Options: Reference*.

# FILELBI System Option: z/OS

Controls the use of the z/OS Large Block Interface support for BSAM and QSAM files, as well as files on tapes that have standard labels.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Category: | Files: External Files |
| PROC OPTIONS GROUP= | EXTFILES |
| Default: | FILELBI |
| z/OS specifics: | All |

## Syntax

**FILELBI** | **NOFILELBI**

## Details

The FILELBI option controls the use of the z/OS Large Block Interface support for BSAM and QSAM files, as well as files on tapes that have standard labels. When FILELBI is specified, the following maximum block sizes are supported:

- 262,144 bytes for 3490E and 3590 tapes
- 65,535 bytes for 3480 and 3490 tapes
- 32,760 bytes for direct access devices

When NOFILELBI is specified, only blocks with a size of 32,760 bytes or less are supported.

**Note:** When NOFILELBI is in effect, FILEBLKSIZE(*tttt*) values for tape devices that support maximum block sizes greater than 32,760 become invalid and are not used. In these cases the values that are used are based on a maximum block size of

32,760. For more information, see "FILEBLKSIZE(device-type)= System Option: z/OS" on page 741.

# FILELOCKS= System Option: z/OS

Specifies the default SAS file locking that is to be used for external files (both UFS and native MVS). Also specifies the operating system file locking to be used for UFS files (both SAS files and external files).

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement |
| Categories: | Files: External Files<br>Files: SAS Files |
| PROC OPTIONS GROUP= | ENVFILES<br>EXTFILES<br>SASFILES |
| Default: | AUTO; ( '/ ' FAIL ) |
| z/OS specifics: | All |

## Syntax

**FILELOCKS=**AUTO | SHARED

**FILELOCKS=** (path setting)

### Required Arguments

**AUTO**
specifies that SAS locking for external files is performed as if the LOCKINTERNAL=AUTO option value had been specified in the FILENAME statement (unless another value for LOCKINTERNAL was specified). For more information, see the LOCKINTERNAL option of "FILENAME Statement: z/OS" on page 616. AUTO is valid only in the configuration file and at SAS invocation.

**SHARED**
specifies that SAS locking for external files is performed as if the LOCKINTERNAL=SHARED option value had been specified in the FILENAME statement (unless another value for LOCKINTERNAL was specified). When SHARED is in effect for a particular file, one SAS application can write a file at the same time that one or more other SAS applications are reading the file. For more information, see the LOCKINTERNAL option of "FILENAME Statement: z/OS" on page 616. The SHARED value is valid only in the configuration file and at SAS invocation.

**path**
specifies a path for a UFS directory. Use *path* with *setting* to specify an operating system locking value for a UFS directory.

**setting**
specifies the operating system locking value for the specified path. Use *setting* only when you specify a UFS directory with *path*. The *setting* value can be one of the following values:

FAIL
SAS attempts to place an operating system lock on the file. Access to the file is denied if the file is already locked, or if it cannot be locked.

NONE
SAS opens the file without checking for an existing lock on the file, and does not place an operating system lock on the file.

CONTINUE
SAS attempts to place an operating system lock on the file. If a file is already locked by someone else, an attempt to open it fails. If the file cannot be locked for some other reason, then the file is opened.

## Details

When SAS accesses a file, it normally attempts to obtain a SAS file lock and an operating system file lock. If either of these locks cannot be obtained, SAS does not access the file.

SAS file locking is performed on all types of files that SAS accesses. However, the AUTO and SHARED values control only the default SAS file locking for external files. It prevents a SAS application from using a particular file in a manner that is incompatible with how the file is currently being used by other SAS applications within the same SAS session. The AUTO and SHARED values specify a default value for SAS file locking for external files for which the LOCKINTERNAL option of the FILENAME statement was not specified. SAS recommends that you specify LOCKINTERNAL=SHARED in the FILENAME statement only for those files that require simultaneous Read and Write access. External files are files that are identified by the FILENAME statement or related internal SAS facilities. For more information, see “Definition of External Files” in *SAS Language Reference: Concepts*.

**Note:** SAS file locking governs use of a file by two separate applications within a single SAS session, or by two separate clients of the same SAS server.

Operating system file locking prevents the current SAS session from using a particular file in a manner that is incompatible with how the file is being used by another z/OS batch job, TSO user, or other z/OS process. Use the *path* and *setting* values to specify operating system file locking for SAS files, external files, and utility files residing in a UFS directory. SAS attempts to place an exclusive lock when it needs to modify or rewrite the file. The operating system grants this request only if no other address spaces (batch jobs, TSO users, or z/OS processes) hold a lock (shared or exclusive) on the file. If SAS merely needs to read the file, then it attempts to place a shared lock. The operating system grants this request

only if no other address spaces hold an exclusive lock on the file. However, multiple address spaces can simultaneously hold a shared lock on the same file.

**Note:** Operating system file locking for UFS files is implemented via the UNIX System Services `fcntl()` function.

When the value of the FILELOCKS option is a set of *path* and *setting* values for a UFS file, the values must be enclosed in parentheses. The AUTO and SHARED values should not be enclosed in parentheses.

You can specify multiple instances of the FILELOCKS option to establish different settings for various paths. One path can be a subdirectory of another path. In that case, the most specific matching path currently in effect governs operating system file locking. The following example shows how you can specify multiple instances of the FILELOCKS option in a configuration file.

```
FILELOCKS = AUTO
filelocks=('/u/myuserid/temp' NONE)
filelocks=('/tmp' CONTINUE)
```

## See Also

"FILENAME Statement: z/OS" on page 616

# FILEMOUNT System Option: z/OS

Specifies whether an off-line volume is to be mounted.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Category: | Files: External Files |
| PROC OPTIONS GROUP= | EXTFILES |
| Default: | FILEMOUNT |
| z/OS specifics: | All |

## Syntax

**FILEMOUNT | NOFILEMOUNT**

## Details

This option applies to the allocation of external files. It tells SAS what to do when an attempt is made to allocate a physical file on a volume that is offline.

If FILEMOUNT is in effect, a request is made to mount the volume. If NOFILEMOUNT is in effect, then the volume is not mounted and the allocation fails.

# FILEMSGS System Option: z/OS

Controls whether you receive expanded dynamic allocation error messages when you are assigning a physical file.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Categories: | Files: External Files<br>Files: SAS Files |
| PROC OPTIONS GROUP= | EXTFILES<br>SASFILES |
| Default: | NOFILEMSGS |
| z/OS specifics: | All |

## Syntax

**FILEMSGS | NOFILEMSGS**

## Details

The FILEMSGS option applies to physical files that are referenced in either a FILENAME statement or function or in a LIBNAME statement or function.

If FILEMSGS is in effect and you try to assign a data set that is allocated to another user, SAS generates detailed error messages explaining why the allocation failed.

If NOFILEMSGS is in effect, you still receive some error messages in your SAS log, but they might not be as detailed.

# FILENULL System Option: z/OS

Specifies whether zero-length records are written to external files.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Category: | Files: External Files |
| PROC OPTIONS GROUP= | EXTFILES |
| Default: | FILENULL |
| z/OS specifics: | All |

## Syntax

**FILENULL** | **NOFILENULL**

### Required Arguments

**FILENULL**
allows zero-length records to be written to external files. FILENULL is the default value.

**NOFILENULL**
prevents zero-length records from being written to external files. This type of record is ignored.

## Details

If your file transfer program cannot handle zero-length records, you should specify NOFILENULL before you create the file that you want to transfer.

# FILEPROMPT System Option: z/OS

Controls whether you are prompted if you reference a data set that does not exist.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Categories: | Files: External Files<br>Files: SAS Files |
| PROC OPTIONS GROUP= | EXTFILES<br>SASFILES |
| Default: | FILEPROMPT (interactive); NOFILEPROMPT (batch) |
| z/OS specifics: | All |

## Syntax

**FILEPROMPT** | **NOFILEPROMPT**

### Required Arguments

**FILEPROMPT**
specifies that you want to be prompted. The prompt enables you to create the data set dynamically or to cancel the request. FILEPROMPT is the default value in the interactive environment.

**NOFILEPROMPT**
specifies that you do not want to be prompted. In this case, the data set is not created, and your LIBNAME or FILENAME statement or function fails.

## Details

The FILEPROMPT option controls whether you are prompted if the physical file that is referenced in a FILENAME statement or function or in a LIBNAME statement or function does not exist. This option has no effect in batch mode.

# FILEREUSE System Option: z/OS

Specifies whether to reuse an existing allocation for a file that is being allocated to a temporary ddname.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Category: | Files: External Files |
| PROC OPTIONS GROUP= | EXTFILES |
| Default: | NOFILEREUSE |
| z/OS specifics: | All |

## Syntax

**FILEREUSE | NOFILEREUSE**

## Details

If FILEREUSE is in effect and there is a request to allocate a file that is already allocated, the existing allocation is used whenever dynamic allocation can use the existing allocation. The default, NOFILEREUSE, requests that dynamic allocation create a new unique allocation. For more information about reusing an existing allocation, see *z/OS V1R8.0 MVS Authorized Assembler Services Guide* from IBM.

# FILESEQDSNTYPE System Option: z/OS

Specifies the default value that is assigned to DSNTYPE when it is not specified with a FILENAME statement, a DD statement, or a TSO ALLOC command.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Category: | Files: External Files |
| PROC OPTIONS GROUP= | EXTFILES |
| Default: | NONE |
| z/OS specifics: | All |

## Syntax

**FILESEQDSNTYPE=**BASIC | LARGE | EXTREQ | EXTPREF | NONE

### Required Arguments

**BASIC**
specifies that the system selects the BASIC format if the data set is sequential (DSORG=PS or PSU), or if DSORG is omitted from all sources and the data set is not VSAM. The data set cannot exceed 65535 tracks per volume.

**LARGE**
specifies that the system selects the LARGE format if the data set is sequential (DSORG=PS or PSU), or if DSORG is omitted from all sources and the data set is not VSAM. The data set can exceed 65535 tracks per volume.

**EXTREQ**
specifies that the data set is in the EXTENDED format if the data set is VSAM, sequential, or if DSORG is omitted from all sources. The assignment fails if the system cannot allocate an extended format data set.

**EXTPREF**
specifies that the data set is in the EXTENDED format if the data set is VSAM, sequential, or if DSORG is omitted from all sources. If extended format is not possible, then the system selects the BASIC format.

**NONE**
specifies that the default DSNTYPE of the system should be used when a new sequential file is allocated.

## Details

This option is valid for z/OS V1R7 systems and later.

## See Also

- DSNTYPE in the "FILENAME Statement: z/OS" on page 616
- "FILENAME Statement: z/OS" on page 616

# FILESPPRI= System Option: z/OS

Specifies the default primary space allocation for new physical files.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Categories: | Files: External Files<br>Files: SAS Files |
| PROC OPTIONS GROUP= | EXTFILES<br>SASFILES |
| Default: | 1 |
| z/OS specifics: | All |

## Syntax

**FILESPPRI=***primary-space-size*

## Details

The default primary space is allocated in units that are specified by the FILEUNIT= option. Use the FILESPSEC= option to specify secondary space allocation and the FILEDIRBLK= option to specify the number of directory blocks to be allocated.

The value of this option is used if you omit the SPACE= option from the FILENAME statement or function or from the LIBNAME statement or function when creating a new physical file.

The range of acceptable values for FILESPPRI= is 1-32760.

# FILESPSEC= System Option: z/OS

Specifies the default secondary space allocation for new physical files.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Categories: | Files: External Files<br>Files: SAS Files |
| PROC OPTIONS GROUP= | EXTFILES<br>SASFILES |
| Default: | 1 |
| z/OS specifics: | All |

## Syntax

**FILESPSEC=***secondary-space-size*

## Details

The default secondary space is allocated in units that are specified by the FILEUNIT= system option. Use the FILESPPRI= option to specify primary space allocation, and use the FILEDIRBLK= option to specify the number of directory blocks to allocate.

The value of this option is used if you omit the SPACE= option in the FILENAME statement or function or in the LIBNAME statement or function when creating a new physical file.

The range of acceptable values is 0-32760.

# FILESTAT System Option: z/OS

Specifies whether ISPF statistics are written.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |

Category: Files: External Files

PROC OPTIONS GROUP= EXTFILES

Default: NOFILESTAT

z/OS specifics: All

## Syntax

**FILESTAT | NOFILESTAT**

## Details

The FILESTAT option causes ISPF statistics to be written in the directory entry for a new member of a partitioned data set, or updated for an existing member that already contains ISPF statistics. The NOFILESTAT option suppresses ISPF statistics.

The FILESTAT option saves ISPF statistics for PDS or PDSE members that are allocated with a FILENAME statement or the FILENAME function, and for those members that are specified with aggregate syntax. ISPF statistics are not updated for PDS or PDSE members that are allocated externally with a JCL DD statement or a TSO ALLOC command.

To get statistics on the log file, specify the log on the SAS invocation options as follows:

```
LOG="data.set.name(member)"
```

This statement causes SAS to dynamically allocate the log file, which causes statistics to be generated. Note that in the preceding example, the SASLOG DD statement generated by the cataloged procedure is ignored.

# FILESYNC= System Option: z/OS

Specifies when operating system buffers that contain contents of permanent SAS files are written to disk.

Valid in: Configuration file, SAS invocation

Category: Files: SAS Files

PROC OPTIONS GROUP= SASFILES

Default: HOST

z/OS specifics: All

See: "FILESYNC= System Option" in *SAS System Options: Reference*

## Syntax

**FILESYNC=** SAS | CLOSE | HOST | SAVE

### Required Arguments

**SAS**
specifies that SAS requests the operating system to force buffered data to be written to disk when it is best for the integrity of the SAS file. SAS is the default value.

**CLOSE**
specifies that SAS requests the operating system to force buffered data to be written to disk when the SAS file is closed.

**HOST**
specifies that the operating system schedules when the buffered data for a SAS file is written to disk.

**SAVE**
specifies that the buffers are written to disk when the SAS file is saved.

## Details

By using the FILESYNC= system option, SAS can tell the operating system when to force data that is temporarily stored in operating system buffers to be written to disk. Only SAS files in a permanent SAS library are affected; files in any temporary library are not affected. The FILESYNC= system option affects only SAS files in UFS libraries.

For direct access bound libraries and sequential access bound libraries, updates to files are performed as if FILESYNC=SAS has been specified, regardless of the setting of the FILESYNC option.

# FILESYSOUT= System Option: z/OS

Specifies the default SYSOUT CLASS for a printer file.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Category: | Log and Procedure Output Control: ODS Printing |
| PROC OPTIONS GROUP= | LISTCONTROL |
| Default: | Z |

z/OS specifics: All

## Syntax

**FILESYSOUT=***sysout-class*

### Required Argument

***sysout-class***
is a single character (number or letter only). Valid classes are site dependent. At some sites, data center personnel might have set up a default class that cannot be overridden.

## Details

The FILESYSOUT= option specifies the default SYSOUT CLASS that is used when a printer file is allocated dynamically and when the SYSOUT= option is omitted from the FILENAME statement or FILENAME function.

# FILESYSTEM= System Option: z/OS

Specifies the default file system used when the filename is ambiguous.

Valid in: Configuration file, SAS invocation, OPTIONS statement, SAS System Options window

Category: Files: External Files

PROC OPTIONS GROUP= EXTFILES

Default: MVS

z/OS specifics: All

## Syntax

**FILESYSTEM=**MVS | HFS

### Required Arguments

**MVS**
specifies that the filesystem is native z/OS, which includes partitioned data sets (PDS, PDSE).

**HFS**
specifies the UNIX file system (UFS).

## Details

The FILESYSTEM= system option specifies the file system that is used when the physical filename is valid in both file systems. For example:

```
options filesystem='HFS';
/* resolves to a UNIX file system */
/* path, such as /homedir/hfs.file */
filename myhfs 'hfs.file';
```

## See Also

"How SAS Determines the File System" on page 109

# FILETEMPDIR System Option: z/OS

Specifies the parent directory for FILENAME TEMPFILE.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation |
| Category: | Files: External Files |
| PROC OPTIONS GROUP= | EXTFILES |
| Default: | NULL |
| z/OS specifics: | All |

## Syntax

**FILETEMPDIR**='dir-name'

### Required Argument

**dir-name**
specifies an existing UFS directory to use as a parent directory. This directory contains the subdirectories and files that are created as a result of specifying the TEMP *device-type* or the TEMPFILE option of the FILENAME statement.

## Details

A temporary data set that is created by a FILENAME statement is put in the Work library if the Work library is in a UFS directory. If the Work library is not in a UFS directory, the data set is put in the directory that is specified by the FILETEMPDIR system option. If the option is not specified, the data set is put in the `/tmp` directory.

# FILEUNIT= System Option: z/OS

Specifies the default unit of allocation for new physical files.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Categories: | Files: External Files<br>Files: SAS Files |
| PROC OPTIONS GROUP= | EXTFILES<br>SASFILES |
| Default: | CYLS |
| z/OS specifics: | All |

## Syntax

**FILEUNIT=***unit-type*

### Required Argument

***unit-type***
specifies the unit of allocation. Valid values include BLK, BLKS, CYL, CYLS, TRK, and TRKS, or an integer. The default is CYLS. If an integer is specified, it is the block size that is used for the allocation.

## Details

The FILEUNIT= option specifies the default unit of allocation that is used for new physical files if the SPACE= option is not specified in either the FILENAME statement or function or the LIBNAME statement or function.

# FILEVOL= System Option: z/OS

Specifies which VOLSER to use for new physical files.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Categories: | Files: External Files<br>Files: SAS Files |
| PROC OPTIONS GROUP= | EXTFILES<br>SASFILES |
| Default: | None |
| z/OS specifics: | All |

## Syntax

**FILEVOL=***volser* | (*volser-1, volser-2* ...)

### Required Argument

***volser***
specifies 1 to 30 volume serial numbers (VOLSERs); the VOLSERs can be separated by blanks or commas. A VOLSER is a six-character name of a z/OS DASD or tape volume. The name contains one to six alphanumeric or special characters. VOLSERs are site-specific.

## Details

The FILEVOL= option specifies the default VOLSER that is used for allocating new physical files if the VOL= option is omitted from the FILENAME statement or function or from the LIBNAME statement or function.

Parentheses are required if more than one VOLSER is specified.

# FILSZ System Option: z/OS

Specifies that the host sort utility supports the FILSZ parameter.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |

Category: Sort: Procedure Options

PROC OPTIONS GROUP= SORT

Default: FILSZ

z/OS specifics: All

## Syntax

**FILSZ** | **NOFILSZ**

### Required Arguments

**FILSZ**
specifies that the host sort utility supports the FILSZ parameter. SAS uses the FILSZ= option in the SORT control statement that it generates and passes to the sort program. FILSZ is more efficient than the SIZE parameter.

**NOFILSZ**
specifies that the host sort utility does not support the FILSZ parameter. SAS uses the SIZE= option in the SORT control statement that it generates and passes to the sort utility program.

## Details

If a program product sort utility that supports the FILSZ parameter is installed, specifying the FILSZ option increases the sort efficiency.

## See Also

"Consider Changing the Values of SORTPGM= and SORTCUTP=" on page 913

# FONTRENDERING= System Option: z/OS

Specifies whether SAS/GRAPH devices that are based on the SASGDGIF, SASGDTIF, and SASGDIMG modules render fonts by using the operating system or by using the FreeType engine.

Valid in: Configuration file, SAS invocation, OPTIONS statement, SAS System Options window

Category: Log and Procedure Output Control: ODS Printing

PROC OPTIONS GROUP= ODSPRINT

Restriction: This option is set to HOST_PIXELS for devices that begin with “Z”.

Note: This option can be restricted by a site administrator.

## Syntax

**FONTRENDERING=**HOST_PIXELS | FREETYPE_POINTS

### Required Arguments

**HOST_PIXELS**
specifies that fonts are rendered by the operating system and that font size is requested in pixels.

**Note:** On z/OS, HOST_PIXELS is not supported. If HOST_PIXELS is specified, SAS uses FREETYPE_POINTS as the value for this option.

**FREETYPE_POINTS**
specifies that fonts are rendered by the FreeType engine and that font size is requested in points. This is the default.

## Details

Use the FONTRENDERING= system option to specify how SAS/GRAPH devices that are based on the SASGDGIF, SASGDTIF, and SASGDIMG modules render fonts. When the operating system renders fonts, the font size is requested in pixels. When the FreeType engine renders fonts, the font size is requested in points.

Use the GDEVICE procedure to determine which module a SAS/GRAPH device uses:

```
proc gdevice c=sashelp.devices browse nofs;
   list devicename;
quit;
```

For example,

```
proc gdevice c=sashelp.devices browse nofs;
   list gif;
quit;
```

The following is partial output from the GDEVICE procedure output:

```
                                                GDEVICE procedure
                                       Listing from SASHELP.DEVICES - Entry GIF
Orig Driver: GIF                  Module:   SASGDGIF  Model:     6031
Description: GIF File Format                             Type: EXPORT
*** Institute-supplied ***
Lrows:  43  Xmax:   8.333 IN      Hsize:    0.000 IN  Xpixels:        800
Lcols:  88  Ymax:   6.250 IN      Vsize:    0.000 IN  Ypixels:        600
Prows:   0                        Horigin:  0.000 IN
Pcols:   0                        Vorigin:  0.000 IN
Aspect:   0.000                   Rotate:
Driver query: Y                   Queued messages: N
                                  Paperfeed:   0.000 IN
```

The **Module** entry names the module that is used by the device.

# FONTSLOC= System Option: z/OS

Specifies the location of the SAS fonts that are loaded during the SAS session.

| | |
|---|---|
| Valid in: | SAS invocation |
| PROC OPTIONS GROUP= | ENVDISPLAY |
| Default: | NULL |
| z/OS specifics: | All |
| See: | "FONTSLOC= System Option" in *SAS System Options: Reference* |

## Syntax

**FONTSLOC=***HFS directory path*

### Required Argument

***HFS directory path***
specified if the font files are saved in a UFS directory.

## Details

SAS distributes font files for use by the universal printer GIF driver in a UFS directory.

# FSBCOLOR System Option: z/OS

Specifies whether you can set background colors in SAS windows on vector graphics devices.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation |
| Category: | Environment Control: Display |
| PROC OPTIONS GROUP= | ENVDISPLAY |
| Default: | NOFSBCOLOR |
| z/OS specifics: | All |

## Syntax

**FSBCOLOR | NOFSBCOLOR**

### Required Arguments

**FSBCOLOR**
enables you to set the background color in your SAS windows. For example, if you specify FSBCOLOR when you invoke SAS, you can issue commands such as the following in any SAS window:

```
color back blue
```

This command sets the background color to blue.

Use the FSBCOLOR option only on vector graphics devices. The FSBCOLOR system option is ignored if you specify it on a program symbols device. SAS issues an error message if you try to set the background color of a window.

**NOFSBCOLOR**
specifies that no background colors are to be used. NOFSBCOLOR is the default value on all devices.

## Details

Nongraphics terminals and program symbols graphics terminals, such as the IBM 3279, the PC 3270 emulators, and the Tektronix 4205, do not enable you to set the background color of individual windows. The background color is always black for these terminals. Vector graphics terminals such as the IBM 3179G, 3192G, and 3472G enable you to set the background color.

# FSBORDER= System Option: z/OS

Specifies what type of symbols are to be used in borders.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation |
| Category: | Environment Control: Display |
| PROC OPTIONS GROUP= | ENVDISPLAY |
| Default: | BEST |
| z/OS specifics: | All |

## Syntax

**FSBORDER=**BEST | PS | APL | NONE

### Required Arguments

**BEST**
tells SAS to choose the border symbols based on the type of terminal that you are using.

**PS**
tells SAS to use programmed symbols for border symbols in the windowing environment.

**APL**
tells SAS to use APL symbols.

**NONE**
indicates that no special border symbols are to be used (normal text is used).

## Details

The FSBORDER= system option specifies what type of symbols are to be used in window borders and other widgets.

# FSDEVICE= System Option: z/OS

Specifies the full-screen device driver for your terminal.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation |

Category: Environment Control: Display

PROC OPTIONS GROUP= ENVDISPLAY

Alias: FSD=

Default: none

z/OS specifics: All

## Syntax

**FSDEVICE=***device-name*

## Details

The value of the FSDEVICE= system option is needed to run windowing procedures. For a list of all devices that are supported by the SAS terminal-based interactive windowing system under z/OS, see "Terminal Support in the z/OS Environment" on page 257.

# FSMODE= System Option: z/OS

Specifies the full-screen data stream type.

Valid in: Configuration file, SAS invocation

Category: Environment Control: Display

PROC OPTIONS GROUP= ENVDISPLAY

Default: IBM

z/OS specifics: All

## Syntax

**FSMODE=***data-stream-type*

### Required Argument

***data-stream-type***
is the name of an acceptable data stream type. Valid values are

**IBM**
is the default.

**FACOM**
**FUJITSU**
specifies the F6683 data stream, which can be used for F6683 and F6653 terminals.

**HITAC**
**HITACHI**
specifies the T560/20 data stream, which can be used for T560/20, H2020, and H2050 terminals.

## Details

The FSMODE= system option specifies the type of IBM 3270 data stream for the terminal. An incorrect setting of this option can cause a 3270 data stream program check or a system abend.

# FULLSTATS System Option: z/OS

Specifies whether to write all available system performance statistics to the SAS log.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Categories: | Log and Procedure Output Control: SAS Log<br>System Administration: Performance |
| PROC OPTIONS GROUP= | LOGCONTROL |
| Alias: | FULLSTIMER |
| Default: | NOFULLSTATS |
| z/OS specifics: | All |

## Syntax

**FULLSTATS** | **NOFULLSTATS**

### Required Arguments

**FULLSTATS**
tells SAS to write expanded statistics to the SAS log.

**NOFULLSTATS**
tells SAS not to write expanded statistics to the SAS log.

# Details

The STATS, FULLSTATS, STIMER, and MEMRPT system options control the resource usage statistics that are written to the SAS log for each SAS step.

The STATS system option controls whether any statistics are listed and provides a quick way to turn off all resource usage Notes. The STIMER and MEMRPT system options specify the type of statistics that are reported. The FULLSTATS system option controls whether just one line of CPU time or memory resource statistics, or both is listed, or whether expanded statistics are listed on multiple lines.

Expanded statistics for STIMER include CPU time, elapsed time, EXCP count, and possibly RSM hiperspace time (the hiperspace time is listed only if it is not zero).

Expanded statistics for MEMRPT include program memory and data memory usage for the step and program memory and data memory usage for the entire SAS session.

The following example illustrates the statistics that are generated with the FULLSTATS system option:

***Example Code 31.1*** *Output from FULLSTATS*

```
NOTE: The DATA statement used the following resources:
      CPU     time -         00:00:00.00
      Elapsed time -         00:00:00.06
      EXCP count   - 145
      Task  memory - 4614K (144K data, 4470K program)
      Total memory - 19153K (4768K data, 14385K program)
      Timestamp    - 10/31/2012 3:42:05 PM
```

The following table describes the statistics for the FULLSTATS option:

***Table 31.1*** *Description of FULLSTATS Statistics*

| Statistic | Description |
|---|---|
| CPU time | is the total CPU time used in the address space during the execution of this DATA step or proc. This number includes all CPUs on a multiprocessor system and all threads generated to complete this SAS step. |
| Elapsed time | is the actual clock time that passed during the execution of this DATA step or proc. |
| RSM Hiperspace time | is the total CPU time used by the z/OS real storage manager in support of hiperspace libraries during the execution of this DATA step or proc. This statistic is not reported if its value is zero. |

| Statistic | Description |
|---|---|
| EXCP count | is the number of Execute Channel Program (EXCP) system service calls executed in the address space during the execution of this DATA step or proc. This number is a measure of the IO activity during this SAS step. |
| Task memory | is the amount of memory that was used by the current SAS DATA step or proc. |
| Total memory | is the actual memory, in kilobytes, that is required for all tasks. This session total is useful for deciding the minimum region size required so that the entire job can execute successfully. |
| Timestamp | is the date and time that the DATA step was run. |

**Note:** z/OS hardware does not have a vector facility, and the values of **`Vector affinity time`** and **`Vector usage time`** are always zero when running SAS on z/OS.

## See Also

- “Collecting Performance Statistics” on page 904

### System Options

- “MEMRPT System Option: z/OS” on page 813
- “STATS System Option: z/OS” on page 865
- “STIMER System Option: z/OS” on page 868

# GHFONT= System Option: z/OS

Specifies the default graphics hardware font.

Valid in: Configuration file, SAS invocation

Category: Environment Control: Display

PROC OPTIONS GROUP= ENVDISPLAY

Default: None

z/OS specifics: All

## Syntax

**GHFONT=***font-specification*

### Required Arguments

Examples of values for *font-specification* are

**F6X9**
specifies characters that are six pixels wide and nine pixels high.

**F9X12**
specifies characters that are nine pixels wide and twelve pixels high.

**I6X9**
specifies an italic font with characters that are six pixels wide and nine pixels high. See your system administrator for a complete list of fonts that are available to you.

## Details

The GHFONT= option specifies the default hardware font in graphics. It applies only to vector graphics devices that support stroke precision in the vector graphics symbol set (for example, IBM terminals such as 3179G, 3192G, and 3472G).

This option is used with SAS software products where you can specify a smaller font and display more information in the tables on the display.

# HELPHOST System Option: z/OS

Specifies the name of the computer where the remote help browser is running.

Valid in: Configuration file, SAS invocation, OPTIONS statement, SAS System Options window

Category: Environment Control: Help

PROC OPTIONS GROUP= HELP

Default: None

z/OS specifics: All

## Syntax

**HELPHOST=***host*

### Required Argument

***host***
specifies the name of the computer where the remote help is to be displayed. Quotation marks or parentheses are required. The maximum number of characters is 2048.

## Details

If you do not specify the HELPHOST option, and the HELPBROWSER system option is set to REMOTE, then an HTML page that contains remote help instructions appears in the SAS session. If you use the default value of the HELPHOST option, then the address is determined from the network address of the TN3270 server that you are using to connect to z/OS.

## See Also

- "Converting Item Store Help to HTML Help" on page 230
- Chapter 11, "Using the SAS Remote Browser," on page 223

**System Options**

- "HELPBROWSER= System Option" in *SAS System Options: Reference*
- "HELPHOST System Option" in *SAS System Options: Reference*
- "HELPPORT= System Option" in *SAS System Options: Reference*

# HELPLOC= System Option: z/OS

Specifies the location of the text and index files for the facility that is used to view SAS Help and Documentation.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation |
| Category: | Environment Control: Files |
| PROC OPTIONS GROUP= | HELP |
| Default: | NONE |
| z/OS specifics: | All |

## Syntax

**HELPLOC=**<(>*location-1*,<*location-2,* ...><)>

### Required Argument

***location***
specifies the location of the Help files that are to be used with the remote browser.

## Details

The HELPLOC= system option specifies the location of the Help files and index files that the SAS Remote Browser uses. You can concatenate values to the HELPLOC value during initialization with the following methods:

- Use the INSERT system option to place a new value at the front of the list of values.
- Use the APPEND system option to place a new value at the end of the list of values.

For more information, see the "APPEND= System Option: z/OS" on page 705 and "INSERT= System Option: z/OS" on page 783 system options documentation.

## See Also

- "Converting Item Store Help to HTML Help" on page 230
- Chapter 11, "Using the SAS Remote Browser," on page 223
- "Using User-Defined Item Store Help Files" on page 228

**System Options**

- "APPEND= System Option: z/OS" on page 705
- "HELPTOC System Option: z/OS" on page 776
- "INSERT= System Option: z/OS" on page 783

# HELPTOC System Option: z/OS

Specifies the table of contents files for the online SAS Help and Documentation.

Valid in: configuration file, SAS invocation

Category: Environment Control: Help

PROC OPTIONS GROUP= HELP

Default: HELPTOC=(/help/helpnav.hlp/navigation.xml /help/common.hlp/toc.htm, common.hhc)

UNIX specifics: applet and HTML files must reside in the path specified by the HELPLOC option

## Syntax

**HELPTOC** *TOC-pathname-1* < *TOC-pathname-2* < *TOC-pathname-3*> >

### Required Argument

***TOC-pathname***
specifies a partial pathname for the table of contents that is to be used by the online SAS Help and Documentation. *TOC-pathname* can be any or all of the following:

**/help/*applet-TOC-filename***
specifies the partial pathname of the table of contents file that is to be used by the SAS Documentation Java applet in a UNIX environment. The *applet-TOC-filename* must have a file extension of .txt, and it must reside in a path that is specified by the HELPLOC system option. The default is **`/help/helpnav.hlp/config.txt`**.

See the default table of contents file for the format that is required for an index file.

**/help/*accessible-TOC-filename***
specifies the partial pathname of an accessible table of contents file that is to be used by the online SAS Help and Documentation in UNIX or z/OS environments. An accessible table of contents file is an HTML file that can be used by web browsers. The *accessible-TOC-filename* must have a file extension of .htm, and it must reside in a path that is specified by the HELPLOC system option. The default pathname is **`/help/common.hlp/toc.htm`**.

See the default table of contents file for the format that is required for a table of contents.

***HTML-Help-TOC-pathname***
specifies the complete pathname to the Microsoft HTML Help table of contents that is to be used by the online SAS Help and Documentation in Windows environments. The default pathname is **`common.hhc`**. For information about creating an index for Microsoft HTML Help, see your Microsoft HTML Help documentation.

## Details

Use the HELPTOC system option if you have a customized table of contents that you want to use, instead of the table of contents that SAS provides. If you use one configuration file to start SAS in more than one operating environment, you can specify all of the partial pathnames in the HELPTOC option. The order of the pathnames is not important, although only one pathname of each type can be specified.

When the HELPTOC option specifies the pathname for UNIX or z/OS operating environments, SAS determines the complete path by replacing `/help/` in the partial pathname with the pathname specified in the HELPLOC option. If the HELPLOC option contains more than one pathname, SAS searches each path for the table of contents.

For example, when HELPTOC is **`/help/common.hlp/mytoc.htm`**, and the value of HELPLOC is **`/u/myhome/myhelp`**, the complete path to the table of contents is **`/u/myhome/myhelp/common.hlp/mytoc.htm`**.

## See Also

"HELPLOC= System Option: z/OS" on page 775

# HOSTINFOLONG System Option: z/OS

Specifies to print additional operating environment information in the SAS log when SAS starts.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation |
| Category: | Log and Procedure Output Control: SAS Log |
| PROC OPTIONS GROUP= | LOGCONTROL |

## Syntax

**HOSTINFOLONG** | **NOHOSTINFOLONG**

### Required Arguments

**HOSTINFOLONG**
specifies to print additional operating environment information in the SAS log when SAS starts.

**NOHOSTINFOLONG**
specifies to omit additional operating environment information in the SAS log when SAS starts.

## Details

When HOSTINFOLONG is specified, SAS writes additional information about the operating environment to the SAS log.

```
NOTE: Copyright (c) 2002-2012 by SAS Institute Inc., Cary, NC, USA.
NOTE: SAS (r) Proprietary Software 9.4 (TS04.01B0P09052012)
      Licensed to SAS Institute Inc., Site 1.
NOTE: This session is executing on the z/OS  V01R13M00 platform.

NOTE: Running on IBM Model 2817 Serial Number 035EA6.


NOTE: Updated analytical products:

SAS/OR 12.1

NOTE: Additional host information:

IBM 2817-706, DEVA, FMID HBB7780, CPU: 8, GP: 6, zAAP: 0, zIIP: 2
```

## See Also

- "The SAS Log" in *SAS Programmer's Guide: Essentials*

**System Options:**

- "CPUID System Option" in *SAS System Options: Reference*

# HSLXTNTS= System Option: z/OS

Specifies the size of each physical hiperspace that is created for a SAS library.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Category: | Files: SAS Files |
| PROC OPTIONS GROUP= | SASFILES |
| Default: | 1,500 |
| z/OS specifics: | All |

## Syntax

**HSLXTNTS=***value*

## Details

The HSLXTNTS= option specifies the size in pages of each physical hiperspace that is created for a SAS library with the HIPERSPACE option in the LIBNAME statement or LIBNAME function. These physical hiperspaces are analogous to physical data set extents. When one is filled, another is obtained. They are logically combined internally to form a single logical hiperspace representing a library.

The value that you specify must be in the range 0 to 524,287. If you specify 0, SAS uses the value 1,800. To verify the maximum number of pages specific to your site, contact your system administrator.

## See Also

- "Optimizing SAS I/O" on page 905
- *Tuning SAS Applications in the OS/390 and z/OS Environments*

# HSMAXPGS= System Option: z/OS

Specifies the maximum number of hiperspace pages allowed in a SAS session.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Category: | Files: SAS Files |
| PROC OPTIONS GROUP= | SASFILES |
| Default: | 75,000 |
| z/OS specifics: | All |

## Syntax

**HSMAXPGS=***value*

## Details

The HSMAXPGS= option specifies the maximum number of hiperspace pages that can be allocated in a single SAS session for all hiperspaces. The value of the HSMAXPGS= option is equal to the product of the values of the HSLXTNTS= and HSMAXSPC= options.

The value that you specify must be in the range 0 to 2,147,483,647. If you specify 0, SAS allocates 1,920 blocks of hiperspace to the library. Check with your system administrator for any site-specific maximum number of pages that you can have.

If you are responsible for controlling resource use at your site and you are concerned with hiperspace usage, then you can use the IBM SMF installation exit, IEFUSI, to limit the hiperspace resources that are available to users.

## See Also

- "Optimizing SAS I/O" on page 905
- *Tuning SAS Applications in the OS/390 and z/OS Environments*

# HSMAXSPC= System Option: z/OS

Specifies the maximum number of hiperspaces allowed in a SAS session.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Category: | Files: SAS Files |
| PROC OPTIONS GROUP= | SASFILES |
| Default: | 50 |
| z/OS specifics: | All |

## Syntax

**HSMAXSPC=***value*

## Details

The HSMAXSPC= option specifies the maximum number of physical hiperspaces that can be allocated in a single SAS session. The size of each hiperspace is specified by the HSLXTNTS= option.

The value that you specify must be in the range 0 to 2,147,483,647. If you specify zero, SAS allocates 1,920 blocks of VIO for the library. Check with your system administrator for any site-specific maximum number of hiperspaces that you can have.

## See Also

- "Optimizing SAS I/O" on page 905
- *Tuning SAS Applications in the OS/390 and z/OS Environments*

# HSWORK System Option: z/OS

Tells SAS to place the Work library in a hiperspace.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation |
| Category: | Files: SAS Files |
| PROC OPTIONS GROUP= | SASFILES |
| Default: | NOHSWORK |
| z/OS specifics: | All |

## Syntax

**HSWORK | NOHSWORK**

## Details

HSWORK indicates that a hiperspace should be used for the Work library. Specifying NOHSWORK indicates that the Work library is not a hiperspace.

NOHSWORK is the default setting for this option, and this default is probably suitable for most of your programming needs. However, there might be times when you want to place the Work library in a hiperspace. For example, the performance of programs (with regard to elapsed time) that perform only output operations to the Work library can improve significantly when the Work library is a hiperspace library. The maximum size of the resulting WORK library is the lessor of the following:

- HSMAXPGS
- HSLXTNTS * HSMAXSPC

**Note:** The effect on performance of using a hiperspace for WORK data sets is site-dependent. Your system administrator might want to make recommendations based on investigation of this issue for your site.

## See Also

- "Optimizing SAS I/O" on page 905
- *Tuning SAS Applications in the OS/390 and z/OS Environments*

# INSERT= System Option: z/OS

Inserts the specified value at the beginning of the specified system option.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, Options window |
| Category: | Environment Control: Files |
| PROC OPTIONS GROUP= | ENVFILES |
| Default: | None |
| z/OS specifics: | SAS invocation syntax |

## Syntax

**INSERT=**(*system-option*=*inserted-value*)

### Required Arguments

***system-option***
can be AUTOEXEC, CMPLIB, FMTSEARCH, HELPLOC, MAPS, MSG, SASAUTOS, SASHELP, or SASSCRIPT.

***inserted-value***
is the new value that you want to insert at the beginning of the current value of **`system-option`**.

## Details

If you specify a SAS system option more than once, then the last specification of the option is the one that SAS uses. You must use the INSERT system option to add additional values to the beginning of the value that is already specified for the following system options:

| | | |
|---|---|---|
| AUTOEXEC | HELPLOC | SASAUTOS |
| CMPLIB | MAPS | SASHELP |
| FMTSEARCH | MSG | SASSCRIPT |

For example, if your configuration file contains the following option specification:

```
sasautos='prefix.prod.sasautos'
```

and you enter the following SASRX command,

```
sasrx -sasautos 'prefix.test.sasautos'
```

then the only location where SAS looks for autocall macros is **'prefix.test.sasautos'**. The output of PROC OPTIONS shows **'prefix.test.sasautos'** as the value of the SASAUTOS option.

If you want SAS to look in both locations for autocall macros, then you must use the following INSERT option:

```
sasrx -insert=(sasautos='prefix.test.sasautos')
```

PROC OPTIONS then shows the following value for the SASAUTOS option:

```
('prefix.test.sasautos' 'prefix.prod.sasautos')
```

If the original value of **system-option** or **inserted-value** is enclosed in parentheses, then the resulting option value is merged into one pair of parentheses. For example,

```
SASAUTOS=(.a.sasautos .b.sasautos)
INSERT=(sasautos=(.c.sasautos .d.sasautos))
```

sets the value of the SASAUTOS option to

```
(.c.sasautos .d.sasautos .a.sasautos .b.sasautos)
```

## See Also

- "Changing an Option Value By Using the INSERT and APPEND System Options" in *SAS System Options: Reference*
- Appendix 3, "Encoding for z/OS Resource Names," on page 939

### System Options

- "APPEND= System Option: z/OS" on page 705
- "CMPLIB= System Option" in *SAS System Options: Reference*
- Appendix 3, "Encoding for z/OS Resource Names," on page 939

# ISPCAPS System Option: z/OS

Specifies whether to convert to uppercase printable ISPF parameters that are used in CALL ISPEXEC and CALL ISPLINK.

Valid in: Configuration file, SAS invocation, OPTIONS statement, SAS System Options window

Category: Host Interfaces: ISPF

PROC OPTIONS GROUP= ISPF

Default: NOISPCAPS

z/OS specifics: All

## Syntax

**ISPCAPS | NOISPCAPS**

## Details

If ISPCAPS is in effect, then the values of variables and literals that are used as parameters are passed to ISPF in uppercase.

If NOISPCAPS is in effect, then the caller must ensure that the parameters are in the proper case. The names of most ISPF parameters must be in uppercase.

The following example shows two ISPLINK calls. The first turns on the ISPCAPS option. As a result, the parameters that are specified in lowercase in the second ISPLINK call are passed to ISPF in uppercase.

```
DATA _NULL_;
   CALL ISPLINK('SAS','ISPCAPS');
   CALL ISPLINK('display', 'dmiem1');
   RUN;
```

To display the current settings of your ISPF options, use PROC OPTIONS GROUP=ISPF.

## See Also

"SAS Interface to ISPF" on page 293

# ISPCHARF System Option: z/OS

Specifies whether the values of SAS character variables are converted using their automatically specified informats or formats each time they are used as ISPF variables.

Valid in: Configuration file, SAS invocation, OPTIONS statement, SAS System Options window

Category: Host Interfaces: ISPF

PROC OPTIONS GROUP= ISPF

Default: NOISPCHARF

z/OS specifics: All

## Syntax

**ISPCHARF | NOISPCHARF**

## Details

If ISPCHARF is specified, then formats and informats are used for SAS character variables that have been defined to ISPF via the SAS VDEFINE user exit. If NOISPCHARF is in effect, then formats and informats are not used for these SAS character variables.

To display the current settings of your ISPF options, use PROC OPTIONS GROUP=ISPF.

## See Also

"SAS Interface to ISPF" on page 293

# ISPCSR= System Option: z/OS

Tells SAS to set an ISPF variable to the name of a variable whose value is found to be invalid.

Valid in: Configuration file, SAS invocation

Category: Host Interfaces: ISPF

PROC OPTIONS GROUP= ISPF

Default: none

z/OS specifics: All

## Syntax

**ISPCSR=***variable-name*

## Details

The ISPF variables that are specified by both ISPCSR= and ISPMSG= are set by the SAS VDEFINE user exit whenever the exit finds an ISPF variable that has a zero length, or whenever the SAS informat that is associated with the variable finds the value invalid. SAS uses the VDEFINE user exit to define *variable-name* as a character variable length of eight, placing it in the pool of functions that are automatically specified.

To display the current settings of your ISPF options, use PROC OPTIONS GROUP=ISPF.

## See Also

"SAS Interface to ISPF" on page 293

# ISPEXECV= System Option: z/OS

Specifies the name of an ISPF variable that passes its value to an ISPF service.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation |
| Category: | Host Interfaces: ISPF |
| PROC OPTIONS GROUP= | ISPF |
| Default: | none |
| z/OS specifics: | All |

## Syntax

**ISPEXECV=***variable-name*

## Details

Assigning a value to the specified variable causes that value to be passed to ISPF for execution. When accessed, the variable contains the return code for the service request. SAS uses the VDEFINE user exit to define *variable-name* as a character variable of length two, placing it in the pool of functions that are automatically specified.

For example, if ISPEXECV=SASEXEC, then you could do the following from an ISPF panel:

&SASEXEC = 'DISPLAY PANEL (XXX)'

IF (&SASEXEC ¬= '00') ...

To display the current settings of your ISPF options, use PROC OPTIONS GROUP=ISPF.

## See Also

"SAS Interface to ISPF" on page 293

# ISPMISS= System Option: z/OS

Specifies the value assigned to SAS character variables defined to ISPF when the associated ISPF variable has a length of zero.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Category: | Host Interfaces: ISPF |
| PROC OPTIONS GROUP= | ISPF |
| Default: | None |
| z/OS specifics: | All |

## Syntax

**ISPMISS=***value*

## Details

When the ISPF variable has a length of zero, the value of ISPMISS= is the value that is assigned to SAS character variables that are defined to ISPF via the SAS VDEFINE user exit. Associated formats or informats are automatically specified. The specified value must be one byte in length.

**Note:** The specified value is substituted only if the SAS system option ISPCHARF is in effect when the variable is identified to ISPF via VDEFINE. For more information, see "ISPCHARF System Option: z/OS" on page 785.

To display the current settings of your ISPF options, use PROC OPTIONS GROUP=ISPF.

## See Also

"SAS Interface to ISPF" on page 293

# ISPMSG= System Option: z/OS

Tells SAS to set an ISPF variable to a message ID when a variable is found to be invalid.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation |
| Category: | Host Interfaces: ISPF |
| PROC OPTIONS GROUP= | ISPF |
| Default: | None |
| z/OS specifics: | All |

## Syntax

**ISPMSG=***variable-name*

## Details

The ISPF variables that are specified by both ISPMSG= and ISPCSR= are set by the VDEFINE user exit whenever the exit finds an ISPF variable that has a zero length, or whenever the SAS informat that is associated with the variable finds the value invalid. The SAS VDEFINE user exit identifies *variable-name* to ISPF as a character variable length of eight, placing it in the pool of functions that are automatically specified.

To display the current settings of your ISPF options, use PROC OPTIONS GROUP=ISPF

## See Also

"SAS Interface to ISPF" on page 293

# ISPNOTES System Option: z/OS

Specifies whether ISPF error messages are to be written to the SAS log.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Categories: | Host Interfaces: ISPF<br>Log and Procedure Output Control: SAS Log |
| PROC OPTIONS GROUP= | ISPF<br>LOGCONTROL |
| Default: | NOISPNOTES |
| z/OS specifics: | All |

## Syntax

**ISPNOTES | NOISPNOTES**

## Details

If ISPNOTES is specified, then ISPF error messages are written to the SAS log. If NOISPNOTES is in effect, then ISPF error messages are not written to the SAS log.

The ISPTRACE option overrides the NOISPNOTES option, so all messages are written to the SAS log when ISPTRACE is specified.

To display the current settings of your ISPF options, use PROC OPTIONS GROUP=ISPF.

## See Also

"SAS Interface to ISPF" on page 293

# ISPNZTRC System Option: z/OS

Specifies whether nonzero ISPF service return codes are to be written to the SAS log.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Categories: | Host Interfaces: ISPF<br>Log and Procedure Output Control: SAS Log |
| PROC OPTIONS GROUP= | ISPF<br>LOGCONTROL |
| Default: | NOISPNZTRC |

z/OS specifics: All

## Syntax

**ISPNZTRC | NOISPNZTRC**

## Details

If ISPNZTRC is specified, nonzero ISPF service return codes are written to the SAS log. If NOISPNZTRC is in effect, then nonzero ISPF service return codes are not written to the SAS log.

To display all parameter lists and return codes in the SAS log, use the ISPTRACE option instead of ISPNZTRC.

To display the current settings of your ISPF options, use PROC OPTIONS GROUP=ISPF.

## See Also

"SAS Interface to ISPF" on page 293

# ISPPT System Option: z/OS

Specifies whether ISPF parameter value pointers and lengths are to be written to the SAS log.

Valid in: Configuration file, SAS invocation, OPTIONS statement, SAS System Options window

Categories: Host Interfaces: ISPF
Log and Procedure Output Control: SAS Log

PROC OPTIONS GROUP= ISPF
LOGCONTROL

Default: NOISPPT

z/OS specifics: All

## Syntax

**ISPPT | NOISPPT**

## Details

The ISPPT option is used for debugging. If ISPPT is specified, then ISPF parameter value pointers and lengths are displayed. If NOISPPT is in effect, then ISPF parameter value pointers and lengths are not displayed.

To display the current settings of your ISPF options, use PROC OPTIONS GROUP=ISPF.

## See Also

"SAS Interface to ISPF" on page 293

# ISPTRACE System Option: z/OS

Specifies whether the parameter lists and service return codes are to be written to the SAS log.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Categories: | Host Interfaces: ISPF<br>Log and Procedure Output Control: SAS Log |
| PROC OPTIONS GROUP= | ISPF<br>LOGCONTROL |
| Default: | NOISPTRACE |
| z/OS specifics: | All |

## Syntax

**ISPTRACE | NOISPTRACE**

## Details

If ISPTRACE is specified, then all ISPF service calls and return codes are written to the SAS log. Fixed binary parameters are written to the SAS log, converted to decimal display. After a VDEFINE or VDELETE service request, the list of currently defined SAS variables is written to the SAS log.

If NOISPTRACE is in effect, then ISPF service calls and return codes are not written to the SAS log.

**Note:** The ISPTRACE option can be set based on the value of the ISPF variable named DMITRACE. In the following example, if the DMITRACE value is YES, then ISPTRACE is in effect. If the DMITRACE value is NO, then NOISPTRACE is in effect.

```
CALL ISPLINK('DMI','*ISPTRACE');
```

To display the current settings of your ISPF options, use PROC OPTIONS GROUP=ISPF.

## See Also

"SAS Interface to ISPF" on page 293

# ISPVDEFA System Option: z/OS

Specifies whether all current SAS variables are to be identified to ISPF via the SAS VDEFINE user exit.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Category: | Host Interfaces: ISPF |
| PROC OPTIONS GROUP= | ISPF |
| Default: | NOISPVDEFA |
| z/OS specifics: | All |

## Syntax

**ISPVDEFA | NOISPVDEFA**

## Details

If ISPVDEFA is specified, then all current SAS variables are identified to ISPF via the SAS VDEFINE user exit. If a VDEFINE service request is issued that has a value that is specified automatically, then any variables that it specifies are defined twice.

If NOISPVDEFA is in effect, then only those variables that are passed automatically to the VDEFINE user exit are defined.

To display information about ISPF options, use PROC OPTIONS GROUP=ISPF.

## See Also

"SAS Interface to ISPF" on page 293

# ISPVDLT System Option: z/OS

Specifies whether VDELETE is executed before each SAS variable is identified to ISPF via VDEFINE.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Category: | Host Interfaces: ISPF |
| PROC OPTIONS GROUP= | ISPF |
| Default: | NOISPVDLT |
| z/OS specifics: | All |

## Syntax

**ISPVDLT | NOISPVDLT**

## Details

If ISPVDLT is specified, then each SAS variable is deleted from ISPF with the VDELETE user exit before it is identified to ISPF with VDEFINE. This specification prevents a SAS variable from being identified to ISPF more than once in any SAS DATA step.

If NOISPVDLT is in effect, then SAS variables are not deleted from ISPF before they are defined. This specification can cause SAS variables to be defined to ISPF more than once in a SAS DATA step.

To display the current settings of your ISPF options, use PROC OPTIONS GROUP=ISPF.

## See Also

"SAS Interface to ISPF" on page 293

# ISPVDTRC System Option: z/OS

Specifies whether to trace every VDEFINE for SAS variables.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Categories: | Host Interfaces: ISPF<br>Log and Procedure Output Control: SAS Log |
| PROC OPTIONS GROUP= | ISPF<br>LOGCONTROL |
| Default: | NOISPVDTRC |
| z/OS specifics: | All |

## Syntax

**ISPVDTRC | NOISPVDTRC**

## Details

Tracing means that, as each SAS variable is identified to ISPF with the SAS VDEFINE user exit, its name, its VDEFINE length, and any nonzero ISPF return codes are written to the SAS log.

If NOISPVDTRC is in effect, then no information is written to the SAS log when a SAS variable is identified to ISPF via VDEFINE. The NOISPVDTRC setting is useful when many variables are defined with one service request because SAS actually issues multiple VDEFINE requests (one for each variable).

To display the current settings of your ISPF options, use PROC OPTIONS GROUP=ISPF.

## See Also

"SAS Interface to ISPF" on page 293

# ISPVIMSG= System Option: z/OS

Specifies the ISPF message ID that is to be set by the SAS VDEFINE user exit when the informat for a variable returns a nonzero return code.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Category: | Host Interfaces: ISPF |
| PROC OPTIONS GROUP= | ISPF |
| Default: | None |
| z/OS specifics: | All |

## Syntax

**ISPVIMSG=***message-ID*

## Details

The message ID is stored in the ISPF variable that is specified by the ISPMSG= option.

To display the current settings of your ISPF options, use PROC OPTIONS GROUP=ISPF.

## See Also

"SAS Interface to ISPF" on page 293

# ISPVRMSG= System Option: z/OS

Specifies the ISPF message ID that is to be set by the SAS VDEFINE user exit when a variable has a null value.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Category: | Host Interfaces: ISPF |

PROC OPTIONS GROUP= ISPF

Default: None

z/OS specifics: All

## Syntax

**ISPVRMSG=***message-ID*

## Details

The message ID is stored in the ISPF variable that is specified by the ISPMSG= option.

To display the current settings of your ISPF options, use PROC OPTIONS GROUP=ISPF.

## See Also

"SAS Interface to ISPF" on page 293

# ISPVTMSG= System Option: z/OS

Specifies the ISPF message ID that is to be displayed by the SAS VDEFINE user exit when the ISPVTRAP option is in effect.

Valid in: Configuration file, SAS invocation, OPTIONS statement, SAS System Options window

Category: Host Interfaces: ISPF

PROC OPTIONS GROUP= ISPF

Default: None

z/OS specifics: All

## Syntax

**ISPVTMSG=***message-ID*

## Details

To display the current settings of your ISPF options, use PROC OPTIONS GROUP=ISPF.

## See Also

"SAS Interface to ISPF" on page 293

# ISPVTNAM= System Option: z/OS

Restricts the information that is displayed by the ISPVTRAP option to the specified variable only.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Category: | Host Interfaces: ISPF |
| PROC OPTIONS GROUP= | ISPF |
| Default: | None |
| z/OS specifics: | All |

## Syntax

**ISPVTNAM=***variable-name*

## Details

To display the current settings of your ISPF options, use PROC OPTIONS GROUP=ISPF.

## See Also

"SAS Interface to ISPF" on page 293

# ISPVTPNL= System Option: z/OS

Specifies the name of the ISPF panel that is to be displayed by the SAS VDEFINE user exit when the ISPVTRAP option is in effect.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Category: | Host Interfaces: ISPF |
| PROC OPTIONS GROUP= | ISPF |
| Default: | None |
| z/OS specifics: | All |

## Syntax

**ISPVTPNL=***panel*

## Details

To display the current settings of your ISPF options, use PROC OPTIONS GROUP=ISPF.

**Note:** The panel specified by ISPVTPNL should not reference any variables that are defined by the ISPF VDEFINE service as the result of a call to the ISPEXEC or ISPLINK CALL routine. In particular, if the application defines the ZCMD variable in this way, the ISPVTPNL panel must not reference this variable.

## See Also

"SAS Interface to ISPF" on page 293

# ISPVTRAP System Option: z/OS

Specifies whether the SAS VDEFINE user exit writes information to the SAS log (for debugging purposes) each time it is entered.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Categories: | Host Interfaces: ISPF<br>Log and Procedure Output Control: SAS Log |
| PROC OPTIONS GROUP= | ISPF<br>LOGCONTROL |
| Default: | NOISPVTRAP |
| z/OS specifics: | All |

## Syntax

**ISPVTRAP | NOISPVTRAP**

## Details

If ISPVTRAP is specified, the SAS VDEFINE user exit writes a message to the SAS log each time it is entered. If the parameters for the ISPVTPNL, ISPVTVARS, and ISPVTMSG options are set, it sets the ISPVTVARS variables and displays the ISPVTPNL panel with the ISPVTMSG message on it. If you press the End key on the information display, the option is set to NOISPVTRAP.

If NOISPVTRAP is in effect, the SAS VDEFINE user exit does not write information to the SAS log each time it is entered.

To display the current settings of your ISPF options, use PROC OPTIONS GROUP=ISPF.

## See Also

"SAS Interface to ISPF" on page 293

# ISPVTVARS= System Option: z/OS

Specifies the prefix for the ISPF variables to be set by the SAS VDEFINE user exit when the ISPVTRAP option is in effect.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Category: | Host Interfaces: ISPF |
| PROC OPTIONS GROUP= | ISPF |

Default: None

z/OS specifics: All

## Syntax

**ISPVTVARS=***prefix*

## Details

The numbers 0 through 5 are appended to this prefix to generate the ISPF variable names. These variables contain the following information:

| | |
|---|---|
| *prefix*0 | whether the variable is being read or written |
| *prefix*1 | the name of the variable that is being updated |
| *prefix*2 | the address of the parameter list for the VDEFINE user exit |
| *prefix*3 | the address of the variable that is being updated |
| *prefix*4 | the length of the variable that is being updated |
| *prefix*5 | the value of the variable that is being updated. |

For example, if ISPVTVARS=SASVT, then the variables SASVT0 - SASVT5 would be created. Possible values for these variables could be as follows:

| | |
|---|---|
| SASVT0 | READ (or WRITE) |
| SASVT1 | MYVAR |
| SASVT2 | 083C1240 |
| SASVT3 | 00450138 |
| SASVT4 | 7 |
| SASVT5 | MYVALUE |

To display the current settings of your ISPF options, use PROC OPTIONS GROUP=ISPF.

## See Also

"SAS Interface to ISPF" on page 293

# JREOPTIONS= System Option: z/OS

Identifies the Java Runtime Environment (JRE) options for SAS.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation |
| PROC OPTIONS GROUP= | EXECMODES |
| Default: | None |
| z/OS specifics: | All |
| CAUTION: | **Changing Java options that affect SAS might cause SAS to fail.** Before you change the settings for the JREOPTIONS option, contact SAS Technical Support to ensure that the Java setting that you want to change does not affect SAS. A best practice is to change only the Java properties for your own Java code. |

## Syntax

**JREOPTIONS=**(*-JRE-option-1* <*-JRE-option-2* ...> )

### Required Argument

***-JRE-option***
specifies one or more Java Runtime Environment options. JRE options must begin with a hyphen. Use a space to separate multiple JRE options. Valid values for *JRE-option* depend on your installation's Java Runtime Environment. For information about JRE options, see your installation's Java documentation.

## Details

If you specify the JREOPTIONS system option more than once, SAS appends each set of JRE options to the JRE options that you previously defined. For example, the JREOPTIONS specifications on the first two lines of the following example are equivalent to the single JREOPTIONS specification that appears on the last line of the example.

```
jreoptions=(-jreoption1 -jreoption2)
jreoptions=(-jreoption3 -jreoption4)

jreoptions=(-jreoption1 -jreoption2 -jreoption3 -jreoption4)
```

If a JRE option is specified more than once, the last specification is the one that is used. Invalid JRE options are ignored.

## Example: Specifying a JRE Option

```
jreoptions=(-Xmx128m -Xms128m)
```

# LINESIZE= System Option: z/OS

Specifies the line size for the SAS Log and SAS procedure output.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Category: | Log and Procedure Output Control: SAS Log |
| PROC OPTIONS GROUP= | LOG_LISTCONTROL<br>LISTCONTROL<br>LOGCONTROL |
| Default: | The terminal's width setting for interactive modes; 132 characters for noninteractive modes |
| z/OS specifics: | Default value |
| See: | "LINESIZE= System Option" in *SAS System Options: Reference* |

## Syntax

**LINESIZE=***n* | *hex*X | MIN | MAX

### Required Arguments

***n***
specifies the line size in characters.

***hex*X**
specifies the line size as a hexadecimal value. You must specify the value beginning with a number (0–9), followed by an X. For example, the value 2dx specifies 45 characters.

**MIN**
sets the line size of the SAS procedure output to 64 characters.

**MAX**
sets the line size of the SAS procedure output to 256 characters.

## Details

Under z/OS, the default for the windowing environment is the display's width setting. For interactive line mode, the default is 78 characters. For noninteractive mode and batch mode, the default is 132 characters. The minimum value of *n* is 64 characters; the maximum is 256 characters.

## See Also

"The SAS Log" in *SAS Programmer's Guide: Essentials*

# LOG= System Option: z/OS

Specifies a destination for a copy of the SAS log when running in batch mode.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation |
| Category: | Environment Control: Files |
| PROC OPTIONS GROUP= | ENVFILES<br>LOGCONTROL |
| Default: | SASLOG |
| z/OS specifics: | *file-specification* |

## Syntax

**LOG=**<*file-specification*>

**NOLOG**

### Optional Argument

***file-specification***
identifies an external file. Under z/OS, it can be a valid ddname, a physical filename, or the name of a file stored in the directory structure of the UNIX file system. The ddname must have been previously associated with an external file using either a TSO ALLOCATE command or a JCL DD statement.

## Details

When SAS is started with the OBJECTSERVER and NOTERMINAL system options and no log is specified, SAS discards all log and alternate log messages.

NOLOG suppresses the creation of the SAS log. Do not use this value unless your SAS program is thoroughly debugged.

Using directives in the value of the LOG system option enables you to control when logs are opened and closed and how they are named, based on real-time events, such as time, month, day of week, and so on. For a list of directives, see the "LOGPARM= System Option: z/OS" on page 805.

If you start SAS in batch mode or server mode and the LOGCONFIGLOC= option is specified, logging is done by the SAS logging facility. The traditional SAS log option

LOGPARM= is ignored. The traditional SAS log option LOG= is honored only when the %S{App.Log} conversion character is specified in the logging configuration file. For more information, see "The SAS Logging Facility" in *SAS Logging: Configuration and Programming Reference*.

## See Also

- "Copying Output to an External File" on page 147
- "The SAS Log" in *SAS Programmer's Guide: Essentials*

**System Options**

- "ALTLOG= System Option: z/OS" on page 703
- "LOGPARM= System Option: z/OS" on page 805

# LOGPARM= System Option: z/OS

Controls when SAS log files are opened, closed, and, in conjunction with the LOG= system option, how they are named.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation |
| Category: | Log and Procedure Output Control: SAS Log |
| PROC OPTIONS GROUP= | LOGCONTROL |
| z/OS specifics: | Restrictions on the OPEN argument and the length of log filename |
| See: | "LOGPARM= System Option" in *SAS System Options: Reference* |

## Syntax

**LOGPARM**=

"<OPEN=APPEND | REPLACE | REPLACEOLD>
<ROLLOVER=AUTO | NONE | SESSION | *n* | *n*K | *n*M | *n*G>
<WRITE=BUFFERED | IMMEDIATE> "

### Optional Arguments

**OPEN=**

when a log file already exists, controls how the contents of the existing file are treated.

APPEND
appends the log when opening an existing file. If the file does not already exist, a new file is created. This option cannot be used if the LOG= system option specifies a member of a PDS or PDSE.

REPLACE
overwrites the current contents when opening an existing file. If the file does not already exist, a new file is created.

REPLACEOLD
appends the log when opening an existing file. If the file does not already exist, a new file is created. This option can be used if the LOG= system option specifies a UFS file, but it cannot be used if a member of a PDS or PDSE is specified.

Default REPLACE

**ROLLOVER=AUTO | NONE | SESSION | *n* | *n*K | *n*M | *n*G**
controls when or if the SAS log *rolls over* (that is, when the current log is closed and a new one is opened). If you use ROLLOVER=*n* to roll over your files, the OPEN= parameter is ignored, and the initial log file is opened with OPEN=APPEND.

AUTO
causes an automatic *rollover* of the log when the directives in the value of the LOG= option change (that is the current log is closed and a new log file is opened).

Interaction The name of the new log file is determined by the value of the LOG= system option. If LOG= does not contain a directive, however, the name would never change, so the log would never roll over, even when the ROLLOVER=AUTO value is used.

NONE
specifies that rollover does not occur, even when a change occurs in the name that is specified with the LOG= option.

Interaction If the LOG= value contains any directives, they do not resolve. For example, if Log="#b.log" is specified, the directive "#" does not resolve, and the name of the log file remains "#b.log".

SESSION
at the beginning of each SAS session, opens the log file, resolves directives that are specified in the LOG= system option, and uses its resolved value to name the new log file. During the course of the session, no rollover is performed.

***n***
***n*K**
***n*M**
***n*G**
causes the log to roll over when the log reaches a specific size, stated in multiples of 1 (bytes); 1,024 (kilobytes); 1,048,576 (megabytes); or 1,073,741,824 (gigabytes). When the log reaches the specified size, it is closed and renamed by appending "old" to the log filename, and if it exists,

the lock file for a server log. For example, a filename of 2012Dec01.log is renamed 2012Dec01old.log. A new log file is opened using the name specified in the LOG= option.

**Note:** ROLLOVER=*n* is not supported for data sets. It is supported for UFS files.

Restriction The minimum log file size is 10K.

See "Examples: Rolling Over the SAS Log" in *SAS Programmer's Guide: Essentials*

CAUTION **Old log files can be overwritten.** SAS maintains only one old log file with the same name as the open log file. If rollover occurs more than once, the old log file is overwritten.

Default NONE

Restriction Rollover does not occur more often than once a minute.

Interaction Rollover is triggered by a change in the value of the LOG= option.

See "LOG= System Option: z/OS" on page 804

**WRITE=**
specifies when content is written to the SAS log.

**BUFFERED**
writes content to the SAS log only when a buffer is full in order to increase efficiency.

**IMMEDIATE**
writes to the SAS log each time that statements are submitted that produce content for the SAS log.

Default BUFFERED

## Details

The LOGPARM= system option controls the opening and closing of SAS log files. This option also controls the naming of new log files in conjunction with the LOG= system option and the use of directives in the value of LOG=. If the LOG= option specifies a ddname rather than a physical data set name or UFS filename, then only the WRITE argument of the LOGPARM option is recognized. The ROLLOVER and OPEN arguments are ignored.

Native z/OS filenames that contain more than eight characters are truncated to eight characters. The character count begins with the first character of the filename. If a period is encountered, the character count begins again. For example,

```
testFeb1234.Wednesday
```

is truncated to the following

```
testFeb1.Wednesda
```

Note that **testFeb1234** is truncated to **testFeb1**, and that **Wednesday** is truncated to **Wednesda**.

If a directive is specified in a PDS member name, the directive is fully expanded. The PDS member name might then exceed eight-characters, which is the maximum length for a PDS member name, and an error occurs.

Directives are fully expanded for the UNIX file system.

Using directives in the value of the LOG= system option enables you to control when logs are open and closed and how they are named, based on real-time events, such as time, month, day of week, and so on. The following table contains a list of directives that are valid in LOG= values:

The z/OS directives begin with #. Specifying a % directive instead of a # directive is not supported on z/OS.

***Table 31.2*** *Directives for Controlling the Name of SAS Log Files*

| Directive | Description | Range |
|---|---|---|
| #a | Locale's abbreviated day of week | Sun–Sat |
| #A | Locale's full day of week | Sunday–Saturday |
| #b | Local's abbreviated month | Jan–Dec |
| #B | Locale's full month | January–December |
| #C | Century number | 00–99 |
| #d | Day of the month | 01–31 |
| #H | Hour | 00–23 |
| #j | Julian day | 001–366 |
| #l * | User ID | Identifies a user to the system. The user ID consists of 1 through 8 alphanumeric or national ($, #, @) characters. The first character must be an alphabetic character or a national character ($, #, @). |
| #M | Minutes | 00–59 |

| Directive | Description | Range |
|---|---|---|
| #m | Month number | 01–12 |
| #n | Current system node name (without domain name) | none |
| #p * | Process ID | Returns your user ID in TSO, the name on the JOB card in the JCL, or the start command or procedure name for a started task (STC). |
| #s | Seconds | 00–59 |
| #u | Day of week | 1= Monday–7=Sunday |
| #v * | Unique identifier | Alphanumeric expression that creates a log filename that does not currently exist. |
| #w | Day of week | 0=Sunday–6=Saturday |
| #W | Week number (Monday as first day; all days in new year preceding first Monday are in week 00) | 00–53 |
| #y | Year without century | 00–99 |
| #Y | Full year | 1970–9999 |
| ## | Pound escape writes a single number sign in the log filename. | # |

* Because #v, #l, and #p are not a time-based format, the log filename never changes after it has been generated. Therefore, the log never rolls over. In these situations,specifying ROLLOVER=AUTO is equivalent to specifying ROLLOVER=SESSION.

## Example: Specifying the LOGPARM Option

- *Rolling over the log at a certain time and using directives to name the log according to the time:* If this command is submitted at 9:43 AM, this example

creates a log file called test0943.log, and the log rolls over each time the log filename changes. In this example, at 9:44 AM, the test0943.log file is closed, and the test0944.log file is opened.

```
sasrx -log "test#H#M.log" -logparm "rollover=auto"
```

- *Preventing log rollover but using directives to name the log:* For a SAS session that begins at 9:34 AM, this example creates a log file that is named test0934.log, and prevents the log file from rolling over:

```
sasrx -log "test#H#M.log" -logparm "rollover=session"
```

- *Preventing log rollover and preventing the resolution of directives:* This example creates a log file that is named test#H#M.log, ignores the directives, and prevents the log file from rolling over during the session:

```
sasrx -log "test#H#M.log" -logparm "rollover=none"
```

- *Creating log files with unique identifiers:* This example uses a unique identifier to create a log file with a unique name:

```
sasrx -log "#v.log" -logparm "rollover=session"
```

SAS creates a log file called useridv1.log, if useridv1.log does not already exist. If useridv1.log exists, then SAS creates a log file called useridv2.log, and so on. Because of the native z/OS filename restriction to eight characters, truncation might occur and this feature might not behave as expected.

Because #v is not a time-based format, the log filename never changes after it has been generated. Therefore, the log never rolls over. In this situation, specifying ROLLOVER=SESSION is equivalent to specifying ROLLOVER=AUTO.

## See Also

"LOG= System Option: z/OS" on page 804

# LRECL= System Option: z/OS

Specifies the default logical record length to use for reading and writing external files.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Category: | Files: External Files |
| PROC OPTIONS GROUP= | EXTFILES |
| Default: | 256 if you are using RECFM=F to specify fixed length records. Otherwise, it is 32,767. |
| z/OS specifics: | The LRECL= system option applies only to UFS files. It does not apply to native files. |
| See: | "LRECL= System Option" in *SAS System Options: Reference* |

## Syntax

**LRECL**=*n* | *n*K | *n*M | *n*G | *n*T | *hex*X | MIN | MAX

### Required Arguments

***n***
specifies the logical record length in multiples of 1 (bytes); 1,024 (kilobytes); 1,048,576 (megabytes); 1,073,741,824 (gigabytes); or 1,099,511,627,776 (terabytes). For example, a value of `32` specifies 32 bytes, and a value of `32k` specifies 32,768 bytes, which exceeds the allowed maximum value.

Default 256

Range 1 - 32,767

***hex*X**
specifies the logical record length as a hexadecimal number followed by an X. The first hexadecimal character must be in the range 0-9. For example, the value 0A0X sets the logical record length to 160.

**MIN**
specifies a logical record length of 1.

**MAX**
specifies a logical record length of 32,767.

## Details

The logical record length for reading or writing external files is first determined by the LRECL= option on the access method statement, function, or command that is used to read or write an individual file, or the DDName value in the z/OS operating environment. If the logical record length is not specified by any of these methods, SAS uses the value specified by the LRECL= system option.

Use a value for the LRECL= system option that is not an arbitrarily large value. Large values for this option can result in excessive use of memory, which can degrade performance.

# MEMLEAVE= System Option: z/OS

Specifies the amount of memory in the user's region that is reserved exclusively for the use of the operating environment.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation |
| Category: | System Administration: Memory |
| PROC OPTIONS GROUP= | MEMORY |

Default: 512K

z/OS specifics: All

## Syntax

**MEMLEAVE=***n* | *n*K | *n*M | MIN | *hex*X

### Required Arguments

***n* | *n*K | *n*M**
specifies the amount of memory reserved in multiples of 1 (bytes); 1,024 (kilobytes); or 1,048,576 (megabytes). You can specify decimal values for the number of kilobytes or megabytes. For example, a value of 8 specifies 8 bytes, a value of .782k specifies 801 bytes, and a value of 3m specifies 3,145,728 bytes.

**MIN**
specifies the amount of memory reserved as the minimum value, 0 bytes.

***hex*X**
specifies the amount of memory reserved as a hexadecimal number of bytes.

## Details

MEMLEAVE= reserves memory in your region that SAS does not use. A minimum memory reservation is required so that the operating environment can perform cleanup activities in the event of an abnormal termination of SAS. You might need to reserve additional memory based on the amount of processing that is taking place in your region outside of SAS.

The value of MEMLEAVE= has no bearing on the values of the PROCLEAVE= and SYSLEAVE= system options. MEMLEAVE= reserves memory that is never used by SAS. This memory is used exclusively by the operating environment. PROCLEAVE= and SYSLEAVE= reserve SAS memory only.

Setting MEMLEAVE= to 0 is not recommended. The optimal setting depends on the application and the system resources that are available at your site.

**Note:** To adjust the size of your memory region, see the JCL documentation for your operating environment.

## See Also

- “MEMSIZE= System Option: z/OS” on page 814
- “PROCLEAVE= System Option: z/OS” on page 829
- “SYSLEAVE= System Option: z/OS” on page 872

# MEMRPT System Option: z/OS

Specifies whether memory usage statistics are to be written to the SAS log for each step.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Category: | System Administration: Memory |
| PROC OPTIONS GROUP= | MEMORY<br>LOGCONTROL |
| Default: | MEMRPT |
| z/OS specifics: | All |

## Syntax

**MEMRPT** | **NOMEMRPT**

### Required Arguments

**MEMRPT**
if the STATS option is in effect, MEMRPT specifies that memory usage statistics are to be written to the SAS log.

**NOMEMRPT**
specifies that memory usage statistics are not to be written to the SAS log.

## Details

The STATS system option specifies that statistics are to be written to the SAS log. If STATS is in effect and MEMRPT is in effect, then the total memory used by the SAS session is written to the SAS log for each step.

Additional memory statistics can be written to the SAS log by specifying the FULLSTATS system option.

Note that the program memory statistics reported by FULLSTATS reflect the size of respective program images or load modules; they do not include the size of the DATA step programs or other code that is generated dynamically by SAS software.

## See Also

- "Collecting Performance Statistics" on page 904

- "The SAS Log" in *SAS Programmer's Guide: Essentials*

**System Options**

- "FULLSTATS System Option: z/OS" on page 771
- "STATS System Option: z/OS" on page 865
- "STIMER System Option: z/OS" on page 868

# MEMSIZE= System Option: z/OS

Specifies the limit on the total amount of memory that can be used by a SAS session.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation |
| Category: | System Administration: Memory |
| PROC OPTIONS GROUP= | MEMORY |
| Default: | Varies, see the following Details section |
| z/OS specifics: | All |

## Syntax

**MEMSIZE=***n* | *n*K | *n*M | *n*G | *hex*X | MIN | MAX

Note: You can also use the KB, MB, and GB syntax notation.

### Required Arguments

***n* | *n* K | *n* M | *n* G**
specifies total memory size in bytes (0–2,147,483,647), kilobytes (0–2,097,151), megabytes (0–2047), or gigabytes (0–2). You can specify decimal values for the number of kilobytes, megabytes, or gigabytes. For example, to specify 33,554,432 bytes, you can use 32M, 32768K, or 33554432.

***hex*X**
specifies the memory size as a hexadecimal value. You must specify the value beginning with a number (0–9), followed by hexadecimal characters (0–9, A–F), and then followed by an X. For example, the value 2000000x sets the memory size to 32M and a value of 4000000x sets the memory size to 64M.

**MIN**
causes SAS to calculate the value of MEMSIZE= using the formula in the following Details section.

**MAX**
causes SAS to calculate the value of MEMSIZE= using the formula in the following Details section.

## Details

SAS always calculates the value of the MEMSIZE option. The user-specified value is no longer used. The calculated value is the amount of available REGION space (both above and below the 16M line) minus the value of the MEMLEAVE option. You can display the value of the MEMSIZE option to determine the calculated value.

## See Also

- "Managing Memory " on page 917

**System Options**

- "MEMLEAVE= System Option: z/OS" on page 811
- "REALMEMSIZE= System Option: z/OS" on page 830

# METAPROFILE= System Option: z/OS

Identifies the file that contains the SAS Metadata Server user profiles.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation |
| Category: | Communications: Metadata |
| PROC OPTIONS GROUP= | META |
| See: | "METAPROFILE System Option" in *SAS Language Interfaces to Metadata* |

## Syntax

**METAPROFILE=***"XML-document"*

### Required Argument

***"XML-document"***
is the UNIX file system pathname or MVS DDNAME of the XML document that contains metadata user profiles for logging on to the SAS Metadata Server. The pathname is the physical location that is recognized by the operating environment. An example referencing a UNIX pathname is **`metaprofile="/usr/lpp/SAS/metaprofile.xml"`**. An example referencing a DDNAME is **`metaprofile=METACFG`**. The maximum length is 1024 characters.

## Details

This system option is one of a group of system options that defines the default metadata information to use for the SAS session. Usually, these values are set at installation time in the SAS configuration file.

The XML document defines a list of named connections that contain server connection properties for logging in to the SAS Metadata Server, such as the following properties:

- the name of the host computer on which the server is invoked
- the TCP port
- the user ID and password of the requesting user.

The METACONNECT= system option then specifies which named connection in the user profiles to use.

On z/OS, SAS does not automatically attempt to open **`metaprofile.xml`** as it does on other platforms. You must always specify the METAPROFILE option to access a metadata profile configuration.

If you specify a filename on z/OS for the METADATA option that is not more than eight characters long, SAS first checks whether the name refers to a DDNAME. If the name is for a DDNAME, SAS uses the file. If the name is not for a DDNAME, SAS accesses the file as if it is a UNIX file.

To create or edit a metadata user profile, use the Metadata Server Connections dialog box, which you can open by executing the SAS windowing command METACON. For more information about the dialog box, open SAS Help and Documentation from the SAS windowing environment. For information about the SAS Metadata Server, see the *SAS Intelligence Platform: System Administration Guide*

# MINSTG System Option: z/OS

Tells SAS whether to minimize its use of storage.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Category: | System Administration: Memory |
| PROC OPTIONS GROUP= | MEMORY |
| Default: | NOMINSTG |
| z/OS specifics: | All |

## Syntax

**MINSTG** | **NOMINSTG**

### Required Arguments

**MINSTG**
tells SAS to minimize storage in use.

**NOMINSTG**
tells SAS not to minimize storage in use.

## Details

The MINSTG system option tells SAS to minimize its use of storage by returning unused storage and deleting unused load modules at the termination of steps and pop-up windows. This option should be used on memory-constrained systems or when sharing the address space with other applications, such as ISPF split-screen or multisession products. If MINSTG is in effect, then CATCACHE= is set to 0.

# MSG= System Option: z/OS

Specifies the library that contains the SAS messages.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation |
| Category: | Environment Control: Files |
| PROC OPTIONS GROUP= | ENVFILES |
| Alias: | SASMSG= |
| Default: | SASMSG |
| z/OS specifics: | All |

## Syntax

**MSG=***file-specification-1* | (*file-specification-1 file-specification-2* ...)

### Required Argument

***file-specification***
identifies an external file. Under z/OS, it can be a valid ddname or a physical filename. The ddname must have been previously associated with an external file using either a TSO ALLOCATE command or a JCL DD statement.

You can specify one or more files. They are searched in the order in which they are listed.

## Details

Under z/OS, the MSG= system option specifies the file that contains error, warning, and informational messages that are issued during a SAS session.

You can use the APPEND and INSERT system options to add additional file specifications. For more information, see the APPEND and INSERT system options.

## See Also

- “APPEND= System Option: z/OS” on page 705
- “INSERT= System Option: z/OS” on page 783
- “MSGCASE System Option: z/OS” on page 818
- “MSGSIZE= System Option: z/OS” on page 819

# MSGCASE System Option: z/OS

Specifies whether notes, warnings, and error messages that are generated by SAS are displayed in uppercase characters.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation |
| Category: | Environment Control: Files |
| PROC OPTIONS GROUP= | ENVFILES |
| Default: | NOMSGCASE |
| z/OS specifics: | All |

## Syntax

**MSGCASE | NOMSGCASE**

## Details

MSGCASE specifies that text taken from the message file is translated to uppercase for display.

MSGCASE is supported in the national language support (NLS) formats. For information about the NLS formats, see the *SAS National Language Support (NLS): Reference Guide*.

## See Also

- "MSG= System Option: z/OS" on page 817
- "MSGSIZE= System Option: z/OS" on page 819

# MSGSIZE= System Option: z/OS

Specifies the size of the message cache.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation |
| Categories: | System Administration: Memory<br>Environment Control: Files |
| PROC OPTIONS GROUP= | MEMORY<br>ENVFILES |
| Default: | 196,608 |
| z/OS specifics: | All |

## Syntax

**MSGSIZE=***n* | *n*K | *n*M | *n*G | MIN | MAX | *hex*X

### Required Arguments

***n* | *n*K | *n*M | *n*G**
specifies the size of the message cache in multiples of 1 (bytes); 1,024 (kilobytes); 1,048,576 (megabytes); or 1,073,741,824 (gigabytes). You can specify decimal values for the number of kilobytes, megabytes, or gigabytes. For example, a value of 8 specifies 8 bytes, a value of .782k specifies 801 bytes, and a value of 3m specifies 3,145,728 bytes.

**MIN**
sets message cache size to 0 and tells SAS to use the default value.

**MAX**
sets message cache size to 2,147,483,647.

***hex*X**
specifies message cache size as a hexadecimal number of bytes.

## Details

The MSGSIZE= option is set during the installation process and normally is not changed after installation.

## See Also

- "MSG= System Option: z/OS" on page 817
- "MSGCASE System Option: z/OS" on page 818

# MSYMTABMAX= System Option: z/OS

Specifies the maximum amount of memory available to the macro variable symbol tables.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Category: | Macro: SAS Macro |
| PROC OPTIONS GROUP= | MACRO |
| Default: | 2,097,152 bytes (2MB) |
| z/OS specifics: | Default value |
| See: | *SAS Macro Language: Reference* |

## Syntax

**MSYMTABMAX=***n* | *n*K | *n*M | *n*G | *hex*X | MIN | MAX

Note: You can also use the KB, MB, and GB syntax notation.

### Required Arguments

***n* | *n*K | *n*M | *n*G**
specifies the maximum amount of memory that is available for the macro symbol table in multiples of 1 (bytes); 1,024 (kilobytes); 1,048,576 (megabytes); or 1,073,741,824 (gigabytes). You can specify decimal values for the number of kilobytes, megabytes, or gigabytes. For example, to specify 1,048,576 bytes, you can use 1M, 1024K, or 1048576.

***hex*X**
specifies the symbol table size as a hexadecimal value. You must specify the value beginning with a number (0–9), followed by hexadecimal characters (0–9, A–F), and then followed by an X. For example, the value 0c000x sets the

symbol table size to 49,152 and a value of 180000x sets the symbol table size to 1,572,864.

**MIN**
sets symbol table size to 0 and requires SAS to use the default value.

**MAX**
sets symbol table size to 2,147,483,647.

## Details

The portable default value for MSYMTABMAX is 24,576. Under z/OS, the default value is 1,048,576 bytes.

# MVARSIZE= System Option: z/OS

Specifies the maximum size for macro variables that are stored in memory.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Category: | Macro: SAS Macro |
| PROC OPTIONS GROUP= | MACRO |
| Default: | 65,534 bytes |
| z/OS specifics: | Default values |
| See: | *SAS Macro Language: Reference* |

## Syntax

**MVARSIZE=***n* | *n*K | *hex*X | MIN | MAX

Note: You can also use the KB syntax notation.

### Required Arguments

***n* | *n*K**
specifies the maximum macro variable size in multiples of 1 (bytes) and 1,024 (kilobytes). You can specify decimal values for the number of kilobytes. For example, a value of 8 specifies 8 bytes, and a value of 0.782k specifies 801 bytes.

***hex*X**
specifies the maximum macro variable size as a hexadecimal value. You must specify the value beginning with a number (0–9), followed by hexadecimal characters (0-9, A-F), and then followed by an X. For example, the value 2dx

sets the maximum macro variable size to 45 bytes and a value of 0a0x sets the maximum macro variable size to 160 bytes.

**MIN**
sets maximum macro variable size to 0 and requires SAS to use the default value.

**MAX**
sets maximum macro variable size to 65,534.

# OPLIST System Option: z/OS

Specifies whether the settings of the SAS system options are written to the SAS log.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation |
| Category: | Log and Procedure Output Control: SAS Log |
| PROC OPTIONS GROUP= | LOGCONTROL |
| Default: | NOOPLIST |
| z/OS specifics: | Information logged |

## Syntax

**OPLIST | NOOPLIST**

## Details

Under z/OS, the OPLIST system option writes to the SAS log the settings of all options that were specified on the command line. It does not list the settings of system options that were specified in the configuration file.

## See Also

"VERBOSE System Option: z/OS" on page 886

# PAGEBREAKINITIAL System Option: z/OS

Inserts an initial page break in SAS log and procedure output files.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation |

Category: Log and Procedure Output Control: SAS Log and Procedure Output

PROC OPTIONS GROUP= LOG_LISTCONTROL
LISTCONTROL
LOGCONTROL

Default: PAGEBREAKINITIAL

z/OS specifics: Default value

See: "PAGEBREAKINITIAL System Option" in *SAS System Options: Reference*

## Syntax

**PAGEBREAKINITIAL** | **NOPAGEBREAKINITIAL**

### Required Arguments

**PAGEBREAKINITIAL**
begins the SAS log and listing files on a new page.

**NOPAGEBREAKINITIAL**
does not begin the SAS log and listing files on a new page.

## Details

The PAGEBREAKINITIAL option inserts a page break at the start of the SAS log and listing files. The default behavior is to begin the SAS log and listing files on a new page. Specify NOPAGEBREAKINITIAL to eliminate the page break.

## See Also

"The SAS Log" in *SAS Programmer's Guide: Essentials*

# PAGESIZE= System Option: z/OS

Specifies the number of lines that compose a page of SAS output.

Valid in: Configuration file, SAS invocation, OPTIONS statement, SAS System Options window

Category: Log and Procedure Output Control: SAS Log and Procedure Output

PROC OPTIONS GROUP= LOG_LISTCONTROL
LISTCONTROL
LOGCONTROL

Default: Terminal screen size for the windowing environment; 21 for interactive line mode; 60 for noninteractive modes

z/OS specifics: Default value, range of available values

See: "PAGESIZE= System Option" in *SAS System Options: Reference*

## Syntax

**PAGESIZE=***n* | *n*K | *hex*X | MIN | MAX

### Required Arguments

***n* | *n*K**
specifies the number of lines that compose a page in multiples of 1 (bytes) or 1,024 (kilobytes). You can specify decimal values for the number of kilobytes. For example, a value of 8 specifies 8 bytes, and a value of .782k specifies 801 bytes.

***hex*X**
specifies the maximum number of lines that compose a page as a hexadecimal value. You must specify the value beginning with a number (0–9), followed by hexadecimal characters (0–9, A–F), and then followed by an X. For example, the value `2dx` sets the maximum number of lines that compose a page to 45 lines.

**MIN**
sets the number of lines that compose a page to the minimum setting, which is 15.

**MAX**
sets the maximum number of lines that compose a page, which is 32,767.

## Details

Under z/OS, the windowing environment uses the terminal screen size to determine page size.

## See Also

"The SAS Log" in *SAS Programmer's Guide: Essentials*

# PARMCARDS= System Option: z/OS

Specifies the file reference to use as the PARMCARDS file.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| PROC OPTIONS GROUP= | ENVFILES |
| Default: | SASPARM |
| z/OS specifics: | Valid values for *fileref* |
| See: | "PARMCARDS= System Option" in *SAS System Options: Reference* |

## Syntax

**PARMCARDS=***fileref*

### Required Argument

***fileref***
specifies the file reference of the file to be opened.

## Details

The PARMCARDS= system option specifies the file reference of a file that SAS opens when it encounters a PARMCARDS statement in a procedure.

# PFKEY= System Option: z/OS

Specifies which set of function keys to designate as the primary set of function keys.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation |
| Category: | Environment Control: Display |
| PROC OPTIONS GROUP= | ENVDISPLAY |
| Default: | PRIMARY |
| z/OS specifics: | All |

## Syntax

**PFKEY=***pfkey-set*

### Required Argument

***pfkey-set***

specifies which set of 12 function keys is to be considered the primary set. Acceptable values include the following:

**PRIMARY**

specifies that the primary set be F13 through F24. Thus, F13 through F24 would have the basic settings; F1 through F12 would have the extended settings. You can use PRI as an alias for PRIMARY.

**ALTERNATE**

specifies that the primary set be F1 through F12. Thus, F1 through F12 would have the basic settings; F13 through F24 would have the extended settings. You can use ALT as an alias for ALTERNATE.

**12**

specifies that F1 through F12 exactly match F13 through F24. Thus, both F1 through F12 and F13 through F24 would have the basic settings. As a result, the Keys window displays only F1 through F12.

## Details

The PFKEY= option enables you to specify which set of 12 programmed function keys is to be considered primary.

The following values are displayed in the KEYS window when you specify PFKEY=PRIMARY. F1 through F12 are the extended settings; F13 through F24 are the basic settings.

| **Extended Set** | | **Basic Set** | |
|---|---|---|---|
| **Key** | **Definition** | **Key** | **Definition** |
| F1 | mark | F13 | help |
| F2 | smark | F14 | zoom |
| F3 | unmark | F15 | zoom off; submit |
| F4 | cut | F16 | pgm; recall |
| F5 | paste | F17 | rfind |
| F6 | store | F18 | rchange |
| F7 | prevwind | F19 | backward |
| F8 | next | F20 | forward |
| F9 | pmenu | F21 | output |

| Extended Set | | Basic Set | |
|---|---|---|---|
| **Key** | **Definition** | **Key** | **Definition** |
| F10 | command | F22 | left |
| F11 | keys | F23 | right |
| F12 | undo | F24 | home |

# PGMPARM= System Option: z/OS

Specifies the parameter that is passed to the external program specified by the SYSINP= option.

Valid in: Configuration file, SAS invocation

Category: Files: External Files

PROC OPTIONS GROUP= EXTFILES

Default: None

z/OS specifics: All

## Syntax

**PGMPARM=**'*string*'

### Required Argument

***string***
can be up to 255 characters long. The quotation marks are optional unless the string contains blanks or special characters.

## Details

The PGMPARM= option specifies the parameter that is passed to the external program specified by the SYSINP= option. For more information about using the PGMPARM= and SYSINP= options, contact your on-site SAS support personnel.

# PRINT= System Option: z/OS

Specifies a destination for SAS output when running in batch mode.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation |
| Category: | Environment Control: Files |
| PROC OPTIONS GROUP= | ENVFILES |
| Default: | SASLIST |
| z/OS specifics: | *file-specification* |

## Syntax

**PRINT=**<*file-specification*>

**NOPRINT**

### Optional Arguments

***file-specification***
identifies an external file. Under z/OS, it can be a valid ddname, a physical filename, or the name of a file stored in the directory structure of the UNIX file system. The ddname must have been previously associated with an external file using either a TSO ALLOCATE command or a JCL DD statement.

**NOPRINT**
suppresses the creation of the SAS output file.

## See Also

- "Directing Output to a Printer" on page 150

**System Options**

- "ALTPRINT= System Option: z/OS" on page 704

# PRINTINIT System Option: z/OS

Initializes the procedure output file.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation |

Category: Log and Procedure Output Control: Procedure Output

PROC OPTIONS GROUP= LISTCONTROL

Default: NOPRINTINIT

z/OS specifics: System response to PRINTINIT

See: "PRINTINIT System Option" in *SAS System Options: Reference*

## Syntax

**PRINTINIT** | **NOPRINTINIT**

### Required Arguments

**PRINTINIT**
empties the SAS output file and resets the file attributes upon initialization.

**NOPRINTINIT**
preserves the existing output file if no new output is generated. NOPRINTINIT is the default value.

## Details

Under z/OS, specifying PRINTINIT causes the procedure output file to be emptied before SAS writes output to it. It also forces the file attributes to be correct for a print file. Specify NOPRINTINIT if a previous program or job step has already written output to the same file and you want to preserve that output.

# PROCLEAVE= System Option: z/OS

Specifies an amount of memory that is to be held in reserve, and that is to be made available only when memory allocation would otherwise fail.

Valid in: Configuration file, SAS invocation, OPTIONS statement, SAS System Options window

Category: System Administration: Memory

PROC OPTIONS GROUP= MEMORY

Default: (0,153600)

z/OS specifics: All

## Syntax

**PROCLEAVE=***n* | *n*K | *n*M | (*n* | *n*K | *n*M, | *n* | *n*K) | *n*M)

### Required Arguments

***n* | *n*K | *n*M**
specifies in bytes, kilobytes, or megabytes how much memory to leave unallocated above the 16-megabyte line. The amount of unallocated memory below the 16-megabyte line is set to the default value. Valid values are any integer from 0 to the maximum amount of available memory.

**(*n* | *n*K | *n*M, *n* | *n*K | *n*M )**
specifies in bytes, kilobytes, or megabytes how much memory to leave unallocated below the 16-megabyte line, followed by the amount of memory to leave unallocated above the line. Valid values are any integer from 0 to the maximum amount of available memory.

## See Also

"Use SYSLEAVE= and PROCLEAVE= to Handle Out-of-Memory Conditions" on page 918

# REALMEMSIZE= System Option: z/OS

Specifies the amount of real memory SAS can expect to allocate.

| | |
|---|---|
| Valid in: | SAS invocation, configuration file |
| Category: | System Administration: Memory |
| PROC OPTIONS GROUP= | MEMORY |
| Default: | 0 |
| z/OS specifics: | All |

## Syntax

**REALMEMSIZE=***n* | *n*K | *n*M | *n*G | *hex*X

Note: You can also use the KB, MB, and GB syntax notation.

### Required Arguments

***n* | *n*K | *n*M | *n*G**
specifies the amount of memory that can be used in multiples of 1 (bytes); 1,024 (kilobytes); 1,048,576 (megabytes); or 1,073,741,824 (gigabytes). You can specify decimal values for the number of kilobytes, megabytes, or gigabytes. For example, a value of 8 specifies 8 bytes, a value of .782k specifies 801 bytes, and a value of 3m specifies 3,145,728 bytes.

***hex*X**
specifies the amount of memory as a hexadecimal value. You must specify the value beginning with a number (0–9), followed by an X. For example, the value 2dx sets the amount of memory to 45 bytes and a value of 0a0x sets the amount of memory to 160 bytes.

## Details

The REALMEMSIZE option is accepted to provide compatibility with SAS code that is written on other platforms. The option is designed for use on platforms that do not have the concept of REGION, and it is not an effective tuning tool on z/OS. Although SAS on z/OS accepts the REALMEMSIZE option, it does not use any value that is specified for the option.

The value of REALMEMSIZE should not be changed from the default. Use the MEMLEAVE option for tuning memory use on z/OS.

## See Also

"MEMSIZE= System Option: z/OS" on page 814

# REXXLOC= System Option: z/OS

Specifies the ddname of the REXX library to be searched when the REXXMAC option is in effect.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation |
| Category: | Host Interfaces: REXX |
| PROC OPTIONS GROUP= | REXX |
| Default: | SASREXX |
| z/OS specifics: | All |

## Syntax

**REXXLOC=***ddname*

## Details

The REXXLOC= option specifies the ddname of the REXX library to be searched for any SAS REXX EXEC files, if the REXXMAC option is in effect.

## See Also

- "SAS Interface to REXX" on page 313

**System Options**

- "REXXMAC System Option: z/OS" on page 832

# REXXMAC System Option: z/OS

Enables or disables the REXX interface.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Category: | Host Interfaces: REXX |
| PROC OPTIONS GROUP= | REXX |
| Default: | NOREXXMAC |
| z/OS specifics: | All |

## Syntax

**REXXMAC** | **NOREXXMAC**

### Required Arguments

**REXXMAC**
enables the REXX interface. When the REXX interface is enabled, if SAS encounters an unrecognized statement, then it searches for a REXX EXEC file whose name matches the first word of the unrecognized statement. The

REXXLOC= system option specifies the ddname of the REXX library to be searched.

**NOREXXMAC**
disables the REXX interface. When the REXX interface is disabled, if SAS encounters an unrecognized statement, then a "statement is not valid" error occurs.

## Details

Setting the NOXCMD option automatically sets NOREXXMAC and prevents REXXMAC from being set.

## See Also

- "SAS Interface to REXX" on page 313

**System Options**

- "REXXLOC= System Option: z/OS" on page 831
- "XCMD System Option: z/OS" on page 892

# SASAUTOS= System Option: z/OS

Specifies the location of the autocall library.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Categories: | Environment Control: Files<br>Macro: SAS Macro |
| PROC OPTIONS GROUP= | ENVFILES<br>MACRO |
| Default: | SASAUTOS |
| z/OS specifics: | *file-specification* |
| See: | *SAS Macro Language: Reference*<br>"Autocall Libraries" on page 515 |

## Syntax

**SASAUTOS=***file-specification* | (*file-specification-1, file-specification-2* ...)

### Required Argument

***file-specification***

identifies the name of an external autocall library. Under z/OS, it can be any valid SAS fileref or a physical filename of a PDS, PDSE, or UFS directory.

You can specify one or more autocall libraries. They are searched in the order in which they are listed.

## Details

SAS looks for autocall members in autocall libraries specified by SASAUTOS=. By default, SAS looks in the library that is associated with the SASAUTOS fileref. Once you specify the SASAUTOS= system option, that specification replaces the default.

The SASAUTOS= system option enables the concatenation of autocall libraries that have different encodings. For example, the following statements concatenate two libraries where one library has the **open_ed-1047** encoding and one library has the **open_ed-1143** encoding.

```
FILENAME XYG1 'SASPROD.XYG1.AUTOCALL.SAS' ENCODING='open_ed-1047';
FILENAME mymacro 'USERID.AUTOCALL.SAS' ENCODING='open_ed-1143';
OPTIONS SASAUTOS=(mymacro, XYG1, SASAUTOS);
```

You can use the APPEND= and INSERT= system options to add additional file specifications. For more information, see the APPEND= and INSERT= system options.

If the LOCKDOWN SAS system option is specified, then all SAS autocall libraries that are defined at SAS initialization are automatically added to the list of accessible files. SAS displays a list of accessible files if a LOCKDOWN LIST statement is issued in the autoexec file. For more information, see “LOCKDOWN Statement” and “LOCKDOWN System Option” in *SAS Intelligence Platform: Application Server Administration Guide*.

**Note:** SAS issues an error message if the specified autocall library does not exist.

## See Also

- “Changing an Option Value By Using the INSERT and APPEND System Options” in *SAS System Options: Reference*

### System Options

- “APPEND= System Option: z/OS” on page 705 for the correct syntax to use when starting SAS
- “APPEND= System Option” in *SAS System Options: Reference* for the correct syntax to use after starting SAS

- "INSERT= System Option: z/OS" on page 783 for the correct syntax to use when starting SAS
- "INSERT= System Option" in *SAS System Options: Reference* for the correct syntax to use after starting SAS

# SASHELP= System Option: z/OS

Specifies the location of the Sashelp SAS library.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation |
| Category: | Environment Control: Files |
| PROC OPTIONS GROUP= | ENVFILES |
| Default: | SASHELP |
| z/OS specifics: | *library-specification* |
| See: | "SASHELP= System Option" in *SAS System Options: Reference* |

## Syntax

**SASHELP=***library-specification* | (*library-specification-1 library-specification-2* ...)

### Required Argument

***library-specification***
is the same as the library-specification described for the LIBNAME statement for z/OS.

You can specify one or more libraries. They are searched in the order in which they are listed.

## Details

If the SASHELP= option is not specified, then the value SASHELP is used.

**Note:** If a ddname is supplied as a library-specification, then the ddname must refer to a single z/OS data set or UFS directory. It cannot refer to an externally allocated concatenation of data sets.

The following example shows one way to assign a list of library specifications to SASHELP:

```
SASHELP=(UPDATE 'MVS:ORIGINAL.SASHELP')
```

The first library specification **UPDATE** refers to a ddname that must be allocated external to SAS. The second library specification refers to the z/OS data set **ORIGINAL.SASHELP**. The file system prefix **'MVS:'** is specified to distinguish this specification from a UFS path. If the system option FILESYSTEM=HFS is in effect, then SAS assumes that **ORIGINAL.SASHELP** refers to a UFS directory in the current USS working directory.

## See Also

- "Changing an Option Value By Using the INSERT and APPEND System Options" in *SAS System Options: Reference*

### System Options

- "APPEND= System Option: z/OS" on page 705 for the correct syntax to use when starting SAS
- "APPEND= System Option" in *SAS System Options: Reference* for the correct syntax to use after starting SAS
- "INSERT= System Option: z/OS" on page 783 for the correct syntax to use when starting SAS
- "INSERT= System Option" in *SAS System Options: Reference* for the correct syntax to use after starting SAS

# SASLIB= System Option: z/OS

Specifies the ddname for an alternate load library.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation |
| Category: | Environment Control: Files |
| PROC OPTIONS GROUP= | ENVFILES |
| Default: | SASLIB |
| z/OS specifics: | All |

## Syntax

**SASLIB=***ddname*

### Required Argument

***ddname***
is the ddname of a single load library or a concatenation of load libraries that SAS is to search before it searches the standard libraries. The *ddname* must be allocated before SAS is invoked.

## Details

The SASLIB= option can be used to specify a load library that contains alternate formats, informats, and functions.

# SASSCRIPT System Option: z/OS

Specifies one or more storage locations of SAS/CONNECT script files.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Category: | Communications: Networking and Encryption |
| PROC OPTIONS GROUP= | COMMUNICATIONS |
| Default: | None |
| z/OS specifics: | Location of directories |
| See: | "SASSCRIPT=" in *SAS/CONNECT User's Guide* |

## Syntax

**SASSCRIPT=**'*dir-name*' | ('*dir-name-1*','*dir-name-2*, ...')

## Details

For z/OS, the **`dir-name`** must be a UFS directory.

You can use the APPEND= and INSERT= system options to add additional file specifications. For more information, see the APPEND= and INSERT= system options.

## See Also

- “APPEND= System Option: z/OS” on page 705
- “INSERT= System Option: z/OS” on page 783

# SASUSER= System Option: z/OS

Specifies the location of an external SAS library that contains the user Profile catalog.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation |
| Category: | Environment Control: Files |
| PROC OPTIONS GROUP= | ENVFILES |
| Default: | SASUSER |
| z/OS specifics: | *library-specification* |
| See: | “SASUSER= System Option” in *SAS System Options: Reference* |

## Syntax

**SASUSER=***library-specification*

### Required Argument

***library-specification***
can be any valid ddname, the name of the physical file that comprises a SAS library, or a UNIX file system directory; the ddname must have been previously associated with the Sasuser SAS library using either a TSO ALLOCATE command or a JCL DD statement.

## Details

If a UNIX file system directory is to be specified, it must already exist.

## See Also

“Sasuser Library” on page 16

# SEQENGINE= System Option: z/OS

Specifies the default engine to use when assigning sequential access SAS libraries.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Category: | Files: SAS Files |
| PROC OPTIONS GROUP= | SASFILES |
| Default: | TAPE |
| z/OS specifics: | All |

## Syntax

**SEQENGINE=***engine-name*

### Required Argument

***engine-name***
can have the following values:

**TAPE**
specifies the engine for accessing sequential SAS libraries in the latest tape format.

**V9TAPE**
**V9SEQ**
**V8TAPE**
**V8SEQ**
**V7TAPE**
**V7SEQ**
specifies the engine for accessing sequential SAS libraries in SAS 9.2, Version 8, or Version 7 tape format. The SAS 9.2, Version 8, and Version 7 engines are identical.

**V6TAPE**
**V6SEQ**
specifies the engine for accessing sequential SAS libraries in Version 6 tape format.

## Details

When you assign a SAS library that is not currently assigned within the SAS session, if the engine is not specified on the assignment request, then SAS has to

determine which engine to use to process the library. If the library already exists, and if its engine format can be determined, then SAS uses the newest engine that is compatible with the format of the library. Otherwise, if the engine format of the library cannot be determined, then SAS selects an engine to use by default. If the assignment request specifies a device or type of library that supports only sequential access, then SAS uses the engine that is specified by the SEQENGINE system option. Otherwise, SAS uses the engine that is specified by the ENGINE option.

The SEQENGINE option supplies the default value when the library assignment specification refers to one of the following conditions:

- a new tape data set
- an empty tape data set
- an empty disk data set with RECFM=U specified
- a library that is processed by the IBM product, BatchPipes

## See Also

- "How SAS Assigns an Engine" on page 81

**System Options**

- "ENGINE= System Option: z/OS" on page 737

# SET= System Option: z/OS

Defines an environment variable.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, Options statement, SAS System Options window |
| Category: | Environment Control: Files |
| PROC OPTIONS GROUP= | ENVFILES |
| Default: | None |
| z/OS specifics: | All |

## Syntax

**SET**=*variable-name=value*

**SET**=*'variable-name=value'*

**SET**=*variable-name='value'*

### Required Arguments

***variable-name***
specifies the name of the environment variable to define.

***value***
specifies the value to assign to the environment variable.

## Details

An equal sign between *variable-name* and *value* is optional, but it is recommended for readability. Quotation marks or parentheses around the entire *variable-name=value* expression, or around *value*, are required if *value* contains spaces or other special characters.

# SORT= System Option: z/OS

Specifies the minimum size of all allocated sort work data sets.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Category: | Sort: Procedure Options |
| PROC OPTIONS GROUP= | SORT |
| Default: | 0 |
| z/OS specifics: | All |

## Syntax

**SORT=***n* | *n*K

### Required Argument

***n* | *n*K**
specifies the minimum size of sort work files that SAS allocates in the units specified by the SORTUNIT option.

## Details

The SORT= option specifies the minimum size of all sort work files that SAS allocates. The units are specified by the SORTUNIT= option. If the DYNALLOC

system option is specified, then any value that you specify for the SORT= option is ignored.

The host sort is used if the number of observations that are to be sorted is unknown.

## Example: Specifying the SORT Option

The following example, which includes descriptions of the options in the code, allocates three sort work data sets and specifies a primary space of two cylinders for each data set.

```
NODYNALLOC    /*Host sort does not support doing DYNALLOC for SORTWKxx*/
SORTPGM=HOST  /*Always use HOST sort utility*/
SORT=4        /*Unadjusted minimum primary space for DYNALLOC*/
SORTWKNO=3    /*Allocate 3 sort work datasets*/
SORTUNIT=CYLS /*Allocation will be in cylinders*/
SORTDEV=3390 /*Device to allocate space on*/
SORTWKDD=SASS /*DDname prefix for allocation*/
```

Each of the three sort work data sets are created with a minimum amount of primary space. SAS calculates the minimum space by dividing the value specified for the SORT= option by the number of sort files, and rounding up to the next whole number. Therefore, the three allocations are similar to the following JCL allocation:

```
//SASSWK01 DD SPACE=(CYL,(2)),UNIT=SYSDA
//SASSWK02 DD SPACE=(CYL,(2)),UNIT=SYSDA
//SASSWK03 DD SPACE=(CYL,(2)),UNIT=SYSDA
```

## See Also

- “Specify the Minimum Space for Sort Work Data Sets ” on page 914

**System Options**

- “DYNALLOC System Option: z/OS” on page 734
- “SORTUNIT= System Option: z/OS” on page 861

# SORTALTMSGF System Option: z/OS

Enables sorting with alternate message flags.

Valid in: Configuration file, SAS invocation, OPTIONS statement, SAS System Options window

Category: Sort: Procedure Options

PROC OPTIONS GROUP= SORT

Default: NOSORTALTMSGF

z/OS specifics: All

## Syntax

**SORTALTMSGF | NOSORTALTMSGF**

## Details

Specify SORTALTMSGF if the sort utility on your host requires nonstandard flags for the message parameter. For information about specifying the appropriate setting for the SORTALTMSGF option, see the documentation for your sort utility.

# SORTBLKMODE System Option: z/OS

Enables block mode sorting.

Valid in: Configuration file, SAS invocation, OPTIONS statement, SAS System Options window

Category: Sort: Procedure Options

PROC OPTIONS GROUP= SORT

Default: SORTBLKMODE

z/OS specifics: All

## Syntax

**SORTBLKMODE | NOSORTBLKMODE**

## Details

If SORTBLKMODE is in effect, block mode sorting is used if the sort utility supports it. Specify NOSORTBLKMODE to disable block mode sorting, even if the sort utility supports it.

# SORTBLKREC System Option: z/OS

Enables control of SORTBLKMODE buffers.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Category: | Sort: Procedure Options |
| PROC OPTIONS GROUP= | SORT |
| Default: | SORTBLKREC |
| z/OS specifics: | All |
| See: | "SORTBLKMODE System Option: z/OS" on page 843 |

## Syntax

**SORTBLKREC**=n

## Details

SORTBLKREC can be used to control the size for the SORTBLKMODE buffers. The default SORTBLKMODE buffer size is based on the size of the data set that is being sorted. Specifying a memory buffer that is too large can have adverse effects.

**Note:** The suggested optimal setting is SORTBLKREC=5000. However, you might need to adjust the value, depending on the data that you are sorting.

# SORTBUFMOD System Option: z/OS

Enables modification of the sort utility output buffer.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Category: | Sort: Procedure Options |
| PROC OPTIONS GROUP= | SORT |
| Default: | SORTBUFMOD |

z/OS specifics: All

## Syntax

**SORTBUFMOD | NOSORTBUFMOD**

## Details

Specify NOSORTBUFMOD if the sort utility on your host does not support modification of its sort buffer. For information about specifying the appropriate setting for the SORTBUFMOD option, see the documentation for your sort utility.

# SORTCUT= System Option: z/OS

Specifies the size of the data in observations above which the host sort is likely to perform more efficiently than the internal sort.

Valid in: Configuration file, SAS invocation, OPTIONS statement, SAS System Options window

Category: Sort: Procedure Options

PROC OPTIONS GROUP= SORT

Default: 51200

z/OS specifics: All

## Syntax

**SORTCUT=***n* | *n*K | *n*M | *n*G | MIN | MAX | *hex*X

Note: You can also use the KB, MB, and GB syntax notation.

### Required Arguments

***n* | *n*K | *n*M | *n*G**
specifies the number of observations in multiples of 1 (*n*); 1,024 (*n*K); 1,048,576 (*n*M); or 1,073,741,824 (*n*G). You can specify decimal values for the number of kilobytes, megabytes, or gigabytes. For example, a value of `800` specifies 800 observations, a value of `.782k` specifies 801 observations, and a value of `3m` specifies 3,145,728 observations.

**MIN**
specifies 0 observations.

**MAX**
specifies 9,007,199,254,740,992 observations.

***hex*X**
specifies the number of observations as a hexadecimal value. You must specify the value beginning with a number (0–9), followed by hexadecimal characters (0–9, A–F), and then followed by an X. For example, the value `2ffx` specifies 767 observations.

## Details

If SORTPGM=BEST is specified, then SAS uses the host sort if the size of the data exceeds the specified value for SORTCUT. If SORTPGM is set to anything other than BEST, then SAS uses the specified program. SAS might issue a message to the log if it would have selected a different sort.

If the values of both SORTCUT and SORTCUTP are specified as 0, then the host sort is used. SORTCUTP is used only when SORTCUT=0 is specified. If the specified value of SORTCUT is greater than 0, then that value is used and the specified value of SORTCUTP is ignored. If the size of the data to be sorted is unknown, such as when a WHERE statement or data set option might be filtering the data, then the host sort is used.

**Note:** The number of observations in a data set is a better predictor of sort performance than is the number of bytes in the data set. Therefore, SAS recommends that you use SORTCUT instead of SORTCUTP so that SAS chooses the optimum sort program. SORTCUTP is still available for compatibility with previous SAS releases.

## See Also

- “Consider Changing the Values of SORTPGM= and SORTCUTP=” on page 913
- “Efficient Sorting ” on page 913

**System Options**

- “SORTCUTP= System Option: z/OS” on page 846
- “SORTPGM= System Option: z/OS” on page 856

# SORTCUTP= System Option: z/OS

Specifies the size of the data in bytes above which the host sort is likely to perform more efficiently than the internal sort. SORTCUTP is used only when SORTCUT=0.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Category: | Sort: Procedure Options |
| PROC OPTIONS GROUP= | SORT |
| Default: | 4M |
| z/OS specifics: | All |

# Syntax

**SORTCUTP=***n* | *n*K | *n*M | *n*G | MIN | MAX | *hex*X

Note: You can also use the KB, MB, and GB syntax notation.

## Required Arguments

***n* | *n*K | *n*M | *n*G**
specifies the value of SORTCUTP= in bytes, kilobytes, megabytes, or gigabytes, respectively.

The value of SORTCUTP= can be specified in multiples of 1 (bytes); 1,024 (kilobytes); 1,048,576 (megabytes); or 1,073,741,824 (gigabytes). You can specify decimal values for the number of kilobytes, megabytes, or gigabytes. For example, a value of 8 specifies 8 bytes, a value of .782k specifies 801 bytes, and a value of 3m specifies 3,145,728 bytes.

**MIN**
sets SORTCUTP= to 0.

**MAX**
sets SORTCUTP= to 2,147,483,647 bytes.

***hex*X**
specifies SORTCUTP= as a hexadecimal number of bytes.

# Details

The SORTCUTP= option specifies the number of bytes above which the external host sort utility is used instead of the SAS sort program, if SORTPGM=BEST is in effect.

If SORTPGM=BEST is specified, then SAS uses the host sort if the size of the data exceeds the specified amount for SORTCUT. If SORTPGM is set to anything other than BEST, then SAS uses the specified program. SAS might issue a message to the log if it would have selected a different sort.

The host sort is used if the number of observations that are to be sorted is unknown.

**Note:** SAS recommends that you use the SORTCUT system option instead of SORTCUTP.

The following equation computes the number of bytes to be sorted:

*number-of-bytes*=((*length-of-obs*)+(*length-of-all-keys*))***number-of-obs*

## See Also

- "Consider Changing the Values of SORTPGM= and SORTCUTP=" on page 913
- "Efficient Sorting " on page 913

**System Options**

- "SORTCUT= System Option: z/OS" on page 845
- "SORTPGM= System Option: z/OS" on page 856

# SORTDEV= System Option: z/OS

Specifies the unit device name if SAS dynamically allocates the sort work file.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Category: | Sort: Procedure Options |
| PROC OPTIONS GROUP= | SORT |
| Default: | SYSDA |
| z/OS specifics: | All |

## Syntax

**SORTDEV=***unit-device-name*

## Details

To specify a device name, use a generic device type unit name, such as 3390, rather than a group name, such as SYSDA.

To determine the disk space requirements, SAS must look up the device characteristics for the specified unit name. A group name might represent multiple

device types, which makes it impossible to predict on which device type the sort work files are allocated and what the memory requirements are.

For group names, the device characteristics of the Work library are used. Use of these characteristics can result in a warning message, unless NOSORTDEVWARN is in effect.

## See Also

- “Specify the Minimum Space for Sort Work Data Sets ” on page 914

**System Options**

- “DYNALLOC System Option: z/OS” on page 734
- “SORTDEVWARN System Option: z/OS” on page 849

# SORTDEVWARN System Option: z/OS

Enables device type warnings.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Category: | Sort: Procedure Options |
| PROC OPTIONS GROUP= | SORT |
| Default: | SORTDEVWARN |
| z/OS specifics: | All |

## Syntax

**SORTDEVWARN | NOSORTDEVWARN**

## Details

Specify NOSORTDEVWARN to disable warning messages sent when SORTDEV= specifies a group or esoteric device type.

# SORTEQOP System Option: z/OS

Specifies whether the host sort utility supports the EQUALS option.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Category: | Sort: Procedure Options |
| PROC OPTIONS GROUP= | SORT |
| Default: | SORTEQOP |
| z/OS specifics: | All |

## Syntax

**SORTEQOP | NOSORTEQOP**

## Details

The SORTEQOP option specifies whether the host sort utility accepts the EQUALS option. (The EQUALS option sorts observations that have duplicate keys in the original order.) If the utility does accept the EQUALS option, then SORTEQOP causes the EQUALS option to be passed to it unless you specify NOEQUALS in the PROC SORT statement. If NOSORTEQOP is in effect, then the EQUALS option is not passed to the host sort utility unless you specify the EQUALS option in the PROC SORT statement.

Note that equals processing is the default for PROC SORT. Therefore, if NOSORTEQOP is in effect, and if you did not specify the EQUALS option in the PROC SORT statement, then the host sort interface must do additional processing to ensure that observations with identical keys remain in their original order. This requirement of the host system might adversely affect performance.

For information about specifying the appropriate setting for the SORTEQOP option, see the documentation for your sort utility.

# SORTLIB= System Option: z/OS

Specifies the name of the sort library.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |

Category: Sort: Procedure Options

PROC OPTIONS GROUP= SORT

Default: SYS1.SORTLIB

z/OS specifics: All

## Syntax

**SORTLIB=***physical-filename*

### Required Argument

***physical-filename***
specifies the name of a partitioned data set.

## Details

The SORTLIB= option specifies the name of the partitioned data set (load library) that contains the host sort utility (other than the main module that is specified by the SORTPGM= or SORTNAME= option). This library is dynamically allocated to the ddname SORTLIB. If the host sort utility resides in a link list library or if the sort library is part of the JOBLIB, STEPLIB, or TASKLIB libraries, then this option is unnecessary and should not be specified.

**Note:** If the SORTLIB ddname is already allocated, then changing the SORTLIB specification does not have any effect. It does not matter whether the original allocation was made by SAS or an application external to SAS.

# SORTLIST System Option: z/OS

Enables passing of the LIST parameter to the host sort utility.

Valid in: Configuration file, SAS invocation, OPTIONS statement, SAS System Options window

Category: Sort: Procedure Options

PROC OPTIONS GROUP= SORT

Default: NOSORTLIST

z/OS specifics: All

## Syntax

**SORTLIST** | **NOSORTLIST**

### Required Arguments

**SORTLIST**
tells SAS to pass the LIST parameter to the host sort utility when the SORT procedure is invoked. The host sort utility uses the LIST parameter to determine whether to list control statements.

**NOSORTLIST**
tells SAS not to pass the LIST parameter to the host sort utility.

## Details

The SORTLIST option controls whether the LIST parameter is passed to the host sort utility.

**Note:** If the default for your sort utility is to print messages, then NOSORTLIST has no effect.

# SORTMSG System Option: z/OS

Controls the class of messages to be written by the host sort utility.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Category: | Sort: Procedure Options |
| PROC OPTIONS GROUP= | SORT |
| Default: | NOSORTMSG |
| z/OS specifics: | All |

## Syntax

**SORTMSG** | **NOSORTMSG**

### Required Arguments

**SORTMSG**
tells SAS to pass the MSG=AP parameter to the host sort utility.

**NOSORTMSG**
tells SAS to pass the MSG=CP parameter to the host sort utility, which means that only critical messages are written.

# SORTMSG= System Option: z/OS

Specifies the ddname to be dynamically allocated for the message print file of the host sort utility.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Category: | Sort: Procedure Options |
| PROC OPTIONS GROUP= | SORT |
| Default: | SYSOUT |
| z/OS specifics: | All |

## Syntax

**SORTMSG=***ddname*

### Required Argument

***ddname***
can be any valid ddname or a null string. The ddname is dynamically allocated to either a SYSOUT data set (with class *) under batch or a terminal under TSO, and the ddname is passed to the host sort utility.

# SORTNAME= System Option: z/OS

Specifies the name of the host sort utility.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Category: | Sort: Procedure Options |
| PROC OPTIONS GROUP= | SORT |
| Default: | SORT |

z/OS specifics: All

## Syntax

**SORTNAME=***host-sort-utility-name*

### Required Argument

***host-sort-utility-name***
is any valid operating environment name. A valid operating environment name can be up to eight characters, the first of which must be a letter or special character ($, #, or @). The remaining characters, following the first, can be any of the above, or digits.

## Details

The SORTNAME= option specifies the name of the host sort utility to be invoked if SORTPGM=HOST or if SORTPGM=BEST and the host sort utility is chosen instead of the SAS sort utility. For information about sort utility selection, see "SORTPGM= System Option: z/OS" on page 856.

# SORTOPTS System Option: z/OS

Specifies whether the host sort utility supports the OPTIONS statement.

Valid in: Configuration file, SAS invocation, OPTIONS statement, SAS System Options window

Category: Sort: Procedure Options

PROC OPTIONS GROUP= SORT

Default: SORTOPTS

z/OS specifics: All

## Syntax

**SORTOPTS | NOSORTOPTS**

## Details

The SORTOPTS option specifies whether the host sort utility accepts the OPTIONS statement. The OPTIONS statement is generated by the host sort interface only if the 31-bit extended parameter list is requested via the SORT31PL option.

If the SORT31PL and NOSORTOPTS options are both specified, then not all of the available sort options can be passed to the host sort utility. The sort might fail if all of the options cannot be passed to the utility. In particular, the sort work areas cannot be used because the SORT option cannot be passed the value of the SORTWKDD= option.

You should therefore specify the DYNALLOC option, even though this specification can cause problems with multiple sorts within a single job. Older releases of some vendors' sort utilities dynamically allocate sort work files only if they are not already allocated. As a result, subsequent sorts might fail if they require more sort work space than the first sort.

# SORTPARM= System Option: z/OS

Specifies parameters for the host sort utility.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Category: | Sort: Procedure Options |
| PROC OPTIONS GROUP= | SORT |
| Default: | None |
| z/OS specifics: | All |

## Syntax

**SORTPARM=**'*string*'

### Required Argument

***string***
is a string of parameters. It can contain up to 255 characters. Single quotation marks are required if the *string* contains blanks or special characters.

## Details

The parameters that you specify are appended to the OPTIONS statement that is generated by the SAS host sort interface. This capacity enables you to specify options that are unique to the particular sort utility that you are using. The sort utility must accept a 31-bit parameter list and an OPTIONS statement. Otherwise, this option is ignored.

**Note:** Options that you specify with the SORTPARM option are not passed to the sort program as parameters.

# SORTPGM= System Option: z/OS

Specifies which sort utility SAS uses, the SAS sort utility or the host sort utility.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Category: | Sort: Procedure Options |
| PROC OPTIONS GROUP= | SORT |
| Default: | BEST |
| z/OS specifics: | All |

## Syntax

**SORTPGM=***utility* | BEST | HOST | SAS

### Required Arguments

***utility***
can be any valid operating environment name that specifies the name of an accessible utility, except one of the three keywords for this option.

**BEST**
The choice is made based on the value of the SORTCUT option, or the SORTCUTP option when SORTCUT=0.

**HOST**
specifies to use the host sort utility.

**SAS**
specifies to the SAS sort utility.

## Details

The host sort utility might be more suitable for large SAS data sets than the sort utility that is supplied by SAS.

If SORTPGM=BEST is specified, then SAS uses the host sort if the size of the data exceeds the specified amount for SORTCUT. Or, it uses the specified value of SORTCUTP if SORTCUT=0. If SORTPGM is set to anything other than BEST, then SAS uses the specified program. SAS might issue a message to the log if it would have selected a different sort.

The name of the host sort utility is also specified with the SORTNAME= system option.

The host sort is used if the number of observations that are to be sorted is unknown.

## See Also

- “Consider Changing the Values of SORTPGM= and SORTCUTP=” on page 913
- “Efficient Sorting ” on page 913
- “Specify the Minimum Space for Sort Work Data Sets ” on page 914

**System Options**

- “SORTCUT= System Option: z/OS” on page 845
- “SORTCUTP= System Option: z/OS” on page 846
- “SORTNAME= System Option: z/OS” on page 853

# SORTSHRB System Option: z/OS

Specifies whether the host sort interface can modify data in buffers.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Category: | Sort: Procedure Options |
| PROC OPTIONS GROUP= | SORT |
| Default: | SORTSHRB for all modes except batch; NOSORTSHRB for batch mode |
| z/OS specifics: | All |

## Syntax

**SORTSHRB** | **NOSORTSHRB**

### Required Arguments

**SORTSHRB**
specifies that two or more tasks are likely to be sharing the data in buffers. If SORTSHRB is in effect, the host sort interface cannot modify data in buffers but must move the data first. Moving the data before modifying it could have a severe performance impact, especially for large sorts.

SORTSHRB is the default value for the windowing environment, interactive line mode, and noninteractive mode, where it is more likely that multiple tasks use the same data.

**NOSORTSHRB**
specifies that no tasks share the data in buffers. If NOSORTSHRB is in effect, the host sort interface can modify data in buffers. NOSORTSHRB is the default value for batch mode because it is unlikely that buffers are shared during batch jobs, where larger sorts are usually run. If not sharing buffers between tasks is not suitable for your batch environment, be sure to specify SORTSHRB.

## Details

SAS data sets can be opened for input by more than one SAS task (or window). When this happens, the buffers into which the data is read can be shared between the tasks. Because the host sort interface might need to modify the data before passing it to the host sort utility, and by default does this directly to the data in the buffers, data can be corrupted if more than one task is using the data in the buffers.

# SORTSIZE= System Option: z/OS

Specifies the SIZE parameter that SAS is to pass to the sort utility.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Categories: | Sort: Procedure Options<br>System Administration: Memory |
| PROC OPTIONS GROUP= | SORT<br>MEMORY |
| Default: | MAX |
| z/OS specifics: | Valid values |
| See: | "SORTSIZE= System Option" in *SAS System Options: Reference* |

## Syntax

**SORTSIZE=***n* | *n*K | *n*M | *n*G | MAX | SIZE

### Required Arguments

***n***
specifies a number of bytes of memory to be used by the sort utility. If *n* is 0, the sort uses the default that was defined when it was installed.

***n*K**
specifies a number of kilobytes of memory to be used by the sort utility.

***n*M**
specifies a number of megabytes of memory to be used by the sort utility.

***n*G**
specifies a number of gigabytes of memory to be used by the sort utility.

**MAX**
specifies that the characters MAX are to be passed to the system sort utility. This specification causes the sort utility to size itself. Not all sort utilities support this feature.

**SIZE**
specifies that the sort is to use the total amount of free space in the virtual machine minus the amount that is specified by the LEAVE= option in the PROC SORT statement.

## See Also

"Consider Changing the Values of SORTPGM= and SORTCUTP=" on page 913

# SORTSUMF System Option: z/OS

Specifies whether the host sort utility supports the SUM FIELDS=NONE control statement.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Category: | Sort: Procedure Options |
| PROC OPTIONS GROUP= | SORT |
| Default: | SORTSUMF |
| z/OS specifics: | All |

## Syntax

**SORTSUMF** | **NOSORTSUMF**

### Required Arguments

**SORTSUMF**
specifies that the host sort utility supports the SUM FIELDS=NONE control card.

**NOSORTSUMF**
specifies that the host sort utility does not support the SUM FIELDS=NONE control card. If NOSORTSUMF is in effect and the NODUPKEY option was specified when PROC SORT was invoked, then records that have duplicate keys are eliminated.

## Details

If the NODUPKEY procedure option is specified when the SORT procedure is invoked, the SORTSUMF system option can be used to specify whether the host sort utility supports the SUM FIELDS=NONE statement.

Note that duplicate keys are not the same as duplicate records. Duplicate keys can be eliminated with the NODUPKEY option in the PROC SORT statement.

For information about specifying the appropriate setting for the SORTSUMF option, see the documentation for your sort utility.

# SORTUADCON System Option: z/OS

Specifies whether the host sort utility supports passing a user address constant to the E15/E35 exits.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Category: | Sort: Procedure Options |
| PROC OPTIONS GROUP= | SORT |
| Default: | SORTUADCON |
| z/OS specifics: | All |

## Syntax

**SORTUADCON** | **NOSORTUADCON**

### Required Arguments

**SORTUADCON**
specifies that the host utility supports passing a user address constant to the E15/E35 exits.

**NOSORTUADCON**
specifies that the host sort utility does not support passing a user address constant to the E15/E35 exits.

## Details

For information about specifying the appropriate setting for the SORTUADCON option, see the documentation for your sort utility.

# SORTUNIT= System Option: z/OS

Specifies the unit of allocation for sort work files.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Category: | Sort: Procedure Options |
| PROC OPTIONS GROUP= | SORT |
| Default: | CYLS |
| z/OS specifics: | All |

## Syntax

**SORTUNIT=**CYL<S> | TRK<S> | BLK<S> | *n*

### Required Arguments

**CYL<S>**
specifies that the units be cylinders. The space calculation for cylinder allocations requires that the characteristics of the device on which the allocations are made need to be known. The device type is specified with the SORTDEV= option. The device type should be specified as generic, such as 3390, rather than esoteric, such as DISK. When an esoteric name is specified, it is impossible to predict what device type is used. Therefore, the device characteristics are also unknown.

**TRK<S>**
specifies that the units be tracks. The space calculation for track allocations requires that the characteristics of the device on which the allocations are made need to be known. The device type is specified with the SORTDEV= option. The device type should be specified as generic, such as 3390, rather than esoteric, such as DISK. When an esoteric name is specified, it is impossible to predict what device type is used. Therefore, the device characteristics are also unknown.

**BLK<S>**
specifies that the files are allocated with an average block size equal to the record length rounded up to approximately 6K (6144). Therefore, if the input record length was 136, the average block size used for the allocation would be 6120.

***n***
is an integer that specifies the average block size.

## Details

The SORTUNIT= option specifies the unit of allocation to be used if SAS dynamically allocates the sort work files. For more information, see the "DYNALLOC System Option: z/OS" on page 734.

## See Also

"Specify the Minimum Space for Sort Work Data Sets " on page 914

# SORTWKDD= System Option: z/OS

Specifies the prefix of sort work data sets.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Category: | Sort: Procedure Options |
| PROC OPTIONS GROUP= | SORT |
| Default: | SASS |
| z/OS specifics: | All |

## Syntax

**SORTWKDD=***prefix*

### Required Argument

***prefix***
is a four-character, valid operating environment name, which must begin with a letter or a national character ($, #, or @), followed by letters, national characters, or digits. SORT is not a valid value for SORTWKDD. SAS issues an error message if you specify `SORTWKDD=SORT`.

## Details

The SORTWKDD= option specifies the prefix to be used to generate the ddnames for the sort work files if SAS or the host sort utility dynamically allocates them. For more information, see "DYNALLOC System Option: z/OS" on page 734. The ddnames are of the form *prefix*WK*nn*, where *nn* can be in the range of 01 to the value of the SORTWKNO= option, which has a default value of 3 and a range of 0-99.

## See Also

- "Reserved z/OS Ddnames" on page 40
- "Specify the Minimum Space for Sort Work Data Sets " on page 914

# SORTWKNO= System Option: z/OS

Specifies how many sort work data sets to allocate.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Category: | Sort: Procedure Options |
| PROC OPTIONS GROUP= | SORT |
| Default: | 3 |
| z/OS specifics: | All |

## Syntax

**SORTWKNO=***n*

### Required Argument

***n***
can be 0-99. If SORTWKNO=0 is specified, any existing sort work files are freed and none are allocated.

## Details

The SORTWKNO= option specifies how many sort work files are to be allocated dynamically by either SAS or the SORT utility.

## See Also

- “Specify the Minimum Space for Sort Work Data Sets ” on page 914

**System Options**

- “DYNALLOC System Option: z/OS” on page 734

# SORT31PL System Option: z/OS

Controls what type of parameter list is used to invoke the host sort utility.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Category: | Sort: Procedure Options |
| PROC OPTIONS GROUP= | SORT |
| Default: | SORT31PL |
| z/OS specifics: | All |

## Syntax

**SORT31PL | NOSORT31PL**

## Details

If SORT31PL is in effect, a 31-bit extended parameter list is used to invoke the host sort utility. If NOSORT31PL is in effect, a 24-bit parameter list is used.

If SORT31PL is specified, then the SORTOPTS system option should also be specified. Also, because sorts that currently support a 31-bit parameter list also support the EQUALS option, the SORTEQOP system option should be specified in order to maximize performance.

For information about specifying the appropriate setting for the SORT31PL option, see the documentation for your sort utility.

# STAE System Option: z/OS

Enables or disables a system abend exit.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Category: | Environment Control: Error Handling |
| PROC OPTIONS GROUP= | ERRORHANDLING |
| Default: | STAE |
| z/OS specifics: | All |

## Syntax

**STAE | NOSTAE**

## Details

The STAE option causes SAS error trapping and handling to be activated by an ESTAE macro in the host supervisor.

# STATS System Option: z/OS

Specifies whether statistics are to be written to the SAS log.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Categories: | System Administration: Performance |

Log and Procedure Output Control: SAS Log

PROC OPTIONS GROUP= LOGCONTROL
PERFORMANCE

Default: STATS

z/OS specifics: All

## Syntax

**STATS** | **NOSTATS**

### Required Arguments

**STATS**
tells SAS to write selected statistics to the SAS log.

**NOSTATS**
tells SAS not to write any statistics to the SAS log.

## Details

The STATS system option specifies whether performance statistics are to be written to the SAS log. The statistics that are written to the log are determined by the MEMRPT, STIMER, and FULLSTATS system options.

## See Also

- “Collecting Performance Statistics” on page 904

**System Options**

- “FULLSTATS System Option: z/OS” on page 771
- “MEMRPT System Option: z/OS” on page 813
- “STIMER System Option: z/OS” on page 868

# STAX System Option: z/OS

Specifies whether to enable attention handling.

Valid in: Configuration file, SAS invocation

Category: Environment Control: Error Handling

PROC OPTIONS GROUP= ERRORHANDLING

Default: STAX

z/OS specifics: All

## Syntax

**STAX** | **NOSTAX**

### Required Arguments

**STAX**
causes attention handling to be activated by a STAX macro in the host supervisor.

**NOSTAX**
causes the SAS session to end when the attention key is pressed.

# STEPCHKPTLIB= System Option: z/OS

Specifies the libref of the library where checkpoint-restart data is saved.

Valid in: Configuration file, SAS invocation

Category: Environment Control: Error Handling

PROC OPTIONS GROUP= ERRORHANDLING

Default: WORK

Requirement: Can be used only in batch mode

## Syntax

**STEPCHKPTLIB=***libref*

### Required Argument

***libref***
specifies the libref that identifies the library where the checkpoint-restart data is saved. The LIBNAME statement that identifies the checkpoint-restart library must use the BASE engine and be the first statement in the batch program.

## Details

### Overview of the STEPCHKPTLIB= System Option

When the STEPCHKPT system option is specified, checkpoint-restart data for batch programs is saved in the libref that is specified in the STEPCHKPTLIB= system option. If no libref is specified, SAS uses the Work library to save checkpoint data. The LIBNAME statement that defines the libref must be the first statement in the batch program.

If the Work library is used to save checkpoint data, then the NOWORKTERM and NOWORKINIT system options must be specified so that the checkpoint-restart data is available when the batch program is resubmitted. These two options ensure that the Work library is saved when SAS ends and is restored when SAS starts. If the NOWORKTERM option is not specified, the Work library is deleted at the end of the SAS session and the checkpoint-restart data is lost. If the NOWORKINIT option is not specified, a new Work library is created when SAS starts, and again the checkpoint-restart data is lost.

The STEPCHKPTLIB= option must be specified for any SAS session that accesses checkpoint-restart data that is not saved to the Work library.

### Setting Up and Executing Checkpoint Mode and Restart Mode

To set up checkpoint mode and restart mode, make the following modification to your batch program:

- Add the CHECKPOINT EXECUTE_ALWAYS statement before any DATA and PROC steps that you want to execute each time the batch program is submitted.
- Add the LIBNAME statement that defines the checkpoint-restart libref as the first statement in the batch program if your checkpoint-restart library is a user-defined library. If you use the Work library as your checkpoint library, no LIBNAME statement is necessary.

  **Note:** You can use a ddname instead of a libref.

# STIMER System Option: z/OS

Specifies whether to write a subset of system performance statistics to the SAS log.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation |
| Category: | System Administration: Performance |
| PROC OPTIONS GROUP= | PERFORMANCE, SMF |
| Default: | STIMER |

z/OS specifics: All

## Syntax

**STIMER** | **NOSTIMER**

### Required Arguments

**STIMER**
writes only the CPU time and memory that are used to the SAS log. When the STATS option is also in effect, SAS writes the CPU time statistic to the SAS log.

**NOSTIMER**
does not write any statistics to the SAS log.

## Details

Additional statistics can be written to the SAS log by specifying the FULLSTATS or MEMRPT system options.

## See Also

- "Collecting Performance Statistics" on page 904

**System Options**

- "FULLSTATS System Option: z/OS" on page 771
- "MEMRPT System Option: z/OS" on page 813
- "STATS System Option: z/OS" on page 865

# SVC11SCREEN System Option: z/OS

Specifies whether to enable SVC 11 screening to obtain host date and time information.

Valid in: Configuration file, SAS invocation

Category: System Administration: Performance

PROC OPTIONS GROUP= EXECMODES

Default: NOSVC11SCREEN

z/OS specifics: All

## Syntax

**SVC11SCREEN** | **NOSVC11SCREEN**

### Required Arguments

**SVC11SCREEN**
causes SAS to issue SVC 11 to obtain the datetime value.

**NOSVC11SCREEN**
causes SAS to use the STCK instruction to obtain the datetime value.

# SYNCHIO System Option: z/OS

Specifies whether synchronous I/O is enabled.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation |
| Category: | Files: SAS Files |
| PROC OPTIONS GROUP= | SASFILES |
| Default: | NOSYNCHIO |
| z/OS specifics: | Default value |

## Syntax

**SYNCHIO** | **NOSYNCHIO**

### Required Arguments

**SYNCHIO**
causes data set I/O to wait for completion.

**NOSYNCHIO**
allows other logical SAS tasks to execute (if any are ready) while the I/O is being done.

## Details

The SYNCHIO system option is a mirror alias of the system option NOASYNCHIO. NOSYNCHIO is equivalent to ASYNCHIO.

## See Also

"ASYNCHIO System Option: z/OS" on page 709

# SYSIN= System Option: z/OS

Specifies the location of the primary SAS input data stream.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation |
| Category: | Environment Control: Files |
| PROC OPTIONS GROUP= | ENVFILES |
| Defaults: | none (interactive)<br>SYSIN (batch) |
| z/OS specifics: | All |

## Syntax

**SYSIN=***file-specification* | NOSYSIN

### Required Arguments

***file-specification***
identifies an external file. Under z/OS, it can be a valid ddname, a physical filename, or the name of a file stored in the directory structure of UNIX System Services. The ddname must have been previously associated with an external file using either a TSO ALLOCATE command or a JCL DD statement.

**NOSYSIN**
disables SYSIN, as if the *file-specification* were blank. This option is useful for testing your autoexec file. It invokes SAS in batch mode and processes your autoexec file. SAS exits after your autoexec file is processed.

## Details

This option is applicable when you run SAS programs in noninteractive or batch mode. SYSIN= is overridden by SYSINP= if a value for SYSINP= has been specified.

# SYSINP= System Option: z/OS

Specifies the name of an external program that provides SAS input statements.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation |
| Category: | Files: External Files |
| PROC OPTIONS GROUP= | EXTFILES |
| Default: | None |
| z/OS specifics: | All |

## Syntax

**SYSINP=***external-program-name*

### Required Argument

***external-program-name***
identifies an external program, using eight characters or less.

## Details

SAS calls this external program every time it needs a new SAS input statement. The PGMPARM= option enables you to pass a parameter to the program that you specify with the SYSINP= option. For more information about the PGMPARM option, see "PGMPARM= System Option: z/OS" on page 827.

The SYSINP= option overrides the SYSIN= system option.

# SYSLEAVE= System Option: z/OS

Specifies how much memory to leave unallocated to ensure that SAS software tasks are able to terminate successfully.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Category: | System Administration: Memory |
| PROC OPTIONS GROUP= | MEMORY |

Default: (0,153600)

z/OS specifics: All

## Syntax

**SYSLEAVE=** *n* | *n*K | *n*M | (*n* | *n*K | *n*M, | *n* | *n*K | *n*M)

### Required Arguments

***n* | *n*K | *n*M**
specifies in bytes, kilobytes, or megabytes how much memory to leave unallocated above the 16-megabyte line. The amount of unallocated memory below the 16-megabyte line is set to the default value. Valid values are any integer from 0 to the maximum amount of available memory.

**(*n* | *n*K | *n*M, *n* | *n*K | *n*M)**
specifies in bytes, kilobytes, or megabytes how much memory to leave unallocated below the 16-megabyte line, followed by the amount of memory to leave unallocated above the line. Valid values are any integer from 0 to the maximum amount of available memory.

## See Also

"Use SYSLEAVE= and PROCLEAVE= to Handle Out-of-Memory Conditions" on page 918

# SYSPREF= System Option: z/OS

Specifies a prefix for partially qualified physical filenames.

Valid in: Configuration file, SAS invocation, OPTIONS statement, SAS System Options window

Category: Files: External Files

PROC OPTIONS GROUP= EXTFILES

Defaults: User profile prefix (interactive)
user ID (batch)

z/OS specifics: All

## Syntax

**SYSPREF=***prefix*

## Details

The SYSPREF= option specifies a prefix to be used in constructing a fully qualified physical filename from a partially qualified name. Wherever a physical name must be entered in quotation marks in SAS statements or in SAS windowing environment commands, you can enter a data set name in the form '*.rest-of-name*', and SAS inserts the value of the SYSPREF= option in front of the first period.

Unlike the user profile prefix, the SYSPREF= option can have more than one qualifier in its name. For example, if you specify SYSPREF=SAS.TEST, then '.SASDATA' is interpreted as 'SAS.TEST.SASDATA'. The maximum length of *prefix* is 42 characters.

If no value is specified for SYSPREF=, then SAS uses the user profile prefix (in the interactive environment) or the user ID (in batch).

# SYSPRINT= System Option: z/OS

Specifies the handling of output that is directed to the default print file.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Category: | Log and Procedure Output Control: ODS Printing |
| PROC OPTIONS GROUP= | LISTCONTROL |
| Default: | None |
| z/OS specifics: | All |

## Syntax

**SYSPRINT=*** | DUMMY | *ddname*

### Required Arguments

*
terminates redirection of output.

**DUMMY**
suppresses output to the default print file.

***ddname***
causes output to the default print file to be redirected to the specified ddname.

# S99NOMIG System Option: z/OS

Tells SAS whether to recall a migrated data set.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Categories: | Files: SAS Files<br>Files: External Files |
| PROC OPTIONS GROUP= | SASFILES<br>EXTFILES |
| Default: | NOS99NOMIG |
| z/OS specifics: | All |

## Syntax

**S99NOMIG | NOS99NOMIG**

## Details

The S99NOMIG option tells SAS what to do when a physical file that you reference (in a FILENAME statement, for example) has been migrated. If S99NOMIG is in effect, then the data set is not recalled and the allocation fails. If NOS99NOMIG is in effect, the data set is recalled, and allocation proceeds as it would have if the data set had not been migrated.

# TAPECLOSE= System Option: z/OS

Specifies how sequential access bound libraries on tape are handled when SAS closes the library data set.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Category: | Files: SAS Files |
| PROC OPTIONS GROUP= | SASFILES |
| Default: | REREAD |

z/OS specifics: Default value, valid values

## Syntax

**TAPECLOSE=**REREAD | LEAVE | REWIND | DISP | FREE

### Required Arguments

**REREAD**
specifies that the operating system rewind the tape volume to the start of the SAS library when SAS closes the library data set. Specifying TAPECLOSE=REREAD is recommended if the library is to be processed by multiple SAS procedures or DATA steps in the same SAS session.

**LEAVE**
specifies that the operating system leave the tape volume positioned immediately following the end of the data set on the current volume when SAS closes the library data set. Specifying TAPECLOSE=LEAVE is recommended if the subsequent data set on the tape volume is the next data set from that volume that SAS processes. For more information about the LEAVE parameter, see the example in "Optimizing Performance" on page 60.

**REWIND**
specifies that the operating system rewind the tape volume to the beginning of the tape when SAS closes the library data set.

**DISP**
specifies that the operating system position the tape volume in accordance with the termination disposition specified via the DISP parameter when the library data set was allocated. If the disposition is PASS, the action described for TAPECLOSE=LEAVE is performed. For other dispositions, the action described for TAPECLOSE=REWIND is performed, and in some cases, the tape volume can be unloaded if necessary.

**FREE**
specifies that the operating system deallocate the tape volume when SAS closes the library data set. Specifying this option makes the tape volume available for use by other jobs in the system as soon as SAS has closed the library, rather than at the end of the SAS session. Do not specify TAPECLOSE=FREE if the library data set is used in multiple SAS procedures or DATA steps in the same SAS session.

## Details

In general, SAS closes the library data set at the conclusion of the SAS procedure or DATA step that is processing the library. The TAPECLOSE option has no effect on processing direct bound libraries or UFS libraries. Specifying FREE=CLOSE on the JCL DD statement for a library is honored only if TAPECLOSE has a value of REWIND, DISP, or FREE. If TAPECLOSE has a value of REREAD or LEAVE, then the

FREE=CLOSE specification is ignored. For more information about FREE=CLOSE, see the IBM JCL Reference for the version of z/OS that your site is using.

**Note:** If the FILECLOSE data set option is specified, then it overrides the TAPECLOSE system option.

## See Also

"FILECLOSE= Data Set Option: z/OS" on page 439

# USER= System Option: z/OS

Specifies the location of the default SAS library.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Category: | Environment Control: Files |
| PROC OPTIONS GROUP= | ENVFILES |
| Default: | None |
| z/OS specifics: | *library-specification* |
| See: | "USER= System Option" in *SAS System Options: Reference* |

## Syntax

**USER=***library-specification*

### Required Argument

***library-specification***
can be a ddname that was previously associated with a SAS library, the name of a physical file that comprises a SAS library, or a UNIX System Services directory.

# UTILLOC= System Option: z/OS

Specifies location of certain types of temporary utility files.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation |

| | |
|---|---|
| Category: | Files: SAS Files |
| PROC OPTIONS GROUP= | SASFILES |
| Default: | WORK |
| z/OS specifics: | Valid values |
| See: | "UTILLOC= System Option" in *SAS System Options: Reference* |

# Syntax

**UTILLOC =** *"location"* ( | *"location-1"*, *"location-2"*, "...")

## Required Argument

***location***
can be one of the following:

- a UFS directory in the UNIX file system.
- an ALLOC command that specifies the amount of space to be used for each utility file. For information about the syntax of the ALLOC command, see "ALLOC Command Details" on page 879.
- the Work library. The effect of specifying UTILLOC=WORK depends on whether the Work library resides in a UFS directory or in a direct access bound library. If the Work library resides in UFS, then UTILLOC=WORK causes certain temporary utility files to reside within temporary subdirectories of the Work library directory. If the Work library resides in a direct access bound library, then UTILLOC=WORK is equivalent to specifying an ALLOC command that provides the same maximum amount of space as that to which the current Work library can be extended on its first (or only) volume. This default provides an adequate amount of space for most applications.

# Details

## Overview of the UTILLOC= System Option

The UTILLOC option specifies one or more locations for a new type of utility file that is introduced as part of the SAS 9 architecture. These utility files are comparable to SAS files with a type of UTILITY, but they are not members of the Work library or any other SAS library. UTILLOC utility files are primarily used by applications that are enabled for multiple threads of execution.

Each location that is specified for the UTILLOC option identifies a single place at which utility files can be created. If multiple locations are specified, then the locations are used on a rotating basis by SAS applications as utility files are required. A location can be specified as a UFS directory or as an ALLOC command. An ALLOC command is not a location in the usual sense. Instead, it describes the

operands that are used to create a temporary z/OS data set that is to contain the utility file. Single quotation marks can be used in place of the double quotation marks that are shown in the syntax diagram.

When SAS uses a UFS location for a utility file, it first creates a temporary subdirectory that is subordinate to the specified location. It then creates the utility file in the temporary subdirectory. This temporary subdirectory and its contents are automatically deleted before the SAS session ends, provided that SAS ends normally. For information about removing temporary subdirectories that remain after a SAS session terminates abnormally, see Appendix 7, "The cleanwork Utility," on page 975.

Each time SAS uses an ALLOC command for a utility file, SAS uses the operands that are specified as part of the ALLOC command to allocate a new temporary z/OS data set. This temporary data set receives a unique system-generated name, which allows multiple distinct utility files to be used at the same time. It is not possible to specify the data set name that is to be used for these temporary data sets.

For applications that use multiple utility files at the same time, specifying multiple locations that correspond to separate physical I/O devices might improve performance by reducing competition for device resources.

## ALLOC Command Details

All of the following operands must be specified on the ALLOC command:

- UNIT(*device type*)
- TRACKS, CYL, or BLOCK(*block length*)
- SPACE(*primary*<,*secondary*>)

One or more of the following operands can be also specified on the ALLOC command:

- UCOUNT(*number of devices*)
- VOL(*volser* [,*volser*...])
- STORCLAS(*storage class*)
- MGMTCLAS(*management class*)
- DATACLAS(*data class*)
- DSNTYPE(LARGE)

The ALLOC command operands that are listed have the same syntax and meaning as when they are specified on the TSO ALLOCATE command. For more information, see the IBM documentation about the ALLOCATE command. An ALLOC command can be specified as a UTILLOC file location even in the batch environment. It is not necessary to have SAS running under TSO when you specify an ALLOC command as a utility file location. When you use an ALLOC command as a UTILLOC location, SAS recommends that you specify the UTILLOC command with a configuration file.

Certain SAS procedures can create a large number of separate utility files that are to be used at the same time. When a UTILLOC location is specified as an ALLOC command, each utility file resides in a separate, temporary z/OS data set. The primary space amount is allocated on disk for each utility file even if SAS needs to

write only a small amount of data. SAS recommends that you specify a primary allocation amount that is modest in size. To increase the maximum amount of data that the utility files can contain, increase the secondary allocation amount or allow the utility files to extend to multiple volumes. SAS does not recommend specifying a large amount of primary allocation space.

To allow utility files to extend to multiple volumes, specify UCOUNT(*n*), where *n* is the maximum number of volumes, or use the DATACLAS operand to specify an SMS data class that designates a volume count greater than one. Specifying a list of volumes with the VOL operand is supported, but it is not recommended.

When you use multiple ALLOC command utility locations, the same space operands should be specified for each location because the UTILLOC locations are used on a rotating basis. The location that is used for each utility file cannot be predicted in general, so it is best to specify the same maximum size for all utility files. Also, you can reduce competition for device resources by specifying multiple UTILLOC locations that include UNIT or STORCLAS operands that refer to different sets of disk devices. Contact the system programmer at your site for information about selecting the appropriate UNIT and STORCLAS operands to achieve the objective of reducing competition for device resources.

The temporary data sets that are created for utility files must be regular-format sequential data sets. Extended-format sequential data sets are not supported. Therefore, for the DATACLAS operand, do not specify a data class with a Data Set Name Type of **`extended`**.

## Diagnosing ALLOC Command Problems

Problems that occur when processing utility files that are specified by an ALLOC command can be grouped into the following categories:

- errors in the syntax of the ALLOC command. These problems include errors such as misspelling the name of an operand, failing to supply the required operands, and so on.
- failure of the system to perform the dynamic allocation requested by the ALLOC command. These problems can occur because the requested resources are not available or because names that are not defined on the system are specified.
- insufficient space in the utility file. These problems occur when SAS is writing data to the utility file and the utility file becomes full, but the system is not able to allocate additional space to the utility file data set. The failure to allocate additional space can occur because no secondary space amount was specified, because the maximum number of extents have been allocated, or because no more disk space is available on the disk volume or volumes allocated to the utility file.

SAS does not detect problems with UTILLOC location specifications until an attempt is made to create a utility file.

The following example shows the type of message that is issued if the ALLOC command has a syntax error. In this case, the block length is omitted from the BLOCK operand. BLOCK(*block length*) should have been specified instead:

```
Dynalloc syntax error: Unknown, or unsupported parm.
Invalid syntax for data set dynamic allocation specification.
```

```
         Data set dynamic allocation specification:  ALLOC UNIT(DISK)
UCOUNT(2) BLOCK SPACE(500,500) NEW DELETE
ERROR: Utility file open failed.
ERROR: Object creation failure.
ERROR: Sort initialization failure.
```

In the following example the ALLOC command has valid syntax, but it refers to a unit name, BADUNIT, that is not defined on the system:

```
         SVC 99 could not process data set dynamic allocation
specification.  R15: 0X4, Reason: 0X21C, Info: 0
         Data set dynamic allocation specification:  ALLOC UNIT(BADUNIT)
CYL SPACE(20,100) NEW DELETE
ERROR: Utility file open failed.
ERROR: Object creation failure.
ERROR: Sort initialization failure.
```

In the following example no secondary space was specified, so SAS could not extend the utility file after the primary space amount was consumed:

```
         Data set SYS10321.T171203.RA000.USERID.R0106386 could not be extended.
         Data set dynamic allocation specification:  ALLOC UNIT(DISK)
UCOUNT(2) TRACKS SPACE(1,1) NEW DELETE
         Space used on volume SCRAT2 = 16 tracks and 16 extents.
         Space used on volume SCRAT1 = 16 tracks and 16 extents.
         Total space used = 32 tracks and 32 extents.
ERROR: Unexpected error  Filename = SYS10321.T171203.RA000.USERID.R0106386.
ERROR: No disk space is available for the write operation.  Filename =
       SYS10321.T171203.RA000.USERID.R0106386.
ERROR: Failure while attempting to write page 17 of sorted run 1.
ERROR: Failure while attempting to write page 17 to utility file 1.
```

**Note:** The operands NEW and DELETE are shown as part of the dynamic allocation requests. These operands should not be specified as part of the ALLOC command because they are added automatically by SAS.

You can also use the `debug_utilloc` command to determine whether the syntax of your UTILLOC option is valid. Submit the command from a line in the SAS Program Editor window, and SAS writes the ALLOC command and any errors to the SAS log.

You can specify the TKMVSENV environment file option TKOPT_TKIOP_DIAG_SPACE to request the production of diagnostic messages for an output utility file when the file is closed. These messages detail the space allocation that is associated with the utility file allocation, and the amount of space that the utility file actually used. The diagnostic messages are written to the SAS log as shown in the following example:

```
NOTE: Data set SYS12311.T140918.RA000.user01.R0101080 usage diagnostics:

         Data set dynamic allocation specification:  ALLOC UNIT(3390)

 SPACE(5,5) CYL NEW DELETE

         Space used on volume SCRD02 = 75 tracks and 1 extents.

         Total space used = 75 tracks and 1 extents.
```

## Example: Specifying the UTILLOC= System Option

Here are some examples of the different arguments that you can specify with the UTILLOC= system option:

- `UTILLOC='ALLOC UNIT(DISK) UCOUNT(2) CYL SPACE(20,100)'`
- `UTILLOC='/tmp'`
- `UTILLOC=('ALLOC UNIT(DISK) STORCLAS(POOL1) CYL SPACE(20,100)', 'ALLOC UNIT(DISK) STORCLAS(POOL2) CYL SPACE(20,100)')`
- `UTILLOC=("/dept/prod/utility1", "/dept/prod/utility2")`

# V6GUIMODE System Option: z/OS

Specifies whether SAS uses SAS 6 style SCL selection list windows.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation |
| Category: | Environment Control: Display |
| PROC OPTIONS GROUP= | ENVDISPLAY |
| Default: | NOV6GUIMODE |
| z/OS specifics: | All |

## Syntax

**V6GUIMODE | NOV6GUIMODE**

## Details

The V6GUIMODE option specifies whether SAS uses SAS 6 style SCL selection list windows such as the selection list windows displayed with the following SAS Component Language functions: CATLIST, DATALISTC, DATALISTN, DIRLIST, FILELIST, LIBLIST, LISTC, LISTN, SHOWLIST, and VARLIST. This specification also applies to the POPMENU function when the list of items is displayed in a scrollable list box. The V6GUIMODE option also displays the SAS 6 directory window for the BUILD and FSLETTER procedures instead of using the SAS Explorer window.

If you specify the V6GUIMODE option when you invoke SAS, then your SAS session might hang if you invoke a fullscreen procedure such as FSEDIT, FSVIEW, or BUILD with a PROC statement and also issue the VAR command from within the fullscreen window. You might also see this problem if you invoke a SAS/AF application with the DM statement. This condition does not occur if you invoke the fullscreen window with a command or SCL routine.

# VALIDMEMNAME= System Option: z/OS

Specifies the rules for naming SAS data sets, data views, and item stores.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, OPTIONS statement, SAS System Options window |
| Category: | Files: SAS Files |
| PROC OPTIONS GROUP= | SASFILES |
| Applies to: | Base SAS engine and SPDS engine |
| Restriction: | The VALIDMEMNAME= option is not supported by the tape engines V9TAPE, V8TAPE, V7TAPE, and V6TAPE |
| Note: | For more information, see "Restricted Options" in *SAS System Options: Reference*. |

## Syntax

**VALIDMEMNAME**=COMPATIBLE | EXTEND

### Required Arguments

**COMPATIBLE**
specifies that a SAS data set name, a view name, or an item store must follow these rules:

- The length of the names can be up to 32 characters.
- Names must begin with a letter of the Latin alphabet (A-Z, a-z) or the underscore. Subsequent characters can be letters of the Latin alphabet, numerals, or underscores.
- Names cannot contain blanks or special characters except for the underscore.
- Names can contain mixed-case letters. SAS internally converts the member name to uppercase. Therefore, you cannot use the same member name with a different combination of uppercase and lowercase letters to represent different variables. For example, `customer`, `Customer`, and `CUSTOMER` all represent the same member name. How the name is saved on disk is determined by the operating environment.

This is the default.

Alias COMPAT

**EXTEND**
specifies that a SAS data set name, a SAS view name, or an item store must follow these rules:

- Names can include national characters.
- The name can include special characters, except for the characters / \ * ? " < > |: -.

  **Note:** The SPD Engine does not allow '.' (the period) anywhere in the member name.

- The name must contain at least one character.
- The length of the name can be up to 32 bytes.
- Null bytes are not allowed.
- Names cannot begin with a blank or a '.' (the period).

  **Note:** The SPD Engine does not allow '$' as the first character of the member name.

- Leading and trailing blanks are deleted when the member is created.
- Names can contain mixed-case letters. SAS internally converts the member name to uppercase. Therefore, you cannot use the same member name with a different combination of uppercase and lowercase letters to represent different variables. For example, `customer`, `Customer`, and `CUSTOMER` all represent the same member name. How the name appears is determined by the operating environment.

Restriction The windowing environment supports the extended rules in the Editor, Log, and Output windows when VALIDMEMNAME=EXTEND is set. In most SAS windows, these extended rules are not supported. For example, these rules are not supported in the VIEWTABLE window and windows that you open using the **Solutions** menu.

Requirement When VALIDMEMNAME=EXTEND, SAS data set names, view names, and item store names must be written as a SAS name literal. If you use either the percent sign (%) or the ampersand (&), then you must use single quotation marks in the name literal in order to avoid interaction with the SAS Macro Facility.For more information, see "SAS Name Literals" in *SAS Programmer's Guide: Essentials*.

Tip The name is displayed in uppercase letters.

See "SAS Names" in *SAS Programmer's Guide: Essentials*

Examples
```
data "August Purchases"n;

data 'Años de empleo'n.;
```

CAUTION **Throughout SAS, using the name literal syntax with SAS member names that exceed the 32-byte limit or have excessive embedded quotation marks might cause unexpected results.** The intent of the VALIDMEMNAME=EXTEND system option is to enable compatibility

with other DBMS member naming conventions, such as allowing embedded blanks and national characters.

CAUTION **Using the special character # when VALIDMEMNAME=EXTEND could cause a SAS data set to be overwritten by a generation data set.** When VALIDMEMNAME= is set to EXTEND, it is possible to name a SAS data set name that uses the naming conventions for generation data sets, which append the special character # and a three-digit number to its member name. To avoid conflict, do not name SAS data sets similar to archived SAS data sets. For example, for a data set named A, generation data sets would automatically be named A#001, A#002, and so on. If you name a SAS data set A#003, the SAS data set could be deleted by SAS in the process of adding to a generation group.

CAUTION **When VALIDMEMNAME is set to EXTEND, the use of '(' and ')' individually or in reverse order can have unpredictable results.** Parentheses should be used only to indicate a member of a partitioned data set.

CAUTION **In the z/OS operating environment, if the session encoding is not the default EBCDIC 1047 (U.S. English), the representation of the special character # can cause incompatibility between releases.** For SAS 9.3, the special character # is represented by the specified session encoding. For SAS releases prior to SAS 9.3, the # special character is represented in EBCDIC 1047.

# Details

## Overview of VALIDMEMNAME

When VALIDMEMNAME= EXTEND valid characters that are allowed in a SAS data set name, view name, and item store name are extended to these characters:

- international characters
- characters supported by third-party databases
- characters that are commonly used in a filename

Only the DATA, VIEW, and ITEMSTOR SAS member types support the extension of characters. The other member types, such as CATALOG and PROGRAM do not support the extended characters. INDEX and AUDIT types that exist only with the associated DATA member do support extended characters.

## Handling File Extension Delimiters

If you reference a SAS file directly by its physical name, the final embedded period is assumed to be an extension delimiter, regardless of the VALIDMEMNAME setting. Consequently, if you use the EXTEND option for VALIDMEMNAME=, and the member name itself contains a period, then the full extension should be specified as part of the reference.

The following example illustrates this concept. The comments in the example are from the SAS log:

***Example Code 31.1*** *SAS Log Contents from Using VALIDMEMNAME=EXTEND*

```
1    options validmemname=extend;
NOTE: Windowing environment support for VALIDMEMNAME=EXTEND is limited
  to Editor, Log, and Output windows.
2    libname ufs "./saslib";
NOTE: Libref UFS was successfully assigned as follows:
      Engine:        V9
      Physical Name: /u/userid/saslib
3    data ufs."my.member"n; x=1; run;
NOTE: The data set UFS.'MY.MEMBER'n has 1 observations and 1 variables.
4    data _null_; set "./saslib/my.member"; run;
NOTE: There were 1 observations read from the data set ./saslib/my.member.
5    data _null_; set "./saslib/my.member.sas7bdat"; run;
NOTE: There were 1 observations read from the data set
  ./saslib/my.member.sas7bdat.
```

## See Also

- "Words and Names" in *SAS Programmer's Guide: Essentials*

**System Option:**

- "VALIDVARNAME= System Option" in *SAS System Options: Reference*

# VERBOSE System Option: z/OS

Specifies whether SAS writes the start-up system option settings to the SAS log.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation |
| Category: | Log and Procedure Output Control: SAS Log |
| PROC OPTIONS GROUP= | LOGCONTROL |
| Default: | NOVERBOSE |
| z/OS specifics: | Data written and where it is written |

## Syntax

**VERBOSE | NOVERBOSE**

## Details

If you specify the VERBOSE system option at SAS invocation, then the settings of all SAS system options that were set at SAS invocation are displayed in the SAS log. They are displayed in the sequence in which they were processed.

The settings are written to your SAS log. If SAS fails to initialize (for example, because of an unrecognized option specification), the VERBOSE output is written to the SASCLOG file (normally the terminal when SAS is run interactively).

## See Also

"OPLIST System Option: z/OS" on page 822

# WORK= System Option: z/OS

Specifies the location of the SAS Work library.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation |
| Category: | Environment Control: Files |
| PROC OPTIONS GROUP= | ENVFILES |
| Default: | WORK |
| z/OS specifics: | *library-specification* |
| See: | "WORK= System Option" in *SAS System Options: Reference* |

## Syntax

**WORK=***library-specification*

### Required Argument

***library-specification***
can be a ddname that was previously associated with a SAS library or the name of a physical file that comprises a SAS library.

**Note:** If the specified location is a WORK directory that is in UFS path, then the WORK directory is not in the `/tmp` directory. Instead, it is in a subdirectory of `/tmp` such as this.

```
/tmp/SASutilxxxxxxxxxxx
```

## See Also

"Work Library and Other Utility Files" on page 26

# WORKTERM System Option: z/OS

Specifies whether SAS erases WORK files at the termination of a SAS session.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation, Option statement, SAS System Options window |
| Category: | Environment Control: Files |
| PROC OPTIONS GROUP= | ENVFILES |
| z/OS specifics: | Default setting |

## Syntax

**WORKTERM | NOWORKTERM**

## Details

WORKTERM is the most appropriate setting when the Work library resides in a UFS directory because reusing a UFS Work library from a previous session is not practical. However, NOWORKTERM is the appropriate setting when the Work library resides in a direct access bound library because of one of the following conditions:

- the library resides in a temporary z/OS data set that is deleted by the system anyway
- the library resides in a permanent data set that might be reused.

SAS recommends that you specify NOWORKTERM in the default options table and not specify it in a configuration file or in the SAS invocation options. If you follow this recommendation, SAS automatically selects the appropriate setting during SAS initialization, based on the type of Work library.

# WTOUSERDESC= System Option: z/OS

Specifies a WTO DATA step function descriptor code.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation |
| Category: | DATA Step: WTO Function |

PROC OPTIONS GROUP= INSTALL

Default: 0

z/OS specifics: All

## Syntax

**WTOUSERDESC=** *n*

### Required Argument

***n***
specifies the message descriptor code. The valid values for *n* are from 0 to 16.

## Details

The message descriptor code is assigned to any message that is sent using the WTO DATA step function or CALL routine. See the IBM documentation for supported DESCRIPTOR code values and their meanings.

**Note:** Unlike z/OS, SAS does not support multiple descriptor codes.

## See Also

**CALL Routines**

- "CALL WTO Routine: z/OS" on page 462

**Functions**

- "WTO Function: z/OS" on page 498

**System Options**

- "WTOUSERMCSF= System Option: z/OS" on page 889
- "WTOUSERROUT= System Option: z/OS" on page 891

# WTOUSERMCSF= System Option: z/OS

Specifies WTO DATA step function MCS flags.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation |
| Category: | DATA Step: WTO Function |
| PROC OPTIONS GROUP= | INSTALL |
| Default: | NULL |
| z/OS specifics: | All |

## Syntax

**WTOUSERMCSF=**(BRDCST | HRDCPY | NOTIME | BUSYEXIT)

### Required Arguments

**BRDCAST**
tells SAS to broadcast the message to all active consoles.

**HRDCPY**
tells SAS to queue the message for hard copy only.

**NOTIME**
tells SAS not to append time to the message.

**BUSYEXIT**
tells SAS, in case of a WTO buffer shortage, to return rather than wait for an available buffer.

## Details

If you supply a value for WTOUSERMCSF=, it is included in the MCSFLAG field for every write-to-operator message that is sent with the WTO DATA step function or CALL routine.

You can supply one or more of the valid values. If you supply more than one value, the values must be enclosed in parentheses. The parentheses are optional if you specify only one value.

## See Also

**CALL Routines**

- “CALL WTO Routine: z/OS” on page 462

**Functions**

- “WTO Function: z/OS” on page 498

**System Options**

- “WTOUSERDESC= System Option: z/OS” on page 888
- “WTOUSERMCSF= System Option: z/OS” on page 889

# WTOUSERROUT= System Option: z/OS

Specifies a WTO DATA step function routing code.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation |
| Category: | DATA Step: WTO Function |
| PROC OPTIONS GROUP= | INSTALL |
| Default: | 0 |
| z/OS specifics: | All |

## Syntax

**WTOUSERROUT=***n*

### Required Argument

***n***

specifies the routing code. The valid values of *n* are from 0 to 16. Specifying a value of 0 for the WTOUSERROUT= system option disables the WTO function.

## Details

The routing code is assigned to any message that is sent with the WTO DATA step function or CALL routine. See the IBM documentation for supported routing code values and their meaning.

**Note:** Unlike z/OS, SAS does not support multiple descriptor codes.

## See Also

**CALL Routines**

- “CALL WTO Routine: z/OS” on page 462

**Functions**

- “WTO Function: z/OS” on page 498

**System Options**

- “WTOUSERMCSF= System Option: z/OS” on page 889

# XCMD System Option: z/OS

Specifies whether the X command is valid in the SAS session.

| | |
|---|---|
| Valid in: | Configuration file, SAS invocation |
| Category: | Input Control: Data Processing |
| PROC OPTIONS GROUP= | INPUTCONTROL |
| Default: | XCMD |
| z/OS specifics: | All |

## Syntax

**XCMD | NOXCMD**

## Details

If XCMD is in effect, you can issue operating environment commands through any of the available SAS interfaces, including the X command or the X statement; TSO command, statement, function, or CALL routine; SYSTEM function or CALL routine; %TSO macro; or %SYSEXEC macro.

If NOXCMD is in effect, then all of the above interfaces are disabled. In addition, the following interfaces are disabled:

- PIPE and NAMEPIPE device types in the FILENAME statement
- FILENAME function
- REXX macro interface
- ISPF interface
- the capability to invoke an external program as a SAS procedure

## See Also

“REXXMAC System Option: z/OS” on page 832

# 32

# TKMVSENV Options under z/OS



## TKMVSENV Options in the z/OS Environment

This chapter provides information about environment options that are specific to z/OS. For more information, see "TKMVSENV File" on page 35.

For more information about the environment variables that are supported and their recommended values, see the following sources.

***Table 32.1*** *SAS References*

| Type of Environment Variables | Reference |
|---|---|
| SAS Installation | Installation instructions for SAS Foundation for z/OS on support.sas.com |

| Type of Environment Variables | Reference |
| --- | --- |
| SAS Troubleshooting | SAS Technical Support |
| Configuring for the Java Platform | Configuration Guide for SAS Foundation for z/OS on support.sas.com |

# Dictionary

## set _BPXK_SETIBMOPT_TRANSPORT="stack-name" Environment Variable

Specifies for 64-bit SAS the IBM TCP/IP stack name to set the stack affinity for z/OS systems that are running more than one TCP/IP stack.

### Details

For 64-bit SAS, this option specifies the IBM TCP/IP stack name to set the stack affinity for z/OS systems that are running more than one TCP/IP stack. See set TCPIPMCH=stack-name for the equivalent TKMVSENV option for 31-bit SAS.

## set DISABLESASIPV6= Environment Variable

Disables support for TCP/IP IPv6 on z/OS.

### Details

This Boolean variable disables support for TCP/IP IPv6 on z/OS.

# set TCPIPMCH=stack-name Environment Variable

Specifies for 31-bit SAS the IBM TCP/IP stack name to set the stack affinity for z/OS systems that are running more than one TCP/IP stack.

## Details

For 31-bit SAS, this option specifies the IBM TCP/IP stack name to set the stack affinity for z/OS systems that are running more than one TCP/IP stack. See set _BPXK_SETIBMOPT_TRANSPORT="<*stack-name*>" for the equivalent TKMVSENV option for 64-bit SAS.

# set TCPRSLV=IBM | SASC Environment Variable

Sets the TCP/IP DNS resolver to either the IBM DNS Resolver or to the SAS/C DNS Resolver.

## Details

This option sets the TCP/IP DNS resolver to either the IBM DNS Resolver or to the SAS/C DNS Resolver. By default, SAS uses the IBM DNS Resolver unless the DISABLESASIPV6 option has been set.

# set TKOPT_CWD=path Environment Variable

Causes the current working directory to be set to path for the SAS session.

## Details

This option causes the current working directory to be set to path for the SAS session. If the pathname is nonexistent or invalid, no action is taken. The path can be absolute or relative.

# set TKOPT_ECHOENV Environment Variable

Displays all environment variables before SAS starts.

## Details

The TKOPT_ECHOENV option provides information that can help you debug problems when you are running SAS in z/OS server spaces. To display all of the environment variables before SAS starts, specify `set 'TKOPT_ECHOENV=Y'` in the TKMVSENV file or `-set 'TKOPT_ECHOENV=Y'` on the command line.

The TKOPT_ECHOENV option does not require that you specify a value after the = sign. For example, specifying `set 'TKOPT_ECHOENV=Y'` returns the same information that specifying `set 'TKOPT_ECHOENV='` returns. Specifying TKOPT_ECHOENV=DISABLE does not disable the option. You must remove the option from the TKMVSENV file or comment out the option to disable it.

**Note:** The option name is case sensitive. `Tkopt_echoenv` is not the same as `TKOPT_ECHOENV`. The specification of the option initiates the display of the environment variables. The option value can be any value.

# set TKOPT_ENV_UTILLOC=<path> Environment Variable

Specifies the fully qualified pathname of a UFS directory to contain temporary files that are created by SAS before the completion of SAS initialization, or by the spawner.

## Details

When specified in the TKMVSENV file for a SAS session or a SAS server, this option specifies the fully qualified pathname of a UFS directory. The directory contains temporary files that are created by SAS before the completion of SAS initialization. When specified for a SAS object spawner, this option specifies the fully qualified pathname of a UFS directory to contain any temporary files that are created by the spawner.

# set TKOPT_LPANAME=xxxxxxxx Environment Variable

Specifies the name of the SAS application entry point invoked by the SASLPA main entry point.

## Details

This option specifies the name of the SAS application entry point invoked by the SASLPA main entry point. If you placed the LPA resident module in LPA with a name other than SASXAL, you must specify the same name for the TKOPT_LPANAME option value.

# set TKOPT_SVCNO=nnn, set TKOPT_SVCR15=nn Environment Variables

Specifies how the SAS SVC is installed at the user site.

## Details

These variables specify how the SAS SVC is installed at the user site. This information is necessary because the threaded kernel might need to use some of the SVC services independently of the SAS application. These variables should be specified with the same values as the SVC0SVC and SVC0R15 SAS options.

# set TKOPT_TKIOP_DIAG_SPACE= Environment Variable

Results in the production of diagnostic messages when a utility file is closed.

## Details

This option results in the production of diagnostic messages when a utility file is closed. These messages detail the space allocation that is associated with the utility file allocation and the amount of space that the utility file actually used.

# set TKOPT_UMASK=nnn Environment Variable

Specifies the UNIX `umask` to apply to this session.

## Details

This option specifies the UNIX `umask` to apply to this session. This mask is applied to any UFS files created and operates as a standard UNIX `umask`. *nnn* must be exactly three octal digits between 0 and 7.

PART 7

# Appendixes

# Appendix 1

# Optimizing Performance

# Introduction to Optimizing Performance

SAS software includes many features that can help you manage CPU, memory, and I/O resources effectively. The following sections describe features that are either specific to z/OS or that have characteristics that are specific to z/OS. The information is applicable to your site whether you run SAS interactively or in batch mode.

For additional information about optimizing SAS performance under z/OS, see *Tuning SAS(R) Applications in the OS/390 and z/OS Environments*, by Michael Raithel (available from SAS Press).

For information about optimizing SAS performance on any host operating system, see "Optimizing System Performance" in *SAS Programmer's Guide: Essentials*.

# Collecting Performance Statistics

## Overview of Collecting Performance Statistics

Several SAS system options provide information that can help you optimize your SAS programs. The STATS system option writes statistics to the SAS log. The FULLSTATS, MEMRPT, and STIMER system options can be specified in combination to select the statistics that are written to the SAS log.

STATS
: specifies that statistics are to be written to the SAS log. NOSTATS specifies that no statistics are to be written to the SAS log, regardless of the values of STIMER, MEMRPT, and FULLSTATS. STATS and NOSTATS can be specified at any time during a SAS session. For more information, see "STATS System Option: z/OS" on page 865.

STIMER
: specifies that the CPU time statistic is to be collected and maintained throughout the SAS session. If STATS and STIMER are in effect, then the CPU time statistic is written into the SAS log for each task. If FULLSTATS, STATS, and STIMER are in effect, the statistics listed under FULLSTATS in the following list are written to the SAS log. STIMER must be specified at SAS invocation. For more information, see "STIMER System Option: z/OS" on page 868.

MEMRPT
: specifies that memory usage statistics are to be written to the SAS log. If STATS and MEMRPT are in effect, then the amount of memory used by each task and

the total amount of memory used for the SAS session is written into the SAS log. If FULLSTATS, STATS, and MEMRPT are in effect, then additional statistics are written into the SAS log, as specified in the following list item for FULLSTATS. MEMRPT and NOMEMRPT can be specified at any time during a SAS session. For more information, see "MEMRPT System Option: z/OS" on page 813.

FULLSTATS
specifies that additional statistics are to be written to the SAS log. The actual statistics added are determined by the values of STIMER and MEMRPT. If STIMER is in effect, then elapsed time is displayed. RSM hiperspace time and EXCP count are also displayed if their values are nonzero. If MEMRPT is in effect, then for each task, both task and total memory are displayed, including the amount of memory used for data and amount of memory used for program. FULLSTATS and NOFULLSTATS can be specified at any time during a SAS session. For more information, see "FULLSTATS System Option: z/OS" on page 771.

## Logging SMF Statistics

SMF statistics are generated by IBMs System Management Facility. If your system is configured to enter the SMF exit, and if the SAS system options SMF and SMFEXIT= are in effect, up to 20 SMF statistics can be written to the SAS SMF records that are written for each procedure or DATA step.

The SMFEXIT option is optional. The SMF and STIMER options are required. You must specify SMF and STIMER to create SMF records from SAS, and you must also have the SAS Supervisor Call (SVC) installed and the SVC0SVC option set correctly.

For more information about SMF statistics, see the *Configuration Guide for SAS Foundation for z/OS*.

# Optimizing SAS I/O

## Process SAS Files or Data Libraries in Memory

### Overview of Processing in Memory

The volume of data that SAS applications must process has steadily increased, and the processing time has remained the same or has decreased. The increased speed

of z/Series processors and the ability of some SAS procedures to perform some processing in parallel has accelerated many applications. However, these improvements cannot completely address the time required to transfer data between a file on an I/O device and central storage of the processor. Since the amount of real storage available to z/Series processors has continued to grow exponentially, processing SAS files or libraries in memory is an increasingly attractive strategy for reducing the elapsed time of SAS jobs. This topic describes three techniques that avoid I/O by storing SAS files or libraries in memory for some part of their processing.

## Use the SASFILE Statement to Load a Frequently Used SAS Data Set into Memory

By default, any SAS data set that is processed by a SAS procedure or DATA step is closed at the conclusion of the procedure or step. This action causes the buffers to be released and any updated pages to be written to disk. If a subsequent procedure or step needs to read or update the SAS data set again, the same pages that were already in buffers might need to be read back from disk again. Such extra I/O can be avoided by specifying two SASFILE statements:

- one statement to open or load the SAS data set before the procedures or DATA steps in which the data set is used

  **Note:** The SASFILE statement loads the entire member into memory. That is, it ignores any previous setting of the OBS option.

- a second statement to close the data set after its last use within the SAS session

The SASFILE statement can provide benefits whenever some pages of a SAS data set are accessed repeatedly. For example, suppose a SAS data set is read by two separate DATA steps. If the SASFILE statement is used to load the file into memory before the first step, each page of the data set is read only once, as part of processing the SASFILE statement. Then the DATA steps access the pages of the data set directly from memory without requiring any I/O. In this case, the amount of I/O that is required is reduced by half.

If any of the procedures or steps access every page in the SAS data set, the best strategy is to specify the SASFILE LOAD option. If only some of the pages are to be accessed, then specify the SASFILE OPEN option. This option causes the actual I/O to be deferred until the page is first referenced, thus avoiding I/O for any pages that are not referenced.

Obtaining the full performance benefit of SASFILE can require a sufficiently large REGION size, so contact your z/OS systems administrator if necessary. For more information, see "SASFILE Statement: z/OS" on page 675 and "SASFILE Statement" in *SAS Global Statements: Reference*.

## Use the Hiperspace Access Method for Temporary Libraries

SAS files processed by a Base SAS engine can be placed in hiperspace libraries, if their contents do not need to be retained after the conclusion of the SAS session. A z/OS hiperspace is a virtual storage area that is separate from the virtual storage address space in which SAS runs. Hiperspaces reside in central storage, although their contents can be paged out to auxiliary storage if it is required by the demand for central storage frames.

Storing members in, or retrieving members from, a hiperspace library requires no DASD I/O (except for paging activity, if required). Member pages are accessed via direct memory-to-memory transfers. These transfers are much faster than transfers to and from disk and require negligible CPU overhead.

The HIPERSPACE access method can be used in two ways. First, the Work library can be placed in a hiperspace by specifying the HSWORK option. In this case SAS ignores any external allocation of the Work library (for example, via the ddname WORK). Second, specifying the LIBNAME option HIPERSPACE causes SAS to create a new temporary library in hiperspace. For more information, see "Hiperspace Libraries" on page 66.

## Allocate Temporary Libraries to VIO

Libraries whose contents do not need to be retained after the conclusion of the SAS session can also be allocated to virtual input/ouput (VIO). VIO is a system facility that simulates an actual disk device, but stores the data in memory, or if necessary due to central storage constraints, in auxiliary storage (paging data sets). Using VIO can often eliminate all DASD I/O (and associated elapsed time delays) associated with SAS library processing.

Any SAS bound library that resides in a DSORG=PS data set can be allocated to VIO. This includes both direct access and sequential access bound libraries. The Work library is an ideal candidate for VIO. To allocate a library in VIO, specify a value for the UNIT parameter that corresponds to VIO at your installation. UNIT is a parameter of the JCL DD statement and the TSO ALLOCATE command. UNIT is also an option of the LIBNAME statement. Typically, UNIT=VIO causes the system to use VIO, but a different value for the UNIT parameter might be required at your z/OS installation. Contact your z/OS systems administrator for a recommended value.

Despite the simplicity and convenience of using VIO, it has the following limitations:

- The maximum size of a VIO library is 65535 tracks, and the library data set cannot be extended to an additional volume.
- At some z/OS installations, VIO allocations can be automatically converted to DASD if the size of the allocation exceeds a certain number of tracks.

- Testing at the SAS facilities indicated that the CPU costs associated with VIO processing, although low enough to be negligible for most workloads, are still about twice the CPU cost of hiperspace library processing for sequential access patterns. For random access patterns, VIO requires significantly more CPU than hiperspace, and the amount can be sufficient to merit consideration in deciding which technique to use.

## Comparison of Techniques for Processing SAS Files or Data Libraries in Memory

The following table provides a brief comparison of the methods that you can use to process SAS files or data libraries in memory.

| Point of Consideration | SASFILE | Hiperspace | VIO |
|---|---|---|---|
| Can library members be saved permanently? | Yes, the SASFILE CLOSE statement automatically saves changes to the library, which can reside on disk. | No, hiperspace libraries are temporary. | No, VIO libraries are temporary. However, unlike hiperspace libraries, they can be passed to subsequent steps of a batch job if they are allocated externally in the JCL. |
| Might require assistance from z/OS systems programmer? | Yes, to set appropriate REGION size. | Yes, to determine what limits might exist on use of hiperspace pages. | No. |
| Maximum Size | Total concurrent data use for entire SAS session is limited by private region size (< 2G). | (installation dependent) Can exceed 2G per library or in aggregate. | Limited to 3.4G per library. |
| Implementation Effort | Must analyze SAS program to identify SAS data sets that are repeatedly accessed across multiple procedures or DATA steps. SASFILE statements must be | Must add HIPERSPACE option to the LIBNAME statement and set the SAS system options HSLXTNTS, | Must specify UNIT=VIO and possibly adjust SPACE parameter on library allocation. |

| Point of Consideration | SASFILE | Hiperspace | VIO |
|---|---|---|---|
| | inserted at the appropriate places to load or open and close the member. | HSMAXPGS, and HSMAXSPC appropriately. | |
| Can be used with Work Library? | Yes. | Specify HSWORK option. | Modify SAS start-up (JCL, clist, exec) to allocate WORK to VIO. |
| Eligible Engines | BASE engines. | BASE engines. | BASE or TAPE engines. |
| Other Limitations | Can be used only with SAS data sets that are being read or updated. Cannot be used when creating or replacing SAS data sets. | | |

# Optimize I/O for Direct Access Bound Libraries

## Overview of Optimize I/O for Direct Access Bound Libraries

Determining whether the primary access pattern that you want to use is sequential or random, and then selecting an appropriate page size based on your determination, helps you optimize the performance of your SAS session. Based on the primary access pattern that you are using, select an appropriate page size according to the guidelines in "Sequential Processing Pattern" on page 910 and "Random Processing Pattern" on page 910.

The BUFSIZE data set option enables you to establish a non-default page size for a new SAS data set, but there are some limitations. When it is determined, the page size becomes a permanent attribute of the SAS data set and influences the efficiency of both the output operation that creates the data set as well as that of subsequent Read or Update operations.

The minimum page size that can be specified for a SAS data set is the block size of the library that contains it. Because the library block size is fixed when the library is created, achieving optimal performance might require creating new libraries with

special block sizes. You might also have to divide into separate libraries those members that you access sequentially and those members that you access randomly.

## Sequential Processing Pattern

Sequential processing describes operations in which the pages of a library are read or written in the order in which they exist in the member from first to last. For example, using a data set to write a new member or to replace an existing member of a SAS data set is a sequential operation. Likewise, reading all the observations of a SAS data set in the order in which they appear is also a sequential operation. Sequential processing can be optimized by following these recommendations:

- If practical, place the member in a library that has a block size that corresponds to the optimum half-track value. The optimum half-track value for libraries that reside on 3390 devices is 27K.
- Evaluate the effect of specifying BUFNO=10 for operations that process a member sequentially. In tests run at the SAS facilities, increasing the BUFNO value from 3 (the default) to 10 reduced the elapsed time for sequential write processing by 25% to 30% and the elapsed time for sequential read processing by 50%. Note that the actual percentage of improvement depends on the characteristics of your system's hardware and software configuration. BUFNO values between 10 and 100 might also provide further reductions in elapsed time, but that benefit can be outweighed by the increase in- memory requirements.

## Random Processing Pattern

Random processing refers to operations in which the pages of a library member are read or rewritten in a nonconsecutive order. For example, updating a SAS data set by using a transaction file is typically a random access operation. The following list contains techniques that might improve the performance of random processing:

- SAS must read an entire page to retrieve each individual observation. When you create library members that are to be accessed randomly, establish the smallest possible page size by setting the member BUFSIZE equal to the library block size.
- Placing the member in a library with a smaller block size such as 6K might provide a small increase in the I/O throughput rate for random processing. However, the smaller block size typically impairs the performance of sequential processing by a larger amount on current DASD controllers. Therefore, if the library members are to be processed both sequentially and randomly, half-track blocking (27K on a 3390 device) is recommended.
- Specifying a BUFNO value greater than the default provides a performance benefit only if there is a set of pages that are being repeatedly accessed by some part of the operation, and the BUFNO value is set larger than the number

of pages in that set. Otherwise, increasing the BUFNO value beyond the default can slightly degrade performance for random processing.

# Optimize I/O for Sequential Access Bound Libraries

Sequential access bound libraries are processed by the TAPE engine and can reside on disk or tape.

- Beginning with SAS 9.4M2, specify the DLLBI SAS system option or the DLLBI=YES LIBNAME statement option when you create sequential access bound libraries on tape devices. DLLBI=YES enables block size (BLKSIZE) values to exceed 32760. Unless overridden on the allocation, SAS selects the optimum block size for the device, typically 224K-256K. Setting the optimum BLKSIZE value results in significant improvements in the I/O rate (bytes per elapsed second) relative to BLKSIZE=32760, and might improve tape utilization as well.
- Use the default BUFSIZE when you access sequential format bound libraries. The default BUFSIZE is always the most appropriate choice.
- For libraries on tape, structure your SAS job to write all library members as part of a single PROC COPY operation. Using one PROC COPY operation avoids the I/O delays that result when SAS repositions back to the beginning of the tape data set between every SAS procedure or DATA step.
- For libraries on tape that are assigned internally, specify the engine in the LIBNAME statement. This specification avoids an extra tape mount.

# Determine Whether You Should Compress Your Data

## Overview of Compressing Data

Compressing data reduces I/O and disk space but increases CPU time. Therefore, whether data compression is worthwhile to you depends on the resource cost-allocation policy in your data center. Often your decision must be based on which resource is more valuable or more limited, DASD space or CPU time.

You can use the portable SAS system option COMPRESS= to compress all data sets that are created during a SAS session. Or, use the SAS data set option COMPRESS= to compress an individual data set. Data sets that contain many long character variables generally are excellent candidates for compression.

The following tables illustrate the results of compressing SAS data sets under z/OS. In both cases, PROC COPY was used to copy data from an uncompressed

source data set into uncompressed and compressed result data sets. PROC COPY uses the system option values COMPRESS=NO and COMPRESS=CHAR, respectively.

**Note:** When you use PROC COPY to compress a data set, you must include the NOCLONE option in your PROC statement. Otherwise, PROC COPY propagates all the attributes of the source data set, including its compression status.

In the following tables, the CPU row shows how much time was used by an IBM 3090-400S to copy the data. The SPACE values show how much storage (in megabytes) was used.

For the first table, the source data set was a problem-tracking data set. This data set contained mostly long, character data values, which often contained many trailing blanks.

***Table A13.1*** *Compressed Data Comparison 1*

| Resource | Uncompressed | Compressed | Change |
|---|---|---|---|
| CPU | 4.27 sec | 27.46 sec | +23.19 sec |
| Space | 235 MB | 54 MB | -181 MB |

For the preceding table, the CPU cost per megabyte is 0.1 seconds.

For the next table, the source data set contained mostly numeric data from an MICS performance database. The results were again good, although not as good as when mostly character data was compressed.

***Table A13.2*** *Compressed Data Comparison 2*

| Resource | Uncompressed | Compressed | Change |
|---|---|---|---|
| CPU | 1.17 sec | 14.68 sec | +13.51 sec |
| Space | 52 MB | 39 MB | -13 MB |

For the preceding table, the CPU cost per megabyte is 1 second.

For more information about compressing SAS data, see *SAS(R) Programming Tips: A Guide to Efficient SAS(R) Processing*.

## Consider Using SAS Software Compression in Addition to Hardware Compression

Some storage devices perform hardware data compression dynamically. Because this hardware compression is always performed, you might decide not to enable the

SAS COMPRESS option when you are using these devices. However, if DASD space charges are a significant portion of your total bill for information services, you might benefit by using SAS software compression in addition to hardware compression. The hardware compression is transparent to the operating environment. If you use hardware compression only, then space charges are assessed for uncompressed storage.

# Efficient Sorting

## Consider Changing the Values of SORTPGM= and SORTCUTP=

SAS software includes an internal sort program that is often more efficient than host sort programs for sorting small volumes of data. Host sort programs are generally more efficient when the data volume is too high to perform the sort entirely in memory.

Under z/OS, the default value of the SAS system option SORTPGM= is BEST. This value causes SAS to use the SAS sort program for smaller SAS data sets. For larger SAS data sets, SAS uses the host sort program if the size of the data exceeds the specified value for SORTCUT. If SORTPGM is set to anything other than BEST, then SAS uses the specified program. You use the SORTNAME= system option to specify the name of the host sort program.

You might want to change the default value of the SORTCUT option to optimize sorting for your particular applications. The older SORTCUTP option is no longer recommended. However, for backward compatibility, setting the value of the SORTCUT option to zero can affect your decision about which sort to use.

**Note:**

- Host sorts perform best when the number of observations to be sorted is known. In some circumstances, SAS does not know how many observations are in a data source. In these situations, SAS does not pass either the FILSZ= or SIZE= option to the host sort. The action that the host sort takes when one of these conditions occurs depends on the particular host sort that is being used.
- The host sort is used if the number of observations that are to be sorted is unknown, such as when sorting with a WHERE= filter, or when sorting a SAS data set that is on tape.

# Take Advantage of the DFSORT Performance Booster

If your installation uses Release 13 or later of IBMs DFSORT as its host sort utility for large sorts, then you can take advantage of a DFSORT "performance booster." To do so, specify SORTBLKMODE in an OPTIONS statement, in the OPTIONS parameter list of the SAS cataloged procedure, or in a configuration file.

SORTBLKMODE causes SAS to work in conjunction with DFSORT to process your SAS sorting applications faster.

SORTBLKREC can improve the performance of SAS software by controlling the amount of memory used for the SORTBLKMODE buffers when you specify DFSORT and SORTBLKMODE. You can specify SORTBLKREC in an OPTIONS statement, in the OPTIONS parameter list of the SAS cataloged procedure, or in a configuration file.

## See Also

- "SORTBLKMODE System Option: z/OS" on page 843
- "SORTBLKREC System Option: z/OS" on page 844

# Specify the Minimum Space for Sort Work Data Sets

## Allocate the Minimum Space for Multiple Sorts

SAS uses the DYNALLOC system option to specify whether SAS or the host sort utility dynamically allocates the sort work data sets. If you specify the NODYNALLOC option, then SAS allocates the sort work data sets. If you specify the DYNALLOC option, then the host sort utility allocates the data sets. NODYNALLOC is the default setting for the DYNALLOC option.

When SAS allocates the sort work data sets, you need to ensure that adequate space is allocated for your data sets. SAS attempts to allocate enough space for each sort work data set. If adequate space is not available, SAS issues a system error message.

The SORT= option specifies the minimum size of all allocated sort work data sets. You can use this option to ensure that you have enough allocated space to perform

several sorts, especially if one or more of the sorts requires more space than the first sort. For example, you want SAS to allocate the space for the following sorts:

SORT 1:
    20 cylinders

SORT 2:
    50 cylinders

SORT 3:
    25 cylinders

SORT 4:
    200 cylinders

SAS uses the following process to allocate the space for each sort:

1. Allocate 20 cylinders for the first sort.
2. Free the space that it allocated for the previous sort because it needs more allocated space to perform the next allocation.
3. Allocate 50 cylinders for the second sort.
4. Reuse the allocated space for the third sort.
5. Free the space that it allocated for the previous sort because it needs more allocated space to perform the next allocation.
6. Allocate 200 cylinders to perform the fourth sort.

This process works, and you are not informed that it is happening, but it is not efficient.

It is more efficient to use the SORT= option to specify that SAS should allocate 200 cylinders for the first sort so that SAS can reuse the same space for all of the sorts. If you use the SORT= option, SAS does not have to free the allocated space before it allocates more space for the next sort.

## Specify the SAS SORT Options

SAS uses the SORT= option to specify the minimum size of the sort work data sets if you specify the NODYNALLOC option, and you are using the host sort interface. You can also specify other options with the SORT= option to specify the type of unit, device, and so on, to use with the sort work data sets. The following list describes the function of each of the SAS system options that you can use when you specify the NODYNALLOC option:

SORT=
    specifies the minimum total size for all the data sets that are allocated dynamically. To calculate the primary space for each individual data set, SAS divides the value specified for the SORT= option by the number of sort files. SAS then rounds up to the next whole number.

SORTUNIT=
    specifies the unit of allocation as cylinders, tracks, or blocks.

SORTDEV=
specifies the name of the unit device for the sort work file.

SORTPGM=
specifies which sort utility SAS uses.

SORTWKDD=
specifies the prefix of the sort work data sets.

SORTWKNO=
specifies how many sort work data sets to allocate.

**Note:** You should not set the SAS system option SORTWKDD to a value of SORT (SORTWKDD=SORT), and you should not use ddnames prefixed with SORTWKDD=*value* to pre-allocate libraries or files in your JCL file. These two actions can result in subsequent PROC SORT failures in your SAS programs.

## Concurrent Sorting

SAS does not support concurrent host sorts. Attempting to invoke a host sort while one is already running causes SAS to revert to the internal sort, which might have an adverse effect on performance. Attempts to run concurrent sorts usually occur in a server environment, but running sorts in a server environment is not recommended.

# Some SAS System Options That Can Affect Performance

## MAUTOSOURCE and IMPLMAC

The MAUTOSOURCE and IMPLMAC SAS system options affect the operation of the SAS autocall macro facility, and they interact in a way that you should be aware of.

Specifying IMPLMAC enables you to use statement-style macros in your SAS programs. With IMPLMAC in effect, each SAS statement is potentially a macro, and the first word (token) in each statement must be checked to determine whether it is a macro call.

When IMPLMAC is in effect without MAUTOSOURCE, no special checking takes place until the first statement-style macro is compiled. When both IMPLMAC and MAUTOSOURCE are in effect, however, this checking is done unconditionally. The

initial occurrence of a word as the first token of a SAS statement results in a search of the autocall library. A significant number of directory searches can occur, especially when a large DATA step is compiled. The CPU time that is consumed by maintaining and searching the symbol table also degrades performance.

The combination of MAUTOSOURCE and IMPLMAC can add 20% to CPU time and 5% to I/O for a non-trivial job. Therefore, for best performance, leave NOIMPLMAC as the installation default.

## REXXMAC

When SAS encounters an apparent SAS statement that it does not recognize, it typically generates a "statement is not valid" error message in the SAS log. However, when the REXXMAC system option is in effect, SAS passes the first word in the apparent statement to the z/OS REXX processor, which looks for a member by that name in the SASREXX library. Hence, a mistyped statement could have unintended results and could have a negative impact on performance. For more information, see "REXXMAC System Option: z/OS" on page 832 and "REXXLOC= System Option: z/OS" on page 831.

## SPOOL and NOSPOOL

The SPOOL system option is appropriate when you are running SAS interactively, without using the windowing environment. When SPOOL is in effect, SAS input statements are stored in a Work library utility file; they are retrieved later by %INCLUDE and %LIST commands. SAS is shipped with SPOOL as the default setting for interactive sessions, but you might want to consider resetting it to NOSPOOL for batch jobs. In a batch job that has a large number of input lines, NOSPOOL can reduce I/O by as much as 9%.

# Managing Memory

## Overview of Managing Memory

When the amount of available memory is not sufficient, increase the REGION size. If you want to limit SAS from using the entire REGION, use the MEMLEAVE option. SAS automatically sets the value of the MEMSIZE option to the amount of available storage in the REGION less the value of MEMLEAVE. MEMSIZE is the amount of memory available to SAS.

The following sections provide details about available memory management techniques.

## Specify a Value for MEMLEAVE= When You Invoke SAS

MEMLEAVE= specifies a value that is subtracted from the total amount of memory available in the user's REGION. The amount of memory specified by MEMLEAVE= is reserved for the use of the operating environment. The remainder of the user's REGION remains available to SAS. MEMLEAVE= applies equally well to all SAS sessions, regardless of the size of the REGION.

The default value of MEMLEAVE= is 512K. You might need to increase this value depending on memory demands expected for host programs that are running in the same REGION. Increasing the value prevents SAS from using too much of that REGION. For example, you might want to increase the value of MEMLEAVE= if you plan to run a memory-intensive host sort routine while also running a large SAS session.

## Consider Using Superblocking Options to Control Memory Fragmentation

Superblocking options are SAS system options that set aside large blocks of memory for different classes of use. In most cases, the default values for these options are appropriate and should not be altered. However, if you receive a superblock-overflow warning message in the SAS log, you might want to use these options to adjust the memory allocation for your job.

For complete information about superblocking system options, see the installation instructions for SAS software in the z/OS environment. You can also submit the following SAS statement to list the superblocking system options:

```
proc options group=memory;
run;
```

## Use SYSLEAVE= and PROCLEAVE= to Handle Out-of-Memory Conditions

To help ensure that a job ends "gracefully" when out of memory, you might want to increase the values of the SAS system options SYSLEAVE= and PROCLEAVE=.

- The SYSLEAVE= option reserves a specified amount of memory to ensure that, when a SAS task ends, enough memory is available to close data sets and to "clean up" other resources. For more information, including the SAS default value, see "SYSLEAVE= System Option: z/OS" on page 872.
- The PROCLEAVE= option specifies an amount of memory that is to be held in reserve, and that is to be made available only when memory allocation would otherwise fail. For more information, including the SAS default value, see "PROCLEAVE= System Option: z/OS" on page 829.

# Specify a Larger Region Size

If you submit large jobs, such as a JAVA GRAPH job, to one of the following z/OS servers in the SAS Intelligence Platform, then adequate space might not be allocated for the task. Here is a list of the types of servers that might require an allocation of more space.

- standard (nonpooled) workspace server
- server-side pooled workspace server
- stored process server

If this situation occurs, then you might have to change your RACF profile to run larger jobs. SAS recommends that you increase your RACF OMVS maximum region size by specifying a value for MAXASSIZE of 600MB.

MAXASSIZE is a parameter of the IBM ALTUSER command that sets a maximum region size for an address space. ASSIZEMAX is a parameter of the IBM ADDUSER and ALTUSER commands that specifies a maximum region size for a specific user. ASSIZEMAX can be used to override the value specified by MAXASSIZE.

**CAUTION**
**Contact your system programmer for information about how to increase your OMVS maximum region size.**

# Memory Cheat Sheet for z/OS

Use the following questions to diagnose memory problems with SAS:

1. What is the error message in the SAS log or JES messages log?
2. How much available memory is reported at the beginning of the SAS log?
3. Does your site have any known restrictions on the amount of memory that is available to a particular job (for example, for an IEFUSI exit)?
4. Did you specify the size of the memory region anywhere? If so, what value was specified? How and where was the value specified?

# Loading SAS Modules Efficiently

SAS software has three possible program configurations:

- unbundled
- bundled (LPA/ELPA version)
- bundled (non-LPA version).

In an unbundled configuration, all modules are loaded individually from the SAS software load library. Running in this manner is not generally recommended because it significantly increases library-directory searches and I/O. However, SAS is shipped with this setting by default because some of the installation tasks must invoke SAS before the installer has had the opportunity to select a bundled version.

In the two bundled configurations of SAS, many individual modules are combined into one large executable file. Invoking a bundled version of SAS eliminates both wasted space between modules and the overhead of loading each module individually. Performance is also improved slightly.

In a multiuser SAS environment, the most effective way to reduce memory requirements is to use the LPA/ELPA bundled configuration. This configuration dramatically reduces each user's working-set size.

**Note:** Working-set size is the amount of real system memory that is required to contain a) the programs that consume most of the system execution time, and b) the data areas that these programs reference.

The non-LPA bundled configuration is intended for sites that do not want to place SAS modules in the Link Pack Area. In this configuration, the bundle is loaded into each user's address space. Although this decreases library-directory searches and I/O, it has the unfortunate side-effect of increasing individual working-set sizes. Therefore, this method is not recommended if you have many SAS users at your site.

For detailed information about the bundled configurations and how to install them, see the installation instructions for SAS software in the z/OS environment.

# Other Considerations for Improving Performance

## Leave AUTOSCROLL 0 in Effect for the LOG and OUTPUT Windows

The AUTOSCROLL command controls how information is scrolled as it is written to the Log and Output windows. Specifying small scrolling increments is very expensive in terms of response time, network data traffic, and CPU time.

Under z/OS, AUTOSCROLL is preset to 0 for the Log window. AUTOSCROLL 0 suppresses automatic scrolling and positions the Log window at the bottom of the most recent output when a DATA step or procedure is completed. At that time, of course, you can scroll up to view the contents of the log.

To see the effect of this command, enter AUTOSCROLL 1 on the command line of the Log window and then run PROC OPTIONS. Then enter AUTOSCROLL 0 and run PROC OPTIONS again. The CPU time ratio is more than 30 to 1.

## Use the EM3179 Device Driver When Appropriate

If you are running Attachmate or any other full-functioned 3270 emulator over a slow connection, specify the SAS system option FSDEVICE=EM3179 when you invoke SAS. Menus in applications such as SAS/ASSIST are then displayed as text menus instead of icon menus. The text menus require much less network data transfer and are considerably faster across slow lines.

# Appendix 2

# Using EBCDIC Data on ASCII Systems



## About EBCDIC and ASCII Data

### Overview of EBCDIC and ASCII Data Representation

*Extended Binary Coded Decimal Interchange Code (EBCDIC)* is an 8-bit character encoding method for IBM mainframe machines. *American Standard Code for*

*Information Interchange (ASCII)* is a 7-bit character encoding method for most other machines, including Windows, UNIX, and Macintosh machines.

Hexadecimal characters are used to represent one byte or eight bits of data. In a binary system, each bit can have the value 0 or 1. An aggregation of four bits can therefore take on 16 ($2^4$) possible values. This means that two hexadecimal characters can be used to represent one byte of data. In the EBCDIC and ASCII encoding methods, each character is represented by two hexadecimal characters. (This pertains primarily to Western language, single-byte encoding methods. There are other encoding methods that store a single character in two bytes of storage, such as encoding methods that are used for Japanese or Korean data.)

Each encoding method represents the same data differently, as shown in the following examples:

- On an EBCDIC system, the digit 4 is represented by the hexadecimal value 'F4'x. On an ASCII system, the digit 4 is represented by the hexadecimal value '34'x.
- On an EBCDIC system, the hexadecimal value '50'x represents the symbol &. On an ASCII system, the same hexadecimal value represents the letter P.

When SAS reads a file, it expects the data in the file to be in the encoding that matches the ENCODING= option for the SAS session. For example, on a Windows machine, the default encoding for a single-byte SAS session with a US English locale is LATIN1. SAS expects the data in a file on that Windows machine to use a LATIN1 encoding. However, if a file originates on an EBCDIC machine and it is stored on a Windows machine, then SAS would misinterpret the data from this file if no other encoding information is provided. For this reason, specific steps must be performed to convert data that originates on an EBCDIC system before it can be used on an ASCII system (for example, the Windows machine). Here are the two main methods to make EBCDIC data available on an ASCII system:

- On the ASCII system, read the data directly from the EBCDIC system.
- Use an FTP program to move the data, with or without any conversion of the data.

# EBCDIC File Structures

When you decide how to move data from an EBCDIC system to an ASCII system, consider the structure of the EBCDIC source file. On EBCDIC systems, you might have files with fixed-length records or files with variable-length records. Either type of file contains a header with information about the file. The header includes a Record Format attribute that indicates whether the records are fixed length or variable length. The header for a file with fixed-length records includes a Logical Record Length attribute that indicates the length of each record in bytes.

In SAS, the Record Format attribute corresponds to the RECFM= option in a FILENAME statement. To access a file with fixed-length records, specify RECFM=F. To access a file with variable-length records, specify RECFM=V. Similarly, the Logical Record Length attribute corresponds to the LRECL= option.

The Logical Record Length attribute in the header for a file with variable-length records indicates the maximum record length. Each record in a file with variable-length records begins with a *record descriptor word (RDW)*. The RDW is a 4-byte binary integer field. The first two bytes of the RDW indicate the length of the current record. The last two bytes of the RDW contain information that is used by the operating system. The length of the record includes the four bytes of the RDW at the beginning of the record. Because the length of each record is specified in an EBCDIC file (either in the header or in the RDW), there are no end-of-record indicators in EBCDIC files.

A file with variable-length records also contains *block descriptor words (BDWs)*. Like the RDW, the BDW is a 4-byte, binary integer field. The first two bytes indicate the block size, and the last two bytes are used by the operating system. Each block can contain multiple records. If the block size is not specified when the file is created, the default block size is the logical record length plus 4. Otherwise, the size of a block is the number of bytes that are contained in the block. This value is the sum of the record lengths in the block (obtained from the RDWs) plus 4 (the length of the BDW).

## ASCII File Structure

On ASCII systems, a file does not contain a header with information about the file, such as record format or lengths. The RECFM attribute for ASCII files is variable (RECFM=V), and the record length (LRECL) is unlimited. Instead of defining record lengths like EBCDIC files do, ASCII files use end-of-record indicators to flag the end of a record. On a Windows machine, the end-of-record indicators are the carriage return (CR) and line feed (LF) characters. On a UNIX machine, an LF indicates the end of a record. On a Macintosh machine, a CR indicates the end of a record. Other types of machines use different combinations of characters to identify the end of record. For all ASCII machines, the hexadecimal value for CR is '0D'x, and the hexadecimal value for LF is '0A'x.

When SAS reads a file from disk on an ASCII machine, default values for some file attributes must be used because these attributes are not defined. The default RECFM value is V (variable-length record), and the default LRECL value is 32767. This means that SAS scans the input from an ASCII file, parses the data into variable values based on the INPUT statement, and looks for an end-of-record indicator. If the end of a record is not found within the specified number of characters (based on LRECL), then SAS truncates the record and prints a message in the log. For example, suppose LRECL is set to 256, and there is a record that is 300 characters. SAS reads the first 256 characters based on the INPUT statement, and then discards the last 44 characters. A message in the log states that “One or more lines have been truncated.” You can override the current LRECL value using the LRECL= option in the INFILE statement.

## Numeric Values

When stored as character data, the decimal digits 0 through 9 each occupy one byte of storage. One 8-bit byte includes two 4-bit *nibbles*. Each nibble can have 16 ($2^4$) possible values. The first nibble is the *high-order nibble*, and the second is the *low-order nibble*. In EBCDIC and ASCII systems, the high-order nibble has a standard value. Decimal digits are represented in EBCDIC with a high-order nibble of F. Decimal digits are represented in ASCII with a high-order nibble of 3. This means that in an EBCDIC system, the digits 0 through 9 are represented by the hexadecimal values 'F0'x through 'F9'x. In an ASCII system, the digits 0 through 9 are represented by the hexadecimal values '30'x through '39'x. This encoding method treats decimal digits as characters.

As an alternative to storing decimal digits as characters, there are other encoding methods that can be used on an EBCDIC system. For example, a packed-decimal encoding method represents two decimal digits in one byte of storage. A zoned-decimal encoding method represents one decimal digit in one byte of storage, and the sign of the entire value is included within one byte of storage. (The byte that stores the decimal digit and the sign of the entire value can be either the first byte or the last byte, depending on the type of machine.)

You must know the numeric encoding that is used on the source EBCDIC system so that the source data is interpreted correctly on the ASCII system. For SAS, this means that you must specify the correct informats to use for numeric data.

# Moving Data from EBCDIC to ASCII Systems

## Overview of Accessing EBCDIC Data on ASCII Systems

There are several ways to access EBCDIC data on an ASCII system. For example, some ASCII machines have peripheral devices that can read 3480 or 3490 cartridge tapes that are created on an EBCDIC system. These devices can read the data directly from a tape into an application on an ASCII machine. Alternatively, these devices can copy data from a tape and store it on the ASCII machine's hard drive.

A more common method of moving and converting data is to use an FTP program to transfer the data. By default, most FTP programs convert EBCDIC data into ASCII when transferring data. If the source data contains only character data (including

digits that are encoded as characters), this is the recommended method. During the conversion process, the FTP program creates the appropriate end-of-record indicators for the ASCII system. After conversion, you can use an INFILE statement to access the newly created file on the ASCII system. Use an INPUT statement to specify the correct informat values to use when reading the data in the file.

**Note:** Even when all of the EBCDIC source data is encoded as character data, there might be some characters that are not interpreted correctly during conversion. The correct interpretation of these characters depends on the encoding method that is used on the EBCDIC machine. As a best practice, verify that your data was converted correctly by viewing the data that SAS reads from a converted file.

When an EBCDIC file contains numeric data that is not encoded as character data, such as when a packed-decimal or zoned-decimal encoding method is used, the default FTP conversion does not work correctly. Some numeric data can resemble standard character data. In this case, FTP conversion incorrectly assigns ASCII characters to EBCDIC numeric data. For more information, see "Example of Incorrect Conversion of Packed-Decimal Numeric Data".

**Note:** There is no way to correctly convert packed-decimal encoded data from EBCDIC into ASCII. Other methods to convert the data must be used if a packed-decimal, zoned-decimal, or other numeric encoding method is used on the EBCDIC system. For more information, see "Convert EBCDIC Files with Variable-Length Records" on page 929.

In some instances, a byte of EBCDIC data might be interpreted in ASCII as an end-of-line flag or end-of-file flag. If SAS is reading a file with variable-length records when one of these hexadecimal values is encountered, then you might observe unintended results. Depending on the expected data values based on specified informats, you might observe anything from invalid data errors to unexpected termination of the DATA step.

# Example of Incorrect Conversion of Packed-Decimal Numeric Data

This example demonstrates the problems that can result when you convert packed-decimal numeric data as if it were encoded as character data. Suppose an EBCDIC data file contains the numeric value 505, stored as a packed-decimal value ('505C'x). If you looked at the file with an EBCDIC file browser or editor, you would see the characters '&*'. This is because '50'x corresponds to '&' and '5C'x corresponds to '*'. The FTP program interprets the '&' character and converts it to the ASCII value '26'x. The FTP program converts the '*' character to the ASCII value '2A'x, and the resulting converted value is '262A'x. The correct packed-decimal value in ASCII should be '000505'x. Because the input data does not conform to the expected packed-decimal informat, SAS prints an error to the log that states that the data is invalid. Each time invalid data is encountered, SAS writes an error

to the log, and prints the contents of the input buffer and the corresponding DATA step variables.

***Table A14.1*** *Incorrect Conversion of Packed-Decimal Numeric Data*

| Step | Action | Value |
|---|---|---|
| 1 | FTP program reads the EBCDIC packed-decimal numeric value '505'. | '505C'x |
| 2 | FTP program interprets the value as standard EBCDIC characters. | &* |
| 3 | FTP program converts to standard ASCII hexadecimal characters. | '262A'x |
| 4 | SAS flags the data as invalid because packed-decimal numeric data is expected (based on the specified informat value). | ??? |

# Convert EBCDIC Files with Fixed-Length Records

## FTP the File in Binary

When you convert an EBCDIC file with fixed-length records, use FTP to transfer the file in binary. Then, with a FILENAME or INFILE statement, specify RECFM=F, and assign the same value to LRECL that the file has in the EBCDIC system. Use the formatted input style with the following informats:

- $EBCDIC*w*. for character input data
- S370F*xxxw.d* for numeric input data

> **Note:** There are many S370F*xxxw.d* informats. Select those informats that match the type of data that you have. For more information, see *SAS Formats and Informats: Reference* for SAS 9.3 and higher.

Because you are transferring the source file in binary, there is no processing to add end-of-record indicators. For this reason, you must specify the exact number of bytes that are specified for the source file in the EBCDIC system. If there are bytes

in the source file that would be interpreted as end-of-record indicators or end-of-file indicators in an ASCII context, SAS treats those bytes simply as data.

### Example: Convert an EBCDIC File with Fixed-Length Records into an ASCII File

The following code reads a file, fixed.txt, that was previously transferred via FTP in binary from an EBCDIC system to an ASCII system. The source file has fixed-length records that are 60 bytes long. Based on the informat in this example, the last three bytes in each record contain numeric data that was stored using the packed-decimal encoding method.

```
filename test1 'c:\fixed.txt' recfm=f lrecl=60;
data one;
infile test1;
input @1  name  $ebcdic20.
      @21 addr  $ebcdic20.
      @41 city  $ebcdic15.
      @56 state $ebcdic2.
      @58 zip   $s370fpd3.;
run;
```

## Convert EBCDIC Files with Variable-Length Records

### Overview of Converting EBCDIC Files with Variable-Length Records

When you convert an EBCDIC file with variable-length records, you can use an FTP program. The FTP program removes BDWs and RDWs and adds end-of-record indicators that are expected by the ASCII system. The data in the file is converted from EBCDIC to ASCII. If all of the data in the EBCDIC file is encoded as characters, then this process typically works correctly.

**Note:** Even when all of the EBCDIC source data is encoded as character data, there might be some characters that are not interpreted correctly during conversion. The correct interpretation of these characters depends on the encoding method that is used on the EBCDIC machine. As a best practice, verify that your data was converted correctly by viewing the data that SAS reads from a converted file.

When an EBCDIC file contains numeric data that is not encoded as character data, such as when a packed-decimal or zoned-decimal encoding method is used, the default FTP conversion does not work correctly. For more information, see

"Overview of Accessing EBCDIC Data on ASCII Systems" on page 926. To prevent misinterpretation of data during conversion, transfer the file in binary via FTP without converting the data to an ASCII encoding. When the data is transferred in binary and is not converted, be aware that the BDW and RDW information is removed automatically. This removes information that SAS needs to read the data successfully.

## Read Files Directly from the EBCDIC System

If you have direct access between the ASCII machine and the EBCDIC machine, then the best practice is to read the file directly. Direct access is enabled via a peripheral device on the ASCII machine that can read an EBCDIC tape. You can access the file via the FTP access method in a FILENAME statement. There are several advantages to this method of accessing EBCDIC data:

- file preprocessing is not required
- copying the source file is not required
- FTP access method works for fixed-length and variable-length records
- DATA step processing works as expected

The main disadvantage is that this method requires more time for processing because you are accessing the data remotely.

This method of accessing EBCDIC data applies if you have a 3480 or 3490 cartridge tape reader attached to your ASCII machine. In this case, you do not need to preprocess the file on an EBCDIC machine. You can read it directly from the tape by setting RECFM=S370VB and using the $EBCDIC*w*. and S370F*xxxw.d* informats.

In a FILENAME statement, specify the FTP access method and the source filename, and provide values for the HOST=, USER=, and PASS= options. The HOST= option specifies the name of the EBCDIC machine, USER= specifies the user account that you use to log on, and PASS= specifies the password that you use to log on. The FTP access method uses an FTP program on the ASCII machine to open a connection between the ASCII machine and the EBCDIC machine. The SAS system connects to and logs on to the mainframe machine with the specified user account and password. The FTP program transfers the file.

**Note:** If you specify the PASS= option, the password is saved as text in your SAS program. The password is not visible in the SAS log. As an alternative to the PASS= option, you can specify the PROMPT option and provide a password at the prompt when you execute the SAS program.

For EBCDIC files with variable-length records, you must also specify the S370V and RCMD= options. The S370V option indicates that the records in the source file have variable lengths. For the RCMD= option, specify RCMD="SITE RDW" to indicate that the FTP process should keep the RDW information during the file transfer.

If you experience connection problems to the EBCDIC machine, you can add the DEBUG option to see the informational messages that are sent to and from the FTP server.

## Example: Read an EBCDIC Source File Directly with the FTP Access Method

This example shows how to read an EBCDIC file with variable-length records directly from an EBCDIC machine using the FTP access method. The user is prompted for her MVS logon password. The ZIP code is entered as a 5-digit EBCDIC number, represented by one digit per byte. The comments section is varying in length up to 200 characters. After the data is read, it is printed to verify the contents of the data set.

```
filename test1 ftp "'SASEBCDIC.VB.TEST1'" host='MVS' user='SASEBCDIC'
PROMPT
          s370v rcmd='site rdw';
data one;
infile test1;
input @1  name     $ebcdic20.
      @21 addr     $ebcdic20.
      @41 city     $ebcdic10.
      @51 state    $ebcdic2.
      @54 zip      s370ff5.
      @60 comments :$ebcdic200.;
run;

proc print;
run;
```

## Reformat an EBCDIC File with Variable-Length Records with IEBGENER

Suppose that you do not have direct access between the ASCII machine and the EBCDIC machine. That is, you do not have a peripheral device that reads EBCDIC data on the ASCII machine. In this situation, you can convert the data by reformatting the file on the mainframe machine. By changing the format of the file, you prevent the FTP program from removing the RDW information that SAS requires to read the data correctly. After you reformat the file, you can transfer the file in binary to the ASCII machine.

To reformat the source file, use the IEBGENER program on the EBCDIC machine. Use this program to make an exact copy of the file with altered header information. Specifically, use IEBGENER to change the RECFM value from V (variable-length records in blocks) to U (undefined record length and unblocked). After making this change, the FTP program no longer removes the RDW information during the file transfer.

When you run the IEBGENER program, in addition to the required arguments, specify the following overrides:

```
SYSUT1 DCB=(RECFM=U,BLKSIZE=32760)
SYSUT2 DCB=(RECFM=U,BLKSIZE=32760) DISP=(NEW,CATLG)
```

**Note:** Do not use the original values of RECFM and BLKSIZE for SYSUT1.

Transfer the new version of the file in binary using an FTP program on the ASCII machine. In SAS, use a FILENAME or INFILE statement to read the transferred file. Set the options appropriately.

- Set the RECFM= option to S370V if the record format for the original file was variable (RECFM=V). Set the RECFM= option to S370VB if the record format for the original file was variable and blocked (RECFM=VB). By specifying the RECFM= option as S370V or S370VB, you tell SAS to process the RDW information for each record and enter the correct number of bytes for each record.
- Specify the same value for the LRECL= option that is in the original file. If you do not specify a value for the LRECL= option, SAS uses the default LRECL value (32767). Using the default value could cause SAS to truncate data records if they are longer than the default LRECL value.

Use the formatted input style with the informats that are described in "FTP the File in Binary" on page 928.

## Example: Read a File with Modified Header Data

This example reads a file that was generated from an EBCDIC file with a header that was modified to change the file format. The modified file was transferred to an ASCII machine for SAS processing. For more information, see "Reformat an EBCDIC File with Variable-Length Records with IEBGENER" on page 931.

The TRUNCOVER option is included in the INFILE statement because the Comment variable can be up to 60 characters (but it is likely shorter). Without the TRUNCOVER option, the INPUT statement could attempt to read past the end of the record. Data from the next record would continue to be assigned to the Comment variable until the variable was full. The LRECL= option is not specified because the default value is sufficient to handle the longest record in the file. After the data is read, it is printed to output for verification.

```
filename test1 'c:\vbtest.xfr' recfm=s370vb;
data one;
infile test1 truncover;
input @1  name    $ebcdic14.
      @15 addr    $ebcdic18.
      @33 zip     s370ff5.
      @38 comment $ebcdic60.;
run;

proc print;
run;
```

# Read EBCDIC Data from Structured COBOL Files

## About Structured COBOL Files

A structured COBOL file is generated using an OCCURS DEPENDING ON clause. This type of file has variable-length records. And, when the file is transferred via FTP in binary, there is no BDW or RDW information. Each record is divided into three parts: a record header (a fixed-length portion of the record), an index variable, and one or more data segments. The documentation for the file provides the length of the record header, the index variable, and a data segment. The record header is the same length for each record. It contains information that pertains to all of the data segments that follow. The index variable provides the number of data segments for the current record. The remainder of the record contains the data segments.

Because of the structure of the records, SAS is able to read the data in these files. The length of a record is the sum of the header length, the index length, and the product of the index value and the size of each data segment. For each data segment, SAS reads the segment, and then writes a copy of the header and the current data segment to a new observation in a SAS data set.

When you read a structured COBOL file, specify RECFM=N in your FILENAME statement. This tells SAS that you are reading a stream of data that does not conform to a typical file structure. Any restrictions to record length are ignored when SAS reads a data stream because SAS does not attempt to buffer the input. SAS writes a statement to the SAS log to notify you that SAS reads a data stream as unbuffered when RECFM=N.

SAS reads an entire structured COBOL file as a single, long record. Therefore, if you need to skip some data or move past a space, you must use relative column pointers in your INPUT statement. Line holders are ignored because the contents of the file are treated as a single input record. The @*column* pointers do not work for these files.

**CAUTION**

**Do not use @*column* pointers when you specify RECFM=N.** Using @*column* pointers initiates an infinite loop in which SAS reads and writes the same data repeatedly until you halt the program or until no more disk space is available.

## Example: Read Data from a Structured COBOL File

In this example, an EBCDIC file was transferred via FTP in binary without first processing the file using IEBGENER. The record header (fixed-length) portion of each record is 59 bytes in length and contains a combination of character and

numeric data. The index variable is two bytes. There is another space (one byte) to separate the index variable from the remainder of the record. The data segment portion of the record consists of one or more repeats of 13 bytes in length. Each repeat contains a combination of character and numeric data.

```
filename test1 'c:\VB.TEST' recfm=n;

data one;
infile test1;
input name $ebcdic20. addr $ebcdic20. city $ebcdic10. st $ebcdic2. +1
      zip s370ff5. +1 idx s370ff2. +1;
do i = 1 to idx;
   input cars $ebcdic10. +1 years s370ff2. ;
   output;
   if i lt idx then input +1 ;
end;
run;
```

# Moving Data from ASCII to EBCDIC Systems

## Overview

There are several ways to transcode ASCII data to EBCDIC:

- Use FTP to write files (data) directly.
- Use the `dd` command.
- Use the `iconv` command.

## Using FTP to Write Files Directly

### Overview of Using FTP to Write Files Directly

FTP automatically performs the conversion when the type of file is specified as text (instead of binary). When you have direct access between the ASCII machine and EBCDIC machine, the best practice is to read the file directly. Direct access is enabled via a peripheral device on the ASCII machine that can read an EBCDIC tape. You can access the file via the FTP access method in a FILENAME statement. There are several advantages to this method of accessing EBCDIC data:

- No file preprocessing is required.
- You do not need to copy the source file.
- The FTP access method works for fixed-length and variable-length records.
- DATA step processing works as expected.

This method of accessing EBCDIC data applies if you have a 3480 or 3490 cartridge tape reader attached to your ASCII machine. In this case, you do not need to preprocess the file on an EBCDIC machine. You can read it directly from the tape by setting RECFM=S370VB and using the $EBCDICw. and S370Fxxxw.d informats.

In a FILENAME statement, specify the FTP access method and the source filename, and provide values for the HOST=, USER=, and PASS= options. The HOST= option specifies the name of the EBCDIC machine, USER= specifies the user account that you use to log on, and PASS= specifies the password that you use to log on. The FTP access method uses an FTP program on the ASCII machine to open a connection between the ASCII machine and the EBCDIC machine. The SAS system connects to and logs on to the mainframe machine with the specified user account and password. The FTP program transfers the file.

### Example: Reading an ASCII File from SAS on z/OS

```
1 filename unixin '/net/bin/u/<user>/sample.txt' encoding=latin1;
2 data _null_;
3       infile unixin;
4       input;
5       put _infile_;
6
run;

NOTE: The infile UNIXIN is:
      File Name=/net/bin/u/<user>/sample.txt,
      Access Permission=-rwxr-xr-x,Number of Links=1,
      Owner Name=<user>,Group Name=R@D,File Size=45,
      Last Modified=Jan 19  2000

This is a test.
Another line.
End of file.
```

## Using the dd Command to Convert and Copy a File

### About the dd Command

The `dd` command reads the InFile parameter or standard input, performs the specified conversion, and then copies the converted data to the OutFile parameter

or standard output. The input block size and output block size can be specified to take advantage of raw physical I/O.

Use the cbs parameter value if you are specifying the `block`, `unblock`, `ascii`, `ebcdic`, or `ibm` conversion value. If an `unblock` or `ascii` value is specified, then the `dd` command performs a fixed-length to varying-length conversion. Otherwise, it performs a varying-length to fixed-length conversion. The cbs parameter value determines the fixed length.

**CAUTION**
**If the specified cbs parameter value is smaller than the smallest input block, the converted block is truncated.**

After it finishes, the `dd` command reports the number of whole and partial input and output blocks. For more information about the `dd` command, see the `dd` manual page on your system.

## dd Command Exit Status

The `dd` command returns the following exit values:

***Table A14.2*** *Exit Status Values for the dd Command*

| Item | Description |
|---|---|
| 0 | The input file was copied successfully. |
| >0 | An error occurred. |

## Examples: dd Command Conversion

Here are two simple examples:

- To convert an ASCII text file to EBCDIC, enter the following:

  ```
  dd if=text.ascii of=text.ebcdic conv=ebcdic
  ```

  This command converts the text.ascii file to EBCDIC representation and stores the EBCDIC version in the text.ebcdic file.

  When you specify the conv=ebcdic parameter, the `dd` command converts the ASCII ^ (circumflex) character to an unused EBCDIC character (9A hexadecimal) and the ASCII ~ (tilde) character to the EBCDIC ^ character (NOT symbol).

- To use the `dd` command as a filter, enter the following:

  ```
  ls -l | dd  conv=ucase
  ```

This command displays a long listing of the current directory in uppercase.

The performance of the `dd` command and `cpio` command in the IBM 9348 Magnetic Tape Unit Model 12 can be improved by changing the default block size. To change the block size, use the `chdev` command as follows:

```
chdev -l Device_name -a block_size=32k
```

# Using the iconv Command to Convert a Text File

## About the iconv Command

Use the `iconv` command to convert the encoding of a text file. Use one the following examples of syntax:

```
iconv -f FromCode -t ToCode FileName
```

```
iconv -l
```

For more information about the syntax and parameters for the `iconv` command, see the `iconv` manual page on your system.

## iconv Command Exit Status

The `iconv` command returns the following exit values:

***Table A14.3*** *Exit Status Values for the iconv Command*

| Item | Description |
|---|---|
| 0 | Input data was successfully converted. |
| 1 | The specified conversions are not supported, the input file cannot be opened or read, or there is a usage-syntax error. |
| 2 | An unusable character was encountered in the input stream. |

## Examples: iconv Command Conversion

Here are two simple examples:

- To convert the contents of the mail.x400 file from code set IBM-850 and store the results in the mail.local folder, enter the following:

```
iconv -f IBM-850 -t ISO8859-1 mail.x400 > mail.local
```

- To convert the contents of a local file to the mail interchange format and send mail, enter the following:

```
iconv -f IBM-943 -t fold7 mail.local > mail.fxrojas
```

# Appendix 3

# Encoding for z/OS Resource Names



## Overview of Encoding for z/OS Resource Names

Beginning with SAS 9.3, z/OS resource names such as z/OS data set names, UNIX File System (UFS) paths, and so on, are processed without being converted to a different encoding. This appendix describes z/OS resource names and the contexts in which they might be specified or displayed by SAS.

Each encoding can associate the same code point with a different character. Some encodings might not associate a code point with any character, even though other encodings associate that code point with a character. For more information about encoding, see the *SAS National Language Support (NLS): Reference Guide*.

## z/OS Resource Names and Encoding

The SAS language and various SAS user interfaces enable the user to specify the names associated with operating system (OS) resources such as z/OS data set

names and UFS paths. SAS also displays OS resource names as part of SAS output, in messages to the SAS log, in various windows of the SAS windowing environment, and so on.

The z/OS resource names are maintained by z/OS as a sequence of binary code points, rather than as characters. In other words, on z/OS, the application programming interfaces do not associate a character encoding with z/OS resource names. The same is true for the user interfaces associated with z/OS components such as JES (JCL), ISPF, the UNIX System Services (USS) shell, and so on. When a z/OS resource name is created, the encoding used to specify the name is not stored or saved with the name itself. The following z/OS data set name illustrates how some code points are associated with different characters by different EBCDIC code pages:

```
PROD.ACCT#104.RAWDATA 1
PROD.ACCTÄ104.RAWDATA 2
DDDC4CCCE7FFF4DCECCEC 3
7964B1333B104B9164131 4
```

1 the data set name as it is represented in EBCDIC 1047

2 the data set name as it is represented in EBCDIC 1143

3 the first hexadecimal character of the code points for the data set name

4 the second hexadecimal character of the code points for the data set name

The 10th code point in the data set name is `X'7B'`. This code point corresponds to the # character in the U. S. English code page (EBCDIC 1047). However, the code page associated with the Finnish code page (EBCDIC 1143) maps the character Ä to the code point `X'7B'`. Therefore, the sequence of characters required to identify this OS resource is different for the EBCDIC 1047 and EBCDIC 1143 encodings.

The difference in the sequence of characters is illustrated in the following example, which reads the external file residing in the z/OS data set. A portion of the SAS log is shown for functionally equivalent programs that were run with SAS 9.3 in the EBCDIC 1047 and EBCDIC 1143 encodings.

The following SAS log excerpt shows the EBCDIC 1047 encoding:

```
5    proc options option=encoding; run;

ENCODING=OPEN_ED-1047
   Specifies default encoding for internal processing of data

6    filename rawdata 'prod.acct#104.rawdata'; 1
7    data acct;
8       account = 104;
9       infile rawdata;
10      attrib transdate format=date9. informat=date9.;
11      input transdate category $ amount; 2
12   run;

NOTE: The infile RAWDATA is:
      Dsname=PROD.ACCT#104.RAWDATA, 3
      Unit=3390,Volume=SDS012,Disp=SHR,Blksize=27920,
      Lrecl=80,Recfm=FB,Creation=2011/06/09
```

1 The highlighted character # in the data set name is associated with the code point X'7B' in the OPEN_ED-1047 encoding.

2 The highlighted character $ in the INPUT statement is part of SAS syntax. Syntactical meaning is based on the character instead of the code point.

3 The highlighted character # in the data set name is associated with the code point X'7B' in the OPEN_ED-1047 encoding.

The following SAS log excerpt shows the EBCDIC 1143 encoding:

```
5    proc options option=encoding; run;

ENCODING=OPEN_ED-1143
   Specifies default encoding for internal processing of data

6    filename rawdata 'prod.acctÄ104.rawdata'; 1
7    data acct;
8       account = 104;
9       infile rawdata;
10      attrib transdate format=date9. informat=date9.;
11      input transdate category $ amount; 2
12   run;

NOTE: The infile RAWDATA is:
      Dsname=PROD.ACCTÄ104.RAWDATA, 3
      Unit=3390,Volume=SDS012,Disp=SHR,Blksize=27920,
      Lrecl=80,Recfm=FB,Creation=2011/06/09
```

1 The highlighted character Ä in the data set name is associated with the code point X'7B' in the OPEN_ED-1143 encoding.

2 The highlighted character $ in the INPUT statement is part of SAS syntax. Syntactical meaning is based on the character instead of the code point.

3 The highlighted character Ä in the data set name is associated with the code point X'7B' in the OPEN_ED-1143 encoding.

In the preceding log excerpts, the same code point, X'7B', is specified in the SAS program for the 10th character of the z/OS data set name. In addition, the same code point, X'7B', is used by SAS in the NOTE message to represent the name of the data set that was read. However, different characters are displayed for this code point in the two log excerpts because the terminal emulation for the first log excerpt used a different encoding than the second log excerpt.

Note that SAS processes z/OS resource names differently than it does SAS syntax. When the NONLSCOMPATMODE option is in effect, SAS syntax is interpreted according to the value of the ENCODING option. NONLSCOMPATMODE allows the same character to be specified in SAS syntax regardless of the SAS session encoding that is in effect. For example, in the first log excerpt, the $ syntax character in the INPUT statement is encoded as X'5B' because it is in EBCDIC 1047. In the second log excerpt, the $ syntax character is encoded as X'67' because it is in EBCDIC 1143. However, both SAS sessions properly recognized these code points as corresponding to the same character, $, because the ENCODING option informed SAS how to interpret the code points. In NONLSCOMPATMODE, syntactical meaning is associated with the character, not a particular code point. NONLSCOMPATMODE is the default value of the NLSCOMPATMODE system option.

In contrast, because z/OS resource names have no inherent encoding, it is the string of code points that identifies the resource to the system, not the associated characters. The associated characters might vary depending on the encoding in which the SAS program is prepared.

# Reverting to SAS 9.2 Behavior

Prior to SAS 9.3, if the NONLSCOMPATMODE option was in effect, SAS, in most cases, transcoded z/OS resource names from SAS session encoding to EBCDIC 1047 before supplying those names to the operating system. Conversely, when displaying the names of z/OS resources, SAS treated the names as if they were encoded in EBCDIC 1047. Therefore, SAS transcoded the names to SAS session encoding in SAS messages and other SAS output. This approach had two drawbacks:

- This behavior was at variance with all z/OS program products and utilities that were supplied by IBM, none of which performed transcoding in this manner.
- UFS paths were limited to the character set that could be represented in EBCDIC 1047.

For the purposes of compatibility, it is possible to preserve the SAS 9.2 behavior described by specifying the following TKMVSENV option when executing SAS:

```
set TKOPT_ENV_ENCODING_PATH=open_ed-1047
```

**Note:** This option is relevant only if you are using a session encoding other than open_ed-1047.

# Appendix 4

# Starting SAS with SASRX

# Overview of SASRX

SASRX is a REXX exec that you can use to invoke SAS. It is provided as an alternative to the SAS CLIST. SASRX supports the same command-line syntax as the SAS CLIST. It also supports these additional features:

- mixed-case option values
- additional options
- option specifications written in a UNIX style
- direct specification of SAS system options
- UNIX file system (UFS) file and directory names as option values

At your installation, the SASRX exec might have been renamed or modified by your on-site SAS support personnel. Ask your support personnel for site-specific information about the SASRX exec.

# Option Syntax

## Overview of Option Syntax

You can specify options on the SASRX command line. As described in the next topic, there are two categories of options and two types of options, and there are two styles of option specification.

## Option Categories

SASRX supports two categories of options, SASRX options and SAS system options.

SASRX options
: SASRX options are defined internally to SASRX. SASRX options control what SASRX does in preparing to invoke SAS. The effect of these options occurs before SAS begins executing, such as through the allocation of data sets. For information about SASRX options, see the tables in "SASRX Options" on page 946.

SAS system options
All other options that SASRX does not recognize are assumed to be SAS system options. SASRX does not validate or act on options that it does not recognize; it only passes them to SAS. For information about SAS system options, see "System Options in the z/OS Environment" on page 689.

# Option Types

SASRX options and SAS system options are further classified as either switch options or value options. Switch options are specified by a keyword that is not followed by any value. Value options are specified as a keyword that is followed by a value.

# Option Specification Styles

SASRX supports two different styles of option specifications, CLIST style and UNIX style. For a CLIST style specification of a switch option, specify only the keyword. For a CLIST style specification of a value option, follow the keyword with optional blank spaces and a value in parentheses [for example, `linesize(72)`].

The distinguishing feature of an option specification written in a UNIX style is that the keyword is prefixed with a hyphen. For a specification of a switch option that is written in a UNIX style, specify the keyword prefixed with a hyphen. Use the following guidelines and examples to write specifications of value options in a UNIX style:

- The value follows after a blank space or an equal sign.

```
-linesize 72
-linesize=72
```

- For SASRX options, any value can be enclosed in parentheses, even if the parentheses are not required. For options that accept a list of values, the list is required to be enclosed in parentheses or quotation marks if it contains more than one value.

```
-input=( 'my.input.one' 'my.input.two' )
-input=" 'my.input.one' 'my.input.two' "
```

- For SAS system options, parentheses can be used only with options that require them for enclosing a list of values. Quotation marks cannot be used instead of parentheses.

## Additional Syntax Considerations

If you specify more than one option, separate the option specifications by one or more blank spaces. When using CLIST style specification, you can also separate option specifications with a comma instead of a blank space.

CLIST style and option specifications written in a UNIX style can be intermixed on the command line, with a special caution that is discussed in "Option Classification When UNIX Style and CLIST Style Are Mixed" on page 957. Because the two option specification styles can be intermixed, and because SAS system options are accepted, SASRX does not support the UNIX convention that an argument that does not begin with a hyphen is an input filename. You must specify **-input** explicitly to identify a SAS program input file, even if option specification written in a UNIX style is used exclusively.

SASRX option names can be truncated to the minimum unique abbreviation. For example, `o` is the minimum abbreviation for the OPTIONS option because no other SASRX option begins with the letter "O." **SASU** is the minimum unique abbreviation for the SASUSER option because other options begin with the letters "SAS." As a general rule, SAS system options cannot be abbreviated.

# SASRX Options

## SASRX Data Set Options

The SASRX options in the following table specify either z/OS data sets or UFS files or directories that are to be allocated for SAS. For each option, the name of a z/OS data set is a valid value.

- Options with `file` in the UFS column accept either a z/OS data set name or a UFS filename as a value.
- Options with `dir` in the UFS column accept either a z/OS data set name or a UFS directory name as a value, as in **-work /tmp**.
- A value is recognized as a UFS file or directory name only if it includes at least one slash (/).
- Options pertaining to input files accept multiple data sets to be concatenated.
- Options pertaining to output files accept a size specification as an alternative to a data set name. For example, the default value for the WORK option is **'200,200'**. This means that a temporary WORK data set is allocated with the ALLOCATE option value of **SPACE(200,200)**.

**Note:**

- The MVS: and HFS: device type prefixes are supported for these options.
- Options that are marked “Set by installation procedure” in the following tables should not be changed.

***Table A16.1*** *SASRX Data Set Options*

| Option Name | Default Value | Description | UFS |
|---|---|---|---|
| AUTOEXEC | | Name of the AUTOEXEC file. | file |
| CLOG | * | Specifications for the SAS console log file. If the value is numeric, it specifies the value for the SPACE operand for the allocation of the file. Space units are as specified by the UNITS option. If the value is a single letter, it specifies the SYSOUT class for the file. If SASRX is running in the background and the CLOG value is *, then the file is allocated to DUMMY. In all other cases, the value specifies the data set name or UFS filename for the file. | |
| CONFIG | | Name of the user configuration file to concatenate with system configuration files. | |
| GDEVICE*n* | | Name of the device catalog library; *n* can be any number from 0 to 9. | |
| IMSLOG | | Name of the IMS LOG file that is to be allocated to ddname IEFRDER. Used only with SAS/ACCESS Interface to IMS-DL/I. | |
| INPUT | | Name of the primary input file. | file |
| LOG | * | Specifications for the SAS log file. If the value is numeric, it specifies the value for the SPACE operand for the allocation of the file. Space units are as specified by the UNITS option. If the value is a single letter, it specifies the SYSOUT class for the file. If SASRX is running in the background and the LOG value is *, then the file is allocated to DUMMY. In all other cases, the value specifies the data set name or UFS filename for the file. | file |
| MAUTS | Set by installation procedure | Name of the system macro autocall library. | |

| Option Name | Default Value | Description | UFS |
|---|---|---|---|
| MTKMVS | Set by installation procedure | Name of the system TKMVSENV file. | file |
| PRINT | * | Specifications for the SAS procedure output file. If the value is numeric, it specifies the value for the SPACE operand for the allocation of the PRINT output file. If the value is a single letter, it specifies the SYSOUT class for the PRINT output. If SASRX is running in the background and the PRINT value is *, then the PRINT output file is allocated to DUMMY. In all other cases, the value specifies the data set name or UFS filename for the PRINT output file. | file |
| SAMPSIO | Set by installation procedure | Name of the SAS sample library. | |
| SASAUTOS | | Name of the user macro autocall library to concatenate with the system macro autocall library. | |
| SASHELP | Set by installation procedure | Name of the Sashelp library. | |
| SASMSG | Set by installation procedure | Name of the SAS message library. | |
| SASUSER | &syspref.SAS9.SASUSER | Name of the Sasuser library. The name can contain symbolic strings for which values are substituted. The string **`&syspref`** is replaced with the current prefix. If the current prefix is null, then it is replaced with the user ID. The string **`&sysuid`** is replaced with the user ID. The string **`&sysprefuid`** is replaced with the user ID if the current prefix and the user ID are the same, or the current prefix is null. Otherwise, **`&sysprefuid`** is replaced with the current prefix and user ID, separated by a period. | dir |
| SYSIN | | SYSIN is an alias for the INPUT option. | |
| SYSTEMCONFIG | Set by installation procedure | Name of the system configuration file. | file |
| SYSTCPD | | Name of the SYSTCPD file. | |
| TKMVSENV | | Name of the user TKMVSENV file to concatenate with the system TKMVSENV file | |

| Option Name | Default Value | Description | UFS |
|---|---|---|---|
| WORK | '200,200' | Size of the temporary Work library data set that is to be created. The size value is specified as an initial quantity and an increment quantity that are separated by a comma. This value can also be enclosed in single quotation marks. The size value can be prefixed with CYL, TRACKS, BLOCKS, or a block size value to indicate the unit of space to be used for the initial and increment quantities.<br><br>The WORK value can also be the name of an existing data set or the name of a UFS directory, instead of a size specification.<br><br>For specific details about the WORK option, see "How the WORK Option Controls the Size of the WORK Data Set". | dir |

# How the WORK Option Controls the Size of the WORK Data Set

The WORK library data set is allocated by a TSO ALLOCATE command before SAS starts. The SASRX WORK option value usually specifies values that are to be used in certain operands of an ALLOCATE command that creates a temporary WORK data set. The following discussion describes how to specify these size values. Alternatively, the WORK option can specify the name of an existing permanent data set or UFS directory that is to be allocated as WORK. For more information about the TSO ALLOCATE command, see the *TSO/E Command Reference* from IBM.

When the WORK option is used to specify the size of a temporary data set, its value has one of the following forms:

CYL, '*n1*, *n2*'
: specifies the size value as a number of cylinders. For example, `-work cyl,'5,5'` yields an ALLOCATE command with `CYL SPACE(5,5)` operands.

TRACKS, '*n1*, *n2*'
: specifies the size value as a number of tracks. For example, `-work tracks,75,75` yields an ALLOCATE command with `TRACKS SPACE(75,75)` operands.

BLOCKS, '*n1*, *n2*'
: specifies the size value as a number of blocks of length 8K. BLOCKS is the default if nothing is specified before the numbers. For example, `-work blocks,400,400` or `-work 400,400` yields an ALLOCATE command with a `SPACE(400,400)` operand.

*n*, '*n1*, *n2*'
specifies that the size value is the number of blocks of length *n*. For example, `-work 27648,'150,150'` yields an ALLOCATE command with `BLOCK(27648) BLKSIZE(0) SPACE(150,150)` operands. Note that the specified block size is used only for size computation. The allocation actually uses BLKSIZE(0).

In all cases, the block size is determined by SAS according to the value of the BLKSIZE or BLKSIZE(device-type) system option. For more information, see "Controlling Library Block Size" on page 56.

If the size value is specified in units of blocks, then the ALLOCATE command uses the ROUND operand, which rounds the library size up to an amount that corresponds to a whole number of cylinders. Therefore, the actual library size might be larger than the specified number of blocks implies.

There are some constraints on block size. Regardless of how the block size is specified, SAS might adjust it slightly to a valid value. If SAS changes the block size, it might slightly change the effective size of the library. For more information about these issues, see "Direct Access Bound Libraries" on page 51.

For suggestions about how to determine the amount of space required for the Work library, see "Work Library and Other Utility Files" on page 26.

# Miscellaneous SASRX Value Options

***Table A16.2*** *Miscellaneous SASRX Value Options*

| Option Name | Default Value | Description |
|---|---|---|
| DBMSCONCAT | LAST | Specifies the DBMSLIB concatenation order; the value can be FIRST or LAST. |
| ENTRY | Set by installation procedure | Specifies the SAS entry point name: SAS, SASB, or SASLPA. |
| INITTSO | | A single TSO command to be executed just before SAS starts (and just after the TSOCOMMANDS, if any, are executed). The command must be enclosed within quotation marks or parentheses. Unlike other options, INITTSO is cumulative. You can specify it multiple times with different commands, and each command is executed. |
| OPTIONS | | Specifies one or more SAS system options. If more than one option is specified, the list must be enclosed in parentheses or |

| Option Name | Default Value | Description |
|---|---|---|
| | | quotation marks. This option is provided for compatibility with the SAS CLIST. SAS system options can be specified on their own with SASRX. |
| PARMCARD | 1 | Specifies the PARMCARD file size |
| PRINTBLOCKSIZE | 264 | Specifies the blocksize for the SAS procedure output file (PRINT file). |
| PRINTLRECL | 260 | Specifies the LRECL for the SAS procedure output file (PRINT file). |
| SORTLINK | * | Specifies whether to put the system sort library in TASKLIB. An asterisk (*) indicates No. A null value ("") indicates Yes. |
| TERMTSO | | A single TSO command to be executed just after SAS terminates. The command must be enclosed within quotation marks or parentheses. Unlike other options, TERMTSO is cumulative. You can specify it multiple times with different commands, and each command is executed. |
| TSOCOMMANDS | | A list of one or more TSO commands (for example, ALLOCATE commands) that are to be executed just before SAS starts. The list of commands must be enclosed in quotation marks or parentheses, and the commands must be separated by semicolons.<br>**Note:** This option is now deprecated. Use the INITTSO option instead. |
| UNITS | CYL | Specifies the allocation unit for LOG, CLOG, PRINT, and PARMCARD. |
| USEREXIT | | The name of a REXX user exit. For more information, see "User Exit" on page 962. |
| WORKDEV | SYSDA | Specifies the value of the UNIT operand for the allocation of WORK. |
| WORKDEVCOUNT | 1 | Specifies the value of the UCOUNT operand for the allocation of WORK. |

# SASRX Load Module Library Options

The following SASRX options specify load module libraries that are to be concatenated in the TASKLIB. Each option accepts one or more library names.

***Table A16.3*** *SASRX Load Module Library Options*

| Option Name | Default Value | Description |
|---|---|---|
| DBMSLIBS | | Name of the database load library to concatenate with SASLOAD. |
| LOAD | | Name of the user or test fix load library to concatenate with SASLOAD. |
| SASLOAD | Set by installation procedure | Name of the SAS load library. |
| SORTLDSN | SYS1.SORT.LINKLIB | Name of the system sort library. This option is concatenated with SASLOAD only if SORTLINK has a null value. |

# SASRX Configuration File Options

SASRX configuration files contain option specifications. Each option specification must be in the same format that is valid for the SASRX command line, and the specifications can be on separate lines in the configuration files.

The configuration files can be either UFS files or MVS data sets. If the files are MVS data sets with fixed length 80-byte records, sequence numbers are ignored if they are present in columns 73–80. Otherwise, you can use all of the character positions. The files can include comments that begin with a slash followed by an asterisk (/*) and end with an asterisk followed by a slash (*/).

When SASRX configuration file options are specified on the SASRX command line, they follow the option priority rules for all command line options as described in "Option Priority" on page 961. If the same SASRX configuration file option is specified more than once, only the last specification is accepted, even if different configuration files are named.

SASRX configuration files can be nested by specifying a SASRX configuration file option within a SASRX configuration file. SASRX configuration file option specifications that are nested are handled differently from those that are entered on the command line. For each configuration file option specification, the contents

of the named configuration file are logically inserted in place of the option and parsed in sequence before the rest of the configuration file is parsed (if the specified file has not been parsed previously). Therefore, each unique nested occurrence of a SASRX configuration file option is fully accepted.

Option specifications in SASRX configuration files can contain symbolic references that are resolved from values that are specified with the SASRXSYSCFGPARMS or SASRXCFGPARMS options. These options are set by the installation procedure. For example, instead of hardcoding the names of the SASLOAD data sets, you can use a symbolic reference to code them as follows:

```
-SASLOAD('&hlq..LIBRARY'
         '&hlq..LIBE')
```

`&hlq.` is resolved from the following option:

```
-sasrxsyscfgparms(-hlq <your high-level qualifier>)
```

This specification reduces the number of configuration changes that you need to make if you change your high-level qualifier.

Symbolic references in SASRX configuration files can also be resolved from the value of a SASRX option that you previously specified. For example, to concatenate a system TKMVSENV file that is site–specific without modifying the shipped configuration, you could leave unchanged the shipped `–MTKMVS` value of the following statement:

```
-MTKMVS  '&hlq..TKMVSENV(TKMVSENV)'
```

and add the following statement in the REXXSITE member:

```
-MTKMVS ( &mtkmvs  '&hlq..MVS.TEMVSENV(CUSTOM)' )
```

The `&mtkmvs` symbolic reference is resolved from the value of the MTKMVS option that you previously specified, so the option specification that is finally resolved is the following:

```
-MTKMVS ('<high-level qualifier>.TKMVSENV(TKMVSENV)'
 '<high-level qualifier>.MVS.TKMVSENV(CUSTOM)' )
```

The following table shows the SASRX configuration file options:

***Table A16.4*** *SASRX Configuration File Options*

| Option Name | Default Value | Description |
|---|---|---|
| SASRXSYSCONFIG | Set by the installation procedure | List of the names of the SASRX system configuration files. |
| SASRXCONFIG | | Name or names of the SASRX user configuration file or files. |
| SASRXSYSCFGPARMS | Set by the installation procedure | Parameters for the SASRX configuration files. |

| Option Name | Default Value | Description |
|---|---|---|
| SASRXCFGPARMS | | Parameters for the SASRX configuration files. |

# SASRX Environment Variable Options

The SASRX environment variable options set the values of environment variables that are used internally by SAS.

The NETENCRALG option is a special case because SAS can use it as an environment variable and as a SAS system option. When NETENCRALG is specified as a SASRX option, both the NETENCRALG environment variable and the SAS system option are set.

The following list shows the SASRX environment variable options:

- INHERIT
- NETENCRALG
- SASCLIENTPORT
- SASDAEMONPORT

# SASRX Switch Options

The following table shows the SASRX switch options. SASRX switch options for which only one option name is listed are off by default. SASRX switch options for which two option names are listed are on by default. Specify the option name prefixed with “NO” to turn the option off. For example, the STAE option is on by default, but the NOSTAE option overrides the default.

The SASRX switch options NOSTAE, NOSTAI, and NOSTAX are for problem diagnosis and should be used only at the direction of SAS Technical Support.

***Table A16.5*** *SASRX Switch Options*

| Option Name | Description |
|---|---|
| FLUSH<br>NOFLUSH | Flush input stack if error. |
| GO | Continue previous SAS session. When GO is specified, SASRX sets the NOWORKINIT SAS system option and |

| Option Name | Description |
|---|---|
| | takes no action on either specified or default values for the WORK allocation. In other words, the WORK data set that was allocated in a previous SAS session remains allocated. |
| LOGGER<br>NOLOGGER | Use the UNIX **logger** command to write error messages and output of the TRACE option to the system console. This option is useful for problem diagnosis when you are running SAS under the UNIX **tso** command in a spawned process. LOGGER is the default when you are running under the UNIX **tso** command. Otherwise, NOLOGGER is the default. If LOGGER is on by default, the logged output of TRACE does not include the command line options because they might include passwords. Specify `-logger` explicitly if you need to log command line options. |
| NOSASUSER | Do not allocate SASUSER data set. |
| SHARE<br>NOSHARE | Share subpool 78. |
| STACK<br>NOSTACK | Create new input stack. |
| STAE<br>NOSTAE | Trap main task abends. |
| STAI<br>NOSTAI | Trap subtask abends. |
| STAX<br>NOSTAX | Trap attentions. |
| SYSMDUMP | Allocate SYSMDUMP. |
| TRACE | Trace TSO commands issued by SASRX. |
| WORKLARGE | Allocate the WORK library with DSNTYPE(LARGE). |

# Alternate Ddname SASRX Options

The following SASRX options enable you to use ddnames other than the default ddnames. Use of these options is discouraged, and they are available only for compatibility with the SAS CLIST.

***Table A16.6*** *Alternate Ddname SASRX Options*

| Option Name | Default Value | Description |
|---|---|---|
| DDAUTOEX | SASEXEC | AUTOEXEC=ddname |
| DDCONFIG | CONFIG | CONFIG=ddname |
| DDLOG | SASLOG | LOG=ddname |
| DDPARMCD | SASPARM | PARMCARDS=ddname |
| DDPRINT | SASLIST | PRINT=ddname |
| DDSASAUT | SASAUTOS | SASAUTOS=ddname |
| DDSASHLP | SASHELP | SASHELP=ddname |
| DDSASMSG | SASMSG | SASMSG=ddname |
| DDSASUSR | SASUSER | SASUSER=ddname |
| DDSYSIN | SYSIN | SYSIN=ddname |
| DDWORK | WORK | WORK=ddname |

# Examples of Option Types and Specification Styles

## Example of Recognizing a SAS Switch Option

The SAS system option DMS is not a SASRX option. When you specify the DMS system option, SASRX assumes that it is a SAS system option. The following two examples are functionally equivalent:

```
sasrx o(dms)
```

```
sasrx dms
```

In the first example, **o** is recognized as a SASRX value option (abbreviation of OPTION), and **dms** is its value. In the second example, **dms** is not recognized as a SASRX option and is therefore assumed to be a SAS system option.

## Example Comparison of UNIX Style and CLIST Style Option Specification

The following SASRX examples are functionally equivalent. The first two examples illustrate new functionality in SASRX, and the third example illustrates compatibility with the SAS CLIST.

**sasrx -linesize 72**
is a specification of the SAS system option LINESIZE with a value of **72** that is written in a UNIX style.

**sasrx linesize(72)**
is a CLIST style specification of the previous option.

**sasrx o(linesize=72)**
is a CLIST style specification of the SASRX option OPTION with a value of **linesize=72**.

The specification **sasrx -linesize(72)** is not valid because a specification of a SAS system option that is written in a UNIX style does not accept a value in parentheses.

# Option Classification When UNIX Style and CLIST Style Are Mixed

Mixing options specifications that are written in UNIX and CLIST styles can result in errors. Therefore, you should use one style or the other exclusively. If you do mix styles, you need to understand how SASRX classifies options.

SASRX parses the command line from left to right. For each option keyword that SASRX encounters, it first classifies the option as either a SASRX option or a SAS system option. SASRX then classifies the option as either a value option or a switch option. Because definitions of SAS system options are not built into SASRX, classifying whether a SAS system option is a switch option or a value option is based on the context. If the next part of the command line is syntactically valid as an option value, the option is classified as a value option. Otherwise, the option is classified as a switch option.

# Examples of Option Classification When UNIX Style and CLIST Style Are Mixed

The following examples illustrate how parsing a command line from left to right can lead to misclassification when a specification for a switch SAS system option that is written in UNIX style is followed by any CLIST style option specification.

**sasrx dms -memrpt**
is parsed correctly. **dms** is classified as a SAS system option because it is not a SASRX option. It is also classified as a switch option because it is followed by a keyword that is prefixed with a hyphen. The hyphen indicates the start of another option and not a value.

**sasrx -dms memrpt**
is not parsed correctly. Again, **dms** is classified as a SAS system option, but it is misclassified as a value option because **memrpt** appears to be its value, rather than another option. The command is parsed as **sasrx -dms=memrpt**.

**sasrx -nosasuser memrpt**
is parsed correctly because **nosasuser** is classified as a SASRX switch option rather than as a SAS system option. Therefore, SASRX uses its internal definition of this option to recognize it as a switch option, and it parses **memrpt** as a separate option and not as a value for **nosasuser**.

# Quoting Option Specifications

An option value must be enclosed within quotation marks if blank spaces or punctuation marks are contained within the value. For example, in the option specification **-sysparm="A B C"**, the option value **A B C** includes blank spaces, so it must be enclosed within quotation marks.

For SASRX options, a value that is a fully qualified data set name must be enclosed within single quotation marks. A data set name that is not enclosed in quotation marks is assumed to be unqualified. For SAS system options, quotation marks are optional for a single data set name, but they are required for data set names in a concatenated list.

For both SASRX options and SAS system options, quotation marks are optional for a single UFS filename. However, they are required for UFS filenames in a concatenated list, as in this example:

```
-autoexec=('~/tests/a1.sas' '~/tests/a2.sas')
```

When quotation marks are nested, each quotation mark at an inner level must either be doubled (for example, by replacing single quotation marks with two single quotation marks), or be replaced with a quotation mark of the opposite type (for

example, by replacing single quotation marks with double quotation marks). The following examples show both of these methods:

```
-options 'news=(''sas.news(news)'' ''.my.sas(news)'')'
-options 'news=("sas.news(news)" ". my.sas(news)")'
```

Any SASRX option value can be enclosed in quotation marks even if the quotation marks are not required. Some SAS system options do not accept values that are enclosed in quotation marks.

For option specifications written in a UNIX style, there are no requirements for quotation marks other than those described previously.

For CLIST style option specifications, to meet backward-compatibility requirements, SASRX requires the same rules for quotation marks as the SAS CLIST. The following rules for quotation marks apply in addition to the requirements described:

- CLIST style option specifications require that the single quotation marks that indicate a fully qualified data set name must be doubled.

  In the following example, to indicate that **prefix.my.sas** is fully qualified, it must be enclosed in single quotation marks (for example, **'prefix.my.sas'**). The quoting rule requires these quotation marks to be doubled (for example, **''prefix.my.sas''**). Because the option value contains quotation marks, the entire value must then be enclosed in single quotation marks:

  ```
  input('''prefix.my.sas''')
  ```

  The following example illustrates that the first two levels of quoting are for the fully qualified data set names, and that the third level of quoting is for the entire option value:

  ```
  input(' ''prefix.prog1.sas'' ''prefix.prog2.sas'' ')
  ```

  The following example is not valid because single quotation marks indicate an unqualified data set name in a CLIST style specification:

  ```
  input('prefix.my.sas')
  ```

- In a CLIST style specification of the OPTIONS option, quotation marks that are doubled because of nesting must be doubled a second time. The following example is correct:

  ```
  options('news=''''sas.news(news)'''' nodms')
  ```

  The following example is not correct:

  ```
  options('news=''sas.news(news)'' nodms')
  ```

# Additional Examples of Quoting

## Example 1

The following two option specifications that are written in a UNIX style:

```
sasrx -input 'prefix.my.sas'
sasrx -input=('prefix.my1.sas' 'prefix.my2.sas')
```

are equivalent to the following two CLIST style option specifications:

```
sasrx input('''prefix.my.sas''')
sasrx input('''prefix.my1.sas'' ''prefix.my2.sas''')
```

The following option specifications are equivalent, and illustrate that no quotation marks are required for a data set name that is not fully qualified:

```
sasrx -input my.sas
sasrx input(my.sas)
```

## Example 2

All of the following option specifications are equivalent. The first example illustrates that SAS system options do not require a data set name to be enclosed in quotation marks. The second example illustrates that SAS system options allow data set names to be enclosed in quotation marks. It also illustrates that alternating single and double quotation marks makes a nested quoted string more readable. The third example illustrates that when quotation marks of the same type are nested, the inner level of quotation marks must be doubled. The fourth example illustrates that internal single quotation marks must be doubled twice in a CLIST style specification of the OPTIONS option.

```
sasrx -options "news=sas.news(news) nodms"
sasrx -options "news='sas.news(news)' nodms"
sasrx -options 'news=''sas.news(news)'' nodms'
sasrx options('news=''''sas.news(news)'''' nodms')
```

## Example 3

All of the following option specifications are equivalent:

```
sasrx -sysparm "Don't use too many quotes"
sasrx -options (sysparm="Don't use too many quotes")
sasrx -options "sysparm='Don''t use too many quotes'"
sasrx o('sysparm="Don''''t use too many quotes"')
```

## Example 4

When you use the explicit mode of invoking the REXX exec, the entire parameter string must be enclosed in single quotation marks. Any internal single quotation marks must be doubled one more time than would be required otherwise.

```
exec rexx.exec(sasrx) '-autoexec ''prefix.my.sas(auto)'' -nodms' exec
exec rexx.exec(sasrx) 'o(''autoexec=''''''''prefix.my.sas(auto)''''''''
     nodms'')' exec
```

# Option Priority

The order in which options are passed to SAS is not necessarily the same as the order in which they are specified on the SASRX command line. When an option is specified more than once, the effective specification of the option is the last one that is passed to SAS. The options string that is passed to SAS contains, in the following order:

- option values generated by SASRX
- the list of directly specified SAS system options in the order in which they were specified
- the value of the OPTIONS option

Options specified in SASRX configuration files are ordered following the same rules. However, the entire set of options from SASRX configuration files has lower priority than any option from the command line. The entire set of options from the system SASRX configuration file has lower priority than the set of options from the user SASRX configuration file.

# Option Priority Example

The following SASRX command:

```
sasrx o(nodms) dms input(my.sas)
```

yields the following options parameter that is passed to SAS:

```
SYSIN=SYSIN DMS nodms
```

In the previous options parameter:

**SYSIN=SYSIN**
is generated internally from the INPUT option.

**DMS**
is a directly specified SAS system option.

**nodms**
is the value of the OPTIONS option.

In this example, the effective option is **nodms** instead of **dms**, even though **dms** is specified last in the SASRX command.

# Site Customizations

## Overview of Site Customizations

A site can customize the SASRX exec to meet local requirements. SASRX is designed so that it is possible to make most or all of your customizations in a system configuration file, and not in the REXX code. Default option values can be changed by specifying the preferred value in the configuration file. More extensive customization can be accomplished through a user exit, which is described in the next topic.

## User Exit

The main functions of a SASRX exec (such as REXXENW0) are to prepare the TSO environment and to construct and execute the SASCP command that runs SAS. You can use the -USEREXIT option to specify the name of an exec that the SASRX exec calls as a user exit instead of executing SASCP. The parameters that were constructed for the SASCP command are passed to the user exit. The user exit can then examine the parameters and modify option values, add or remove options, or recognize custom options. The user exit is responsible for executing the SASCP command with its revised parameters. If you want your user exit to be used by default for all TSO SAS invocations at your site, then the -USEREXIT option should be specified in the REXXSITE member of your site's `<hlq>.SASRXCFG` data set.

A sample user exit named SASRXXIT is provided as a starting point from which you can write your own user exit. SASRXXIT implements the following five options to demonstrate the capabilities of the user exit interface.

LINESIZE=
: illustrates how the user exit can intercept a SAS option value, and also how it can add an option to the SASCP command. If the LINESIZE= option has been specified, SASRXXIT passes the value unchanged on the SASCP command. If the option has not been specified, SASRXXIT determines the terminal width and adds a LINESIZE option to the SASCP command. The value is set equal to the terminal width. This functionality enables you to automatically adjust your line size to the terminal window that you are using.

NOEXECUTE
: illustrates how the user exit can implement its own option that it does not pass on to SAS. When NOEXECUTE is specified, the user exit does not actually execute the SASCP command. Instead, it only prints it to the terminal. This option is useful for debugging the user exit.

IMSALLOC
: illustrates how the user exit can implement its own option that it does not pass on to SAS. When the IMSALLOC option is specified, data sets that are required by IMS are allocated. To implement this option, replace the sample data set names in the user exit code with the correct names for your site. You can add additional options for selecting data set names if necessary.

CLISTDEMO
: runs a demonstration of a simple example that shows how the CLIST option works with REXX.

ENV=
: propagates the values of any ENV= options from the SASRX exec. These are variables that the user wants to retrieve via the SYSGET or GETEXEC functions. Because these functions can access only the current generation of REXX variables, ENV settings must be propagated into the user exit. Therefore, all user exits must support the ENV option.

# Appendix 5

# 64–Bit SAS Metadata Server



## Overview of the SAS Metadata Server

The SAS Metadata Server is a multi-user server that serves metadata from one or more SAS Metadata Repositories to all of the SAS Intelligence Platform client applications in your environment. The SAS Metadata Server enables centralized control so that all users access consistent and accurate data.

The functionality of the SAS Metadata Server is provided through the SAS Open Metadata Architecture, which is a metadata management facility that provides common metadata services to applications. One metadata server supports all of the applications in your environment and can support hundreds of concurrent users.

The SAS Metadata Server can also run in a multi-server clustered environment to provide failure recovery for high availability, and to provide scalable performance for large deployments.

# Advantages of 64-Bit SAS Metadata Server

The 31-bit SAS 9.3 Metadata Server provided the ability to address 2 gigabytes of memory. SAS 9.4 supports running the Metadata Server for z/OS in 64-bit addressing mode, which provides the ability to address memory with a potential limit of 16 exabytes. The execution JCL for the 64-bit SAS Metadata Server is shipped with MEMLIMIT=8G (gigabytes). You can change this value to accommodate your work load or limits set by your system programmer.

The 64-Bit SAS Metadata Server is implemented with the IBM Language Environment (LE) run-time library, which enables SAS to call third-party DLLs in a native manner. LE run-time options can be used with SAS to configure jobs that have different requirements.

SAS 9.4 supports only the 64-bit Metadata Server for z/OS.

## See Also

*Configuration Guide for SAS Foundation for z/OS* and the installation instructions for the type of installation that you have selected.

# Special Considerations for the 64-Bit SAS Metadata Server

Applications such as the 64-bit metadata server use two types of memory: 31-bit addressable memory and 64-bit addressable memory. The 64-bit metadata server uses 31-bit addressable memory primarily for executables, and stores its data in 64-bit addressable memory. This is important, because z/OS limits these two sorts of memory with two different JCL keywords: REGION and MEMLIMIT. SAS provides default REGION and MEMLIMIT specifications for the 64-bit metadata server. These specifications should be adequate for most users. However, if the server fails because of lack of memory, then increasing the REGION setting does not solve the problem. Because the metadata is stored in 64-bit addressable memory, you must increase the MEMLIMIT value.

# Appendix 6

# Accessing BMDP, SPSS, and OSIRIS Files

# The BMDP, SPSS, and OSIRIS Engines

## Introduction to the BMDP, SPSS, and OSIRIS Engines

The following read-only engines enable you to access files that were created with other vendors' software as if those files were written by SAS software:

BMDP
: accesses system files that were created with BMDP Statistical Software.

SPSS
: accesses SPSS files that were created under Release 9 of SPSS as well as SPSS-X system files and portable export files that are created by using the SPSS EXPORT command.

OSIRIS
: accesses OSIRIS files.

You can use these engines in any SAS applications or procedures that do not require random access. For example, by using one of the engines with the CONTENTS procedure and its _ALL_ option, you can determine the contents of an entire SPSS file.

## Restrictions on the Use of These Engines

Because these are sequential engines, they cannot be used with the POINT= option of the SET statement nor with the FSBROWSE, FSEDIT, or FSVIEW procedures in SAS/FSP software. However, you can use the COPY procedure or a DATA step to copy a BMDP, SPSS, or OSIRIS file to a SAS data set. You can then either use POINT= or use SAS/FSP to browse or edit the file.

# Accessing BMDP Files

## Overview of BMDP Files

The BMDP engine can read only BMDP save files that were created on the same operating environment. For example, the BMDP engine under z/OS cannot read BMDP files that were created under the UNIX operating environment.

## Assigning a Libref to a BMDP File

In order to access a BMDP file, you must use the LIBNAME statement or LIBNAME function to assign a libref to the file.

You do not need to use a LIBNAME statement or function before running PROC CONVERT if you are using PROC CONVERT to convert a BMDP file to a SAS data file. For more information, see “CONVERT Procedure Statement: z/OS” on page 537.

Note that the LIBNAME statement has no options for the BMDP engine.

If you previously used a TSO ALLOC command or a JCL DD statement to assign a ddname to the BMDP file, then you can omit the *physical-filename* (a physical filename in the z/OS operating environment) in the LIBNAME statement or LIBNAME function and use the ddname as the libref. See “Accessing BMDP Files” on page 969.

For information about the LIBNAME statement, see . For“LIBNAME Statement: z/OS” on page 656. information about the LIBNAME function, see “LIBNAME Function” in the *SAS Functions and CALL Routines: Reference*.

## Referencing BMDP Files

Because there can be multiple save files in a single physical BMDP file, you use the value of the BMDP CODE= argument as the name of the SAS data file. For example, if the BMDP save file contains CODE=ABC and CODE=DEF, and if the libref is XXX, you reference the files as XXX.ABC and XXX.DEF. All BMDP CONTENT types are treated the same, so even if file DEF has CONTENT=CORR under BMDP, SAS treats it as CONTENT=DATA.

In your SAS program, if you want to access the first BMDP save file in the physical file, or if there is only one save file, then you can refer to the file as _FIRST_. This approach is convenient if you do not know the BMDP CODE= value.

## Examples of Accessing BMDP Files

Suppose the physical file MY.BMDP.FILE contains the save file ABC. The following statements assign a libref to the data set and then run PROC CONTENTS and PROC PRINT on the BMDP file:

```
libname xxx bmdp 'my.bmdp.file';
proc contents data=xxx.abc;
proc print data=xxx.abc;
run;
```

In the next example, the TSO ALLOC command associates a ddname with the name of the physical file that comprises the BMDP *physical-filename*. The physical filename is omitted in the LIBNAME statement and LIBNAME function, because the libref that is used is the same as the ddname in the TSO statement. The PROC PRINT statement prints the data for the first save file in the physical file.

```
tso alloc f(xxx) da('my.bmdp.file') shr reu;
libname xxx bmdp;
proc print data=xxx._first_;
run;
```

# Accessing OSIRIS Files

## Overview of OSIRIS Files

Although OSIRIS runs only under z/OS, the SAS OSIRIS engine accepts a z/OS data dictionary from any other operating environment that is running SAS software. The layout of an OSIRIS data dictionary is the same on all operating environments. The data dictionary and data files should not be converted between EBCDIC and ASCII, however, because the OSIRIS engine expects EBCDIC data.

## Assigning a Libref to an OSIRIS File

In order to access an OSIRIS file, you must use the LIBNAME statement or LIBNAME function to assign a libref to the file. Specify the OSIRIS engine in the LIBNAME statement as follows:

**LIBNAME** *libref* OSIRIS '*physical-filename*' DICT='*dictionary-filename*';

*libref*
is a SAS libref.

OSIRIS
is the OSIRIS engine.

*physical-filename*
is the physical filename of the data file.

*dictionary-filename*
is the physical filename of the dictionary file. The *dictionary-filename* can also be a ddname. However, if you use a ddname for the *dictionary-filename*, do not use quotation marks.

Specify the OSIRIS engine in the LIBNAME function as follows:

**LIBNAME**(*libref*, '*physical-filename* ', 'OSIRIS', "DICT='*dictionary-filename*'")

You do not need to use a LIBNAME statement or function before running PROC CONVERT if you are using PROC CONVERT to convert an OSIRIS file to a SAS data file. For more information, see "CONVERT Procedure Statement: z/OS" on page 537.

If you previously used a TSO ALLOC command or a JCL DD statement to assign a ddname to the OSIRIS file, you can omit the *physical-filename* in the LIBNAME statement or function. However, you must still use the DICT= option, because the engine requires both files.

# Referencing OSIRIS Files

OSIRIS data files do not have individual names. Therefore, you can use a member name of your choice in SAS programs for these files. You can also use the member name _FIRST_ for an OSIRIS file.

Under OSIRIS, the contents of the dictionary file determine the file layout of the data file. A data file has no other specific layout.

You can use a dictionary file with an OSIRIS data file only if the data file conforms to the format that the dictionary file describes. Generally, each data file should have its own DICT file.

# Examples of Accessing OSIRIS Files

Suppose you want to read the data file MY.OSIRIS.DATA, and the data dictionary is MY.OSIRIS.DICT. The following statements assign a libref to the data file and then run PROC CONTENTS and PROC PRINT on the file:

```
libname xxx osiris 'my.osiris.data'
   dict='my.osiris.dict';
proc contents data=xxx._first_;
```

```
proc print data=xxx._first_;
run;
```

The next example uses JCL. In this example, the DD statements can be omitted if the physical names are referenced in the LIBNAME statement.

```
//JOBNAME JOB
//STEP1   EXEC  SAS
//OSIR    DD  DSN=MY.OSIRIS.DATA,DISP=SHR
//DICT    DD  DSN=MY.OSIRIS.DICT,DISP=SHR
//SYSIN   DD  *
  /* Any one of the following libname */
  /* statements can be used.          */
libname osir osiris dict=dict;
libname xxx osiris 'my.osiris.data' dict=dict;
libname osir osiris dict='my.osiris.dict';
  /* Use this if the osir libref is used */
proc print data=osir._first_;
  /* Use this if the xxx libref is used  */
proc print data=xxx._first_;
//
```

# Accessing SPSS Files

## Overview of SPSS Files

The SPSS engine supports native and portable file formats for both SPSS and SPSS-X files. The engine automatically determines which type of SPSS file it is reading and reads the file accordingly. The SPSS engine supports character variable lengths up to 32K.

**Note:** The SPSS engine supports SPSS save files for SPSS Release 9 and earlier releases. It also supports SPSS-X and the SPSS portable file format that is created by using the SPSS EXPORT command. If you create a system file in a later version of SPSS, you need to use SPSS to resave the data in the export format.

This engine can read only SPSS data files that were created under the same operating environment. For example, the SPSS engine under z/OS cannot read SPSS files that were created under the UNIX operating environment. The only exception is an SPSS portable file, which can originate from any operating environment.

# Assigning a Libref to an SPSS File

In order to access an SPSS file, you must use the LIBNAME statement or LIBNAME function to assign a libref to the file. Specify the SPSS engine in the LIBNAME statement as follows:

**LIBNAME** *libref* SPSS '*physical-filename*';

*libref*
is a SAS libref.

SPSS
is the SPSS engine.

*physical-filename*
is the physical filename of the SPSS file.

The syntax of the LIBNAME function for SPSS is as follows:

**LIBNAME**(*libref*, '*physical-filename*', 'SPSS')

You do not need to use a LIBNAME statement or function before running PROC CONVERT if you are using PROC CONVERT to convert an SPSS file to a SAS data file. For more information, see "CONVERT Procedure Statement: z/OS" on page 537.

Note that the LIBNAME statement and function have no options for the SPSS engine.

If you previously used a TSO ALLOC command or a JCL DD statement to assign a ddname to the SPSS file, then you can omit the *physical-filename* in the LIBNAME statement or function and use the ddname as the libref. For more information, see the second example in "Examples of Accessing SPSS Files" on page 974.

# Referencing SPSS Files

SPSS data files do not have names. For these files, use a member name of your choice in SAS programs.

SPSS data files have only one logical member per file. Therefore, you can use _FIRST_ in your SAS programs to refer to the first data file.

# Reformatting SPSS Files

SAS cannot use SPSS files that contain variables with numeric formats that have a larger number of decimal places than the width of the entire variable. For example, if you have a variable that has a width of 17 and also has 35 decimal places, then

SAS returns errors when you try to run a DATA step on the file or view it with the table viewer. To use the SPSS file with SAS, you have to reformat the variables.

You can reformat the variables by reducing the number of decimal spaces to a value that fits within the width of the variable. In the following code example the statement `revision=cat(format,formatl,'.2');` converts the number of decimal spaces to 2. This value reduces the number of decimal spaces so that it is not greater than the width of the variable.

```
libname abc spss 'FILENAME.POR';
proc contents data=abc._all_ out=new; run;
filename sascode temp;
data _null_; set new; file sascode;
     if formatd > formatl then do;
        revision=cat(format,formatl,'.2');
        put 'format' +1 name +1 revision ';' ;
        end;
     run;
data temp; set abc._all_;
     %inc sascode/source2;
     run;
```

**Note:** The OPTIONS NOFMTERR statement does not allow SAS to use the data set with a DATA step or the table viewer. You have to reformat numeric variables that have a larger decimal value than their width before you can use a DATA step or the table viewer.

# Examples of Accessing SPSS Files

Suppose you want to read the physical file MY.SPSSX.FILE. The following statements assign a libref to the data set and then run PROC CONTENTS and PROC PRINT on the SPSS file:

```
libname xxx spss 'my.spssx.file';
proc contents data=xxx._first_;
proc print data=xxx._first_;
run;
```

In the next example, the TSO ALLOC command associates a ddname with the name of the physical file that comprises the SPSS *physical-filename*. The physical filename is omitted in the LIBNAME statement, because the libref that is used is the same as the ddname in the TSO command. The PROC PRINT statement prints the data in the first member of the SPSS data file.

```
tso alloc f(xxx) da('my.spssx.file') shr reu;
libname xxx spss;
proc print data=xxx._first_;
run;
```

# Appendix 7

# The cleanwork Utility



## Overview of the cleanwork Utility

SAS might create temporary UFS directories that contain the Work library or certain types of utility files. SAS normally deletes these directories at the conclusion of the SAS session or job. However, if SAS is canceled or if SAS terminates abnormally, these directories are not removed. For more information about the creation of temporary directories, see Chapter 3, "SAS Software Files," on page 25.

The SAS **cleanwork** utility program performs the following functions:

- automatically locate these temporary UFS directories
- verify that the SAS session that is associated with each directory is no longer running
- remove the directory and all of its contents.

For information about the processes to install and configure **cleanwork**, see "Installing the cleanwork Utility" on page 976 and "Configuring the cleanwork Utility" on page 976.

**Note:** Installing and configuring **cleanwork** typically require special system administrator privileges.

The WORK and UTILLOC options can specify a UFS path as the location in which SAS creates temporary UFS directories. It is recommended that the specified UFS path correspond to a directory, such as **/tmp**, for which its sticky bit turned on. When the sticky bit is on for a directory, directories that are contained within that directory can be removed only by one of the following users:

- the owner of the directory
- the owner of the directory that is being deleted
- a superuser.

This setting allows multiple SAS users to place temporary directories in the same location without the risk of accidentally deleting each other's files. However, identifying which temporary directories in that location correspond to SAS sessions that have ended can be difficult. The **cleanwork** utility, which typically runs under a superuser account, automates and simplifies this process.

# Installing the cleanwork Utility

The **cleanwork** utility is not installed as part of the process for installing Base SAS. You have to create **cleanwork** as an executable in a UNIX file system after you install SAS. Sample JCL for creating the executable can be found in the LINKCLNW member of the BAMISC library that is created as part of the SAS installation process. Before submitting this job, edit the JCL to specify the following information:

- the appropriate JOB statement information
- the name of the SAS load library data set
- the fully qualified pathname for the directory into which the executable should be placed.

# Configuring the cleanwork Utility

## Syntax

**cleanwork** *directory-1 <directory-2 ...>*

*directory*
names the UFS directory or directories that might contain the temporary directories that were created by SAS. The directory name must match the specified value in the WORK system option or the specified value in the UTILLOC system option.

# How cleanwork Selects Directories for Deletion

The temporary directories that are created by SAS for the Work library and utility files are named according to the following pattern:

```
SAS_util_<serial><pid>_<lpar>
```

**<serial>**
is a four-digit to six-digit hexadecimal serial number that is unique for any given SAS session.

**<pid>**
is the USS process ID number of the SAS session, represented as an eight-digit hexadecimal number.

**<lpar>**
is the name of the LPAR (logical partition) on which SAS session is running.

The **cleanwork** utility deletes any directories with a name that matches the preceding pattern, provided that both of the following conditions are true:

- **<lpar>** matches the name of the LPAR on which the **cleanwork** utility is running.
- No process with an ID of **<pid>** is currently active on the LPAR on which the **cleanwork** utility is running.

In other words, **cleanwork** removes only the directories that are not associated with an active SAS session. Because it can make that determination only on the current system, **cleanwork** can remove only the directories that were created by SAS sessions that ran on the same system on which **cleanwork** is currently running. If SAS sessions on multiple z/OS system images (LPARs) place temporary directories under the same directory location, you need to run **cleanwork** on each system (LPAR).

# Running cleanwork with a crontab

After the **cleanwork** utility has been installed, the **cleanwork** command can be executed as needed by a superuser or the owner of the directory. It is often useful to automatically execute the command at regular intervals with a **crontab**.

# See Also

- Chapter 3, “SAS Software Files,” on page 25
- “Work Library and Other Utility Files” on page 26
- “UTILLOC= System Option: z/OS” on page 877

# Appendix 8

# Host-System Subgroup Error Messages



## Host-System Subgroup Error Messages in the z/OS Environment

This appendix provides brief explanations of many of the host-system subgroup error messages that you might encounter during a SAS session. The explanation for each message includes where the message comes from, a short explanation of its meaning, and information about what you can do to correct the problem.

For information about the steps to take if SAS does not start when you issue the start-up command, see “What If SAS Does Not Start?” on page 6.

# Messages from the SASCP Command Processor

To help you identify and remedy problems when running under TSO, SAS software provides the following list of messages from the SASCP command processor. SASCP is involved in processing SAS software tasks and is invoked by the terminal monitor program as a standard TSO command processor.

SAST001I COMMAND SYSTEM ERROR +
Entering a question mark in the line following this message produces one of these additional messages:

- `NOT ENOUGH MAIN STORAGE TO EXECUTE COMMAND`
- `IKJPARS RETURN CODE` *`rc`*

Either the SAS command processor was unable to allocate enough memory to begin execution, or the system failed while it was parsing the command line. This message should not occur under normal conditions; inform your on-site SAS support personnel.

SAST002I DATA SET *dsn* NOT IN CATALOG or SAST002I DYNAMIC ALLOCATION ERROR, IKJDAIR RETURN CODE *rc* DARC *drc* CTRC *crc*
The SAS command processor was unable to locate a data set that was specified by the TASKLIB operand. This message usually indicates that a data set name was misspelled.

SAST003I MORE THAN 15 TASKLIB DATA SETS SPECIFIED
You have specified more than 15 task-library data sets with the TASKLIB operand. Reduce the number of task-library data sets.

SAST004I *dsn* IS NOT A PARTITIONED DATA SET
For the value of the TASKLIB operand, you have specified a task-library data set that is not a partitioned data set. This message usually indicates a misspelled data set name or a reference to the wrong data set.

SAST005I TASKLIB CANNOT BE OPENED
The SAS command processor was unable to open the task library. You have probably specified an invalid load library as a task-library data set in the TASKLIB operand.

SAST006I SAS ENTRY POINT NAME NOT SPECIFIED
You have not specified a member name for the SAS entry point. Use the ENTRY operand to specify an entry-point name for SAS software .

SAST007I SAS ENTRY POINT NAME *entry-name* NOT FOUND
The SAS command processor was unable to locate the member name that was specified as the SAS entry point. This message usually indicates that an entry-point name was misspelled. Use the ENTRY operand to specify a valid entry-point name.

SAST007I BLDL I/O ERROR ON TASKLIB
An error occurred during BLDL processing of TASKLIB.

SAST009I COMMAND SYSTEM ERROR +
Entering a question mark in the line following this message produces one of these additional messages:

- `NOT ENOUGH MAIN STORAGE TO INVOKE SAS SUBTASK`
- `ATTACH RETURN CODE` *`rc`*

Either the SAS command processor was unable to allocate enough memory to invoke SAS software , or the system was unable to create the SAS subtask. This message should not normally occur; inform your on-site SAS support personnel.

SAST010I *entry-name* ENDED DUE TO ERROR +
This message indicates that the SAS session has terminated abnormally (abended). Entering a question mark in the line following this message produces one of these additional messages:

- `USER ABEND CODE` *`uac`*
- `SYSTEM ABEND CODE` *`sac REASON CODE rc`*

A user abend code, such as 999 ('3E7'x), indicates an error condition. You can specify other user abend codes in the SAS ABORT statement. User abend codes are displayed as hexadecimal values. For example, '3E7'x is the hexadecimal expression of 999. If a system abend code occurs, inform your on-site SAS support personnel.

SAST011I *entry-name* TERMINATED DUE TO ATTENTION
The SAS session has ended because you pressed the BREAK or ATTN key and then entered the word END in response to the message SAST013D.

SAST012I COMMAND SYSTEM ERROR +
Entering a question mark in the line following this message produces one of these additional messages:

- `NOT ENOUGH MAIN STORAGE TO EXECUTE COMMAND`
- `STAE RETURN CODE` *`rc`*

Either the SAS command processor was unable to allocate enough memory to invoke SAS software , or an error occurred during execution of the SASCP command. This message should not normally occur; inform your on-site SAS support personnel.

SAST013D ENTER "END" TO TERMINATE SAS, OR A NULL LINE TO CONTINUE
SAS software displays this prompt when the SAS command processor detects that the BREAK or ATTN key has been pressed. Enter the word END to leave the SAS session, or enter a null line to resume SAS processing.

SAST014I INVALID RESPONSE, MUST BE "END" OR A NULL LINE
You have entered a response other than the word END or a null line after receiving message SAST013D. Enter either the word END or a null line.

SAST015I SASCP INVOKED IN A NON-TSO ENVIRONMENT OR PASSED INVALID PARAMETERSUSE SASCP AS A TSO COMMAND TO INVOKE SAS IN THE FOREGROUNDUSE PGM=SAS TO INVOKE SAS IN THE BACKGROUND
SASCP was not invoked as a TSO command, and it could not locate the appropriate TSO control blocks to reconstruct a TSO command environment, either because it was invoked as a background program or because the TSO environment is nonstandard. If you were running under TSO, contact your on-site SAS support personnel.

SAST017I INVALID PARAMETER LIST PASSED TO IKJDAIR
An invalid parameter list was passed to the TSO service routine IKJDAIR. This message should not normally occur; inform your on-site SAS support personnel.

SAST018I SASCP INVOKED IN A NON-TSO ENVIRONMENT USE PGM=SAS TO INVOKE SAS IN THE BACKGROUND
SASCP was not invoked under TSO.

# Messages from the TSO Command Executor

The TSO command executor is involved with TSO command processors for the X and TSO commands, the X and TSO statements, and the TSO function.

SAST101I ERROR IN PUTGET SERVICE ROUTINE
An error occurred while the TSO command executor was attempting to read a line from the terminal or from the TSO input stack using the TSO service routine IKJPTGT. This message should not normally occur; inform your on-site SAS support personnel.

SAST102I INVALID COMMAND NAME SYNTAX
You have specified an invalid command name in one of the following:

- a TSO or X command
- a TSO or X statement
- a TSO or SYSTEM function
- a TSO or SYSTEM CALL routine.

This message usually indicates that a TSO command name was misspelled.

SAST103I COMMAND *cmd* NOT SUPPORTED
You have entered a TSO command that cannot be issued from within a SAS session. To issue the command, end the session, issue the command, and then start a new session.

SAST104I COMMAND *cmd* NOT FOUND
The TSO command executor could not locate the TSO command name that was specified. This message usually indicates that a TSO command name was misspelled.

SAST105I *cmd* ENDED DUE TO ERROR +

Entering a question mark in the line following this message produces one of these additional messages:

- `SYSTEM ABEND CODE sac REASON CODE rc`
- `USER ABEND CODE uac`

A TSO command that was invoked in one of the following ways ended abnormally with the indicated abend code:

- a TSO or X command
- a TSO or X statement
- a TSO or SYSTEM function
- a TSO or SYSTEM CALL routine.

SAST106I COMMAND SYSTEM ERROR +

Entering a question mark in the line following this message produces one of these additional messages:

- `NOT ENOUGH MAIN STORAGE TO EXECUTE COMMAND`
- `ATTACH RETURN CODE rc`

Either the TSO command executor was unable to allocate enough memory to execute the requested command, or an error occurred during execution of the command executor. This message should not normally occur; inform your on-site SAS support personnel.

SAST107I COMMAND SYSTEM ERROR +

Entering a question mark in the line following this message produces one of these additional messages:

- `NOT ENOUGH MAIN STORAGE TO EXECUTE COMMAND`
- `STAE RETURN CODE rc`

Either the system was unable to allocate enough memory to execute the requested command, or an abend occurred during execution of the command. This message should not normally occur; inform your on-site SAS support personnel.

SAST108I SEVERE COMMAND SYSTEM ERROR +

Entering a question mark in the line following this message produces one of these additional messages:

- `SYSTEM ABEND CODE sac REASON CODE rc`
- `USER ABEND CODE uac`

The TSO command executor encountered severe internal failure. This message should not normally occur; inform your on-site SAS support personnel.

SAST109I TSO SUBMODE, ENTER "RETURN" OR "END" TO RETURN TO THE SAS SYSTEM

SAS software displays this prompt when you enter TSO submode.

SAST110I COMMAND *cmd* TERMINATED DUE TO ATTENTION
You have stopped the execution of the specified TSO command by pressing the BREAK or ATTN key and entering the word END in response to message SAST1112D.

SAST111I SPF COMMAND NOT ALLOWED, SPF ALREADY ACTIVE
You have attempted to issue the TSO ISPF/PDF or SPF command from a SAS session that you invoked under the ISPF/PDF or SPF TSO command processor panel (panel 6). To return to the ISPF/PDF or SPF session, end the SAS session.

SAST112D ENTER "END" TO TERMINATE COMMAND, OR A NULL LINE TO CONTINUE
This prompt is displayed when you press the BREAK or ATTN key during the execution of a TSO command. Enter the word END to terminate the command, or enter a null line to resume the command.

SAST113I INVALID RESPONSE, MUST BE "END" OR A NULL LINE
You have entered a response other than the word END or a null line after receiving message SAST112D. Enter either the word END or a null line.

SAST114I SASTSO NOT SUPPORTED IN NON-TSO ENVIRONMENT
The command that you have entered cannot be executed under the z/OS batch TMP. The command can be executed only during an interactive TSO session.

SAST114I COMMAND *cmd* NOT SUPPORTED IN BACKGROUND
You have entered a TSO command that cannot be issued from a background TSO session.

# Messages from the Internal CALL Command Processor

The internal CALL command processor implements the TSO CALL command for use by an unauthorized caller outside of the Terminal Monitor Program.

SAST201I COMMAND SYSTEM ERROR +
Entering a question mark in the line following this message produces one of these additional messages:

- `NOT ENOUGH MAIN STORAGE TO EXECUTE COMMAND`
- `IKJPARS RETURN CODE` *`rc`*

Either the CALL command was unable to allocate enough memory to begin processing, or the system failed while it was parsing the command line. This message should not normally occur; inform your on-site SAS support personnel.

SAST202I TEMPNAME ASSUMED AS MEMBER NAME
You have not specified a member name with a CALL command invocation, and the CALL command processor used the member name TEMPNAME.

SAST203I PARM FIELD TRUNCATED TO 100 CHARACTERS
The parameter string that was passed to the program by the CALL command processor was too long and was truncated to 100 characters.

SAST204I DATA SET *dsn* NOT IN CATALOG
The CALL command processor was unable to locate the specified program data set. This message usually indicates that a data set name was misspelled. You will be prompted to enter the correct data set name.

SAST204I DATA SET NOT ALLOCATED, IKJDAIR RETURN CODE *rc* DARC *drc* CTRC *crc*
An error occurred while the data set was being allocated; inform your on-site SAS support personnel.

SAST205I MEMBER *mem* SPECIFIED BUT *dsn* NOT A PARTITIONED DATA SET
You have specified a program library in the CALL command that is not a valid load-module library. This message usually indicates that a data set name was misspelled.

SAST206I DATA SET *dsn* NOT USABLE +
Entering a question mark in the line following this message produces this additional information: `CANNOT OPEN DATA SET`

The CALL command processor was unable to open the program library. This message usually indicates an invalid load-module library or a misspelled data set name.

SAST207I MEMBER *mem* NOT IN DATA SET
The CALL command processor could not locate the member name that you specified in the CALL command. This message usually indicates that a member name was misspelled. You will be prompted to enter the correct member name.

SAST207I BLDL I/O ERROR
An error occurred while searching for the program on the data set; inform your on-site SAS support personnel.

SAST208I COMMAND SYSTEM ERROR +
Entering a question mark in the line following this message produces one of these additional messages:

- `NOT ENOUGH MAIN STORAGE TO EXECUTE COMMAND`
- `ATTACH RETURN CODE` *`rc`*

Either the system was unable to allocate enough memory to invoke the specified program, or an error occurred while it was attaching the program. This message should not normally occur; inform your on-site SAS support personnel.

SAST209I INVALID PARAMETER LIST PASSED TO IKJDAIR
The CALL command processor passed an invalid parameter list to the TSO service routine IKJDAIR. This message should not normally occur; inform your on-site SAS support personnel.

# Appendix 9

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```

```
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```

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```
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