SAS Publishing

SAS® 9.1 Companion for OpenVMS Alpha

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Contents

What’s New

Overview

New and enhanced features in Base SAS improve ease of use and SAS performance under the OpenVMS Alpha operating environment:

- SAS is built to take advantage of the OpenVMS Alpha 64-bit architecture.
- Your site administrator can restrict system options for your site.
- You can create filenames similar to those on UNIX and Windows by using Extended (ODS-5) Syntax on ODS-5 enabled volumes.
- Support for cluster-level logicals has been incorporated into SAS in all areas where multi-level logical definitions were previously supported.
- SMTP (Simple Mail Transfer Protocol) is now the default for sending mail from within SAS.

Note:

- This section describes the features of SAS software under the OpenVMS Alpha operating environment that are new or enhanced since SAS 8.2.
- z/OS is the successor to the OS/390 operating system. Throughout this document, any reference to z/OS also applies to OS/390, unless otherwise stated.

△

Migrating Your Existing SAS Files to SAS 9.1

Starting in SAS 9, SAS is built to take advantage of the OpenVMS Alpha 64–bit architecture. The following list explains the compatibility of your existing SAS files with SAS 9.1:

- All of your Version 7 and Version 8 SAS files (except SAS catalogs) are compatible with SAS 9.1. To take advantage of the new SAS 9 features and access your existing SAS catalogs, convert your Version 7 and Version 8 files by using the MIGRATE procedure.

- SAS 9.1 only supports input processing for Version 6 data files using the V6 read-only engine. To access all of your Version 6 files in SAS 9.1, you need to migrate your Version 6 data libraries.

For more information about the compatibility of existing SAS files with SAS 9.1, see "Compatibility of Existing SAS Files with SAS 9.1" on page 135.

You can use the MIGRATE procedure to convert all of your SAS files to the SAS 9.1 format. For more information about the MIGRATE procedure, see the Migration Community at **support.sas.com/rnd/migration**.

If you use Remote Library Services (RLS) to access SAS files on a server, see the *SAS/CONNECT User's Guide* for information about accessing Version 6 SAS files.

Restricted System Options

Your site administrator can restrict SAS system options at three levels: for your site, for a specific group, or for an individual user. Because these options are restricted, you cannot change a value that is specified in the restricted configuration files. Use the new RESTRICT option for the OPTIONS procedure to see all of the system options that have been restricted. For more information about how SAS processes restricted configuration files, see "Six Types of Configuration Files" on page 36. For information about creating a restricted configuration file, see *SAS System Configuration Guide for OpenVMS*.

Support for Extended (ODS-5) Syntax on ODS-5 Enabled Volumes

SAS supports the Extended (ODS-5) Syntax on ODS-5 enabled volumes. The ODS-5 syntax allows longer filenames, supports more characters within filenames, preserves case within filenames, and supports deeper directory structures. These extended file specifications enable users to create filenames similar to those in UNIX and Windows. The ODS-5 and Windows file-naming conventions are similar. For example, if a filename exists in all uppercase, then any lowercase or uppercase reference to that file will resolve to uppercase. See "ODS-5 File Naming Conventions" on page 10.

When using the ODS-5 syntax, you must issue an X statement before using a DCL command in SAS. See "X Statement" on page 427.

Support for Cluster-Level Logicals

OpenVMS 7.2 introduced the new concept of clusterwide logical definitions. Support for cluster-level logicals has been incorporated into SAS in all areas where multi-level logical definitions were previously supported. See the OpenVMS documentation for more information about cluster-level logical definitions.

SAS will use a clusterwide logical when you:

- specify a cluster-level configuration file
- specify a cluster-level autoexec file
- use the GETLOG function .

For more information about creating these files, see "Configuration Files" on page 36 and "Autoexec Files" on page 39.

Specifying an Additional Configuration File

You can specify the CONFIG= system option inside a configuration file to point to an additional configuration file. Because the options specified in this additional file are processed at the point of the CONFIG= specification, their precedence will be lower than the next option listed in the original configuration file. See "Steps for Creating a Configuration File" on page 37.

Functionalities That Are Unavailable from a Captive Account

Functionalities that require either a detached process or a subprocess are unavailable from a captive account . These functionalities are:

- host-specific commands that are executed asynchronously from the SYSTASK statement
- the PIPE device in the FILENAME statement
- remote sign-ons using SAS/CONNECT
- the SAS Help and Documentation in the SAS windowing environment
- the SAS Session Manager (xsassm)
- X commands that cannot be executed in the current process.

For more information, see "Limitations of Using a Captive Account" on page 47.

Changes to SAS E-mail

- The default mail handler is SMTP (Simple Mail Transfer Protocol), which supports attachments. For more information, see "Initializing Electronic Mail" on page 189.
- The BCC option in the FILENAME statement enables you to send blind copy e-mails during a SAS session. For more information, see "Syntax of the FILENAME Statement for E-Mail" on page 189.
- Using the Send Mail dialog box, you can now do the following:
  - include the contents of an active SAS text window (such as the Program Editor or Log) in the body of your e-mail. For more information, see "Sending the Contents of a Text Window" on page 72.
  - attach the contents of a non-text window to your e-mail. Examples of non-text windows include a graph generated by SAS/GRAPH and an image in your PROC REPORT output. For more information, see "Sending the Contents of a Non-Text Window" on page 73.

  Note: The VMS e-mail facility does not support attachments. △

Accessing External Shareable Images

Shareable images are executable files that contain one or more routines written in various programming languages. Shareable images store useful routines that might be needed by many applications. Using the MODULE family of SAS CALL routines and functions, you can invoke a routine that resides in an external shareable image from within SAS. You can access the shareable images by using a DATA step, the IML procedure, and SCL code. For more information, see Chapter 9, “Accessing External Shareable Images from SAS,” on page 207.

Engines

The following features are new or enhanced:

- The new V6 read-only engine enables you to read your Release 6.12 data sets. For more information about the V6 read-only engine, see *SAS Language Reference: Concepts*.
- The V5 and V6TAPE engines are no longer supported. Because of this, neither V5 nor V6TAPE options are valid in the LIBNAME statement or the ENGINE= system option. See “LIBNAME Statement” on page 420 and “ENGINE= System Option” on page 460.

SAS Resources

- The following resources are new:
  - **`SAS.startSessionManager`** specifies whether SAS automatically starts the session manager when a new SAS session is started.
  - **`SAS.suppressTutorialDialog`** specifies whether SAS displays the Getting Started Tutorial dialog box at the start of your SAS session.
  - **`SAS.useNativeXmTextTranslations`** specifies whether any XmText widget translations are inherited by all instances of the Text, Combo Box, and Spin Box widgets used by the SAS X Motif user interface.
  - **`SAS.VMSdisplay`** controls how often SAS yields processing to the X windowing environment.

    For more information, see “Miscellaneous Resources under OpenVMS” on page 120.
- The **`SAS.webBrowser`** resource is no longer supported. The **`SAS.helpBrowser`** now specifies the pathname of the World Wide Web browser for use when viewing the online help or when the WBROWSE command is issued. For more information, see “Miscellaneous Resources under OpenVMS” on page 120.

SAS Language Elements

Commands

- The X command now breaks DCL commands that are longer than 256 characters into smaller chunks before sending them to the operating environment for processing. For more information, see “X Command” on page 270.

Functions

- To call a specific routine or module that resides in a shareable image, you can use the MODULE function. For more information, see “MODULE Function” on page 341.

- You can store the contents of a memory address in a numeric variable on 32–bit and 64–bit platforms by using the PEEKLONG function. This function replaces the PEEK function, which was valid only on 32–bit platforms.For more information, see "PEEKLONG Function" on page 345.

Procedures

- To see all the system options that have been set by your site administrator, use the RESTRICT option in the OPTIONS procedure. For more information, see"OPTIONS Procedure" on page 383.

Statements

- The following options are new in the %INCLUDE statement:
  - BLKSIZE= specifies the number of bytes that are physically read or written in an I/O operation.
  - ENCODING= specifies the encoding to use when reading from the specified source.
  - LRECL= specifies the record length (in bytes).
  - RECFM= controls the record format.
- The V5 and V6TAPE options are not accepted by the LIBNAME statement. For more information, see "LIBNAME Statement" on page 420.

System Options

- The following system options are new:
  - You can specify the location of the Program Editor autosave file by using the AUTOSAVELOC= system option. For more information, see "AUTOSAVELOC= System Option" on page 447.
  - To specify that the asynchronous host command use a detached process, use the DETACH system option. The default is DETACH. For more information, see "DETACH System Option" on page 455.
  - If you create a customized table of contents and index for the SAS Help and Documentation, use theHELPTOC= and HELPINDEX= system options to specify the file location.For more information, see "HELPTOC= System Option" on page 467 and "HELPINDEX= System Option" on page 465.
  - SSLCALISTLOC, SSLCRLLOC, SSLCERTLOC, SSLPVTKEYLOC, and SSLPVTKEYPASS are authentication security options that are under the OpenVMS Alpha operating environment. For details, see the *SAS/CONNECT User's Guide*.
- The following system options have been changed or enhanced:
  - SMTP (Simple Mail Transfer Protocol) is the new default for the EMAILSYS= system option. SMTP supports sending attachments.For more information, see "EMAILSYS= System Option" on page 458.
  - V9 is a new value for the ENGINE= system option. V5 and V6TAPE are obsolete and not accepted as valid values. For more information, see "ENGINE= System Option" on page 460.
  - The SAS$USER logical, the default for the SASUSER= system option, now defaults to the SASUSER91 subdirectory of the SYS$LOGIN directory. For more information, see "SASUSER= System Option" on page 492.

  - MAX is the new default value for the SORTSIZE= system option.For more information, see "SORTSIZE= System Option" on page 494.
  - The value of *stack-size* for the STACK= system option must be an integer between 65,535 and 5,242,880. The default value for most procedures is now 1,048,576 bytes.
- The following system options are obsolete or are no longer supported:
  - DBCS
  - DBCSLANG
  - DBCSTYPE
  - PROCLEAVE
  - SYSLEAVE
  - UNLOAD.

P A R T 1

Running SAS under OpenVMS

CHAPTER

1

Introduction to the OpenVMS Operating Environment

What Is the OpenVMS Operating Environment?

OpenVMS is an interactive virtual-memory operating environment that runs on computers with CPUs developed by Compaq Computer Corporation. To communicate with OpenVMS, you most commonly use the Digital Command Language (DCL).

Like any operating environment, OpenVMS is designed to manage information. It accepts, stores, retrieves, and processes many types of information, such as data, text, programs (such as SAS programs), and output from programs. The OpenVMS system performs all data processing functions in response to DCL commands that you issue. These functions include

- managing a terminal session
- submitting jobs for execution
- storing and retrieving data files
- allocating resources (for example, disk space, time, and internal memory) to individual jobs
- controlling peripheral equipment such as printers, plotters, disk drives, and tape drives.

For detailed information about OpenVMS, see the documentation provided by Compaq Computer Corporation such as *OpenVMS User's Manual*. Also, the operating environment provides an online help facility that you can access by using the Digital Command Language (DCL) HELP command.

OpenVMS VAX and Alpha Platforms

Compaq Computer Corporation offers the OpenVMS operating environment on VAX and Alpha platforms. SAS supports the OpenVMS Alpha platform.

Access to OpenVMS

Requirements for Accessing an OpenVMS System

In order to access an OpenVMS system, you must have an OpenVMS *user name* and a *password*. In SAS documentation, the user name is usually called the *user ID*. Ask your supervisor or system manager for a user ID, a password, and any other information that you might need in order to access OpenVMS at your site. For example, if your system is part of a DECnet for OpenVMS network, then you also need to know how to access the appropriate computer system before you begin the login procedure.

Login Procedure

The login procedure differs from site to site, depending on how your system is configured.

When OpenVMS prompts you for your user ID, type the user ID and press the Return key (or the Enter key, depending on your keyboard). Next, the system prompts you for your password. Type the password and press Return. OpenVMS accepts and validates the user ID and password, even though you cannot see the password on the display. Next you might see messages welcoming you to the OpenVMS system. If you enter an incorrect user ID or password, you must start the login procedure again.

The following sequence illustrates the login procedure:

```
Username: user-ID   <RETURN>
Password:          <RETURN>
.  .  .  system messages .  .  .

$
```

When you log in, OpenVMS defines the environment in which it responds to your DCL commands. This environment is called your OpenVMS *process*.

Certain default characteristics are associated with your process, such as a default disk, a directory name, and resource quotas. This information is taken from the user authorization file. A command interpreter (usually the DCL interpreter) is also associated with your process.

After you have logged in successfully, the system typically displays a dollar sign ($) to indicate that it is ready to accept a command. However, a different symbol might be used at your site, or you might use a menu interface. In this document, all examples assume that your OpenVMS system uses the $ symbol as the system prompt and that it uses the DCL command-line interpreter.

Files That Affect the Login Procedure

User Authorization File

During the login procedure, OpenVMS accesses a file called the *user authorization file* (UAF) to validate your user ID and password. The UAF is maintained by your system manager, and it contains a record for every person who is authorized to use the system.

Besides the user ID and password, the UAF record for each user specifies the user's default disk and default directory. Thus, each time you log in, your session is attached to the default disk at a location called your default (or home) directory. The UAF also specifies the access privileges and quota limits that are associated with your user ID.

LOGIN.COM File

At some sites, the system manager creates a login file, LOGIN.COM, in your home directory when you are authorized to use the system. This file contains DCL commands and utilities that are commonly used at your site.

When you log in, the OpenVMS system automatically searches for the LOGIN.COM file in your home directory. If one exists, the system executes the commands in the file before you receive the first DCL prompt (often the $ symbol).

If you find that you regularly use certain DCL commands and utilities to customize your process, you can avoid entering these commands every time you log in by storing them in the LOGIN.COM file in your home directory.

Check with your system manager first before deleting or moving your LOGIN.COM file. You can create or modify the LOGIN.COM file using an OpenVMS editor.

For example, suppose that user John Smith has the following LOGIN.COM file stored in his home directory [SMITH]:

```
$ !  Login command file for John Smith
$ SHOW TIME
```

Each time Mr. Smith logs in, the command file executes automatically and displays the current date and time. Note that the $ prompt is generally in column 1 of each line that contains a DCL command. (A file containing just **''SHOW TIME''** will also work.) To improve readability, you can insert one or more blanks after the $.

Note: If you use assignment statements in your LOGIN.COM file to create symbols, be sure that they are global assignments by using a double equal sign (==); otherwise, the symbols will be local to the LOGIN.COM file. In other words, an assignment statement that uses a single equal sign (=) creates a symbol that exists only while the LOGIN.COM file is executing. △

The following is an example of a global symbol assignment statement. Mr. Smith modifies the LOGIN.COM file by deleting the SHOW TIME command line and adding the following assignment statement:

```
$ DT == "SHOW TIME"
```

With this modification, Mr. Smith can request the current date and time during his terminal session by entering the following line:

```
$ DT
```

For more information about global and local assignments and about the LOGIN.COM file in general, refer to *OpenVMS User's Manual*.

Logout Procedure

When you are finished using the system, enter **LOGOUT** at the DCL prompt. The system displays a message to confirm that you have logged out.

Basics of the OpenVMS File System

Directories

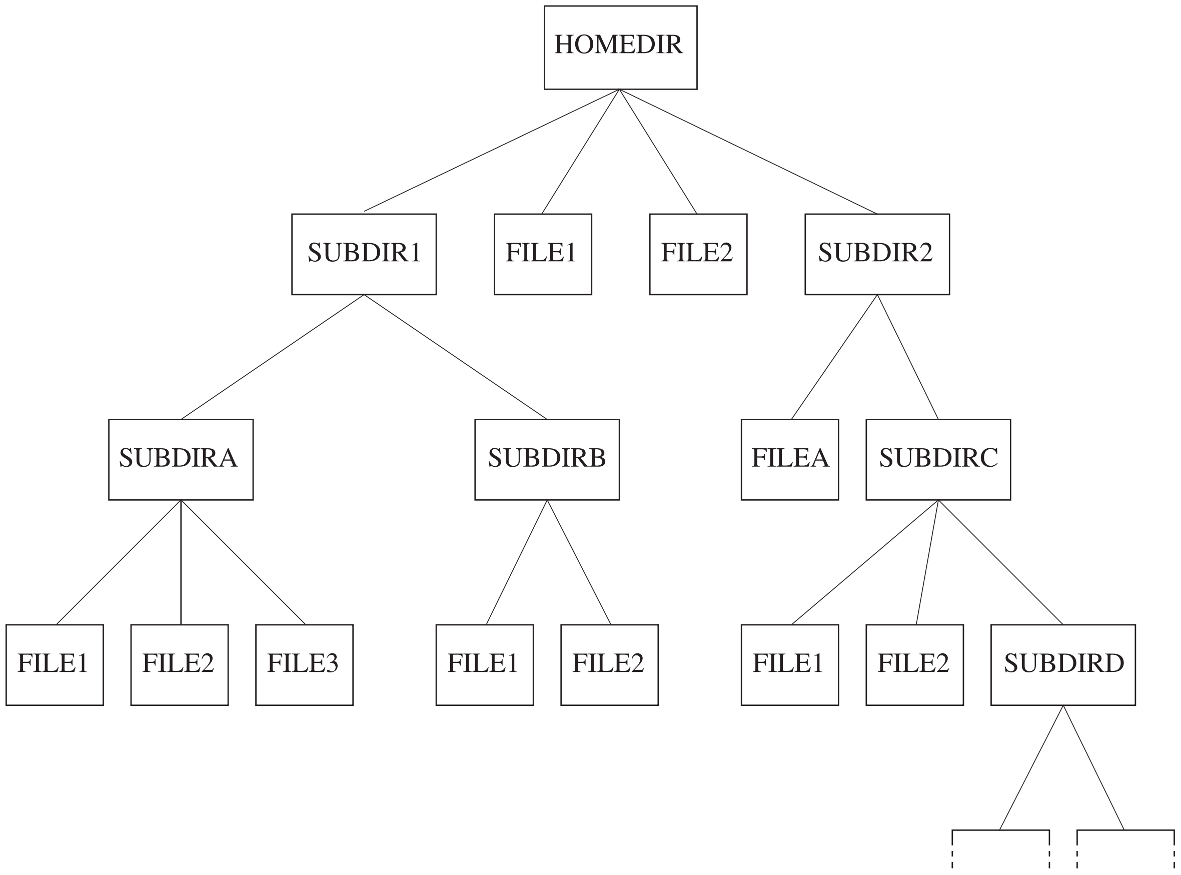
Introduction to the OpenVMS Directory File Structure

In the OpenVMS environment, files are organized into directories. A *directory* contains a list of all the files that are organized within that directory. When you log in, OpenVMS attaches your session to a directory on a default disk that is associated with your user ID. This directory is called your *home directory*. For each user ID, there is only one home directory. Often the home directory name is the same as the user ID.

The home directory can contain both files and other directories called *subdirectories*. Subdirectories can also contain files and subdirectories. The terms directory and subdirectory refer to the same type of file unit. The term subdirectory conveys the relationship of one directory to another in the hierarchical structure that begins with the home directory.

This method of structuring files enables you to group sets of related files within directories. You can organize your files however you like. The following figure illustrates the directory file structure.

Figure 1.1 Directory File Structure



The directory that you are working in at any given time is called your *default directory*. For example, when you log in, your home directory is usually your default directory.

Creating Directories

To create a directory, use the DCL CREATE/DIRECTORY command.

Changing Your Default Directory

To move from one directory to another directory in the file structure, use the DCL SET DEFAULT command. Each time you use the DCL SET DEFAULT command, your default directory changes to the directory that you specify. Be sure to specify a pathname to the target directory. (A full pathname follows an unbroken path from the first-level directory down to the target subdirectory. However, a partial pathname, such as [.SUBDIR], can also be specified.) Using Figure 1.1 on page 7 as an example, the following command specifies the full pathname to the subdirectory SUBDIRC:

```
$ SET DEFAULT [HOMEDIR.SUBDIR2.SUBDIRC]
```

When this command executes, SUBDIRC becomes the default directory.

If you have any doubt about your current location in the file structure, use the DCL SHOW DEFAULT command to show your default directory. Keeping track of your default directory helps you keep track of files. For example, some programs write output files to the default directory.

Files

Files contain various types of data, programming statements, or program output. Under OpenVMS, you can create files with several editors, including the EVE and EDT editors, the Text Processing Utility (TPU) Editor, and the SAS Text Editor. Regardless of which editor you use, each file must have a unique name within that directory.

OpenVMS Filenames

Syntax for File Specifications

What Is a Fully Qualified Name?

A *fully qualified name* indicates how a file fits into a structure (a system of directories and subdirectories) that contains all the files stored under the OpenVMS system. The following type of file specification is a fully qualified name:

node::*device*:*[directory]filename.file-type*;*version*

Rules for File Specifications

A file specification cannot exceed 255 bytes. The *directory* and *file-specification* can each consist of up to 39 characters. The *file-type* can consist of up to 38 characters, although most of the default file types have only 3 characters. Permissible characters are the letters A through Z, the numbers 0 through 9, an underscore (_), a hyphen (-), or a dollar sign ($). You can enter OpenVMS filenames and file types in uppercase, lowercase, or mixed case, but all characters are stored in uppercase format. For more information about file specifications, refer to *OpenVMS Guide to Extended File Specifications*.

Note: The default for OpenVMS filenames is the Traditional ODS-2 Syntax. However, SAS supports the Extended (ODS-5) Syntax on ODS-5 enabled volumes. For more information, see "ODS-5 File Naming Conventions" on page 10. △

Description of File Specification Fields

In many cases you can uniquely identify a file even without specifying all of the fields in a fully qualified name. The following definitions give default values for fields that can be omitted from a file specification:

node
specifies a node name in an OpenVMS network. The node specification is always followed by a double colon (::). The default value for *node* is your OpenVMS system node; therefore, include *node* in the fully qualified name only when you require access to a file that is located on a different node in your OpenVMS network.

device
specifies the name of the physical or logical disk or the physical tape that contains the file. The device specification is always followed by a single colon (:). The default value for *device* is your current disk. When you log in, the default disk is the disk that is associated with your user ID. Include *device* in the fully qualified name only when you need to access a tape file or a file on another disk.

directory
specifies the name of a directory or a sequence of directories. The directory specification must be enclosed in brackets; for example, [DIR1.DIR2.DIR3]. The directories that follow the first directory in the sequence are called subdirectories. In the previous example, DIR2 is a subdirectory of DIR1 and DIR3 is a subdirectory of DIR2.

The default value for directory is the default directory. Include directory in the fully qualified name only when you need to access a file that is not in your default directory. (For more information about the default directory, see "Directories" on page 6.)

Note: You can substitute angle brackets (< >) for square brackets ([ ]) in directory specifications. △

file-specification
specifies the name of a particular file within the directory. If the file is a SAS file, the filename must also comply with SAS naming conventions. (For details about SAS naming conventions, see *SAS Language Reference: Dictionary*.) The *file-specification* field has no default value unless you use a wildcard character.

file-type
usually describes the contents of the file. The *file-type* must be preceded by a period (.).

The default value for *file-type* depends on how the file is created or used. For example, some DCL commands assume default file types. You can assign a file type when you create a file.

version
specifies the version number of the file. Each time you modify or create and save a file, OpenVMS increments the highest existing version number for that file and adds the new version to the directory. Version numbers can range from 1 to 32,767. If you request a file without specifying the version number, then you access the latest version of the file by default. (The latest version of the file is the one that has the highest version number.) If you specify a version number, you must precede it with either a semicolon (;) or a period (.).

Your system manager sets the maximum number of versions of a file that are saved at any given time. For example, if you have edited a file named [DIR1] PROG.DAT 1,000 times and your system is set to keep four backup versions, then the directory [DIR1] contains the following versions:

```
PROG.DAT;1000
PROG.DAT;999
PROG.DAT;998
PROG.DAT;997
```

When you edit PROG.DAT the next time (version 1001), PROG.DAT;1001 is created and PROG.DAT;997 is deleted.

ODS-5 File Naming Conventions

Difference between the ODS-2 and ODS-5 File Naming Conventions

Although the default file naming convention is ODS-2, SAS accepts the Extended (ODS-5) Syntax on ODS-5 enabled volumes. These extended file specifications enable users to create filenames similar to those in the UNIX and Windows environments. The ODS-5 file naming convention behaves like the Windows convention. For example, if a filename exists in all uppercase, then any lowercase or uppercase reference to that file will resolve to uppercase.

Benefits to Using the ODS-5 Volume Structure

Some benefits to using the ODS-5 volume structure include the following:

- ODS-5 allows longer file names. Filenames can be up to 236 8-bit or 118 16-bit characters in length. File specifications longer than 255 bytes will be abbreviated by unmodified applications.
- ODS-5 supports more characters from the 8-bit ISO Latin-1 and the 16-bit Unicode (UCS-2) character sets. However, a few special characters in the ISO Latin-1 character set are not allowed in OpenVMS file specifications.

  The following characters are invalid:

  - C0 control codes (0x00 to 0x1F)
  - Double quotation marks (“)
  - Asterisk (*)
  - Backslash (\)
  - Colon (:)
  - Left and right angle brackets (<>)
  - Slash (/)
  - Question mark (?)
  - Vertical bar (|)

  The remaining special characters in the ISO Latin-1 character set are valid when preceded by the circumflex (^), which acts as an escape character.

  Note: If you use the apostrophe (’) in a file specification, you must enclose it in double quotation marks (“ ^’ “). If you enclose it in single quotation marks (’ ^’ ’), SAS will state that there is an error in the filename due to an uneven quote. △

- ODS-5 file specifications are no longer converted and stored all uppercase. ODS-5 syntax supports mixed-case and lowercase file specifications.
- ODS-5 supports deeper directory structures. Directories can be up to 255 levels. The naming conventions for directories follows that for filenames. A directory name can be up to 236 8-bit or 118 16-bit characters in length.

For more information about the Extended (ODS-5) Syntax, see the *OpenVMS Guide to Extended File Systems*.

Issuing a DCL Command Using ODS-5 Syntax

When using the ODS-5 syntax, you must submit an X statement before issuing a DCL command. For more information, see "Issuing DCL Commands during a SAS Session" on page 43.

Wildcards in OpenVMS Filenames

OpenVMS supports two general-purpose wildcard characters: the asterisk (*) and the percent sign (%). In DCL commands, you can use these wildcard characters in file specifications to operate on a group of files instead of on a specific file.

Note: Using wildcard characters in file specifications can degrade the performance of your operating environment. △

For additional rules for using wildcard specifications in operations across nodes in a network, refer to *OpenVMS Networking Manual*.

For information about using wildcards in file and directory specifications, see "Using Wildcard Characters in External File Specifications" on page 175.

The Asterisk

The asterisk (*) replaces zero or more characters in one or more of the *directory*, *file-specification*, *file-type*, and *version* fields in a file specification. It causes the DCL command to act on all files whose names match the fields that you include in the specification. For example, all of the following file specifications match CAT.SAS:

- *.SAS
- CA*.SAS
- CAT*.SAS
- *A*.SAS
- CAT.*

The asterisk (*) often references sets of files in DCL commands such as PRINT, TYPE, and COPY. For example, the following command prints all versions of all files in directory [DIR1] that have the file type .SAS:

```
$ PRINT [DIR1]*.SAS;*
```

The Percent Sign

The percent sign (%) replaces a single character in *directory*, *file-specification*, and *file-type* fields in the file specification. For example, the following command prints all versions of every file whose name has five characters beginning with the letters PROG and whose file type is .SAS:

```
$ PRINT PROG%.SAS;*
```

In other words, you can use the previous example to print files PROG1.SAS through PROG9.SAS, but not file PROG10.SAS. To print all versions of every file whose name begins with the letters PROG and whose file type is .SAS, enter the following command:

```
$ PRINT PROG*.SAS;*
```

OpenVMS File Types

The *file-type* portion of a filename often indicates the contents of the file. Both OpenVMS and SAS use default file types for output files. DCL commands that create files often assign default file types if you omit *file-type* in the file specification. When you assign file types to files you create, keep in mind that either OpenVMS or SAS might require a certain file type, depending on how a file is used. The following is a list of commonly used OpenVMS file types:

.COM	is usually a DCL command file that can be executed with the DCL @ command or submitted for batch execution with the SUBMIT command. (For information about submitting a SAS job in batch mode, see "Batch Mode under OpenVMS" on page 24.)
.DIR	is usually a directory. The DCL CREATE/DIRECTORY command assigns the file type .DIR by default.
.LIS	is usually a file called a listing, which may contain output of a SAS session.
.LOG	is usually a file called the OpenVMS log, which contains batch job output, or it is the log of a SAS session.
.MAI	is usually a file containing messages that were entered with the OpenVMS Personal Mail Utility (MAIL).

For a complete list of OpenVMS file types, refer to *OpenVMS User's Manual*.

OpenVMS File Types Used by SAS

Warning about Changing File Types

SAS uses unique file types to distinguish between SAS files and OpenVMS external files in a directory.

CAUTION:

Do not change these file types. The file types in the following sections are an integral part of how SAS accesses files under OpenVMS. Changing the file types can cause unpredictable results. △

File Types for SAS Files

Most of the file types that SAS uses are assigned to files that are described as either temporary or permanent *SAS files*. A SAS file is stored in a SAS data library and is referred to as a *member* of a library. Each member has a *member type*. SAS equates some OpenVMS file types with a general set of SAS member types that it uses under all operating environments.

Starting in Version 8, the names of these file types have the following form:

engine-name-filetype

engine-name
: is the name of the SAS engine, such as SAS7B for the Base engine and SAS7S for the sequential engine

filetype
: is the type of file. For example, the SASV7BDAT file type is a data file that is accessed by the SASV7 engine.

For information about SAS engines, see Chapter 6, "Using SAS Engines," on page 153.

In addition, two types of SAS temporary files exist, with OpenVMS file types of .SAS7BUTL and .SAS7BPUT. These files appear only in the SASWORK data library.

File Types for External Files

External files can be processed by other programs and by the FILENAME function and the %INCLUDE, FILE, and INFILE statements in the SAS DATA step. (For more information about external files, see Chapter 7, "Using External Files and Devices," on page 171.) SAS uses the following OpenVMS file types for external files:

.DAT
: is an external file that contains data lines. This is the default file type that SAS uses when it is reading and writing lines with the INFILE and FILE statements. (For more information, see "Default File Types" on page 177.)

.LIS
: is an external file that contains SAS procedure output. By default, the filename of the .LIS file matches the filename of the .SAS program file that generated the output.

.LOG
: is the external file that contains the SAS log. By default, the filename of the .LOG file matches the name of the SAS program file that generated it.

.SAS
: is a SAS program file—that is, an external file that contains SAS statements. Use this file type when you create a file that contains a SAS program. This is the default file type for the FILE command and for the %INCLUDE statement.

.TLB
: is an OpenVMS text library. SAS can access text libraries as external file aggregates. Text library files typically store data or SAS programs that are related. For example, you might want to store all SAS programs that are associated with a particular application in one text library. (For more information about OpenVMS text libraries, refer to *OpenVMS Librarian Utility Manual*.) OpenVMS text libraries are also often used to store SAS macros. (For more information about SAS macros, see Chapter 20, "Macro Facility under OpenVMS," on page 517.)

OpenVMS Logical Names and Logical-Name Tables

Under OpenVMS, logical names are used extensively in place of part or all of a file specification or to refer to devices or queues. For details about logical names and about logical-name tables, refer to *OpenVMS User's Manual*. You might also want to refer to the following sections for information about how OpenVMS logical names are used by SAS or about how you use them in SAS programs:

- "Customizing Your SAS Session Using OpenVMS Logical Names" on page 41
- "Assigning OpenVMS Logical Names" on page 140
- "Assigning OpenVMS Logical Names to External Files" on page 173
- "Commonly Used DCL Commands" on page 15

The OpenVMS Digital Command Language

Introduction to the OpenVMS Digital Command Language

When you communicate with the OpenVMS operating environment, you can use the OpenVMS Digital Command Language (DCL). Like other languages, DCL has grammar rules and a vocabulary. The vocabulary is a set of commands, and the grammar rules determine how you specify the commands.

The Command Line

A completely specified DCL command is called a command line. The general form of a command line is

$ *command/qualifier parameter/qualifier*

dollar sign ($) prompt	is required in all DCL command lines. When you execute DCL commands interactively, the OpenVMS system supplies the system prompt, which by default is the $ prompt. When you enter DCL commands in a command file, such as LOGIN.COM, you must enter the $ prompt in column 1.
command	is a DCL command that identifies the action to be performed. Use *OpenVMS DCL Dictionary* as a general reference to DCL commands and rules of grammar. Some commonly used DCL commands are described in "Commonly Used DCL Commands" on page 15. Some DCL commands are called verbs. These are commands whose names indicate the command's function.
qualifier	is an optional keyword that modifies or expands the action of the command. It is always preceded by a forward slash (/). If a qualifier requires a value, it is given in the following form: *qualifier=value*
parameter	is either a keyword or a file specification (depending on the command) that is acted on by the command. For details about how to enter an OpenVMS file specification, see "OpenVMS Filenames" on page 8. If the command requires one or more parameters, then OpenVMS prompts you for them, unless you include the parameter in the command line. Notice in the command line syntax that both commands and parameters can be qualified.

How to Continue a Long Command on the Next Line

If a command line does not fit on one line, enter a space and a hyphen (-) as the last element in the command line. Then press the RETURN key and continue the command on the next line. Here is an example:

$ *command* -

_$ *parameter/qualifier*

When you end a command line with a hyphen, the next prompt is preceded by an underscore (_).

Interrupting Command-Line Processing

You can interrupt command-line processing by simultaneously pressing the CTRL key and the Y key (CTRL+Y).

Command Procedures

A command procedure is an OpenVMS file that contains sequences of DCL commands. The OpenVMS file type for command procedures is .COM. The LOGIN.COM file is an example of a command procedure. (For more information, see "LOGIN.COM File" on page 5.) To save yourself time when you perform complicated or repetitive tasks, you can create command procedures.

Creating a Command Procedure

Use your favorite editor to create the file of commands. For example, the following series of commands might be included in a command procedure named RENAME.COM:

```
$ PURGE *.*
$ RENAME *.*; *.*;1
```

The first line deletes all but the latest version of all files in your default directory. The second line renames all files in your current directory to version 1.

Invoking a Command Procedure

To invoke the RENAME.COM command procedure, you would enter the following command at the $, or system, prompt:

```
$ @RENAME
```

The at sign (@) indicates that you want to execute a command procedure. For more information about creating and using command procedures, refer to *OpenVMS User's Manual*.

Commonly Used DCL Commands

Some of the most commonly used commands in an interactive command language are those that control your terminal session and those that manage files. The following subset of commands is divided into these two categories: controlling a terminal session and managing files. Many of these commands are used in examples throughout this documentation. The common abbreviation for a command is shown in parentheses beside the fully specified command. These abbreviations are the defaults; if these commands or symbols have been redefined, they might have a different action. See your system manager if the abbreviation does not work as you expected.

Note: You can issue any DCL command from within a SAS program by specifying the command in the SAS X statement or X command. For more information, see "Issuing DCL Commands during a SAS Session" on page 43. △

Commands for Controlling a Terminal Session

Use the following DCL commands to control your terminal session:

DIRECTORY (DIR)
displays a list of files and subdirectories in the specified directory, or in the current directory if no directory or file specification is given. For example, the following command produces a list of files in your default directory:

```
$ DIR
```

HELP
activates the OpenVMS HELP facility.

LOGOUT (LO)
terminates a terminal session and deletes your process.

SET DEFAULT (SET DEF)
changes the default directory. If you move to another disk, this command also changes the default disk device. For more information about the default directory, see "Directories" on page 6.

SET DISPLAY (SET DISP)
indicates where to send the interactive display of an OpenVMS DECwindows application. You need to use this command when you are running interactive SAS on a non-local device such as a PC display running emulation software.

SHOW DEFAULT (SHO DEF)
displays the default directory and the default disk device.

SHOW QUEUE (SHO QUE)
displays all queues including the batch queue.

SUBMIT (SUBM)
places one or more jobs (command procedures) in a batch queue for processing.

Commands for Managing Files

Use the following DCL commands to manage your files:

COPY (COP)
copies one or more files to one or more specified files.

CREATE/DIRECTORY (CRE/DIR)
creates a directory.

DEFINE
associates a logical name with a file specification or equivalence name.

DELETE (DEL)
removes access to a file. The file specification must reference the version(s).

EDIT</*editor*> (ED</*editor*>)
invokes the specified OpenVMS editor to create or modify a file.

PRINT (PR)
prints a file on the default system printer or on a specified device.

PURGE (PUR)
: deletes all versions of a specified file or files except the latest version.

TYPE (TY)
: displays the contents of a file.

Data Security

Introduction to Data Security

SAS protects data sets, catalogs, and external files by using the normal OpenVMS access-control measures: file protection and access control lists. These access-control measures apply equally to SAS data sets, catalogs, and external files. SAS data set security measures, such as data set “read” and “write” passwords, are also available.

File Protection

File protection is a generalized way of controlling access to files, based on the relationship of the user that is accessing the file to the file owner. A typical file protection is specified as a list of user classes and their permitted operations.

File protection consists of four classes of users who can access a file:

SYSTEM
: refers to a user who has a system user identification code (UIC) or SYSPRV privilege. This class is typically reserved for the system manager and operations staff.

OWNER
: refers to a user who has the same UIC as the user who created the file. At most sites, each user has a unique UIC, so the OWNER is always the person who created the file.

GROUP
: refers to a user who has the same group number in his or her UIC as the creator of the file.

WORLD
: refers to any other user on the system.

Permitted operations are

READ access
: is required in order to read a file. For example, you must have READ access to a file if you intend to browse, copy, or move it.

WRITE access
: is required in order to change the attributes of a file, including its file protection, as well as to modify data in the file.

EXECUTE access
: is required in order to execute files such as command procedures. It does not apply to OpenVMS data files such as SAS data sets, catalogs, or external files.

DELETE access
: is required in order to delete or move a file.

A typical file-protection specification might be

```
(S:RWE, O:RWED, G:RE, W)
```

This example permits a SYSTEM user to READ, WRITE, or EXECUTE the file. The OWNER is permitted any operation on the file. Members of the same GROUP as the user are permitted to READ or EXECUTE the file. All other users are denied access to the file.

Specifying File Protection for a Process

To specify file protection for the duration of your process (or until you change the specification), use the SET PROTECTION/DEFAULT DCL command. The /DEFAULT parameter tells OpenVMS to apply the specification to every file that you create during your OpenVMS process except those for which you explicitly specify file protection. For example, the following command specifies new protection values for files that you subsequently create:

```
$ SET PROTECTION=(S:RWE,O:RWED,G:RE,W)/DEFAULT
```

Specifying File Protection for Individual Files

To specify file protection for a particular file or set of files, use the SET PROTECTION command without the /DEFAULT parameter. For example, the following SET PROTECTION command sets new protection values for the file MYDATA.SAS7BDAT:

```
$ SET PROTECTION=(S:RWE,O:RWED,G:RWED,W:RE) -
_$ MYDATA.SAS7BDAT
```

For more information about file protection, refer to *OpenVMS User's Guide* and *OpenVMS Security Manual*.

Access Control Lists

Access control lists (ACLs) provide more specific control over who can perform operations on a file. ACLs allow each file to have a list of identifiers, which can be either UICs or keyword names that are assigned by the system manager. Only users with matching UICs or resource identifiers can perform operations on the file.

The description of ACLs is beyond the scope of this document. For more information, refer to *OpenVMS Security Guide*.

CHAPTER

2

Getting Started with SAS under OpenVMS

Starting a SAS Session under OpenVMS

Invoking SAS

Regardless of which mode of operation you use for running SAS, you will need to ask your system manager what the *SAS command* (the command that invokes SAS) is at your site. At many sites, the SAS command is simply **SAS**, but a different command could have been defined during the SAS installation process at your site.

Note: The examples in this section use **SAS91** as the SAS command. △

Also ask your system manager which interface or mode of operation is the default when you enter the SAS command.

When you invoke SAS, you can specify system options either when you issue the SAS command or in a configuration file:

```
$ SAS91/FULLSTIMER/PRINT=SYS$LOGIN:TEST.OUT
```

For details, see "Specifying System Options in the SAS Command" on page 33 and "Configuration Files" on page 36.

For more information about SAS system options, see Chapter 19, "System Options under OpenVMS," on page 429.

If no system options are specified in the SAS command, a configuration file, an autoexec file, or the VMS_SAS_OPTIONS DCL symbol, then the default system options that are shipped with SAS are in effect. However, your system manager might have overridden the default options; ask your system manager for details about the default options at your site.

What If SAS Does Not Start?

If SAS does not start, the SAS log might contain error messages that explain the failure. Error messages that SAS issues before the SAS log is initialized, however, are written to the SAS console log.

Under OpenVMS, the SYS$OUTPUT logical name specifies the location of the console log. This location depends on the user mode. If you are invoking SAS in interactive mode or using a command procedure, SAS displays the error messages at your terminal. If you are invoking SAS in batch mode, SAS writes the error messages to a batch log file.

Selecting a Mode of Operation under OpenVMS

Under OpenVMS, you can use any of the following methods to run SAS:

- SAS Explorer (see "SAS Windowing Environment under OpenVMS" on page 22)
- batch mode (see "Batch Mode under OpenVMS" on page 24)
- interactive line mode (see "Interactive Line Mode under OpenVMS" on page 26)
- noninteractive mode (see "Noninteractive Mode under OpenVMS" on page 27).

For additional information about these modes, see *SAS Language Reference: Concepts* and the Base SAS software section in SAS Help and Documentation.

Note: You can also run SAS in a SPAWN/NOWAIT subprocess or in a detached process. SPAWN allows you to use the SAS windowing environment. However, the detached process method is similar to batch mode for queues. For details about these methods, see “Running SAS in a SPAWN/NOWAIT Subprocess” on page 29 and “Running SAS in a Detached Process” on page 29. △

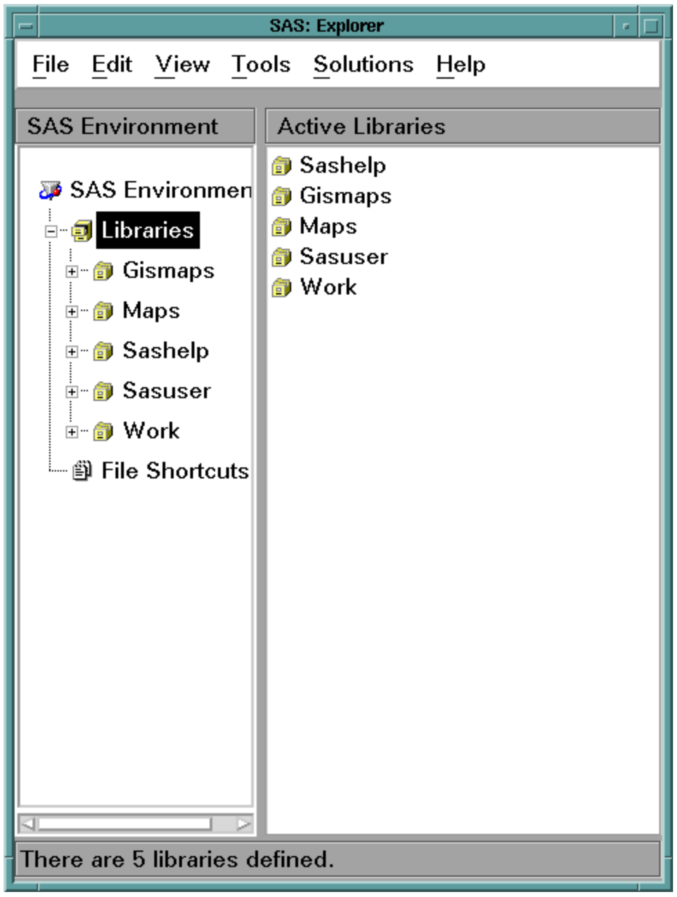
SAS Windowing Environment under OpenVMS

Introduction to the SAS Windowing Environment

Invoking SAS in the windowing environment opens three programming windows: Program Editor, Log, and List.

The Explorer window is available on any display device that uses the Motif interface. For information about Motif, see your Motif documentation. The SAS Explorer window is not the default for SAS in the OpenVMS operating environment.

Display 2.1 SAS Explorer Window



There are 5 libraries defined.

For more information about the SAS windowing environment, see Chapter 3, “Working in the SAS Windowing Environment,” on page 55.

Note: If you are not using an X display, then you need to invoke SAS in interactive line mode using the NODMS system option. For more information, see “Interactive Line Mode under OpenVMS” on page 26. △

Methods for Invoking a SAS Process

If you have the hardware and software to run the Motif interface, you can use any of the following methods to invoke a SAS process:

- □ the SAS command plus any appropriate system options
- □ the Applications menu of the Motif Session Manager
- □ a command procedure (COM) file.

Invoking SAS with the SAS Command

If the SAS windowing environment is not the default, then use the SAS windowing environment system option to specify the SAS windowing environment interface:

```
$ SAS91/DMS
```

If the SAS Explorer window is not the default, then use the EXPLORER system option to specify the Explorer window:

```
$ SAS91/EXPLORER
```

To invoke both the SAS windowing environment and the SAS Explorer window, use the DMSEXP system option:

```
$ SAS91/DMSEXP
```

As explained in “Starting a SAS Session under OpenVMS” on page 21, you can also specify other system options when you invoke SAS in this manner.

To specify a display node, use the SET DISPLAY DCL command. For example, if you want to invoke SAS with the Explorer window and to display the windows on node MYNODE running TCP/IP transport protocol, type the following:

```
$ SET DISPLAY/CREATE/NODE=MYNODE/TRANS=TCPIP
$ SAS91/EXPLORER
```

For more information about the SET DISPLAY DCL command, see the OpenVMS online help. For more information about logical names, refer to *OpenVMS User’s Manual*.

Invoking SAS from Your Motif Session Manager

You can also invoke SAS from the **`Applications`** menu of your Motif Session Manager. To add SAS to the **`Applications`** menu, follow these steps:

1. From the **`Options`** menu, select **`Menus`**.
2. Select **`Applications`** from the **`Menu Names`** list.
3. Enter a menu item name, such as **`MySAS`**, and define SAS91/*system-option* along with the appropriate command-line qualifiers, as the DCL command.
4. Add the menu definition to the **`Item Names`** list by clicking the up arrow.
5. Add the new item name to the existing list of applications by clicking the left arrow.
6. Click Apply and then click Cancel in the Menus dialog box.
7. Select your menu command from the **`Applications`** menu to invoke SAS.

For more information about Session Manager, see the documentation for your Motif interface.

Invoking SAS from a Command Procedure File

To invoke SAS with the Explorer window from a command procedure (COM) file, place the following commands in the COM file:

```
$ DEASSIGN SYS$INPUT
$ SAS91/EXPLORER
```

To invoke SAS with the SAS windowing environment interface from a command procedure (COM) file, place the following commands in the COM file:

```
$ DEASSIGN SYS$INPUT
$ SAS91/DMS
```

To invoke SAS in the DMSEXP mode from a command procedure (COM) file, place the following commands in the COM file:

```
$ DEASSIGN SYS$INPUT
$ SAS91/DMSEXP
```

The DEASSIGN command prevents OpenVMS from looking for program input in the location defined by the SYS$INPUT logical name, and it enables SAS to be initialized with the Explorer window.

If the COM file is named MYSAS.COM, then you would execute the file as follows:

```
$ @MYSAS
```

For more information about command procedure files, see “Command Procedures” on page 15 and *OpenVMS User’s Manual*.

Batch Mode under OpenVMS

What Is Batch Mode?

SAS *batch mode* is equivalent to OpenVMS batch mode. It is useful for SAS programs that require large amounts of time and memory. In batch mode, you submit a job to an OpenVMS batch queue, and the job awaits execution along with batch jobs that have been submitted by other OpenVMS users. The amount of time before your job executes depends on how many other jobs are in the input queue, on what priority the operating environment has assigned to your job, and how your batch queue(s) is configured.

You can use your terminal for other tasks while the job awaits execution, but you cannot change the submitted job in any way until after it executes.

Files Required for Running in Batch Mode

Usually, the first step in executing a program in batch mode is to prepare two types of files:

command procedure file
: contains the DCL commands that are used to set up the SAS environment. For example, it might include commands that do the following:

- □ define OpenVMS logical names
- □ set your default directory to access your data
- □ invoke SAS with the appropriate SAS system options.

program file
contains the SAS program that you want to execute. The name of this file can be included in the text of the command procedure file, or it can be passed as a parameter to the command procedure file. See the examples in "Examples of Batch Job Files" on page 25.

Examples of Batch Job Files

Example 1: Separate Command Procedure and Program Files

In this example, a file called MYPROG.SAS that contains the following simple SAS program is created first:

```
libname in 'disk:[directory]';
proc print data=in.mydata;
   title 'A Simple SAS Program';
run;
```

Next, a command procedure file called CONTROL.COM that contains the following DCL command is created:

```
$ SAS91/LINESIZE=76/NODATE [HOME.SUBDIR]MYPROG.SAS
```

CAUTION:
Do not give your SAS program and the command procedure the same name. Giving them the same name causes confusion when both the OpenVMS log and the SAS log are created. The OpenVMS log is created first (for example, MYPROG.LOG;1) and the SAS log is created second (MYPROG.LOG;2). If your OpenVMS system has been set up to keep only one version of a file, then the OpenVMS batch log will be overwritten by the SAS log. △

To submit the SAS job, the following command is entered at the DCL prompt:

```
$ SUBMIT/NOTIFY CONTROL.COM
```

The job is placed in the default batch queue, and the terminal session is available for other work. You will be notified by the operating environment when your batch job has completed.

Example 2: Passing the Name of the Program File as a Parameter

You can make your command procedure file more generic and pass the name of the SAS program as a parameter. This is helpful if you want to execute several programs in the same environment. To do this, you would modify the command procedure file from Example 1 as follows:

```
$ SAS91/LINESIZE=76/NODATE  'P1'
```

The **`'P1'`** at the end of the SAS command line is the placeholder for the parameter that you are going to pass to the command.

You could then submit a program called MYPROG.SAS by executing the following command:

```
$ SUBMIT/NOTIFY/PARAMETER=("MYPROG.SAS") CONTROL.COM
```

Example 3: Including the Program File in the Command Procedure File

A third alternative is to include the SAS program in the same file as the control commands. In a batch environment, the OpenVMS system assumes that the input source is the command procedure file that is executing. This input source is named by the OpenVMS logical name SYS$INPUT. To combine the control commands and the SAS program in the same file, create a command file that contains the following lines:

```
$ SAS91/LINESIZE=76/NODATE-
   /PRINT=DISK:[DIRECTORY]MYPROG.LIS-
   /LOG=DISK:[DIRECTORY]MYPROG.LOG SYS$INPUT
libname in 'disk:[directory]';
proc print data=in.mydata;
   title 'A Simple SAS Program';
run;

endsas;
```

The hyphen at the end of the first line of the SAS command indicates that the command continues on the next line. Designating SYS$INPUT as your input file tells SAS that your input will be included in the text of the command procedure file. Submit this job as you would any other batch job at your site.

Interactive Line Mode under OpenVMS

What Is Interactive Line Mode?

In SAS *interactive line mode*, you enter SAS statements line by line in response to line prompts that are issued by SAS. The SAS session retains exclusive use of the terminal or terminal window.

Invoking SAS in Interactive Line Mode

To invoke SAS in interactive line mode, enter the following command at the DCL prompt:

```
$ SAS91/NODMS
```

(If your system manager has set up the SAS environment so that the NODMS system option is the default, you can omit the NODMS option.)

As explained in “Starting a SAS Session under OpenVMS” on page 21, you can also specify other system options when you invoke SAS in this manner.

When SAS prompts you with the 1? prompt, enter your SAS statements. By default, both the SAS log and the procedure output files (if any) appear on your display as each step executes.

Recalling SAS Statements with CTRL+B and the Arrow Keys

Under OpenVMS you can recall SAS statements by using the CTRL+B key combination and your up arrow and down arrow keys.

If you specify **`/termio=block`** when you invoke SAS, both CTRL+B and the up arrow key move you backward through SAS statements that you entered previously. However, the default is **`/termio=noblock`**, which means that you can recall only the previous command.

If you have specified **`/termio=block`** when you invoke SAS, and you enter four lines of code and want to recall the first line, press CTRL+B or the up arrow key four times. Each time you press CTRL+B or the up arrow key, the previous line appears after the SAS prompt. When the correct line appears, press RETURN to submit the code.

If you accidentally miss the line that you wanted, then use the down arrow key to move forward through the list of previously entered commands. Each time you press the down arrow key, the next statement appears after the SAS prompt.

Saving SAS Statements

Interactive line mode is most effective when you use the %INCLUDE statement to bring in most of your SAS statements. Using this method, the programs that you enter are not long, and you do not need to save your SAS statements. However, if you want to save your program, the best method is to write your SAS log to an OpenVMS file.

One easy way to save your SAS statements is to use the PRINTTO procedure followed by the %LIST statement after you have entered your program statements. For example:

```
. . . program statements . . .
14? filename mylog '[sasdemo]program.log';
15? proc printto log=mylog;
16? run;
17? %list;
```

This program gives you a listing of every line you have entered during your current SAS session. The lines are saved in an OpenVMS file that is referred to by the fileref MYLOG, which was assigned in the FILENAME statement in line 14.

Note: To redirect the log to your display, enter the following PROC PRINTTO statement with no options:

```
proc printto;
run;
```

△

Ending Your SAS Session

The ENDSAS statement terminates SAS interactive line mode:

```
endsas;
```

Then OpenVMS prompts you for a DCL command.

Note: Like all SAS statements, the ENDSAS statement must be followed by a semicolon (;). △

Noninteractive Mode under OpenVMS

What Is Noninteractive Mode?

In SAS *noninteractive mode*, OpenVMS retains exclusive use of the terminal as the noninteractive SAS job executes. However, if your SAS program invokes windowing procedures, you can interact with the program during program execution. Your SAS program is read from a file that you specify by including the filename in the SAS command.

Note: Noninteractive mode is similar to batch mode: statements are usually not expected to come from the terminal, and the SAS log and procedure output are routed to files with .LOG and .LIS file extensions by default. △

Invoking SAS in Noninteractive Mode

To invoke SAS in noninteractive mode, enter the SAS command followed by the name of the SAS program file that you want to execute. For example, suppose you have stored SAS statements and data lines in a program file named [HOME.SUBDIR]MYPROG.SAS. At the DCL prompt, enter the SAS command and the name of the file as follows:

```
$ SAS91 [HOME.SUBDIR]MYPROG
```

You do not need to include the file type in the filename because the SAS command uses the .SAS file extension by default. If [HOME.SUBDIR] is your current default directory, then you can omit the directory name from the file specification as follows:

```
$ SAS91 MYPROG
```

In either case, SAS executes the statements in MYPROG.SAS and creates two files in the default directory: MYPROG.LOG contains the SAS log output and MYPROG.LIS contains the output from any SAS procedure that produces output.

To print one or both of these files, use the PRINT DCL command. To view these files at your terminal, use the EDIT or TYPE command. Note that if you use the TYPE command to list a SAS log that contains errors, overprinting obscures the line containing the error unless the OVP system option was set to NOOVP during your SAS session. (For a description of the OVP system option, see *SAS Language Reference: Dictionary*.)

Recalling SAS Statements

In noninteractive mode, the %INCLUDE statement serves two purposes. You can use it to include SAS statements that are stored in an external file, or you can issue the following form of the statement to allow input from your current terminal:

```
%include *;
```

Program execution pauses as you are prompted for input from the terminal. The prompt is a line number and an asterisk (*). Although this input method simulates SAS interactive line mode (because you are prompted for statements line by line), the statements are not interpreted line by line. This means that syntax errors are not detected until you terminate input and return to noninteractive processing.

To terminate input and resume noninteractive processing, enter a %RUN statement:

```
%run;
```

Note: Like all SAS statements, the %RUN statement must be followed by a semicolon (;). △

Running SAS in a SPAWN/NOWAIT Subprocess

The SPAWN= system option enables you to run SAS in a SPAWN/NOWAIT subprocess. This method of running SAS is similar to batch mode if you do not specify /DMS or /EXPLORER. The only difference is that in batch mode, SAS runs in its own process rather than in a spawned subprocess.

When you specify SPAWN=NOWAIT in the SAS command and do not specify /DMS or /EXPLORER, SAS assumes the terminal cannot be used to take input from the user. Therefore, SAS will not run in interactive line mode if you do not specify /DMS or /EXPLORER. You can, however, run SAS in noninteractive mode, or invoke SAS under the Motif interface, as shown in the following SAS commands:

```
$ SPAWN/NOWAIT SAS91/SPAWN=NOWAIT MYFILE.SAS

$ SPAWN/NOWAIT SAS91/SPAWN=NOWAIT/EXPLORER

$ SPAWN/NOWAIT SAS91/SPAWN=NOWAIT/DMS
```

Attention-handling is disabled if you are running SAS with SPAWN=NOWAIT in effect. Thus, to terminate the subprocess running SAS, use the STOP DCL command.

For details about invoking the SPAWN= system option, see “SPAWN= System Option” on page 497.

Running SAS in a Detached Process

Advantage to Using a Detached Process

Unlike a spawned process, a detached process is independent of other processes; it is not linked to an OpenVMS parent process. A batch job is one type of detached process. To avoid the restrictions of batch processes, or to free up your DECterm window and still invoke SAS interactively or noninteractively, you can submit a SAS job to run in a detached process.

Example: Invoking the SAS Windowing Environment in a Detached Process

The following DCL command procedure file, DETACH.COM, invokes SAS with the SAS windowing environment interface in a detached process. (The numbered lines are explained following the code.)

```
   $! DETACH.COM
   $ SET NOON
❶$ DEFINE SYS$LOGIN DISK:[HOMEDIR]
   $ SET DEFAULT SYS$LOGIN
   $ @SYS$LOGIN:LOGIN.COM
   $ DEFINE SAS$NET_TYPE XCLIENT
❷$ @DUA1:[SAS91.TOOLS]SAS91.COM
   $ SAS91:==$SAS$ROOT:[IMAGE]SAS91.EXE
   $ SAS91/DMS
   $ EXIT
```

❶ Replace **`DISK:[HOMEDIR]`** with your own disk.

❷ Replace **`DUA1:[SAS91.TOOLS]`** with your own location for SAS. Leave **`SAS91.COM`** as it is. (The SAS91.COM file defines OpenVMS logical names that SAS uses. For more information about the SAS91.COM file, see "Customizing Your SAS Session Using OpenVMS Logical Names" on page 41.)

To execute the DETACH.COM file, you would use a command like the following:

```
$ RUN/DETACHED/INPUT=DETACH.COM-
_$ /OUTPUT=DETACH.LOG-
_$ SYS$SYSTEM:LOGINOUT.EXE
```

Note: If your LOGIN.COM does not include a SET DISPLAY command, you must include one in your DCL command procedure. △

X Window Command Line Options

Specifying X Window Command Line Options

When you invoke some X clients, such as SAS, you can use command line options that are passed to the X Window System. In general, you should specify X Window System options after SAS options on the command line with the /XRESOURCES option. For example,

```
SAS91/xres="-display wizard:0.0"
```

The X Window command line options and their values must be enclosed in double quotation marks. If the first blank-separated element of a /XRES argument list does not begin with a hyphen (-), it is assumed to be the name to use for the application instance.

X Window Command Line Options Available at Invocation

The following list describes the X Window command line options that are available when you invoke a SAS session from the command prompt:

-display *host:server.screen*
specifies the name or IP address of the terminal on which you want to display the SAS session. For example, if your display node is "wizard," you might enter

```
-display wizard:0.0
```

or

```
-display 10.22.1.1:0
```

You can set the display with the OpenVMS **`$SET DISPLAY/CREATE`** DCL command. A **`-display`** option on the command line takes precedence over the default display setting that is set with the **`$SET DISPLAY/CREATE`** command.

Note: Because SAS supports only the TCP/IP transport protocol, the double-colon DECnet naming style (*host::server.screen*) is not valid. △

-name *instance-name*

reads the resources in your SAS resource file that begin with the value specified for *instance-name*. For example, **`-name MYSAS`** reads the resources that begin with **`MYSAS`** such as

```
MYSAS.dmsfont: Cour14
MYSAS.defaultToolbox: True
```

You can also specify the value for *instance-name* without putting **`-name`** in the /XRES option if

```
-name
```

is the first item in the quotation marks. For example,

```
SAS91/xres="SAS"
```

is the same as

```
SAS91/xres="-name SAS"
```

-xrm *string*

specifies a resource to override any defaults. For example, the following resource turns off the Confirm dialog box when you exit SAS:

```
SAS91/XRESOURCE="-xrm "SAS.confirmSASExit: False"
```

As an alternative to the -xrm option to /XRESOURCE, you can use multiple instances of the /XRM command line option to specify individual X resources, for example:

```
SAS91/XRM="SAS.confirmSASExit: False"/XRM="SAS.pmenu.On: False"
```

Techniques for Customizing Your SAS Session under OpenVMS

No matter which mode of operation you use for running SAS, you might want to customize certain aspects of SAS. 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.

Under OpenVMS, you can customize SAS for your session in the following ways:

- Specify SAS system options when you invoke SAS with the SAS command. This method is usually used for one-time overrides of the system option settings that would otherwise be in effect for your SAS session. See “Specifying System Options in the SAS Command” on page 33.
- Specify SAS system options in a 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, or if you always want particular system options to be in effect for a particular job. See “Configuration Files” on page 36.
- Execute SAS statements (such as OPTIONS, LIBNAME, and FILENAME statements) in an autoexec file. This method is most useful for specifying options and files that pertain to a particular SAS application. See “Autoexec Files” on page 39.
- Execute an OPTIONS statement in a SAS program. See “Specifying System Options in the OPTIONS Statement” on page 34.

- ☐ If you are using the SAS windowing environment, change SAS system option settings from within the System Options window. See “System Options Window” on page 32.
- ☐ If you are using the SAS windowing environment, specify a SASUSER library that contains a user profile catalog. See “The SASUSER Data Library” on page 134.
- ☐ Define or redefine OpenVMS logical names that SAS uses. See “Customizing Your SAS Session Using OpenVMS Logical Names” on page 41.
- ☐ Specify SAS system options using the VMS_SAS_OPTIONS DCL symbol. See “Specifying SAS Options in the VMS_SAS_OPTIONS DCL Symbol” on page 35.

Note: For information about customizing your SAS windowing environment, see Chapter 4, “Customizing the SAS Windowing Environment,” on page 77. △

If no system options are specified in the SAS command, a configuration file, or an autoexec file, then the default system options that are shipped with SAS are in effect. However, your system manager might have overridden those default options. Ask your system manager for details about the default system options at your site.

For more information about SAS system options, see Chapter 19, “System Options under OpenVMS,” on page 429 and *SAS Language Reference: Dictionary*.

Customizing Your SAS Session Using System Options

Displaying and Setting System Option Settings

Most SAS system options are set to default values. To display the current settings of SAS system options, use either the OPTIONS procedure, the System Options window, or the GETOPTION function.

OPTIONS Procedure

The OPTIONS procedure writes to the SAS log all system options that are available under OpenVMS. Chapter 19, “System Options under OpenVMS,” on page 429 describes the system options listed by the OPTIONS procedure that are host-specific and that have host-specific behavior. *SAS Language Reference: Dictionary* describes all system options that have no host-specific behavior but might be specified differently in various operating environments.

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;
```

For more information about the OPTIONS procedure, see “OPTIONS Procedure” on page 383 and *Base SAS Procedures Guide*.

System Options Window

The SAS System Options window displays the settings of the SAS system options. The system options are grouped by their function within SAS. Each group has at least one subgroup.

To display the System Options window, do one of the following:

- □ Type `options` on the command line of any SAS windowing environment window or windowing procedure window and press RETURN.
- □ From the `Tools` menu, select `Options`, and then select `System`.

You can select a group of system options by clicking on the icon to the left of the group name in the left side of the System Options window. To open a subgroup either click the icon to the left of the subgroup name in left side of the window or double-click the subgroup name in the right side of the window. You will see a list of the system options in that subgroup, along with their values and a brief description.

You can also use the System Options window to change the settings of system options for the duration of your SAS session. To change the setting of a system option either double-click the name of the system option, or with cursor on the name of the system option press the right mouse button and select `Modify Value`. The Modify Value dialog box opens. You can then modify the setting of the system option as desired. Click OK to save your changes. Click Cancel to ignore any changes and close the Modify Value dialog box.

You can close the System Options window by doing one of the following:

- □ Double-click the window menu button in the upper-left corner.
- □ Click the window menu button in upper-left corner and select `Close` from the menu.

For help and additional information about the System Options window, click Help in the window.

For additional information about system options settings, see “Summary of SAS System Options under OpenVMS” on page 432 and *SAS Language Reference: Dictionary*.

GETOPTION Function

The GETOPTION function returns the value of a SAS system option or graphics option. It can be used within the DATA step or in conjunction with %SYSFUNC in open code. For more information about the GETOPTION function, see *SAS Language Reference: Dictionary*.

Specifying System Options in the SAS Command

General Form of the SAS Command

The way you specify the SAS command determines the mode of operation that you use for running SAS as well as the default SAS system options. The general form of the SAS command is

$ SAS91/*system-option-list file-specification*

Both *system-option-list* and *file-specification* are optional. You can include *system-option-list* for any mode of operation. If you include *file-specification*, then SAS is invoked in noninteractive mode. If you do not include *file-specification*, then the mode of operation will be the SAS windowing environment. For details about invoking SAS in the different modes of operation, see “Selecting a Mode of Operation under OpenVMS” on page 21.

All SAS system options can be specified in the SAS command. Under OpenVMS, each option is preceded by a forward slash (/).

As “Example 1: Setting the LINESIZE= and PRINT= System Options” on page 34 and “Example 2: Specifying System Options in Noninteractive Mode” on page 34 show, system options that take a value (such as LINESIZE= and PRINT=) are specified in the following form:

```
/option-name=value
```

Note: Any option value that is entered on the OpenVMS command line within single quotation marks (') is resolved to its symbol value before it is processed by SAS. Any quoted value that should not be resolved as a symbol must be enclosed in double quotation marks ("). For example, the values for the system options FMTSEARCH=, INITSTMT=, and SYSPARM= must be enclosed in double quotation marks. △

Other system options can be thought of as on (enabled) or off (disabled). Specifying just the keyword enables the option; specifying the keyword with the prefix NO disables the option. For more information, see "Example 3: Disabling System Options" on page 34.

Example 1: Setting the LINESIZE= and PRINT= System Options

In the following example, the LINESIZE= system option tells SAS to use a line length of 80 characters for the log file, the procedure output file, and the print file:

```
$ SAS91/LINESIZE=80/PRINT=SYS$LOGIN:TEST.OUT
```

The PRINT= system option tells SAS to route the procedure output to the file SYS$LOGIN:TEST.OUT.

Example 2: Specifying System Options in Noninteractive Mode

The next example invokes SAS in noninteractive mode, specifying the program file MYPROG and the LINESIZE= and PAGESIZE= system options:

```
$ SAS91/LINESIZE=60/PAGESIZE=80 MYPROG
```

Example 3: Disabling System Options

In the following example, the CENTER and STIMER system options are disabled:

```
$ SAS91/NOCENTER/NOSTIMER
```

Specifying System Options in the OPTIONS Statement

You can use the OPTIONS statement to specify system option settings at any time during a SAS session, except within data lines or parmcard lines. Settings remain in effect for the duration of the session or until you reset them with another OPTIONS statement.

Not all system options can be specified in an OPTIONS statement. The summary table of system options, Table 19.1 on page 433, tells where each system option can be specified.

The following is an example of an OPTIONS statement:

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

For more information about the OPTIONS statement, see *SAS Language Reference: Dictionary*.

Specifying SAS Options in the VMS_SAS_OPTIONS DCL Symbol

You can define SAS options with the VMS_SAS_OPTIONS DCL symbol by using the following syntax:

VMS_SAS_OPTIONS = "*/option 1/option 2/...*"

where *option* is the SAS option that you specify. This example defines a symbol in the local symbol table. To define a symbol in the global symbol table, replace "=" with "==".

Note: Only one definition of the symbol is used by SAS, and the local table is searched before the global table. This means that if a local and a global version of the symbol are defined, the global version will be ignored. △

Precedence for System Option Specifications

For many system options, different values can be specified in the SAS command, in a configuration file, in an OPTIONS statement (submitted in an autoexec file or in a SAS program), and in the System Options window. When the same system option is set in more than one place, the order of precedence is as follows:

1. restricted configuration files
   a. user files
   b. group files
   c. global file.

   (For more information about restricted configuration files, see the *SAS System Configuration Guide for OpenVMS*.)
2. System Options window or OPTIONS statement (submitted from a SAS session or job).
3. autoexec files that contain OPTIONS statements (after SAS is initialized but before the user supplies input):
   a. process-level autoexec file
   b. job-level autoexec file
   c. group-level autoexec file
   d. system-level autoexec file
   e. cluster-level autoexec file.
4. SAS command.
5. configuration files (as SAS is being initialized):
   a. process-level configuration file
   b. job-level configuration file
   c. group-level configuration file
   d. system-level configuration file
   e. cluster-level configuration file.
6. VMS_SAS_OPTIONS DCL symbol:
   a. local or global symbol definition
7. default configuration file: `SAS$ROOT[000000]sasv91.cfg`

In other words:

- The restricted configuration files take precedence over all other occurrences of an option specification.
- The System Options window or OPTIONS statement takes precedence over autoexec files.

- Autoexec files take precedence over the SAS command.
- The SAS command takes precedence over any created configuration files.
- User-created configuration files take precedence over the VMS_SAS_OPTIONS DCL symbol.
- The VMS_SAS_OPTIONS DCL symbol takes precedence over any default configuration file.

Precedence for Similar Types of Options

Some SAS system options have the same effect (and usually the same name) as other types of options. For example, the BUFSIZE= system option is analogous to the BUFSIZE= data set option. Also, under OpenVMS, the CC= system option is analogous to the CC= external I/O statement option that is described in "Host-Specific External I/O Statement Options" on page 402 in the FILENAME statement.

In the case of overlapping options, SAS uses the following rules of precedence:

- A value that is specified in a statement option (for example, an engine/host option in the LIBNAME statement or an external I/O statement option in the FILENAME, INFILE, or FILE statement) takes precedence over a value that is specified in a system option.
- A value that is specified in a data set option takes precedence over a value that is specified in a statement option.

Configuration Files

What Is a SAS Configuration File?

A SAS *configuration file* contains SAS system options that are set automatically when you invoke SAS. Configuration files can contain only SAS system option settings and are processed before SAS initializes.

SAS ships with a default configuration file, **`sasv91.cfg`**, which is located in SAS$ROOT:[000000]. This file contains the master settings for SAS and should not be altered or deleted. If you need to override the settings in the default configuration file, you can create one of the following configuration files.

Six Types of Configuration Files

Under OpenVMS, the OpenVMS logical name SAS$CONFIG is used to refer to SAS configuration files. This logical name can exist in one or more of the process-, job-, group-, system-, or cluster-level logical name tables.

Six types of configuration files can be created:

- The *process-level configuration file* should contain the system option settings that you, as an individual user, want to have in effect each time you invoke SAS.
- The *job-level configuration file* should contain the system option settings that you want to have in effect for a particular SAS job. (You can have multiple job-level configuration files, one for each job or for a group of jobs.)
- The *group-level configuration file* should contain the system option settings that your group manager or system manager has defined for members of your workgroup.

- □ The *system-level configuration file* should contain the system option settings that your system manager has defined for all users at your site.
- □ The *cluster-level configuration file* should contain the system option settings that your system manager wants shared across e-mail nodes in your cluster. The cluster-level file is only valid for OpenVMS 7.2 or later.
- □ The *restricted configuration files* contain system options that are set by the site administrator and cannot be changed by the user. Options can be restricted globally, by group, or by user. For more information about restricted configuration files, see the *SAS System Configuration Guide for OpenVMS*.

Ask your system manager which of these configuration files are used at your site.

Determining the Configuration Files That SAS Processed

To see which configuration files were processed for your SAS session, submit the following code:

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

All of the configuration files that SAS processed are listed as the value of the CONFIG= system option.

Steps for Creating a Configuration File

To create a configuration file, follow these steps:

1 Use any text editor to write SAS system options into an OpenVMS file. Use .CFG as the file extension.

2 Specify one or more system options in each line. A configuration file can contain any system option except the VERBOSE system option. (If this option appears in a configuration file, it is ignored; no error or warning message appears.)

   Note: You can specify the CONFIG= system option inside a configuration file to point to an additional configuration file. Since the options specified in this additional file are processed at the point of the CONFIG= specification, their precedence will be lower than the next option listed in the original configuration file. △

   When specifying a system option, use the same syntax that you would use for specifying system options with the SAS command (see “Specifying System Options in the SAS Command” on page 33) — except don’t include the SAS command itself. For example, a configuration file might contain the following lines:

```
/SASUSER=DISK:[JQK.SASUSER]/WORK=[JQK.SASWORK]
/DMS/LINESIZE=80/PAGESIZE=60
/FULLSTIMER
```

   Note: You cannot include comment lines in a configuration file. △

3 Close the new configuration file.

4 Create the logical name SAS$CONFIG in the appropriate logical name table. For example, the following DEFINE DCL command creates the logical name SAS$CONFIG in the process-level logical name table.

```
$ DEFINE SAS$CONFIG-
_$ DISK:[DIRECTORY]MYCONFIG.CFG
```

For more information about creating logical names, see *OpenVMS User's Manual*.

Specifying a User Configuration File

If you have created the OpenVMS logical name SAS$CONFIG, then SAS automatically executes the configuration file that is associated with that logical name. If SAS$CONFIG exists in more than one logical name table, then SAS executes the configuration files in the order in which they are listed in "Precedence for System Option Specifications" on page 35.

Alternatively, you can use the CONFIG= system option in the SAS command to tell SAS where to find your configuration file. For example, the following SAS command invokes SAS and tells it to use the process-level configuration file MYCONFIG.CFG:

```
$ SAS91/CONFIG=DISK:[DIRECTORY]MYCONFIG.CFG
```

Displaying the Contents of Configuration Files

When you invoke SAS, you can use the VERBOSE system option to write the contents of all configuration files to your OpenVMS display as SAS initializes.

The output from the VERBOSE system option displays the following:

- all of the configuration files that are found (except for the default configuration file)
- all of the options that have been set along with their values.

Note: Since some options are set by default, more options will be displayed than were specified in the configuration files. In the output, the host options will be listed first, followed by the options that are valid in all operating environments. △

Example: Displaying the Contents of Your Configuration Files

Suppose your site has a system-level configuration file, DISK:[SYSTEM]SYSCONFIG.CFG (defined by the logical name SAS$CONFIG in your system-level logical name table) that contains the following system options:

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

Suppose that you have also created your own configuration file, MYCONFIG.CFG, and that it contains the following options:

```
/FULLSTIMER
```

Now suppose you use the following command to invoke SAS:

```
$ SAS91/CONFIG=MYCONFIG.CFG/VERBOSE
```

The output should be similar to the following:

Output 2.1 Contents of Configuration Files

```
The /VERBOSE option was specified.
SYSTEM SAS$CONFIG file
PROCESS SAS$CONFIG
Option         Value
======         ======
APPLETLOC       SAS$ROOT:[MISC.APPLETS]
CONFIG          DISK:[SAS91]SASV9.CFG
                DISK:[SYSTEM]SYSCONFIG.CFG
                DISK:[USER]MYCONFIG.CFG
XKEYPAD         ON
XLOGICAL        ON
XOUTPUT         ON
XSYMBOL         ON
ABORT           RECOVER NOSYSLOG NODUMP
CODEGEN         ON
FULLSTIMER      ON
HELPLOC         SAS$ROOT:[HELP]
JREOPTIONS      -Djava.ext.dirs=/sas$root/misc/base:/sas$root/
                misc/applets
MSG             SAS$MSG:
SETJMP          ON
VERBOSE         ON
MAPS            SAS$MAPS:
SASHELP         SAS$HELP
HELPLOC         SAS$ROOT:[HELP]
APPLETLOC       SAS$ROOT:[MISC.APPLETS]
NODMS
NOOBJECTSERVER
NODMR
NODMSEXP
NOEXPLORER
PAGESIZE        60
LINESIZE        80
TEXTURELOC      SAS$ROOT:[MISC.TEXTURES]
FONTSLOC        SAS$ROOT:[MISC.FONTS]
CONSOLELOG      SYS$OUTPUT
MVARSIZE        8192
MSYMTABMAX      51200
UNIVERSALPRINT
NEWS            SAS$NEWS:
SASUSER         SAS$USER:
WORK            SAS$WORKROOT:
GISMAPS         SAS$GISMAPS:
```

Autoexec Files

What Is an Autoexec File?

Unlike configuration files, which can contain only SAS system options, an *autoexec file* can contain valid SAS statements. Autoexec files are processed immediately after SAS initializes but before it processes any source statements.

For example, an autoexec file could contain the following lines:

```
options fullstimer linesize=75;
libname mylib 'dev:[homedir.subdir]';
dm 'wait 0';
```

In this example, the OPTIONS statement sets some SAS system options, the LIBNAME statement assigns a libref, and the DM statement executes a SAS windowing environment 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. "Summary of SAS System Options under OpenVMS" on page 432 tells where each SAS system option can be specified. △

Difference between Autoexec and Configuration Files

Because autoexec files are processed after SAS is initialized, setting the NODATE and LINESIZE= options in a configuration file affects the appearance of the SAS log header, whereas setting NODATE and LINESIZE= in an autoexec file does not. An OPTIONS statement in an autoexec file is equivalent to submitting an OPTIONS statement as the first statement of your SAS session.

Five Types of Autoexec Files

Under OpenVMS, the OpenVMS logical name SAS$INIT is used to refer to SAS autoexec files. This logical name can exist in one or more of the process-, job-, group-, system-, or cluster-level logical name tables. Therefore, five types of autoexec files can be created:

- The *process-level autoexec file* should contain the SAS statements that you, as an individual user, want to execute immediately after your SAS session is initialized.
- The *job-level autoexec file* should contain the SAS statements that you want to execute for a particular SAS job.
- The *group-level autoexec file* should contain SAS statements that your group manager or system manager has specified for members of your workgroup.
- The *system-level autoexec file* should contain the SAS statements that your system manager has specified for all users at your site.
- The *cluster-level autoexec file* should contain the SAS statements that your system manager has specified for all nodes in your cluster. The cluster-level file is only valid for OpenVMS 7.2 or later.

Ask your system manager which of these autoexec files are used at your site.

Steps for Creating an Autoexec File

To create an autoexec file, follow these steps:

1. Use any text editor to write SAS statements into an OpenVMS file. Use .SAS as the file extension.
2. Type in the SAS statements that you want to include.
3. Close the new autoexec file.
4. Create the logical name SAS$INIT in the appropriate logical name table. For example, the following DCL DEFINE command creates the logical name SAS$INIT in the process-level logical name table.

   ```
   $ DEFINE SAS$INIT-
   _$ DISK:[DIRECTORY]MYEXEC.SAS
   ```

   For more information about creating logical names, see *OpenVMS User's Manual*.

Specifying an Autoexec File

If you have created the OpenVMS logical name SAS$INIT, then SAS automatically executes the statements in the autoexec file that is associated with that logical name. If

SAS$INIT exists in more than one logical name table, then SAS executes the autoexec files in the order in which they are listed in “Precedence for System Option Specifications” on page 35.

Alternatively, you can use the AUTOEXEC= system option in the SAS command to tell SAS where to find your autoexec file. For example, the following SAS command invokes SAS and tells it to execute the autoexec file MYEXEC.SAS:

```
$ SAS91/AUTOEXEC=DISK:[DIRECTORY]MYEXEC.SAS
```

If you are specifying a DECnet location for an autoexec file while you are using a proxy OpenVMS account, then you need to use the following syntax. This example uses the SAS$INIT logical name with the AUTOEXEC= system option:

```
$ DEFINE MYAUTO node """useid""::DISK:[DIRECTORY]AUTOEXEC.SAS
$ SAS91/AUTOEXEC=MYAUTO
```

Note: Check to make sure you have the correct number of quotation marks surrounding *useid*. If you have the incorrect number of quotation marks, then an error will appear in the log when you are using interactive or batch modes. △

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. For example, suppose your autoexec file is MYEXEC.SAS and that it contains the following SAS statements:

```
options fullstimer linesize=75;
libname mylib 'dev:[homedir.subdir]';
dm 'wait 0';
```

If you use the following command to invoke SAS, then the contents of MYEXEC.SAS will be written to the SAS log.

```
$ SAS91/AUTOEXEC=MYEXEC.SAS/ECHOAUTO
```

For more information about the ECHOAUTO system option, see *SAS Language Reference: Dictionary*.

Customizing Your SAS Session Using OpenVMS Logical Names

Introduction to OpenVMS Logical Names Used by SAS

The definitions for OpenVMS logical names are provided in one of the following ways:

- □ by SAS or your system administrator to specify aspects of SAS programs or SAS sessions for your site. These logical names are defined by the SAS91.COM file. For more information, see the *Installation Instructions for the SAS System under OpenVMS Environments*.
- □ by you to customize aspects of your SAS session. For more information about the logical names that you can define, see “Logical Names That You Can Define” on page 42.

Logical Names That You Can Define

You can use the following logical names to customize aspects of your SAS session.

SAS$ALTLOG
: contains the name of the current alternate SAS log file, if one is created. SAS$ALTLOG corresponds to the ALTLOG= system option. For more information, see "ALTLOG= System Option" on page 443.

SAS$ALTPRINT
: contains the name of the current alternate SAS list file, if one is created. SAS$ALTPRINT corresponds to the ALTPRINT= system option. For more information, see "ALTPRINT= System Option" on page 444.

SAS$CONFIG
: defines to SAS the location of a configuration file. For more information, see "Configuration Files" on page 36 and "Precedence for System Option Specifications" on page 35.

SAS$INIT
: defines to SAS the location of an autoexec file. The AUTOEXEC= system option takes its value from SAS$INIT, if SAS$INIT is defined. For more information, see "AUTOEXEC= System Option" on page 446.

SAS$LOG
: contains the name of the SAS log. SAS$LOG corresponds to the LOG= system option. For more information, see "LOG= System Option" on page 473.

SAS$PRINT
: contains the name of the SAS list file. SAS$PRINT corresponds to the PRINT= system option. For more information, see "PRINT= System Option" on page 485.

SAS$TRANTAB
: specifies the names of translation tables that are used by various parts of SAS.

SAS$WORKLIB
: points to your Work subdirectory. For more information about the Work subdirectory, see "The WORK Data Library under OpenVMS" on page 129.

SAS$X_STATUS
: contains the OpenVMS status code that indicates whether an X command or X statement executed properly. The logical name is stored in the JOB logical name table and can be checked after the execution of any X command or statement. If the X command or statement was successful, the value is 1. Any other value indicates that the X command or statement was not successful.

  The following program uses the GETLOG function to determine whether the X statement executed properly. If the X statement did execute properly, then the program continues; if it did not, then the program stops.

```
x 'create/dir [sasxyz.newdir]';
data _null_;
   x=getlog('sas$x_status');
   if x^="1" then do;
      put 'The directory was not created.';
      put 'The OpenVMS return code was:  ' x;
      put 'Program stopping.';
      abort return;
   end;
   else
```

```
      put 'Directory was created successfully.';
run;

libname mylib '[sasxyz.newdir]';

data mylib.test;
   input revenue expenses;
   profit=revenue-expenses;
   datalines;
39800.73 35678.93
28900.38 28456.99
40933.22 5683.33
;
```

Note: The ABORT RETURN statement not only stops the program, but also ends your SAS session. △

Issuing DCL Commands during a SAS Session

Introduction to Issuing DCL Commands within SAS

You can issue DCL commands from within a SAS program by using either the SAS X statement (in any mode of SAS operation) or the SAS X command in interactive and non-interactive mode. Depending on which form of the X statement (or X command) that you use, you can either issue a single DCL command or you can spawn an OpenVMS subprocess from which you can issue multiple DCL commands.

Note: In general, the X statement and the X command are equivalent. The following sections illustrate the X statement but point out any differences that would apply to the X command. △

Issuing DCL Commands with ODS-5 Files

If you want to use DCL commands with ODS-5 files that exceed ODS-2 specifications, then an X command needs to be executed for the parse_style procedure before issuing any DCL commands. The following code allows DCL commands to be used with ODS-5 files:

```
X ''set proc/parse_style=extended''
```

To return to the default for ODS-2 files, enter the following code:

```
X ''set proc/parse_style=traditional''
```

Executing DCL Commands Asynchronously

You can use the SYSTASK statement to execute DCL commands asynchronously. For more information, see “SYSTASK Statement” on page 422 and “WAITFOR Statement” on page 425.

Preventing the Use of DCL Commands

System administrators can specify the NOXCMD option to prevent users from issuing any DCL commands.

Issuing a Single DCL Command Using the X Statement

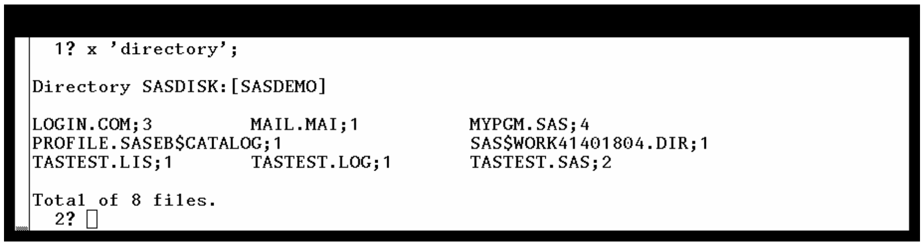
Use the following form of the X statement to issue one DCL command:

X <'>*DCL-command* <'>;

The *DCL-command* is passed to the operating environment and executed. If errors occur, the appropriate error messages are displayed.

In interactive line mode, after the command executes you are prompted for another SAS statement. For example, in the following display the X statement is submitted from an interactive line mode session and executes the DIRECTORY DCL command. The contents of the current directory appear on the display, and then SAS prompts the user for another SAS statement.

Display 2.2 Issuing DCL Commands with the X Statement



```
  1? x 'directory';

Directory SASDISK:[SASDEMO]

LOGIN.COM;3         MAIL.MAI;1          MYPGM.SAS;4
PROFILE.SASEB$CATALOG;1                 SAS$WORK41401804.DIR;1
TASTEST.LIS;1       TASTEST.LOG;1       TASTEST.SAS;2

Total of 8 files.
  2? 
```

The XLOG option specifies to write the output from the X command to the SAS log. However, XLOG is not the default. When XLOG is not turned on, the output from the X command is displayed in the invocation window. The XCMDWIN option determines whether X command output is displayed in a DECTERM window or in the invocation window. XCMDWIN is on by default. For more details on the XCMDWIN option, see "XCMDWIN System Option" on page 508.

Note: You can also use the VMS function, the CALL SYSTEM routine, or the %SYSEXEC macro statement to issue single DCL commands. For details, see the function "VMS Function" on page 359 and the routine "CALL SYSTEM Routine" on page 313. △

How OpenVMS Processes the DCL Command

It is important to understand how OpenVMS processes the DCL command that you issue with the X statement. A DCL command can be executed in either the OpenVMS parent process (the OpenVMS process in which your SAS session is running) or in an OpenVMS subprocess. For some DCL commands, such as DIR or COPY, it makes little difference whether it executes in the parent process or a subprocess. However, for DCL commands such as DEFINE and MOUNT, the process in which they are executed is significant. The following DCL commands are executed in the parent process:

ALLOCATE

ASSIGN

ATTACH

DEALLOCATE

DEASSIGN

DEFINE

MOUNT

SET DEFAULT.

The results of these DCL commands (for example, OpenVMS logical names, tape mounts, and so on) are available to the OpenVMS parent process. All other DCL commands are executed in a subprocess. Therefore, when you use an X statement to submit these commands from SAS, their results are not available to the OpenVMS parent process in which SAS is running. For example, the following DCL command has no effect in the OpenVMS parent process:

```
x 'set protection=o:d/default';
```

This command is executed in a subprocess, so the default protection for the OpenVMS process in which SAS is running does not change.

The XTIMEOUT= system option determines whether a subprocess remains in existence after a DCL command has been executed and control has been returned to SAS. (See the system option "XTIMEOUT= System Option" on page 514.) By default, the same subprocess is used during the entire SAS session. However, when any of the commands in the previous list are executed, the following actions occur regardless of the value of the XTIMEOUT= system option:

- The subprocess is deleted.
- A new subprocess is started when the next X statement is issued.

These actions ensure that the subprocess always accurately reflects any OpenVMS logical names or defaults that were set in the parent process.

Executing a DCL Command Using Procedure Syntax

You can also use procedure syntax to issue a single DCL command. However, the X command and the X statement are more versatile because they each allow you to specify parameters and qualifiers for a DCL command; with procedure syntax, you cannot specify parameters or qualifiers.

When you ask SAS to run a procedure—for example, a procedure named MYPROC—SAS first tries to load the procedure named MYPROC. If the procedure does not exist, then SAS searches for either an image named MYPROC.EXE in your current directory or the OpenVMS logical name MYPROC. If the image MYPROC.EXE is found in your current directory, then SAS issues the MYPROC DCL command via a subprocess. If the OpenVMS logical name exists for MYPROC, then SAS translates the logical name and searches for the image that it points to. If it finds the image, it issues the MYPROC DCL command via a subprocess. If it does not find the image in your current directory, and if no OpenVMS logical name is assigned to the image or if the logical name does not point to an image that exists, then you receive the following error message:

```
ERROR: Procedure MYPROC not found.
```

In this example, note that if SAS issues the MYPROC command, you must either define a symbol called MYPROC or have a DCL verb defined for MYPROC. Otherwise, you receive the error message

```
%DCL-W-IVVERB, unrecognized command verb -
               check validity and spelling.
```

The most useful application of using procedure syntax to issue a DCL command is executing a stand-alone image. Suppose you have a program called CALC.EXE in your current directory that performs arithmetic calculations, and you want to run it from within your SAS session. First, define a symbol with the same name as the image you want to invoke. In this case, you define CALC as the following:

```
$ CALC := RUN MYDISK$:[MYDIR]CALC.EXE
```

Then, from your SAS session, run your program using a procedure statement. The following is an example:

```
$ SAS91
   . . . Log notes . . .
1? proc calc;
2? run;
    Input the calculation: 2+2=
        4.000000
3? endsas;
```

Now suppose that the CALC.EXE image is located in a different directory. The symbol for CALC must still be defined, as in the previous example, but you also need an OpenVMS logical name that points to the actual file. The following is an example:

```
$ DEFINE CALC MYDISK$:[MYPLAYPEN.SUBDIR]CALC.EXE
```

Now SAS can find the image that is defined by the OpenVMS logical name CALC and can issue the CALC DCL command.

Note: You can accomplish the same thing by issuing the following X command:

```
$ SAS91
   . . . Log notes . . .
  1? x 'run calc.exe';
       Input the calculation: 2+2=
               4.000000
  2? endsas;
```

△

Issuing Several DCL Commands Using the X Statement

You can use the X statement to spawn an OpenVMS subprocess from which you can enter multiple DCL commands. In interactive line mode or noninteractive mode, use either of the following forms of the X statement:

- **x '';**
- **x;**

(For more information, see "X Statement" on page 427.)

These statements make it easy for you to manage files and devices from within your SAS session. When you use these forms of the X statement, you receive the following message:

```
Type LOGOFF to return to SAS.
```

During the subprocess, you enter DCL commands in response to the following prompt:

```
SAS_$
```

The SAS_$ prompt appears in the terminal window from where you invoked SAS.

The XCMDWIN option specifies whether to create a DECTERM window from which the spawned subprocess reads its input and writes it output. This option applies only in windowing mode. For more information about the XCMDWIN option, see "XCMDWIN System Option" on page 508. If you use /NOXCMDWIN, the window from which SAS was invoked will be used for both input and output for the subprocess.

Note: If you issue DCL commands that affect or describe process attributes, be aware that these commands pertain to the subprocess, not to the process in which SAS is running. For example, if you define OpenVMS logical names within the subprocess, these logical names are not available to the OpenVMS parent process in which SAS is running. Therefore, it is usually best to define logical names with the form of the X statement described in "Issuing a Single DCL Command Using the X Statement" on page 44. △

To return to the SAS session, enter LOGOFF in response to the SAS_$ prompt.

SAS System Options That Affect Subprocesses

The following SAS system options affect the subprocess environment that is created by an X statement or X command:

XCMDWIN
: in windowing mode, determines whether a separate DECTERM window is created. For more information, see "XCMDWIN System Option" on page 508.

XKEYPAD
: affects which keypad settings the subprocess uses. For more information, see "XKEYPAD System Option" on page 509.

XLOG
: affects whether the output from the X command is displayed in the SAS log file. For more information, see "XLOG System Option" on page 510.

XLOGICAL
: affects which process-level logical names the subprocess uses. For more information, see "XLOGICAL System Option" on page 510.

XOUTPUT
: affects the display of output from the X command. For more information, see "XOUTPUT System Option" on page 511.

XSYMBOL
: affects the Command Line Interpreter (CLI) symbols that are used in the subprocess. For more information, see "XSYMBOL System Option" on page 513.

XTIMEOUT=
: affects the amount of time a subprocess exists or remains inactive before control is returned to SAS. For more information, see "XTIMEOUT= System Option" on page 514.

Note: These options take effect only after a subprocess is spawned. △

Issuing OpenVMS Functions from Captive Accounts

Limitations of Using a Captive Account

If you run SAS from a captive OpenVMS account, then you cannot access the DCL command level, nor can you spawn subprocesses. A *captive OpenVMS account* is under the control of the login command procedure. SAS functionalities that require a detached process will not work under a captive account. The following functionalities require either a detached process or a subprocess, so they are not available from a captive account:

- host-specific commands that are executed asynchronously using the SYSTASK statement
- the PIPE device in the FILENAME statement
- remote signons using SAS/CONNECT
- SAS Help and Documentation in the SAS windowing environment
- the SAS Session Manager
- X commands that cannot be executed in the current process.

Captive accounts are set up in the AUTHORIZE system utility by specifying the option /FLAGS=CAPTIVE.

Difference between Captive and Noncaptive Accounts

As explained in “Issuing DCL Commands during a SAS Session” on page 43, if you run SAS from a *noncaptive* account, you can issue DCL commands by means of the SAS X command, SYSTASK statement, X statement, VMS function, or CALL SYSTEM routine. For most DCL commands, each of these methods spawns an OpenVMS subprocess, and the subprocess executes the DCL command that you specified. (The exceptions are the commands listed in “How OpenVMS Processes the DCL Command” on page 44, which execute in the OpenVMS parent process. Also note that only the X statement and the X command can be used to spawn a subprocess from which you can issue multiple DCL commands. The other methods can be used only to issue single DCL commands.)

In general, if you issue one of these SAS commands, statements, functions, or CALL routines from a *captive* account, a message informs you that a subprocess cannot be spawned from a captive account; the command requested is denied, and control of the process is returned to SAS. Nevertheless, you can use the X statement or the X command to issue a number of general-purpose OpenVMS functions. For more information, see “Functions Available from a Captive Account” on page 48.

Functions Available from a Captive Account

Several general-purpose OpenVMS functions can be called from within the same process that is running SAS. Therefore, even if you are running SAS from a captive account, you can use the FINDFILE function (for example) to see a directory listing of the files in a certain directory. The results are the same as if you had issued an X command from a noncaptive account. Similarly, you can use the DELETE function from a captive account to delete a file from a particular directory structure, and you can use the RENAME function to rename a file.

The following OpenVMS functions are available in SAS and can be called from a captive account:

DELETE
: deletes a file. For more information, see “DELETE Function” on page 316.

FINDFILE
: searches a directory for a file. For more information, see “FINDFILE Function” on page 327.

GETDVI
: returns a specified item of information from a device. For more information, see “GETDVI Function” on page 332.

GETJPI
: retrieves job-process information. For more information, see “GETJPI Function” on page 333.

GETLOG
: returns the value of a DCL logical name. For more information, see “GETLOG Function” on page 334.

GETMSG
: translates an OpenVMS error code into text. For more information, see “GETMSG Function” on page 335.

GETQUOTA
: retrieves disk quota information. For more information, see “GETQUOTA Function” on page 336.

GETSYM
: returns the value of a DCL symbol. For more information, see “GETSYM Function” on page 337.

GETTERM
: returns the characteristics of your terminal device. For more information, see “GETTERM Function” on page 338.

PUTSYM
: creates a DCL symbol in your process. For more information, see “PUTSYM Function” on page 346.

RENAME
: renames a file. For more information, see “RENAME Function” on page 348.

SETTERM
: modifies a characteristic of your terminal device. For more information, see “SETTERM Function” on page 349.

TERMIN
: allows simple input from SYS$INPUT. For more information, see “TERMIN Function” on page 352.

TERMOUT
: allows simple output to SYS$OUTPUT. For more information, see “TERMOUT Function” on page 353.

TTCLOSE
: closes a channel that was previously assigned by TTOPEN. For more information, see “TTCLOSE Function” on page 354.

TTCONTRL
: modifies characteristics of a channel that was previously assigned by TTOPEN. For more information, see “TTCONTRL Function” on page 355.

TTOPEN
: assigns an I/O channel to a terminal. For more information, see “TTOPEN Function” on page 356.

TTREAD
: reads characters from the channel that was assigned by TTOPEN. For more information, see “TTREAD Function” on page 358

TTWRITE
: writes characters to the channel that was assigned by TTOPEN. For more information, see “TTWRITE Function” on page 359.

Misuse of these functions can occur only if your system has insufficient file-protection and directory-protection schemes. SAS honors all protection schemes. For example, if you cannot delete a file from a noncaptive account, then you cannot delete that file from a captive account either.

Note: System administrators can restrict users from calling the above functions from captive accounts by either renaming or deleting the appropriate executables or by making the NOXCMD option the default. The executables that are associated with the above functions are stored in the directory SAS$EXTENSION:[LOAD]. △

Determining the Completion Status of a SAS Job under OpenVMS

Introduction to Three Termination Symbols

Under OpenVMS, three symbols are set at SAS termination that indicate the success or failure of the SAS job: SAS$STATUS, $SEVERITY, and $STATUS.

SAS$STATUS Symbol

SAS$STATUS indicates the final state of the SAS session. A value of 0 indicates normal termination. If any of the following versions of the SAS ABORT statement are used, then SAS$STATUS is set to the value *n*:

```
abort n;
abort return n;
abort abend n;
```

where *n* can range from –2,147,483,648 to 2,147,483,647.

If you issue these statements without specifying *n*, then SAS$STATUS is set to the following values:

abort;
sets SAS$STATUS to 12.

abort return;
sets SAS$STATUS to 12.

abort abend;
sets SAS$STATUS to 999.

If a fatal error occurs and the SAS session does not terminate normally, then SAS$STATUS is set to either 999 or 998, depending on the type of internal error.

For more information about the ABORT statement, see “ABORT Statement” on page 393 and *SAS Language Reference: Dictionary*.

$SEVERITY Symbol

$SEVERITY indicates the most severe status of any step in your SAS program. To see the value of $SEVERITY, use the SHOW SYMBOL $SEVERITY DCL command. The following table correlates the value of $SEVERITY with the severity level of the step in your program.

Table 2.1 Severity Levels for $SEVERITY

Value of $SEVERITY	Severity Level
0	WARNING
1	SUCCESS
2	ERROR
3	INFORMATIONAL
4	FATAL

$STATUS Symbol

$STATUS indicates the most severe status of any step in your SAS program. An OpenVMS severity level is associated with each value. You can check the severity level of $STATUS with the SHOW SYMBOL $STATUS DCL command to determine the final status of your SAS job. The following table shows the severity levels that are associated with $STATUS under the given conditions.

Table 2.2 Severity Levels for $STATUS

Condition	Severity Level	Return Code Value
All steps terminated normally	SUCCESS	"%X1801A261"
SAS issued warning(s)	WARNING	"%X1801A3E0"
SAS issued error(s)	ERROR	"%X1801A44A"
User issued the ABORT statement	INFORMATIONAL	"%X1801A303"
User issued the ABORT RETURN statement	INFORMATIONAL	"%X1801A30B"
User issued the ABORT ABEND statement	FATAL	"%X1801A4F4"
SAS terminated abnormally	FATAL	"%X1801A4FC"
Core internal error	FATAL	"%X1801A4E4"
Host internal error	FATAL	"%X1801A4EC"

Interrupting a SAS Session under OpenVMS

How to Interrupt a SAS Session

If you are running SAS with the SAS Explorer window in the SAS windowing environment, in interactive line mode, or in noninteractive mode, then you can interrupt your SAS session by pressing CTRL+Y. This is called an attention sequence.

Note: CTRL+Y and CTRL+C function identically. You can follow this same procedure to interrupt a SAS task. △

After you press CTRL+Y, SAS will issue you a message. The content of the message depends on the interface you are using and on what task SAS is performing at the time of the interruption. Usually these messages appear immediately after you press CTRL+Y.

Note: If you have to wait a few seconds for these messages, do not repeatedly press CTRL+Y. If you press CTRL+Y more than once, or if you press CTRL+Y while SAS is in the process of initializing or shutting down, the WORK files might not be deleted. In this case, you must use the CLEANUP tool to delete them. For more information, see "The CLEANUP Tool" on page 132. △

How SAS Processes Temporary Work Files

When you end your SAS session with a CTRL+Y, usually all temporary Work files are properly deleted. In noninteractive mode, if you interrupt a SAS session, the .LOG and .LIS files are retained, up to the point where you pressed CTRL+Y.

Interactive Line Mode Options

In interactive line mode after pressing CTRL+Y, you will receive the following message:

```
Select:
  1. Line Mode Process
  2. DATASTEP
  C. Cancel
  T. Terminate System
```

The following table describes each of these options.

Table 2.3 Options when Interrupting an Interactive SAS Session

If you select . . .	The following will result . . .

1	You will see the following instructions:
	`Press Y to cancel submitted statements,`
	`      N to continue.`
	If you type **`Y`**, SAS cancels the statements that were submitted. If you type **`N`**, the statements will continue executing.

2	You will see the following instructions:
	`Press Y to halt data step/proc,`
	`      N to continue.`
	If you type **`Y`**, SAS stops processing the DATA step or procedure. If you type **`N`**, the DATA step or procedure will continue executing.

C	The interruption (begun by pressing CTRL+Y) is cancelled.
T	Your SAS session is terminated.

Windowing Environment Options

In the SAS windowing environment after pressing CTRL+Y, you will receive the following message:

```
Select:
  1. DMS Process
  2. Language Processor
  3. DATASTEP
```

```
C. Cancel
T. Terminate System
```

The following table describes each of these options.

Table 2.4 Options when Interrupting a Session in the SAS Windowing Environment

If you select . . .	The following will result . . .

1	You will see the following instructions:
	`Press Y to terminate this SAS process,`
	`N to continue.`
	If you type **`Y`**, you will terminate the SAS process. If you type **`N`**, the process will continue executing.

2	You will see the following instructions:
	`Press Y to cancel submitted statements,`
	`N to continue.`
	If you type **`Y`**, SAS cancels the statements that were submitted. If you type **`N`**, the statements will continue executing.

3	You will see the following instructions:
	`Press Y to halt data step/proc,`
	`N to continue.`
	If you type **`Y`**, SAS stops processing the DATA step or procedure. If you type **`N`**, the DATA step or procedure will continue executing.

C	The interruption (begun by pressing CTRL+Y) is cancelled.
T	Your SAS session is terminated.

Ending Your SAS Session

Methods for Ending a SAS Session

You can end your SAS session using one of the following methods:

- Select

  File ► Exit

  if you are using SAS in the windowing environment
- Submit **`endsas;`**
- Enter BYE in the command line
- Press CTRL+Z if you are using SAS in interactive line mode.

Messages in the SAS Console Log

If SAS encounters an error or warning condition when the SAS log is not available, then any messages that SAS issues are written to the SAS console log. Normally, the SAS log is unavailable only early in SAS initialization and late in SAS termination.

Under OpenVMS, the SYS$OUTPUT logical name specifies the location of the console log. This location depends on the user mode. If you are working in interactive mode or using a command procedure, SAS displays the error messages at your terminal. If you are working in batch mode, SAS writes the error messages to a batch log file.

Identifying and Resolving Problems under OpenVMS

The SAS Web site contains a great deal of information that is useful for problem-solving and for other purposes. For example, on the SAS Technical Support page (see **`support.sas.com/ts`**), you will find the following resources:

Technical Notes
: information about reported problems, fixes, and undocumented features of SAS. This information is updated regularly on the SAS Web pages. The SAS Notes are also distributed on all product installation CD-ROMs or tapes and are available on a separate CD-ROM or tape by request. SAS Installation Coordinators can contact the SAS Distribution Center to request a current copy of the notes.

Frequently Asked Questions (FAQs)
: answers to the questions that the SAS Technical Support staff are most frequently asked by SAS software users.

Sample Programs
: a collection of thousands of SAS programs that demonstrate different features of SAS and that illustrate how to use SAS to solve application problems.

You will also find information about how to report problems via e-mail.

CHAPTER
3

Working in the SAS Windowing Environment

Introduction to Working in the SAS Windowing Environment

SAS for OpenVMS operating environments features an X Window System interface that is based on Motif. This interface uses the window manager on your system to manage the windows on your display. The appearance of the SAS interface depends partially on which window manager you use.

Many features of the SAS windowing environment are controlled by X resources. For example, colors, window sizes, the appearance of the ToolBox, and key definitions are all controlled through X resources. Chapter 4, "Customizing the SAS Windowing Environment," on page 77 provides general information about resources, such as how to specify resources, and describes all of the resources that you can use to customize the interface.

Note: The About SAS System dialog box displays version information about SAS, your operating environment, and Motif. You can display the About SAS System dialog box by selecting

Help ► About SAS System

△

Description of SAS in the X Environment

Definition of X Window System

The X Window System is a networked windowing system. If several machines are on a network, you can run an X *server* that in turn serves X applications (as *clients*) to all the other machines in the network.

X Window Managers

Window managers are X clients that enable you to manage the windows on a display by moving, resizing, and iconifying the windows. The Motif interface to SAS can be used with any window manager that is compliant with the *Inter-Client Communication*

Conventions Manual (ICCCM). Vendors provide at least one window manager with the X Window System environment.

All window managers perform the same basic functions, but they differ in their style and in their advanced functions. The appearance and function of the interface to SAS depends to some extent on your X window manager. Most window managers provide some kind of frame around a window. The window manager also governs the placement, sizing, stacking, and appearance of windows, as well as their interaction with the keyboard. The basics of interacting with SAS are the same for all window managers: opening pull-down and pop-up menus, moving windows, responding to dialog boxes, dragging text, and so on.

SAS Window Session ID

When you run SAS on an X workstation, SAS shares the display with other X applications, including other SAS sessions. To enable you to distinguish between different applications and SAS sessions, SAS generates a SAS window session ID for each session by appending a number to the application name, which by default is **`SAS`**. This session ID appears in the window title bar for each SAS window and in the window icon title. The SAS sessions are assigned sequentially. Your first SAS session is not assigned a number, so the session ID is **`SAS`**; your second SAS session is assigned the session ID **`SAS2`**; and so on. Although the default application name is **`SAS`**, you can use the **`-name`** parameter to the XRESOURCES system option to change the instance name. The instance name can be up to six characters long.

You can specify the XRESOURCE option with the following syntax:

```
sas91/name=sessionname
```

or

```
sas91/XRES="-name sessionname"
```

Workspace and Gravity in a SAS Session

When you use SAS on an X workstation, the display may be shared by many concurrent applications. When SAS windows from several different sessions and windows from other applications appear on the display, the display can become cluttered. To help alleviate this problem, the windows for a SAS session first appear within an application workspace (AWS). The AWS defines a rectangular region that represents a virtual display in which SAS window are initially created. SAS attempts to position the AWS in relation to the upper-left corner of your display. In other words, the workspace gravitates toward a certain direction (session gravity) on the display. Some window manager configurations might override the placement that SAS has chosen for a window.

If you issue windowing commands or execute SAS procedures that create new SAS windows, the same rules of initial position and size apply to these windows: they are initially placed in the SAS AWS. You can use the WSAVE command to save the current window positions (or geometry). For details, see “Customizing Session Workspace, Session Gravity, and Window Sizes under OpenVMS” on page 117.

Window Types

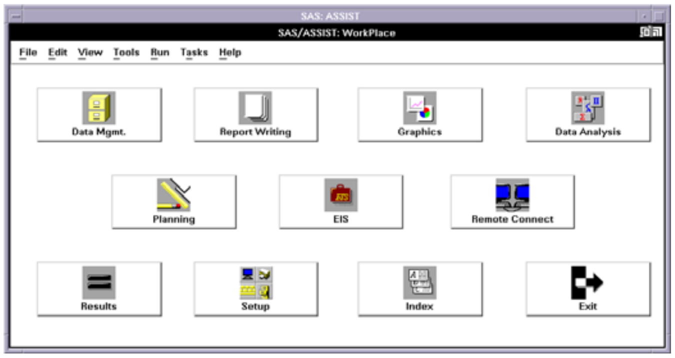
Top-Level Windows

SAS uses primary and interior windows. Some SAS applications consist of one or more primary windows controlled by the X window manager in addition to the interior windows controlled by SAS. The SAS windowing environment primary windows, as well as most SAS application windows, initially appear as top-level windows. Top-level windows interact directly with the X window manager. They have a full title bar along with other window manager decorations. You can manipulate them individually once they appear on the display.

Interior Windows

Interior windows behave differently than primary windows. SAS/ASSIST software is an example of an application with interior windows. Interior windows are contained within container windows, which may or may not be primary windows. The following display shows an interior window in SAS/ASSIST software.

Display 3.1 Sample Interior Window



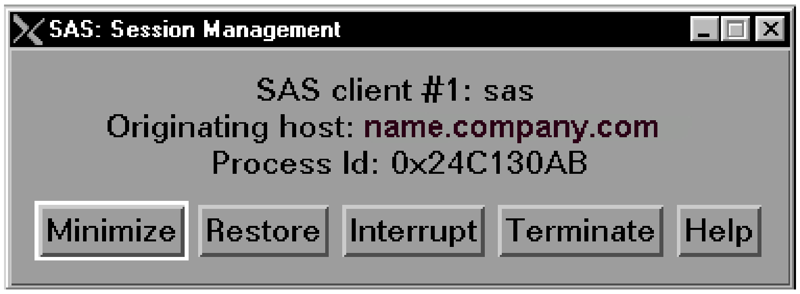
SAS provides some degree of window management for interior windows. Specifically, interior windows have the following sizing and movement capabilities:

- □ You can move interior windows by clicking the left mouse button on the interior window title bar and dragging the window to the desired location. If the destination of the interior window is outside the bounds of the container window, the container window changes according to the value of the **`SAS.awsResizePolicy`** resource. (The space within the container window is the application workspace, which is described in "Workspace and Gravity in a SAS Session" on page 57.) For more information, see "Overview of X Resources" on page 79.
- □ Interior windows cannot be iconified individually. Clicking on the container window icon button iconifies the container window and its interior windows.
- □ A *push-to-back button* (the small overlapping squares in the upper-right corner) is also available with interior windows. However, you cannot push an active window behind an inactive window.

The SAS Session Manager under OpenVMS

What Is the SAS Session Manager?

The SAS Session Manager (xsassm) is an X client that is run by SAS when you use the SAS windowing environment. The session manager window is automatically minimized (iconified). You can restore it by using the window menu.



SAS client #1: sas
Originating host: name.company.com
Process Id: 0x24C130AB

The session manager window describes which SAS session it controls, the originating host machine from which the SAS session was invoked, and the hexadecimal VMS process identifier of the SAS session.

Note: The SAS Session Manager is not available from a captive account. If you need to run SAS in the windowing environment and want to disable the SAS Session Manager, see "Disabling the SAS Session Manager" on page 60. For more information about captive accounts, see "Limitations of Using a Captive Account" on page 47. △

Features of the SAS Session Manager

The SAS session manager enables you to

- □ map and make icons of all windows of the SAS session. The Restore and Minimize buttons restore and minimize all of the windows that are open in the SAS session that is controlled by that session manager. These functions are performed with standard X library calls and will work with most X window managers.
- □ interrupt the SAS session. The Interrupt button sends a signal to SAS. When SAS receives the signal, it displays a dialog box that asks for confirmation before it cancels the submitted statements.
- □ terminate the SAS session. Terminate displays a dialog box that asks you to confirm that you want to terminate the SAS session. If you select OK, the session manager sends a signal to the SAS session that forces the session to terminate.

  CAUTION:
  Terminating your SAS session might result in data loss or data corruption. Before terminating your session, you should attempt to end SAS using one of the methods described in "Ending Your SAS Session" on page 53. △

- □ use your host editor from within your SAS session. When you issue the HOSTEDIT command, SAS passes the request to the session manager, which then invokes your host editor; the session manager must be running in order for the HOSTEDIT command to take effect. When you issue the HOSTEDIT command, SAS creates a temporary file that contains the data from the active SAS window and passes this file to your host editor. (These temporary files are stored in the directory specified by the SASWORK option.) When you save your file in the host editor, the file is copied back into the SAS window if the window is writable, and the temporary files are deleted when the SAS session ends. See "HOSTEDIT Command" on page 262 for more information.

Disabling the SAS Session Manager

In some instances (for example, if you are running SAS from a captive account), you might want to disable the SAS Session Manager. You can disable the SAS Session Manager by performing one of the following steps:

- Select

  Tools ► Options ► Preferences

  On the **General** tab, deselect the **Start Session manager** check box.

- Specify the following X resource on the SAS command line at invocation:

  ```
  $ SAS/XRES=''-XRM=(SAS.startSessionManager: False)''
  ```

  Specifying the **SAS.startSessionManager** X resource will deselect the **Start Session manager** check box in the Preferences dialog box. Specifying this resource in your SAS$XDEFAULTS.DAT file will not disable the SAS Session Manager because the options specified in the Preferences dialog box take precedence.

Note: SAS saves the settings in the Preferences dialog box when it exits. If you have disabled the SAS Session Manager during your session, then the next time you invoke SAS, the SAS Session Manager will not run. To start the SAS Session Manager, select the **Start Session manager** check box in the Preferences dialog box or specify the following on the SAS command line at invocation:

```
$ SAS/XRES=''-XRM=(SAS.startSessionManager: True)''
```

△

Displaying Function Key Definitions under OpenVMS

Benefits of Assigning Function Key Definitions

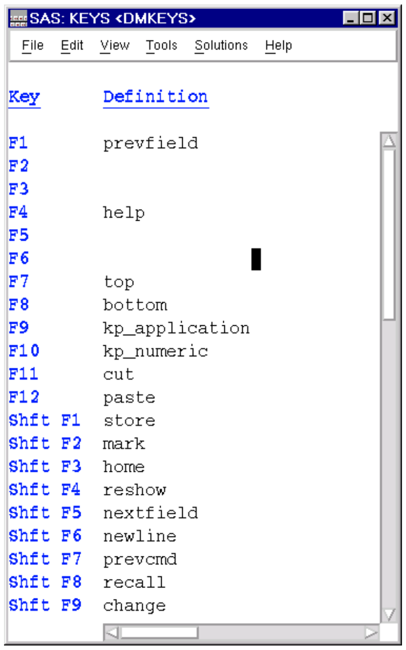
Function keys provide quick access to commands. They enable you to issue commands, insert text strings, and insert commands in programs. Function key definitions can be different on different terminals. These definitions are fully customizable.

Techniques for Displaying Function Key Definitions

You can open the KEYS (DMKEYS) window to display all of your function key definitions. To open this window, select

Tools ► Options ► Keys

Display 3.2 KEYS (DMKEYS) Window



```
Key        Definition

F1         prevfield
F2
F3
F4         help
F5
F6
F7         top
F8         bottom
F9         kp_application
F10        kp_numeric
F11        cut
F12        paste
Shft F1    store
Shft F2    mark
Shft F3    home
Shft F4    reshow
Shft F5    nextfield
Shft F6    newline
Shft F7    prevcmd
Shft F8    recall
Shft F9    change
```

To view a single key definition without bringing up the KEYS window, use the KEYDEF command and specify the key definition that you want to view. For example, the following command displays the definition for key F4:

```
keydef f4
```

For information about customizing key definitions, see “Customizing Key Definitions under OpenVMS” on page 94. For more information about the KEYS window and the KEYDEF command, see SAS Help and Documentation.

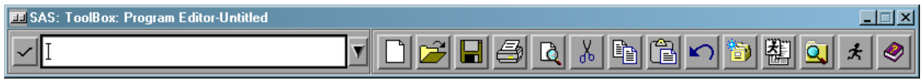
The SAS ToolBox under OpenVMS

Introduction to the SAS ToolBox

The SAS ToolBox has two parts as illustrated in the following display:

- □ A command window that enables you to quickly enter any command in the active SAS window. For information about commands that are available under OpenVMS, see Chapter 12, “Commands under OpenVMS,” on page 249 and the SAS commands section in the Base SAS Software section in SAS Help and Documentation.
- □ A toolbar that contains several tool icons. When you select a tool icon, SAS immediately executes the command that is associated with that icon. The toolbar and the tool icons are completely customizable. For more information, see “Using the Tool Editor” on page 89.

Display 3.3 SAS ToolBox



The name of the active window is displayed in the title bar of the SAS ToolBox. For example, if the Log window were active, the title bar would say SAS ToolBox: Log instead of SAS ToolBox: Program Editor.

Under OpenVMS, a default SAS ToolBox automatically appears at the bottom of the SAS windows. To control its configuration, you use the Preferences dialog box. (See "Modifying the SAS ToolBox Settings" on page 86.)

Customizing the Default Toolbox

By default, SAS loads a standard toolbox definition when you are running the SAS windowing environment. This toolbox contains some commands that are common to the windowing environment, such as New, Save, and Print. You can customize this toolbox using the TOOLEDIT command. Save the customized toolbox in SASUSER.PROFILE.DMS.TOOLBOX. The next time that you invoke SAS this customized toolbox will display.

If you invoke an application that does not have an associated PMENU entry, the SASUSER.PROFILE.DMS.TOOLBOX is displayed. Any tools that are not valid for a window will be dimmed. You can customize the toolbox for the application by using one of the following methods:

□ You can modify the displayed toolbox and save the changes in SASUSER.PROFILE.DEFAULT.TOOLBOX. SAS will load this customized toolbox for all windows that do not have an associated PMENU entry. Since this is a customized toolbox, SAS will not dim any tools that are not valid for a window.

□ You can create application-specific toolboxes (such as with SAS/AF applications) that are automatically loaded when the application is loaded. Save the customized toolbox in SASUSER.PROFILE.*APP*.TOOLBOX, where *APP* is the same entry name as the PMENU entry for the window or application.

Only one toolbox is displayed at a time, and the tools in the toolbox change as you move between applications. For more information about customizing your toolboxes, see "Techniques for Customizing Toolboxes and Toolsets" on page 88.

Default Configuration for the Command Window and Toolbar

By default, the toolbar and the command window are joined and are automatically displayed when SAS initializes unless

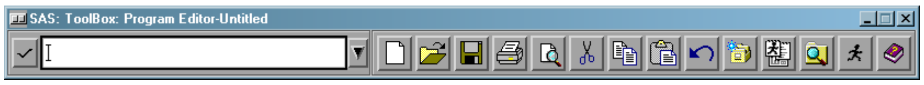
□ you executed your SAS job in a nonwindowing environment mode.

□ the **`SAS.defaultToolBox`** resource or **`SAS.defaultCommandWindow`** resource is set to False. The default is True. For more information about the X resources that control the ToolBox, see "X Resources that Control Toolbox Behavior" on page 88.

□ you deselect **`Display tools window`**, **`Display command window`**, or **`Combine windows`** from the ToolBox tab in the Preferences dialog box.

The following display shows the command window and the toolbar in their default configuration.

Display 3.4 Default Configuration for Command Window and Toolbar



Opening and Closing the Command Window and Toolbar

The following table lists the steps you can use to open and close the command window and toolbar.

Table 3.1 Steps for Opening and Closing the Command Window and Toolbar

Window	How to Open	How to Close
Command Window and Toolbar	To open both of the windows, complete any of the following steps: □ Issue the COMMAND WINDOW command. □ Select Tools ▶ Options ▶ Toolbox □ Issue the TOOLLOAD command. For more information, see "TOOLLOAD Command" on page 265.	To close both windows, use one of the following steps: □ Double-click the window menu button for the combined command window and toolbar. □ Select **`Close`** from the ToolBox window menu. □ Enter the TOOLCLOSE command, as described in "TOOLCLOSE Command" on page 264. □ Select Tools ▶ Options ▶ ToolBox so that ToolBox is deselected.
Command Window	To open only the command window: **1** Deselect **`Combine windows`** from the ToolBox tab in the Preferences dialog box. **2** Complete one of the following steps: □ Select **`Display command window`** in the Preferences dialog box. □ Issue the COMMAND WINDOW command.	To close only the command window: **1** Deselect **`Display command window`** in the Preferences dialog box. **2** Complete one of the following steps: □ Select **`Close`** from the window menu. □ Double-click the window menu button.

Window	How to Open	How to Close
Toolbar	To open only the toolbar: **1** Deselect **`Combine windows`** from the ToolBox tab in the Preferences dialog box. **2** Complete one of the following steps: □ Select **`Display tools window`** in the Preferences dialog box. □ Select Tools ► Options ► ToolBox □ Issue the TOOLLOAD command, as described in "TOOLLOAD Command" on page 265.	To close the toolbar: **1** Deselect **`Combine windows`** from the ToolBox tab in the Preferences dialog box. **2** Complete one of the following steps: □ Deselect **`Display tools window`** in the Preferences dialog box. □ Issue the TOOLCLOSE command, as described in "TOOLCLOSE Command" on page 264. □ Select Tools ► Options ► ToolBox so that ToolBox is deselected.

How to Execute Commands

You can execute commands from either the command window or the toolbar. The following table provides more details about how to execute commands.

Table 3.2 Executing Commands in the Command Window and the Toolbar

Window	Executing a Command
Command Window	To issue a command, **1** Click in the command window. **2** Type in the command. **3** Press ENTER or click the check mark. The command is submitted in the active SAS window. You can use the up and down arrows to scroll through previously entered commands, or you can select a previous command from the drop-down list. Use the middle mouse button (MB2) to select and execute a command from the list. If you use the left mouse button (MB1), the command is selected, but you must then press ENTER or click on the check mark to submit the command.
Toolbar	Clicking a tool icon in the toolbar executes the command or commands associated with that icon. If you place the cursor over an icon for the amount of time specified by the **`SAS.toolBoxTipDelay`** resource, a pop-up window displays text that describes the command for that icon.

Opening Files under OpenVMS

Opening the Open Dialog Box

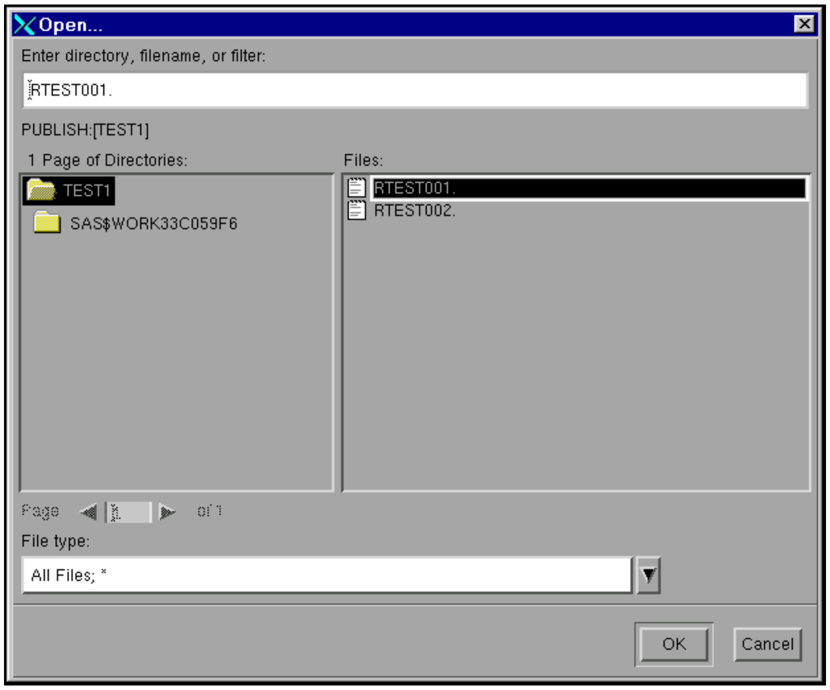
The Open dialog box (see Display 3.5 on page 66) enables you to select a file to read into the active window. To access this dialog box, complete one of the following steps:

- □ Issue the DLGOPEN command in the command window.
- □ Select

  File ► Open

  in the active window.

Display 3.5 Open Dialog Box



The Open dialog box displays files and directories as a graphical hierarchy. You will not see directories that you do not have read permission for. Double-click a directory name to list the files it contains. Select the desired file.

You can display a list of possible file filters by selecting the down arrow next to the **`File Type`** field. Click a file filter to select it.

Description of the Open Dialog Box Options

The following table describes the options found on the Open dialog box.

Table 3.3 Options in the Open Dialog Box

Option	Description
`Enter directory, filename, or filter`	is where you can type in the name of the directory, file, or file filter (file type) that you want to open. To display a list of all the files in a directory, enter the asterisk (*) wild card in the **`Filter`** field or select **`All Files;*`** from the list of file types. The directory listed under the **`Filter`** field is the currently selected directory. You can change this directory either by selecting a name from the **`Page of Directories`** list or by typing the new name directly into the field.
`Page of Directories`	contains the names of the directories specified in the **`Filter`** and **`Page`** fields.The Open dialog box displays nonreadable directories with a different icon.

Option	Description
`Page`	enables you to change the directories that are displayed in the **`Page of Directories`** list. (A new page is defined when the number of entries in the **`Page of Directories`** list exceeds twice the screen height.) You can change the page by using the right or left arrows next to the field or by entering a page number directly within the field.
`Files`	contains the files in the selected directory that match the file filter specified.
`File type`	enables you to select the type or types of files to be shown in the **`Files`** list box. You can display a list of possible file filters by selecting the down arrow next to the field. Click a file filter to select it.

Note: Because of the use of concealed logicals, you will not be able to access the SAS$ROOT:[000000] directory from the Open dialog box. △

Click OK when you have finished making your selection. Click Cancel to close the Open dialog box without selecting a new file.

Specifying the Initial Filter and Directory Using SAS Resources

You can specify the initial file filter in the **`File type`** field by assigning a value to the **`SAS.pattern`** resource. However, the Open dialog box retains its file filter between invocations, so the **`SAS.pattern`** resource applies only to the first invocation of the Open dialog box. You can also use the **`SAS.directory`** resource to specify the directory that you want when you first invoked the Open dialog box.

For more information about specifying SAS resources, see "Overview of X Resources" on page 79.

Changing Your Current Working Directory under OpenVMS

What Is Your Working Directory?

The working directory is the operating system directory where you invoke SAS. By default, SAS uses the current directory as the working directory when you begin your SAS session.

Changing Your Working Directory

You can change the current working directory during your SAS session. You can use the Change Working Directory dialog box to select a new directory, or you can use the X command, the X statement, the CALL SYSTEM routine, or the %SYSEXEC macro statement to issue the change directory (**`set default`**) command.

Change Working Directory Dialog Box

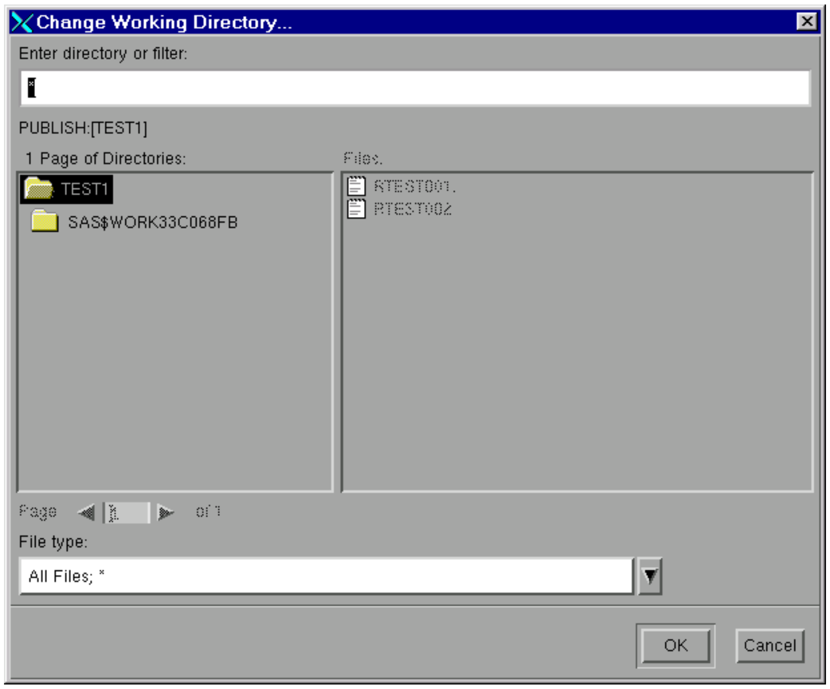
To open this dialog box, complete one of the following steps:

- Issue the DLGCDIR command in the command window
- Select

  Tools ▶ Options ▶ Change Directory

  in the active window.

Display 3.6 Change Working Directory Dialog Box



Enter directory or filter: *

PUBLISH:[TEST1]

File type: All Files; *

The Change Working Directory dialog box works exactly the same as the Open dialog box, except that you can select only a directory (not a file) from the list. For an explanation of the options on the Change Working Directory dialog box, see “Description of the Open Dialog Box Options” on page 66.

Searching for Character Strings under OpenVMS

Introduction to the Find Dialog Box

The Find dialog box enables you to search for character strings in any active SAS text editor windows such as the Program Editor, the SCL editor, or the Notepad.

Opening the Find Dialog Box

To search for a character string, open the Find dialog box, by completing one of the following steps:

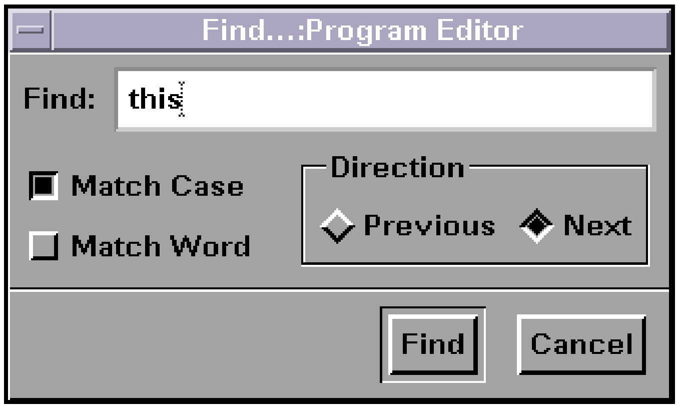
- □ Issue the DLGFIND command in the command window.
- □ Select

  Edit ▶ Find

  in the active window.

When the Find dialog box opens, the name of the active window follows the name of the dialog box (for example, Find...:Program Editor).

Display 3.7 Find Dialog Box



Description of Options in the Find Dialog Box

The Find dialog box works like the Replace dialog box, except it does not have the **`Replace`** field or the Replace and Replace All buttons.

For a description of the options on the Find Dialog Box, see "Description of Options in the Replace Dialog Box" on page 70.

Replacing Character Strings under OpenVMS

Introduction to the Replace Dialog Box

The Replace dialog box enables you to search for and replace character strings in any active SAS text editor windows such at the Program Editor, the SCL editor, or the Notepad.

Opening the Replace Dialog Box

To replace one character string with another, open the Replace dialog box, by completing one of the following steps:

- □ Issue the DLGREPLACE command in the command window.

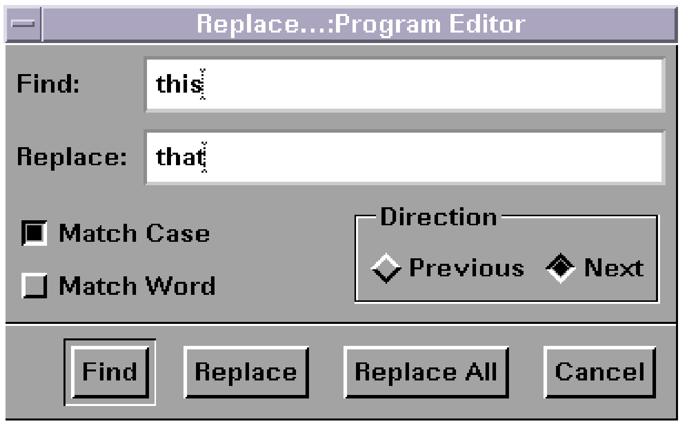
- Select

  Edit ► Replace

  in the active window.

When the Replace dialog box opens, the name of the active window follows the name of the dialog box (for example, Replace...:Program Editor).

Display 3.8 Replace Dialog Box



Find: this

Replace: that

[✓ Match Case]

Match Word

Previous [✓ Next]

Description of Options in the Replace Dialog Box

To find a character string, type the string in the **Find** field, and select Find. To change a character string, type the string in the **Find** field, type its replacement in the **Replace** field, and select Replace. To change every occurrence of the string to its replacement string, select Replace All.

You can tailor your find or replace operation by using the following buttons:

Match Case
: tells the search to match the uppercase and lowercase characters exactly as you typed them.

Match Word
: searches for the specified string delimited by spaces, end-of-line characters, or end-of-file characters.

Previous
: searches for the specified string from the current cursor position toward the beginning of the file.

Next
: searches for the specified string from the current cursor position toward the end of the file.

Setting Up Printers under OpenVMS

You can define different printers to use within your interactive SAS session. To define a printer, complete the following steps:

1 Select

   File ► Print Setup

2 Click New to create a new printer entry.
3 Specify a name and a description for the printer. Click Next.
4 Select the model of the printer. Click Next.
5 Select **`PRINTER`** as the **`Device Type`**. Leave **`Destination`** blank. In the **`Host Options`** field, specify PASSALL=YES and QUEUE=*vmsprinterqueuename*, where *vmsprinterqueuename* refers to the printer queue defined on your OpenVMS system. For more information about the PASSALL and QUEUE options, see "FILENAME Statement" on page 397.

   Click Next.
6 Leave **`None`** as the **`Previewer`**. Click Next.

   Note: Print Preview is unavailable in OpenVMS. △
7 Click Finish to complete the printer setup.

The new printer will appear in the Print Setup window.

For more information about printing in SAS, see Universal Printing in *SAS Language Reference: Concepts*.

Sending Mail from within Your SAS Session under OpenVMS

Default E-mail Protocol in SAS

By default, SAS uses SMTP (Simple Mail Transfer Protocol) to send e-mail from within your SAS session. For information about how to change to the VMS e-mail facility, see "EMAILSYS= System Option" on page 458.

For more information about the SMTP e-mail interface, see *SAS Language Reference: Concepts*.

What Is the Send Mail Dialog Box?

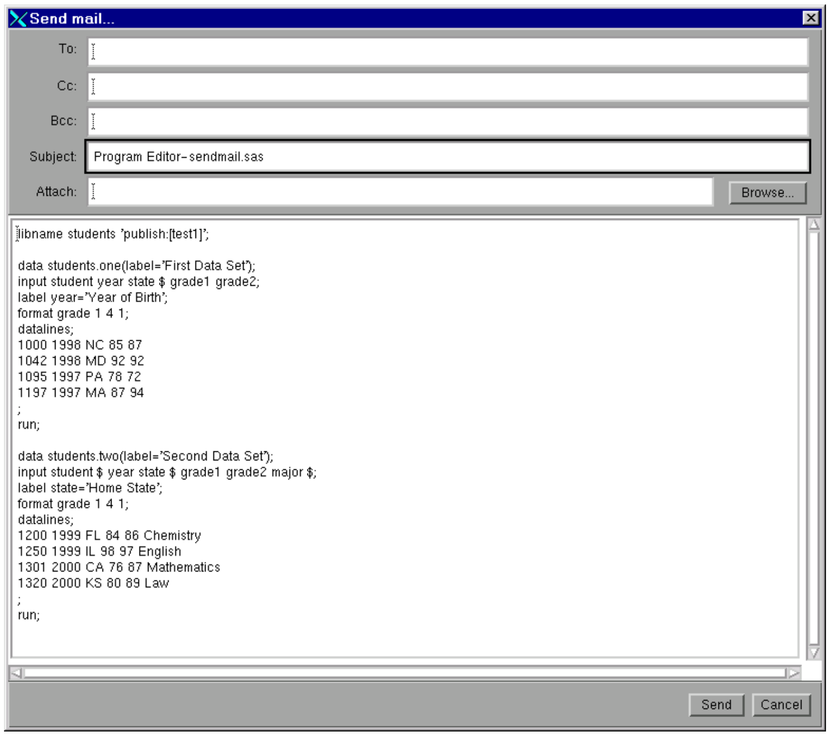
The Send Mail dialog box enables you to send e-mail without leaving your current SAS session.

Sending E-Mail Using the Send Mail Dialog Box

To open the Send Mail dialog box, select

File ► Send Mail

Display 3.9 Send Mail Dialog Box



Subject: Program Editor–sendmail.sas

```
libname students 'publish:[test1]';

data students.one(label='First Data Set');
input student year state $ grade1 grade2;
label year='Year of Birth';
format grade 1 4 1;
datalines;
1000 1998 NC 85 87
1042 1998 MD 92 92
1095 1997 PA 78 72
1197 1997 MA 87 94
;
run;

data students.two(label='Second Data Set');
input student $ year state $ grade1 grade2 major $;
label state='Home State';
format grade 1 4 1;
datalines;
1200 1999 FL 84 86 Chemistry
1250 1999 IL 98 97 English
1301 2000 CA 76 87 Mathematics
1320 2000 KS 80 89 Law
;
run;
```

To send e-mail, complete the following steps as needed:

- ☐ Enter the addresses of the e-mail recipients in the **To**, **CC**, and **BCC** fields. Separate multiple addresses with either blanks or commas.
- ☐ Edit the entry in the **Subject** field as needed.
- ☐ Enter the name of the file that you want to send in the **Attach** field. Separate multiple filenames with blanks. You can also use Browse to select a file.
- ☐ Type your message in the message area or edit the contents grabbed from the active SAS text window.
- ☐ Click Send.

To cancel a message, click Cancel.

Note: The **BCC** and **Attach** fields are only valid with SMTP. The VMS e-mail facility does not support them. If you use the VMS e-mail facility, then you cannot attach images to your e-mails. For more information about attaching images, see "Sending the Contents of a Non-Text Window" on page 73. △

Sending the Contents of a Text Window

You can e-mail the contents of an active SAS text window (such as the Program Editor or the Log) by using the Send Mail dialog box. To open the Send Mail dialog box, select

File ▶ Send Mail

SAS automatically copies the contents in the active SAS window and includes the text in the body of your e-mail. You can change or add to the e-mail message in the Send Mail dialog box.

If you do not want to include the contents of the active SAS window in your message, select

Edit ▶ Clear All

before opening the Send Mail dialog box.

Sending the Contents of a Non-Text Window

To send the contents of a non-text window (such as a graph generated by SAS/GRAPH or an image from your PROC REPORT output), select

File ▶ Send Mail

from the active SAS window.

SAS automatically copies the image data to a temporary file and enters that filename in the **`Attach`** field of the Send Mail dialog box. To change the default file type for this temporary file, see "Changing the Default File Type" on page 73.

SAS only copies the portion of the image that is visible in the active window, along with the window frame and title. This behavior is similar to using the DLGSCRDUMP command. For more information, see "DLGSCRDUMP Command" on page 258.

If you do not want to attach this image to your e-mail, clear the contents of the **`Attach`** field.

Note: The VMS e-mail facility does not support attachments. You can only send attachments when using SMTP. △

Changing the Default File Type

You can change the default file type for the temporary file that SAS creates by using the Preferences dialog box. To open the Preferences dialog box, select

Tools ▶ Options ▶ Preferences

On the **`DMS`** tab in the **`Image type for Email attachments`** box, select one of the following image file types:

- Portable Network Graphics (.png)
- Graphics Interchange Format (.gif)
- Tagged Image File Format (.tif).

Creating Icons for Windows under OpenVMS

Under OpenVMS, you can make icons only of top-level SAS windows and windowing environment containers. You cannot create icons for groups of windows.

Using the Menus under OpenVMS

Under OpenVMS, the pull-down menu (PMENU) facility is turned on by default. Also, some of the menus are customized, omitting items that are not applicable.

You can use the PMENU procedure under OpenVMS to create customized menus. Some aspects of this procedure are specific to OpenVMS. For more information about the PMENU procedure, see "PMENU Procedure" on page 384 and *Base SAS Procedures Guide*.

Using the Mouse under OpenVMS

You can use the left mouse button (MB1) to make a mark, and the middle mouse button (MB2) to paste the mark into a SAS window. Although the right mouse button (MB3) is not used in cut-and-paste operations, various procedures use MB3 to display a pop-up menu.

Note: These instructions are based on the default setting with MB1 being the left-most mouse button. Your mouse buttons might have been reconfigured to meet specific needs. △

SAS Mouse Pointer Shapes

When you use the SAS windowing interface under OpenVMS, you see several mouse pointer shapes. If the mouse pointer has its standard shape (usually an arrow), SAS is ready to receive your input.

Besides the standard shape, two other mouse pointer shapes are common:

watch (or clock) cursor
: indicates that you must wait. SAS is performing other tasks and is not ready to accept your input.

dash inside a circle
: indicates that the pointer is in an inactive window. User interaction with this window is temporarily disabled.

SAS Interface to the TPU Editor

The TPU command (or its aliases, HOSTEDIT or HED) enables you to use the OpenVMS Text Processing Utility (TPU) editor for editing instead of the default SAS Text Editor. For additional details about the TPU command, see "TPU Command" on page 266.

Using Special Character Attributes under OpenVMS

List of Character Attributes

SAS enables you to set the color and highlight attributes of text in some windows. For example, in the Notepad window or in your SAS/AF or SAS/FSP applications, you can turn on character underlining or reverse video to highlight a title. Character attributes are listed in the following table.

Table 3.4 Selector Characters for Character Attributes

Selector Character	Function
0	Turns off all attributes.
1	Turns on bold.
2	Turns on underlining.

Selector Character	Function
3	Turns on reverse video.
4	Turns on blinking.
A	Sets color to gray.
B	Sets color to blue.
C	Sets color to cyan.
G	Sets color to green.
K	Sets color to black.
M	Sets color to magenta.
N	Sets color to brown.
O	Sets color to orange.
P	Sets color to pink.
R	Sets color to red.
W	Sets color to white.
Y	Sets color to yellow.

Selecting an Attribute

To select an attribute, complete the following steps:

1 Press and hold the Modifier 1 key on your keyboard (usually labeled “Meta,” “Alt,” “Hyphen,” or “Extend char”).

2 Press the selector character (for example, 1).

Alternatively, you can use the COLOR command to combine several of these steps in one command. For more information about the COLOR command, see “COLOR Command” on page 251.

Getting Help under OpenVMS

In the SAS windowing environment, extensive online help is available. To open the help, select

Help ▶ SAS Help and Documentation

in the active window. Various topics, including an online version of this documentation, are available from this point.

Note: The online help is unavailable if you are running SAS under a captive account. SAS cannot start a Web browser in a detached process under a captive account. For more information, see “Limitations of Using a Captive Account” on page 47. △

Setting Your System for Help and Online Documentation

SAS Help and Documentation can be displayed only by using a Web browser. You have to specify the browser and its location before you can use it.

To specify a Web browser and its location, complete the following steps:

1 Select

  Tools ▶ Options ▶ Preferences

  The Preferences dialog box opens.

2 Select the **`DMS`** tab.

3 In the **`Help and Documentation Browser`** field, specify the Netscape browser and point to the location of its executable file.

CHAPTER
4

Customizing the SAS Windowing Environment

Overview of Customizing SAS in X Environments

The SAS windowing environment supports the use of X-based graphical user interfaces (GUIs). In OpenVMS Alpha, SAS provides an X Window System interface that is based on the Motif style. For more information about SAS in the X environment, see “Description of SAS in the X Environment” on page 56.

You can customize your working environment by using X resources.

Overview of X Resources

Introduction to X Resources

X clients usually have characteristics that can be customized by the system administrator or by the user; these properties are known as *X resources*. Since SAS functions as an X windows client, many aspects of the appearance and behavior of the SAS windowing environment are controlled by X resources. For example, X resources can be used to define a font, a background color, or a window size. The resources for an application, such as SAS, are placed in a *resource database*.

Specifying X Resources

A resource specification has the following format:

resource-string: *value*

The *resource-string* usually contains two identifiers and a separator. The first identifier is the client or application name (**`SAS`**), the separator is a period (.) or asterisk (*) character, and the second identifier is the name of the specific resource. The *value* given might be a Boolean value (**`True`** or **`False`**), a number, or a character string, depending on the resource type.

The application name and resource name can both specify an *instance value* or a *class value*. A specification for a class applies to a larger scope than a single instance.

The following are sample resource specifications:

```
SAS.maxWindowHeight: 100
SAS.awsResizePolicy: grow
```

For more information about resource specifications, refer to your X Window System documentation.

Methods for Customizing X Resources

SAS functions correctly without any modifications to the resource database. However, you might want to change the default behavior or appearance of the interface. There are several ways to specify your customizations. Some methods modify all SAS sessions displayed on a particular X server. Some methods affect all SAS sessions run on a particular host. Other methods affect only a single SAS session. You can use one of the following methods to specify your customizations:

- Edit the X resource file. (See “Editing the X Resource File” on page 80.)
- Use the Preferences dialog box to modify X resource settings. (See “Modifying X Resource Settings by Using the Preferences Dialog Box” on page 80.)
- Submit the /XRES command line option. (See the system option “XRESOURCES= System Option” on page 512.)
- Submit one or more instances of the /XRM command line option.

If you need more information about X Window System clients and X resources, refer to the documentation provided by your vendor.

Editing the X Resource File

When you start a SAS session, the SAS interface to Motif calls the X Resource Manager to create a resource database for that session. The interface then examines the resource database for any user-defined X resource definitions.

SAS uses the X resource file specified by the SAS$XDEFAULTS logical name. If this logical name is undefined, then SAS uses the SAS$XDEFAULTS.DAT file in your SYS$LOGIN directory.

You can customize the SAS interface to Motif by creating or adding X resource definitions to your SAS$XDEFAULTS file. (Changing the settings of the X resources in your SAS$XDEFAULTS file will not affect other X Window System applications.) To see the default X resource values for the SAS interface to Motif, see the SAS$ROOT:[TOOLS]SAS$XDEFAULTS.DAT file. To change one of these default values, add the changed X resource definition to your SAS$XDEFAULTS file.

Note: SAS does not use the SAS$ROOT:[TOOLS]SAS$XDEFAULTS.DAT file for X resource definitions. This file is only an example of X resources that you can use. △

Modifying X Resource Settings by Using the Preferences Dialog Box

What Is the Preferences Dialog Box?

The Preferences dialog box enables you to control the settings of certain X resources. Changes made through the Preferences dialog box (with the exception of those resources on the `General` tab) become effective immediately, and the settings are saved in the SASUSERPREFS.DAT file in your SASUSER directory.

Opening the Preferences Dialog Box

You can open the Preferences dialog box by

- issuing the DLGPREF command in the command window
- selecting

  Tools ▶ Options ▶ Preferences

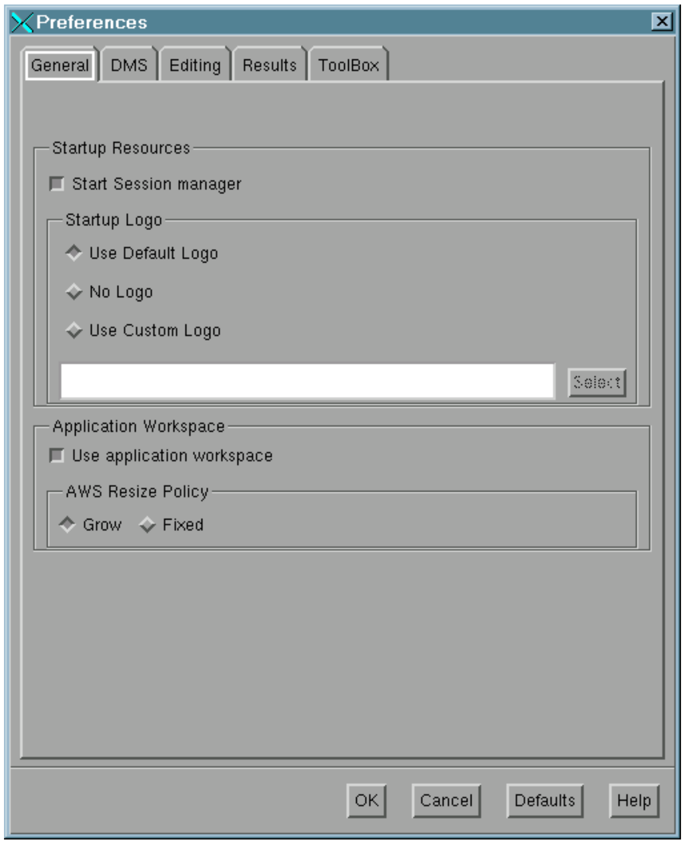
Select the tabs at the top of the window to move between the various settings.

Description of Options on the Preferences Dialog Box

Modifying the General Settings

To modify the General settings, select the `General` tab in the Preferences dialog box. The following display shows the default general settings.

Display 4.1 General Tab in the Preferences Dialog Box



The following is an explanation of the settings:

`Start Session manager`
specifies whether you want the session manager to be started automatically when you start your SAS session. If you want to use your host editor in your SAS session, the session manager must be running. The session manager enables you to interrupt or terminate your SAS session and minimize and restore all of the windows in a SAS session. This check box sets the **`SAS.startSessionManager`** resource.

`Startup Logo`
specifies whether you want SAS to display an XPM file while your SAS session is being initialized and, if so, which file.

If you select **`Use Default Logo`**, SAS uses the default file for your site. If you select **`No Logo`**, then no file is displayed. If you select **`Use Custom Logo`**, you can click $\boxed{\text{Select}}$ to open the Startup Logo dialog box. These check boxes set the **`SAS.startupLogo`** resource.

`Use application workspace`
confines all windows displayed by an application to a single application workspace. This check box sets the **`SAS.noAWS`** resource. You must exit and reopen the windows for changes to this resource to take effect.

`AWS Resize Policy`
controls the policy for resizing the application workspace windows as interior windows are added and removed. (For more information, see “Description of SAS in the X Environment” on page 56 and “Window Types” on page 58.)

`Grow`
The application workspace window will attempt to grow any time an interior window is grown or moved (to make all of its interior windows visible), but it will not shrink to remove unused areas.

`Fixed`
The application workspace window will attempt to size itself to the size of the first interior window and will not attempt any further size changes.

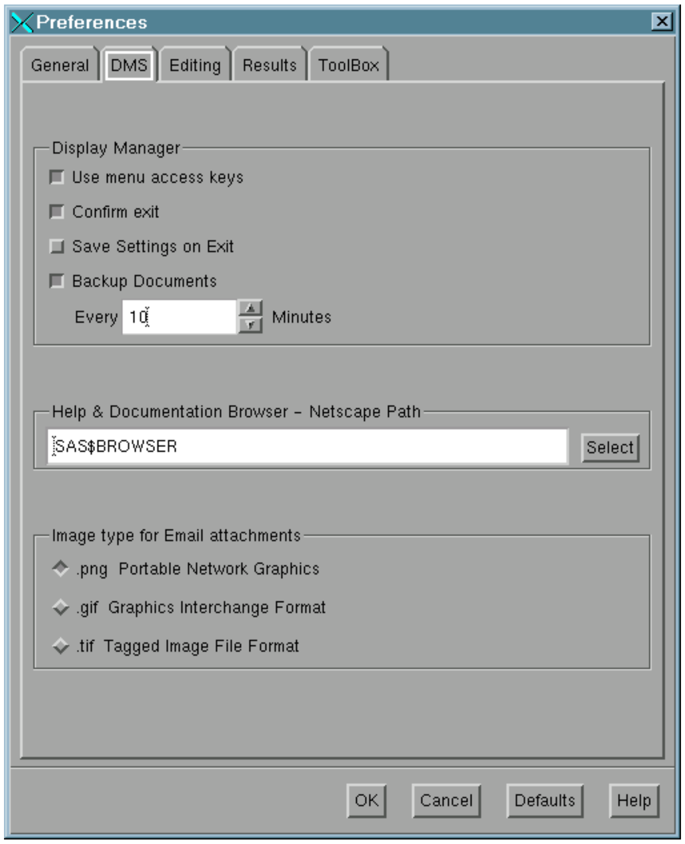
This area sets the **`SAS.awsResizePolicy`** resource.

After you have changed the settings, click OK to implement your choices or click Cancel to cancel your choices. Click Defaults to return to the default settings. Click Help for help about the Preferences dialog box.

Modifying the DMS Settings

To modify these settings, select the **`DMS`** tab in the Preferences dialog box. The following display shows the default settings.

Display 4.2 DMS Tab in the Preferences Dialog Box



The following is an explanation of the settings:

`Use menu access keys`
activates menu mnemonics. When mnemonics are turned on, you can select menu items by typing the single, underlined letter in the item. This check box sets the **`SAS.usePmenuMnemonics`** resource.

`Confirm exit`
displays the Exit dialog box when you exit your SAS session. This check box sets the **`SAS.confirmSASExit`** resource.

`Save Settings on Exit`
tells SAS to issue the WSAVE ALL command when you exit your SAS session. This command saves the global settings, such as window color and window position, that are in effect for all windows that are currently open. This check box sets the **`SAS.wsaveAllExit`** resource.

`Backup Documents`
enables you to specify whether you want SAS to automatically save (at the interval specified by the **`SAS.autoSaveInterval`** resource) the documents that you currently have open. This check box sets the **`SAS.autoSaveOn`** resource.

`Help & Documentation Browser -- Netscape Path`
specifies the location of the Web browser executable that you want to use to view the SAS Help and Documentation. This field sets the **`SAS.helpBrowser`** resource.

`Image type for Email attachments`
specifies the default file type for the temporary file that SAS creates when sending the contents of a non-text window via e-mail. Examples of non-text windows include a graph generated by SAS/GRAPH or an image from your PROC REPORT output. For more information, see “Sending the Contents of a Non-Text Window” on page 73.

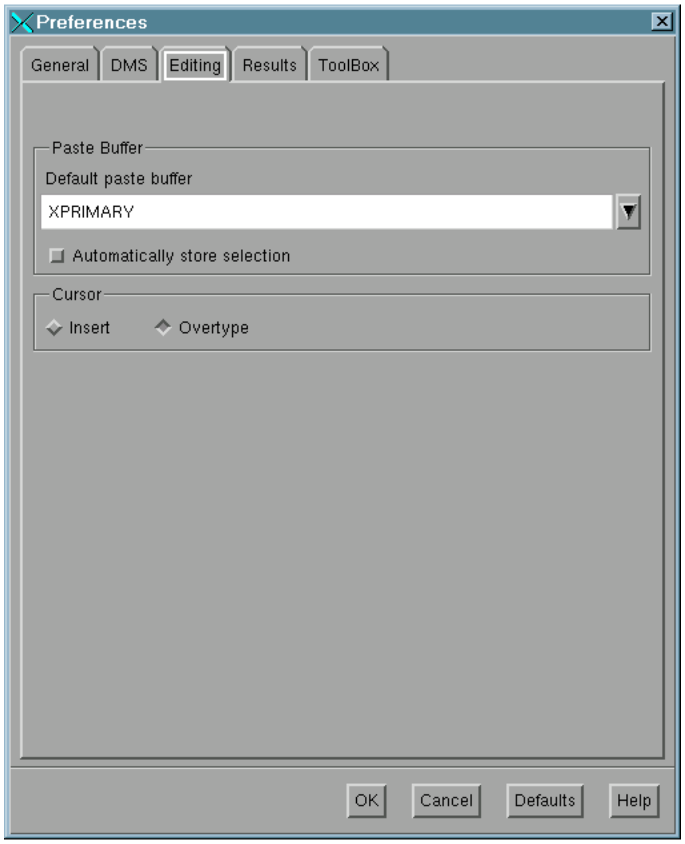
Note: The VMS e-mail facility does not support attachments. You can only send attachments when you are using SMTP. △

After you have changed the settings, click $\boxed{\text{OK}}$ to implement your choices or click $\boxed{\text{Cancel}}$ to cancel your choices. Click $\boxed{\text{Defaults}}$ to return to the default settings. Click $\boxed{\text{Help}}$ for help about the Preferences dialog box.

Modifying the Editing Settings

To modify the Editing settings, select the **`Editing`** tab in the Preferences dialog box. The following display shows the default editing settings.

Display 4.3 Editing Tab in the Preferences Dialog Box



Paste Buffer

Default paste buffer: XPRIMARY

Automatically store selection

Cursor

Insert Overtype

The following is an explanation of the settings:

`Default paste buffer`

defines an alias for the default SAS buffer. The following list describes the paste buffer alias names and the X buffer with which each name is associated:

`XPRIMARY`
is the X primary selection (**`PRIMARY`**). This is the default.

`XTERM`
is the exchange protocol used by the xterm client.

`XSCNDARY`
is the X secondary selection (**`SECONDARY`**).

`XCLIPBRD`
is the X clipboard (**`CLIPBOARD`**).

`XCUT`*n*
is the X cut buffer where *n* is between 0 and 7, inclusive.

This field sets the **`SAS.defaultPasteBuffer`** resource. For more information about paste buffers, see "Customizing Cut-and-Paste Operations under OpenVMS" on page 113.

`Automatically store selection`

generates a STORE command every time that you mark a region of text with the mouse. This check box sets the **`SAS.markPasteBuffer`** resource.

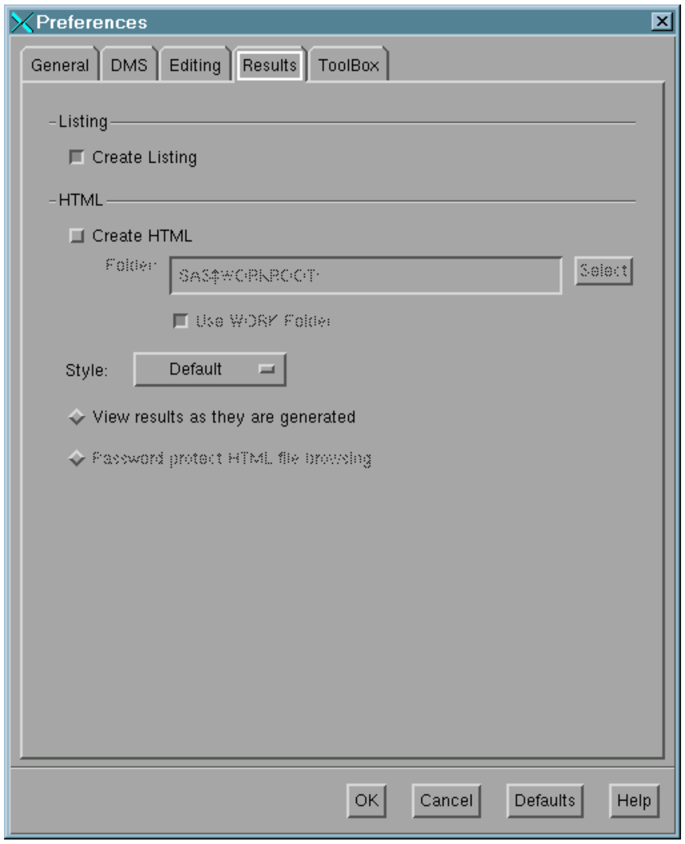
`Cursor`
controls the editing mode in SAS text editor windows. The **`Insert`** and **`Overtype`** check boxes set the **`SAS.insertModeOn`** resource to **`True`** and **`False`**, respectively.

After you have changed the settings, click OK to implement your choices or click Cancel to cancel your choices. Click Defaults to return to the default settings. Click Help for help about the Preferences dialog box.

Modifying the Results Settings

The items on the **`Results`** tab control the format of the results that you produce. To modify these settings, select the **`Results`** tab in the Preferences dialog box.

Display 4.4 Results Tab in the Preferences Dialog Box



The following is an explanation of the settings:

`Create Listing`
specifies that your output is in text format. You can select both **`Listing`** and **`HTML`** format.

`Create HTML`
specifies that your output is in HTML format. You can select both **`Listing`** and **`HTML`** format.

`Style`
specifies the HTML style to use when generating output in HTML format.

`Folder`
specifies the folder in which to store your HTML results. Click Select to choose a folder. Select **`Use WORK Folder`** to designate your SASWORK folder as the repository for your HTML results.

`View results as they are generated`
specifies that HTML output is automatically displayed when it is generated. This value cannot be selected if you have selected **`Password protect HTML file browsing`**.

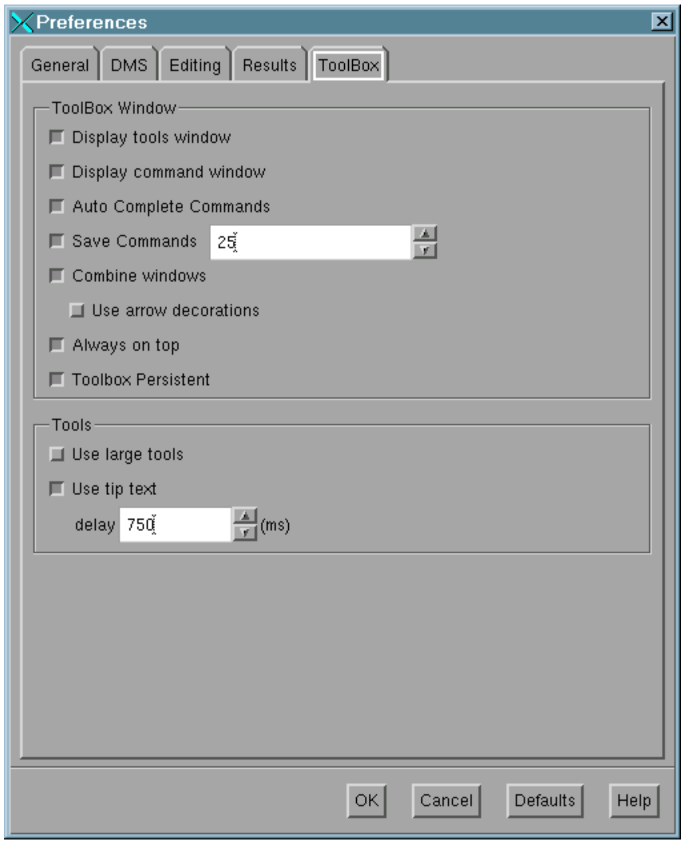
`Password protect HTML file browsing`
requires a password when sending HTML files to a browser. This value cannot be selected if you have selected **`View results as they are generated`**.

After you have changed the settings, click OK to implement your choices or click Cancel to cancel your choices. Click Defaults to return to the default settings. Click Help for help about the Preferences dialog box.

Modifying the SAS ToolBox Settings

The items on the **`ToolBox`** tab affect both the toolbox and the command window. To modify these settings, select the **`ToolBox`** tab in the Preferences dialog box. The following display shows the default SAS ToolBox settings.

Display 4.5 ToolBox Tab in the Preferences Dialog Box



ToolBox Window
Display tools window
Display command window
Auto Complete Commands
Save Commands 25
Combine windows
Use arrow decorations
Always on top
Toolbox Persistent

Tools
Use large tools
Use tip text
delay 750 (ms)

The following is an explanation of the settings:

`Display tools window`
determines whether to display the default toolbox. This check box sets the **`SAS.defaultToolBox`** resource.

`Display command window`
determines whether to display the command window. This check box sets the **`SAS.defaultCommandWindow`** resource.

`Auto Complete Commands`
specifies that commands will be automatically completed as you type the first letters of the command. This check box sets the **`SAS.autoComplete`** resource.

`Save Commands`
specifies the number of commands to be saved. You can change the number by clicking on the up or down arrow next to the number of commands. The default is 25. This field sets the **`SAS.commandsSaved`** resource.

`Combine windows`
combines the toolbar and command window into one window. The toolbar and command window are combined by default. This check box sets the **`SAS.useCommandToolBoxCombo`** resource.

`Use arrow decorations`
adds left and right arrows to either end of the combined toolbox/command window. This check box sets the **`SAS.useShowHideDecorations`** resource.

`Always on top`
keeps the toolbox or the combined toolbar/command window on top of the window stack. This check box is selected by default, which could cause problems with window managers that are not Motif window managers or other applications that want to be on top of the window stack. If you have such a situation, turn off this feature. This check box sets the **`SAS.toolBoxAlwaysOnTop`** resource.

`Toolbox Persistent`
specifies whether the toolbox that is associated with the Program Editor window stays open when you close the window. By default, the Program Editor toolbox stays open whenever you close the Program Editor window. If you deselect this check box, then the toolbox will close if you close the Program Editor window. This check box sets the **`SAS.isToolBoxPersistent`** resource.

`Tools`
The items in the Tools area affect the individual tools in the toolbox:

> **`Use large tools`**
> controls whether tool icons are displayed as 24x24 or 48x48 pixels. The default is 24x24. This check box sets the **`SAS.useLargeToolBox`** resource.
>
> **`Use tip text`**
> specifies whether tool tip text is displayed when you position your cursor over a tool in the toolbox. Some window managers may place the toolbox tip behind the toolbox. If this happens in your environment, deselect this check box. This check box sets the **`SAS.useToolBoxTips`** resource.
>
> **`delay`**
> controls the delay in milliseconds before popping up the toolbox tip. This field sets the **`SAS.toolBoxTipDelay`** resource. You can enter a value directly into the field or use the arrows to the right of the field to change the value.

After you have changed the settings, click OK to implement your choices or click Cancel to cancel your choices. Click Defaults to return to the default settings. Click Help for help about the Preferences dialog box.

Customizing the SAS ToolBox under OpenVMS

Techniques for Customizing Toolboxes and Toolsets

You can customize toolboxes in the following ways:

- □ through the Preferences dialog box. The Preferences dialog box enables you to customize the appearance and behavior of toolboxes. For information about using the Preferences dialog box, see "Modifying X Resource Settings by Using the Preferences Dialog Box" on page 80 and "X Resources that Control Toolbox Behavior" on page 88.
- □ by specifying X resources in your resource file. For more information about X resources that affect toolboxes, see "X Resources that Control Toolbox Behavior" on page 88.
- □ through the Tool Editor dialog box. The Tool Editor enables you to customize the individual tools in a toolbox. For more information, see "Using the Tool Editor" on page 89.

What Is a Toolset?

The Tool Editor also enables you to create custom toolsets for your SAS applications. A *toolset* is a set of predefined tools that is associated with an application. Toolsets make it easier for individual users to customize their application toolboxes. If you create a toolset for an application, users can simply choose the tools they want to appear in their toolboxes and do not have to define the icons, commands, tip text, and IDs for those tools.

For example, you can define a default toolbox for your application that includes tools for opening files, cutting, copying, and pasting text, and saving files. You can define a toolset that includes those tools and tools for opening the Preferences dialog box, opening the Replace dialog box, and entering the RECALL command. These additional tools will not appear in the users' toolbox unless a user adds them to their toolbox with the Tool Editor.

You can view the TOOLSET contents by opening the Tool Editor dialog box and clicking on Actions, provided that the TOOLSET name has the same name as the TOOLBOX you are editing. For more information, see "Changing an Existing Tool" on page 90 and "Creating or Customizing an Application- or Window-Specific Toolset" on page 94.

X Resources that Control Toolbox Behavior

You can control the behavior of toolboxes with the following resources:

SAS.autoComplete: [True | False]
specifies whether SAS automatically fills in the remaining letters of a command that begins with the same letter as a command that you have entered previously as you type it in the command window. The default value is True.

SAS.commandsSaved : close up | *n*
specifies whether SAS saves the commands that you enter in the command window and how many commands are saved. You can specify a number from 0 to 50. If you specify 0, no commands will be saved. If you specify 1 or more, that

number of commands is saved in the file **`commands.hist`** in your Sasuser directory. If you specify 1 or more for this resource and **`SAS.autoComplete`** is True, then SAS will be able to automatically fill in commands that were entered in previous sessions. The default value is 25.

`SAS.defaultToolBox: [True | False]`
controls opening the default toolbox when SAS is invoked. The default is True.

`SAS.isToolBoxPersistent: [True | False]`
controls whether the toolbox stays open when you close the Program Editor window. The default value is True, which means that the toolbox remains open whenever you close the Program Editor window.

`SAS.toolBoxAlwaysOnTop: [True | False]`
controls whether the toolbox is always on top of the window stack. The default value is True, which might cause problems with window managers that are not Motif window managers or other applications that want to be on top of the window stack. If you have such a situation, set this resource to False.

`SAS.toolBoxTipDelay:` ***`delay-in-milliseconds`***
sets the delay in milliseconds before displaying the toolbox tip. The default is 750.

`SAS.useCommandToolBoxCombo: [True | False]`
controls whether the command window and toolbox are joined or separated. The **`SAS.defaultToolBox`** and **`SAS.defaultCommandWindow`** resources control whether the toolbox and command window are displayed. If both are displayed, this resource controls whether they are joined or separated. The default is True.

`SAS.useLargeToolBox: [True | False]`
controls whether tool icons in the toolbox are displayed as 48x48 pixels or 24x24 pixels. The default is False (24x24 pixels).

`SAS.useShowHideDecorations: [True | False]`
controls whether the combined command/toolbox window has arrows at the left and right. You can use these arrows to hide or show portions of the window as they are needed. The default is False.

`SAS.useToolBoxTips: [True | False]`
determines if toolbox tip text is displayed. Some window managers, such as **`tvtwm`**, might place the toolbox tip behind the toolbox. If this happens in your environment, set this resource to False. The default is True.

Using the Tool Editor

Opening the Tool Editor

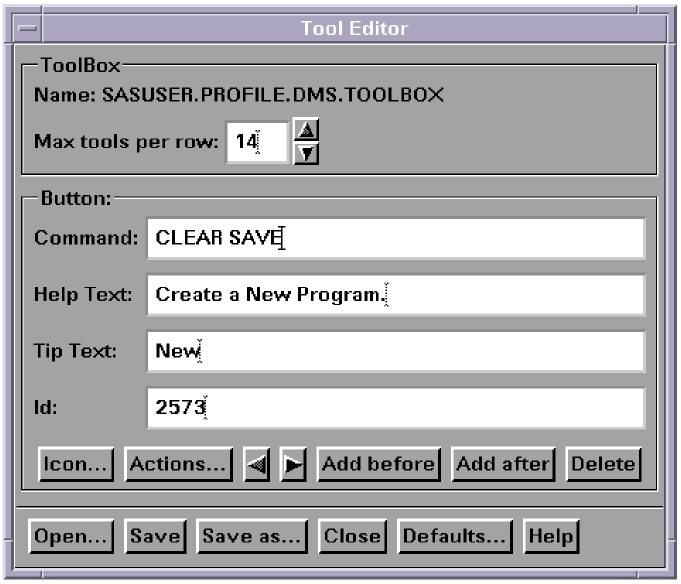
The Tool Editor dialog box enables you to modify the contents and appearance of your toolboxes, as shown in the following display. To invoke the Tool Editor dialog box, do one of the following:

- Select

  Tools ▶ Options ▶ Edit Toolbox

  in the active window.
- Issue the TOOLEDIT command in the command window. For more information, see “TOOLEDIT Command” on page 264.

Display 4.6 Tool Editor Dialog Box



Name: SASUSER.PROFILE.DMS.TOOLBOX

Max tools per row: 14

Command: CLEAR SAVE

Help Text: Create a New Program.

Tip Text: New

Id: 2573

By default, the Tool Editor dialog box edits the current toolbox. To edit a different toolbox, invoke the Tool Editor dialog box and click Open. Then specify the libref, catalog, and entry name for the toolbox that you want to edit. Click OK.

After you invoke the Tool Editor dialog box, the toolbox goes into "preview mode." In preview mode, clicking a tool icon makes that icon the current icon and displays its associated commands in the **Command** field. The current icon always appears selected.

Changing the Appearance of the Entire ToolBox

The items in the **ToolBox** area of the Tool Editor dialog box affect the entire toolbox:

Name
: displays the catalog entry that you are editing. The default toolbox for the SAS windowing environment is named SASUSER.PROFILE.DMS.TOOLBOX.

Max tools per row
: specifies how the icons in the toolbox are arranged. The default size creates a horizontal toolbox. One tool per row creates a vertical toolbox.

Changing an Existing Tool

When you open the Tool Editor dialog box, the first icon in the toolbox is the current icon (the icon appears selected), and its information appears in the **Button** area of the dialog box. To change an existing tool, you can select a tool from the toolset displayed by clicking Actions or you can modify the fields individually.

Note: Clicking Actions displays a toolset only if a toolset is associated with (has the same entry name as) the toolbox that you are editing. For more information, see "Saving Changes to the Toolbox or Toolset" on page 92. △

To use Actions, select the tool that you want to change, and then select Actions. The Tool Editor displays the toolset associated with the toolbox. If you select a tool from this toolset, the Tool Editor enters the appropriate information into the button fields for you.

To modify the fields individually, perform the following steps:

1 Select the icon you want to change.

2 Click and change the **`Button`** area fields as appropriate:

`Command`
specifies the SAS windowing environment command or commands that you want executed when you select the icon. You can use any SAS command that is available under OpenVMS. For information about commands, see Chapter 12, "Commands under OpenVMS," on page 249 and the SAS commands section in the Base SAS section in SAS Help and Documentation. For example, you could create an icon to open the Change Directory dialog box by using the DLGCDIR command, which is described in "DLGCDIR Command" on page 253.

Separate commands with a semicolon (;).

`Help Text`
is used for applications that are designed to be run under Microsoft Windows. The help text is displayed in the SAS windowing environment status line on Windows when a toolbox is ported to and loaded on those operating environments.

`Tip Text`
specifies the text that is displayed when you position the cursor over the icon.

`Id`
is useful if you are creating toolboxes for SAS/AF applications. The ID is the identifier of the corresponding menu item in the application. This number is the value assigned to the item in the ID option of the ITEM statement in PROC PMENU. If you specify an ID, then the application can set the state of the PMENU item to match the state of the tool in the toolbox, and it can make the PMENU item active or inactive to match whether the PMENU item is active or inactive. If you do not specify an ID, the ID defaults to 0.

3 Change the icon if necessary:

a Click Icon or double-click an icon in the preview toolbox. The Select a Pixmap dialog box opens, which displays the icons provided with SAS. These icons are divided into several categories such as SAS windows; data; analysis; numbers and symbols; files, folders, and reports; and so on. To change categories, click the arrow to the right of the **`Icon Category`** field and select a new category.

b Select the icon you want to use and then click OK.

c Save your changes as described in "Saving Changes to the Toolbox or Toolset" on page 92.

Adding Tool Icons to the Toolbox

To add an icon to the toolbox, perform the following steps:

1 Select the icon that is adjacent to where you want to add the new tool icon.

2 Click Add before or Add after, whichever is appropriate. The Toolbox Editor adds a new icon (labeled SAS) to the toolbox and clears the **`Button`** area fields.

3 Enter the appropriate information in the **`Button`** area fields. These fields are described in "Changing an Existing Tool" on page 90.

4 Change the icon, if desired, as described in "Changing an Existing Tool" on page 90.

5 Save your changes as described in "Saving Changes to the Toolbox or Toolset" on page 92.

Changing the Order of the Icons in the Toolbox

To change the position of a tool in the toolbox, select the icon, and then click the left or right arrows in the **Button** area to move the icon.

Deleting Tool Icons from the Toolbox

To delete a tool icon from the toolbox:

1 Select the icon that you want to delete.

2 Click Delete in the **Button** area.

3 Save your changes, as described in “Saving Changes to the Toolbox or Toolset” on page 92.

Returning to the Default Settings

To return all tools in the current toolbox to their default settings, click Defaults at the bottom of the Tool Editor dialog box. When you make this selection, any customizations that you have made are lost. It also deletes any icons that you have added to the toolbox. The Tool Editor dialog box asks you to verify your request. Click Yes to restore the default settings, No to keep your customizations, or Cancel to do neither.

Saving Changes to the Toolbox or Toolset

You can save the changes to the catalog entry that is displayed in the **Name** field of the Tool Editor dialog box, or you can create a new toolbox with a different name.

Note: If you are customizing a window-specific or application-specific toolbox for your personal use, save the customized toolbox in your SASUSER.PROFILE catalog by using the same entry name as the PMENU entry for the window or application. SAS searches for toolboxes first in the SASUSER.PROFILE catalog and then in the application catalog. △

Click Save or Save as to perform the following tasks:

Save
: saves the toolbox information to the catalog entry shown in the **Name** field.

Save as
: causes the Tool Editor dialog box to prompt you to enter a different libref, catalog, and entry name. The entry type for a toolbox is always TOOLBOX.

You can also choose to save the toolbox as a toolset. If you save the toolbox as a toolset, the entry type will be TOOLSET; otherwise, the entry type is always TOOLBOX. Saving a set of tools as a TOOLSET does not change your TOOLBOX entry. For more information about toolsets, see “Techniques for Customizing Toolboxes and Toolsets” on page 88 and “Creating or Customizing an Application- or Window-Specific Toolset” on page 94.

If you click Close or Open without first saving your changes, the Tool Editor dialog box prompts you to save the changes to the current toolbox before continuing. Click Yes to save your changes; click No to ignore any changes you made; or click Cancel to do neither.

After you save the toolbox or toolset, the Tool Editor remains open for additional editing, and the **Name** field changes to the name of the new entry (if you entered a new name).

Note: To SAS/AF application developers or site administrators: If you are editing a window-specific or application-specific toolbox that you want to be accessible to all users, you must save the TOOLBOX entry with the same library, catalog, and entry name as the PMENU entry for the window or application. You need WRITE access to the appropriate location. For example, to store a customized toolbox for the graphics editor, the site administrator would store the toolbox in SASHELP.GI.GEDIT.TOOLBOX. △

Creating a New Toolbox

To create a new toolbox, complete the following steps:

1 Perform one of the following:

- □ Edit an existing toolbox by invoking the Tool Editor dialog box (select

  Tools ▶ Options ▶ Edit Toolbox

  in the active window) and making your changes. Then save the edited toolbox, as described in "Saving Changes to the Toolbox or Toolset" on page 92.
- □ Copy an existing TOOLBOX entry. You can copy a toolbox by opening the CATALOG window, specifying the appropriate catalog, and then entering the COPYITEM command. For example, to copy the default toolbox, enter the following commands in the command window:

```
catalog sasuser.profile
   copyitem sasuser.profile.dms.toolbox
            sasuser.profile.newtools.toolbox
```

2 Edit the new toolbox by using the Tool Editor dialog box (select

Tools ▶ Options ▶ Edit Toolbox

in the active window).

3 Click Open.

4 Specify the libref, catalog, and entry name of the new toolbox.

5 Click OK to create the new toolbox.

How to Load a Different Toolbox

To load a toolbox, issue the TOOLLOAD command in the command window:

```
TOOLLOAD <libref.catalog.entry>
```

Creating or Customizing an Application- or Window-Specific Toolbox

If you are an application developer and want to create or edit an application TOOLBOX, follow these steps:

1 Delete any existing TOOLBOX entry in your SASUSER.PROFILE catalog for the window or application that you want to customize. When you delete the copy of the toolbox in your SASUSER.PROFILE catalog, you automatically receive a copy of the toolbox that is supplied with SAS when you invoke the Tool Editor dialog box.

2 Create or edit the application toolbox, as described in "Creating a New Toolbox" on page 93 or "Using the Tool Editor" on page 89.

3 Save the edited toolbox, as described in "Saving Changes to the Toolbox or Toolset" on page 92.

4 Inform your users that you have changed the window or application toolbox. If they want to use the new toolbox, they must delete the corresponding TOOLBOX entry from their SASUSER.PROFILE catalog. The new toolbox will then be automatically loaded when the window or application is invoked. If users do not delete the corresponding TOOLBOX entry from their SASUSER.PROFILE catalog, that copy of the toolbox will be loaded instead of the new toolbox.

Creating or Customizing an Application- or Window-Specific Toolset

You define application- or window-specific toolsets in the same way that you create an application- or window-specific toolbox. There are only two differences:

□ To create a new toolset, start by defining a toolbox as described in “Creating a New Toolbox” on page 93.

□ After you have defined the toolbox, save it as a TOOLSET entry, not as a TOOLBOX entry.

Note: If you are an application developer, make sure that you delete an existing TOOLSET entry for your application as described in “Creating or Customizing an Application- or Window-Specific Toolbox” on page 93 before you modify your application’s toolset. △

Customizing Key Definitions under OpenVMS

Introduction to Defining Keys

You can define most of the keys on your keyboard. However, a few keys have dedicated functions that are associated with them. For example, the mouse buttons are dedicated to the cursor and cut-and-paste operations and are not available for user customization. For more information, see “Default Keyboard Actions” on page 100.

Methods for Customizing Key Definitions

You can customize your key definitions by using one of the following methods:

□ Through the KEYS window. To open the KEYS window, do one of the following:

  □ Issue the KEYS command.

  □ Select

  Tools ► Options ► Keys

If you change any key definitions through the KEYS window for the SAS windowing environment windows, the definitions are stored in the SASUSER.PROFILE catalog in the entry DMKEYS.KEYS. Key definitions for other SAS windows are stored in catalog entries named BUILD.KEYS, FSEDIT.KEYS, and so on.

For more information about the KEYS command and the KEYS window, refer to the Base SAS section in SAS Help and Documentation.

□ With the KEYDEF command. The KEYDEF command enables you to redefine individual function keys:

```
keydef keyname <command | ~text-string>
```

For example, if you specify **`keydef F8 dlgpref`**, then the F8 key will issue the DLGPREF command that opens the Preferences dialog box.

For more information about the KEYDEF command, refer to the Base SAS section in SAS Help and Documentation.

- By defining the **`SAS.keyboardTranslations`** and **`SAS.keysWindowLabels`** resources in your resources file as described in "Defining Key Translations" on page 95.

Defining Key Translations

What Is a Key Translation?

To customize a key for the X Window System, you define a key sequence and specify an action to be executed when that key sequence is typed on the keyboard. This is known as binding keys to actions; together they are referred to as a translation.

What Is the SAS.keyboardTranslations Resource?

The **`SAS.keyboardTranslations`** resource specifies the set of key bindings that SAS uses in all SAS windows. The default value for the **`SAS.keyboardTranslations`** resource is determined at run time based on the vendor identification string reported by the X server that you are using as the display. These default settings are listed in the **`SAS$ROOT:SAS$XDEFAULTS.DAT`** file. To modify the default bindings supplied by SAS, you must modify the **`SAS.keyboardTranslations`** resource.

Note: The X Toolkit Intrinsics translations specified in this resource apply to both the user area and the command line of all SAS windows that are affected by this resource. This resource does not affect windows that are controlled by Motif interface resources, such as the Command window, the Open or Import dialog boxes, and some other pull-down menu dialog boxes. △

Steps for Creating a Key Definition

To create a key definition, follow these steps:

1. Determine the keysyms for the keys that you want to define. *Keysyms* are the symbols recognized by the X Window System for each key on a keyboard.
2. Modify/add the **`keyboardTranslations`** resource in your resource file to include the definitions of the keys that you want to define. Use a keyboard action routine to define which action you want the key to perform. The definition in the right column in the KEYS window will no longer control the function of any keys that are defined with a keyboard action routine other than **`sas-function-key()`**.
3. Modify/add the **`SAS.keysWindowLabels`** resource in your resource file. The **`SAS.keysWindowLabels`** resource specifies the set of valid labels that will appear in the KEYS window. Modify this resource only if you want to add new labels or modify existing labels in the left column in the KEYS window.

   The **`SAS.keysWindowLabels`** resource defines only the mnemonics used in the KEYS window. For a specific key to perform an action, you must specify a **`SAS.keyboardTranslations`** definition for the key.
4. Start a SAS session and open the KEYS window.
5. Type a command name or other description of each key that you have defined in the right-hand column in the KEYS window.

SAS Keyboard Action Names

SAS declares a set of keyboard actions during X initialization. You can think of these keyboard actions as simple functions. When the actions are executed, they act on the window that currently has keyboard input focus.

Keyboard action names represent X Toolkit action routines that are registered by the SAS interface to Motif for use with X Toolkit keyboard-event translations. A set of default keyboard actions is supplied as part of the interface. You can override and augment these actions by supplying a suitably formatted X Toolkit translation string in the **`SAS.keyboardTranslations`** resource.

Note: Most SAS documentation uses angle brackets (<>) to indicate optional syntax. However, in this topic optional syntax is shown with square brackets ([ ]). The angle brackets that are shown are part of the syntax and should be entered exactly as shown. △

The following list of keyboard actions represents action routines registered by the Motif interface for use with X Toolkit keyboard event translations:

`sas-cursor-down()`
moves the cursor down one line in a SAS window. The cursor does not wrap when it reaches the bottom of the SAS window interior.

`sas-cursor-left()`
moves the cursor left one character in a SAS window. The cursor does not wrap when it reaches the left side of the SAS window interior.

`sas-cursor-right()`
moves the cursor right one character in a SAS window. The cursor does not wrap when it reaches the right side of the SAS window interior.

`sas-cursor-up()`
moves the cursor up one line in a SAS window. The cursor does not wrap when it reaches the top of the SAS window interior.

`sas-delete()`
deletes all text in the current field.

`sas-delete-begin()`
deletes all text from the current cursor position to the beginning of the current text field.

`sas-delete-char()`
deletes the character under the text cursor and leaves the cursor in place.

`sas-delete-end()`
deletes text from the current cursor position to the end of the current text field.

`sas-delete-prev-char()`
deletes the character to the left of the text cursor and moves the cursor back one space.

`sas-delete-prev-word()`
deletes text from the current cursor position to the start of the previous word. If the cursor is in the interior of a word when the action is invoked, the text from the cursor position to the beginning of the word is deleted.

`sas-delete-word()`
deletes text from the current cursor position to the end of the current or next word.

`sas-do-command()`
accepts one or more text-string parameters that are interpreted as SAS commands to be executed when the action is invoked. The action can be invoked with

multiple parameters, separated by commas. The parameters are concatenated, with semicolon delimiters that are supplied by the **`sas-do-command()`** action. The assembled SAS command string is then submitted for execution. For example, the following translation can be used to define a global HOME, SUBMIT key sequence for all SAS windowing environment windows:

```
SAS.keyboardTranslations: <Key>KP_F3:
_sas-do-command(HOME,SUBMIT)
```

`sas-function-key("`*`InternalKeyName`*`")`

invokes the SAS commands associated with the function key identified by the *InternalKeyName* label. *InternalKeyName* is the character string (one to eight characters long) that is passed to the **`SAS.keysWindowLabel`** resource. You must enclose *InternalKeyName* in double quotation marks. For a description of internal key names, see “Defining Key Translations” on page 95. For a list of function-key parameters that SAS recognizes, refer to the sample SAS$XDEFAULTS.DAT file.

For example, the following keyboard translation designates the physical key KP_1 as a function key and associates the “Keypd 1” parameter with KP_1. SAS recognizes the “Keypd 1” parameter as being associated with the command LEFT (that is, scroll left) by default. Thus, it assigns the LEFT command to KP_1.

```
SAS.keyboardTranslations: ~Ctrl<Key>KP_1:
_sas-function-key("Keypd 1")
```

If you specify a function-key parameter that SAS does not recognize, the function-key command is initially left unspecified.

`sas-home-cursor()`

is the equivalent of the HOME command. This action is provided for convenience so that the HOME action can be defined globally.

`sas-insert-char(["`*`InsertionString`*`"])`

inserts or overwrites the character typed into the input field under the text cursor. Insert or overstrike behavior is determined by the **`sas-toggle-insert()`**action, which has a mode that is reflected by the text cursor style displayed: the block cursor indicates overstrike mode, and the underline cursor indicates insert mode. Normally, **`sas-insert-char`** translates the XKeyEvent into the appropriate character and inserts it at the SAS text cursor location. If you specify the parameter, the text string represented by this parameter is inserted at the SAS text cursor location. Any spaces in the string are interpreted by the X Toolkit as a parameter delimiter unless you enclose the string in double quotation marks. For information about embedding quotation marks in the string parameter, refer to your X Window System documentation. To include an escaped quotation mark, use the following syntax:

```
Shift<Key>KP_1:\
   sas-insert-char("One\\"1\\" ")
```

This produces the text string **`One"1"`**at the SAS text cursor location.

Note: Most SAS documentation uses angle brackets (< >) to indicate optional syntax. However, in this topic optional syntax is shown with square brackets ([ ]). The angle brackets that are shown are part of the syntax and should be entered exactly as shown. △

`sas-kp-application()`

sets the workstation’s numeric keypad to allow function key translations to be reinstated. This toggle only works for those keypad keys that are bound to **`sas-function-key()`**actions. Keypad bindings to other actions are not affected by this translation.

sas-kp-numeric()
sets the workstation's keypad to generate numeric characters instead of its previous function key assignment. Note that this toggle only works for keypad keys that are bound to **sas-function-key()**actions. Keypad bindings to other actions are not affected by this translation.

sas-move-begin()
moves the cursor to the beginning of the current text field.

sas-move-end()
moves the cursor to the end of the current text field.

sas-new-line()
generates an end-of-line event when invoked. This is a context-sensitive action. If you are typing in the SAS command line, the text that you enter is submitted for execution. If you invoke the **sas-new-line** action in the SAS application client-area, then the action depends on the attributes of the text area that is under the cursor. In simplest terms, this action is the general line terminator for an input field.

sas-next-field()
advances the cursor to the next field in the SAS window client-area.

sas-next-word()
moves the cursor forward to the beginning of the next word in the current text field. Wrapping is supported; that is, if the **sas-next-word()** action does not find the beginning of a word in the current text field, it advances to the next SAS application field. However, if you are typing in the SAS command-line area of the window, the cursor will not wrap into the SAS window client-area.

sas-page-down()
scrolls the current window contents forward by one page.

sas-page-end()
moves the text cursor to the end of the current page.

sas-page-top()
moves the text cursor to the top of the current page.

sas-page-up()
scrolls the current window contents backward by one page.

sas-prev-field()
returns the cursor to the previous field in the SAS window client-area.

sas-prev-word()
moves the cursor backward to the start of the next word in the current text field. Wrapping is supported; that is, if the **sas-prev-word()** action does not find the beginning of a word in the current text field, then it returns to the end of the previous SAS application field. However, if you are typing in the SAS command-line area of the window, the cursor does not wrap into the SAS window client-area.

sas-to-bottom()
moves the text cursor to the absolute bottom of the window's text range.

sas-to-top()
moves the text cursor to the absolute top of the window's text range.

sas-toggle-insert()
toggles the line-editing behavior of the associated window between insert and overstrike modes. This action applies only to the SAS command line and to the SAS window client-area. The current mode is indicated by the style of the cursor:

block cursor
: indicates overstrike mode.

underline cursor
: indicates insert mode.

`sas-xattr-key(<KeyType>[,<KeyParam>])`
defines the extended attributes that are associated with extended-attribute keys. This action accepts two text-string parameters.

Note: Most SAS documentation uses angle brackets (< >) to indicate optional syntax. However, in this topic optional syntax is shown with square brackets ([ ]). The angle brackets that are shown are part of the syntax and should be entered exactly as shown. △

The **`<KeyType>`** parameter must be one of the following:

XAATTR
: sets a display attribute. If XAATTR is specified, then the second parameter must be one of the following:

  HIGHLIGHT
  : turns on bold.

  UNDERLINE
  : turns on underlining.

  REVERSE
  : turns on reverse video.

  BLINK
  : turns on blinking.

  Note: The BLINK attribute is not supported in the Motif interface. However, if you specify the BLINK attribute, it will be displayed when the catalog is ported to other operating environments. △

XACLEAR
: clears all attributes. If XACLEAR is specified, then you must specify NULL as the second parameter.

XACOLOR
: sets a color attribute. If XACOLOR is specified, then the second parameter must be one of the following:

  BLACK
  : sets the text color to black.

  BLUE
  : sets the text color to blue.

  BROWN
  : sets the text color to brown.

  CYAN
  : sets the text color to cyan.

  GRAY
  : sets the text color to gray.

  GREEN
  : sets the text color to green.

  MAGENTA
  : sets the text color to magenta.

ORANGE
sets the text color to orange.

PINK
sets the text color to pink.

RED
sets the text color to red.

WHITE
sets the text color to white.

YELLOW
sets the text color to yellow.

For example, the following resource definition defines the CTRL+B key sequence to set the extended attribute for the color BLACK:

```
sas.keyboardTranslations:#override \
    Ctrl<Key>b:sas-xattr-key(XACOLOR,BLACK)
```

Default Keyboard Actions

Some keyboard-action routines are assigned to certain keys by default. The following table shows the default keyboard actions, which are defined by the **`SAS.keyboardTranslations`** resource. For more information about this resource, see "Defining Key Translations" on page 95 and your Motif documentation.

Note: Most SAS documentation uses angle brackets (< >) to indicate optional syntax. However, in this topic the angle brackets that are shown are part of the syntax and should be entered exactly as shown. △

Table 4.1 Default Key Actions

Key Name	Keyboard Action Routine
<Key>Home	**`sas-home-cursor()`**
<Key>osfUp	**`sas-cursor-up()`**
<Key>osfDown	**`sas-cursor-down()`**
<Key>osfRight	**`sas-cursor-right()`**
<Key>osfLeft	**`sas-cursor-left()`**
<Key>Return	**`sas-new-line()`**
Shift<Key>Tab	**`sas-prev-field()`**
<Key>Tab	**`sas-next-field()`**
<Key>osfBackSpace	**`sas-delete-prev-char()`**
<Key>osfDelete	**`sas-delete-prev-char()`**
<Key>	**`sas-insert-char()`**
Shift<Key>	**`sas-insert-char()`**

Extended-Attribute Key Resources

The SAS interface to Motif supports the use of attributes such as bold, reverse video, and underline. You can use the **`SAS.keyboardTranslations`** resource to control this feature.

The following table summarizes the functions that are provided through SAS extended-attribute keys.

Note: Most SAS documentation uses angle brackets (< >) to indicate optional syntax. However, in this topic the angle brackets that are shown are part of the syntax and should be entered exactly as shown. △

Table 4.2 Functions Provided through the SAS Software Extended-Attribute Keys

Keyboard Chord	Character Attribute Selected
Mod1<Key>b	Blue
Mod1<Key>r	Red
Mod1<Key>p	Pink
Mod1<Key>g	Green
Mod1<Key>c	Cyan
Mod1 <Key>y	Yellow
Mod1<Key>w	White
Mod1<Key>m	Magenta
Mod1<Key>o	Orange
Mod1<Key>k	Black
Mod1<Key>n	Brown
Mod1<Key>a	Gray
Mod1<Key>0	Clear extended attributes
Mod1<Key>1	Set highlight (bolding) attribute
Mod1<Key>2	Set underline attribute
Mod1<Key>3	Set reverse-video attribute

Customizing Fonts under OpenVMS

Difference between the System Font and Windowing Environment Fonts

SAS uses two main types of fonts:

- The system font is used in most dialog boxes and pull-down menus. SAS inherits the system font defined by the **`*.systemFont`** resource. If this resource is not defined, SAS uses a Helvetica font.
- Windowing environment fonts are used in SAS windows. You can change the SAS windowing environment font either through the Fonts dialog box or by specifying the resources in your resources file. The windowing environment font must be a fixed font.

Note: It is best to change fonts before invoking any applications. Changing fonts while applications are running might result in unexpected behavior. △

How SAS Determines Which Windowing Environment Font to Use

SAS determines the normal (not bold) default windowing environment font as follows:

1 If you have saved a font in SASUSER.PROFILE.DMSFONT.VMSPREFS through the Fonts dialog box, this font is used as the default normal font.

2 If you have not saved a font using the Fonts dialog box, but you have set the **`SAS.DMSFont`** resource, SAS uses the font specified by this resource as the default font.

3 If you have not set the **`SAS.DMSFont`** resource, SAS uses any **`*Font`** resources that you have defined.

4 If you have not set the **`*Font`** resources, but you have set the **`SAS.DMSfontPattern`** resource, SAS uses this resource to determine which font to use. The **`SAS.DMSfontPattern`** resource will have no effect if a **`*Font`** resource is defined.

5 If no resources have been set, SAS chooses a font from the fonts that are available on your server.

If you have not specified a value for the **`SAS.DMSboldFont`** resource, SAS uses the default normal font to determine the default bold font. If the normal **`SAS.DMSFont`** resource has an XLFD name associated with it, then SAS selects the matching bold font and loads it. If SAS cannot automatically select or load a bold font, the normal font is also used for the bold font.

In many cases, font names are given aliases so that a shorter name can be used to refer to a font that has an XLFD name associated with it. The name used in determining a bold font is based on the *XA_FONT* font property for the normal font.

Customizing the Font Using the Fonts Dialog Box

Introduction to Fonts Dialog Box

The Fonts dialog box enables you to change windowing environment fonts for the entire SAS session. If you change the font, the font that you select is stored in SASUSER.PROFILE.DMSFONT.VMSPREFS and will be used in future SAS sessions.

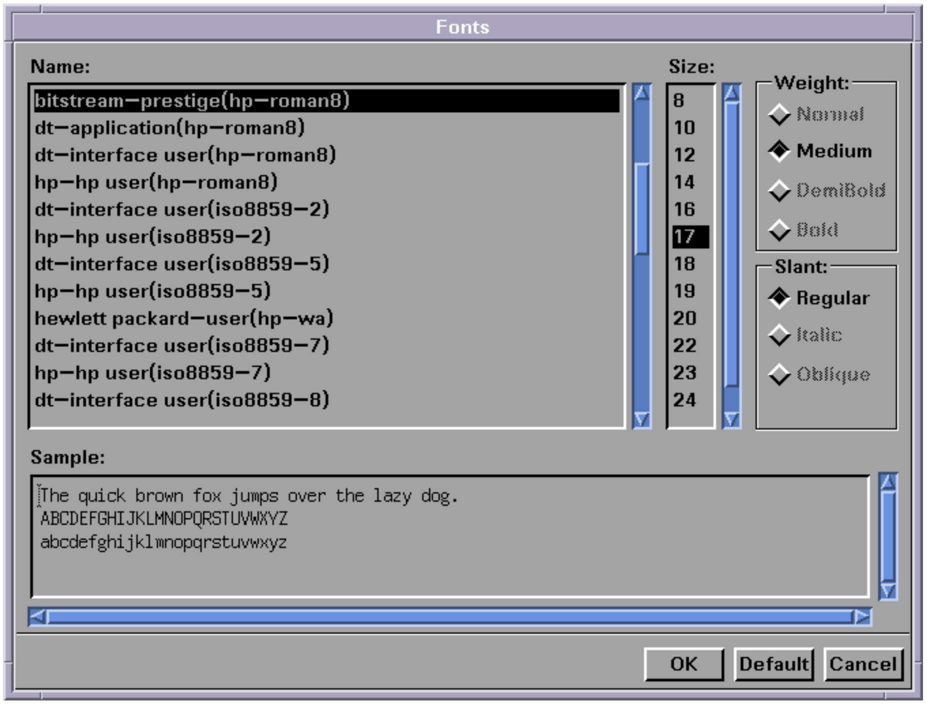
Opening the Fonts Dialog Box

To open the Fonts dialog box, use one of the following methods:

- □ Issue the DLGFONT command in the command window.
- □ Select

  Tools ► Options ► Fonts

Display 4.7 Fonts Dialog Box


Fonts
Name:
bitstream–prestige(hp–roman8)
dt–application(hp–roman8)
dt–interface user(hp–roman8)
hp–hp user(hp–roman8)
dt–interface user(iso8859–2)
hp–hp user(iso8859–2)
dt–interface user(iso8859–5)
hp–hp user(iso8859–5)
hewlett packard–user(hp–wa)
dt–interface user(iso8859–7)
hp–hp user(iso8859–7)
dt–interface user(iso8859–8)
Size:
8
10
12
14
16
17
18
19
20
22
23
24
Weight:
Normal
Medium
DemiBold
Bold
Slant:
Regular
Italic
Oblique
Sample:
The quick brown fox jumps over the lazy dog.
ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
OK
Default
Cancel

How to Change the Windowing Environment Font

To change the windowing environment font, complete the following steps:

1 Open the Fonts dialog box.

2 Select a font name, and if desired, a size, weight, and slant. (Not all fonts are available in all sizes, weights, or slants.) The **`Sample`** field shows what the selected font looks like.

3 Click OK to change the existing font to the selected font.

To return to the default font, click Default.
To cancel any changes and exit the Fonts dialog box, click Cancel.

Specifying Font Resources

You can customize the fonts used in the SAS windowing environment with the following resources:

`SAS.DMSFont:` ***`font-name`***
specifies the font that you want to be used as the default normal font. The font must be a monospace font. The default is dynamic, which means that the default value is determined at run time. If you change the value for the **`SAS.DMSFont`** resource, then you must also change the **`SAS.DMSboldFont`** resource to one that has the same style, set width, font size, point size, spacing, and number of pixels (or dots) per inch.

`SAS.DMSboldFont:` ***`font-name`***
specifies the font that you want to be used as the default bold font. The default is dynamic, which means that the default value is determined at run time. If you change the value for the **`SAS.DMSboldFont`** resource, then you must also change

the **SAS.DMSFont** resource to one that has the same style, set width, font size, point size, spacing, and number of pixels (or dots) per inch.

SAS.DMSfontPattern: ***XLFD-pattern***
specifies an X Logical Font Description (XLFD) pattern that you want SAS to use to determine the windowing environment font. Most fonts in the X Window System are associated with an XLFD, which contains a number of different fields delimited by a dash (-) character. The fields in the XLFD indicate properties such as the font family name, weight, size, resolution, and whether the font is proportional or monospaced. For more information about the XLFD and font names used with X, refer to your X Window documentation.

The *XLFD-pattern* that you specify for **SAS.DMSfontPattern** must contain the same number of fields as an XLFD. An asterisk (*) character means that any value is acceptable for that particular field. For example, the following pattern (which is the default) matches any font that has a regular slant, is not bold, is monospaced, and is an ISO 8859 font:

```
SAS.DMSfontPattern: \
  -*-*-*-r-*--*-*-*-*-m-*-iso8859-1
```

SAS uses the *XLFD-pattern* to choose a font as follows:

1 SAS queries the X server for the list of fonts that match the **SAS.DMSfontPattern** resource.

2 SAS excludes all fonts that have X and Y resolution values different from the current X display, all fonts that have variable character cell sizing (such as proportional fonts), and all fonts that have point sizes smaller than 8 points or larger than 15 points. If this step results in an empty list, SAS chooses a generic (and usually fixed) font.

3 The font with the largest point size is chosen from the remaining list.

Given an XLFD font for the DMS font, the matching XLFD bold font name is derived and loaded. If the SAS interface to Motif cannot automatically select or load a DMS bold font, the DMS font is also used for the DMS bold font. The auto-selection of the DMS bold font is independent of the auto-selection of the DMS font. If the font resources are explicitly specified, then the auto-selection processing is not invoked. Explicitly specified values for the **SAS.DMSFont** and **SAS.DMSboldFont** resources take precedence over automatic selection.

If you have not specified a value for the **SAS.DMSboldFont** resource, then the SAS interface to Motif chooses a value by using the current DMS font as a reference point. The current DMSFont must have an XLFD name associated with it. The **SAS.DMSfontPattern** resource will have no effect if a ***Font** or ***FontList** resource is defined.

In many cases font names are aliased so that a shorter name can be used to refer to a font that has an XLFD name associated with it. The name used in determining a **SAS.DMSboldFont** is based on the *XA_FONT* font property for the DMS font.

SAS.fontPattern: ***XLFD-pattern***
specifies an XLFD font pattern that describes the candidate fonts used to resolve SAS graphics font requests. This enables you to optimize or control the use of X fonts within the context of various SAS graphics applications. The default value of an asterisk (*) usually does not affect performance to a significant degree. Cases where it might be appropriate to restrict the font search include X servers with an excessive number of fonts or X servers operating on performance-limited environments.

SAS.systemFont
specifies the system font. The SAS windowing environment font is used in SAS windows. The system font is used in most dialog boxes and menus. SAS typically inherits the system font from the font resources set by the X window environment. If the ***.systemFont** resource, SAS uses a 12-point Helvetica font.

Specifying Font Aliases

Syntax for Specifying Font Aliases

If your server does not provide fonts to match all of those that SAS supplies, you can use font-alias resources to substitute the fonts that are available on your system. (Ask your system administrator about the fonts that are available.) Use the following syntax to specify font aliases in your resource file:

```
SAS.supplied-fontAlias: substitute-fontfamily
```

where *supplied-font* is the name of the font that SAS supplies and *substitute-fontfamily* is the family name of the font that you want to substitute.

CAUTION:
Do not specify a SAS font as a font alias. A conflict can occur if you specify a font that is supplied by SAS as a font alias, as in the following example:

```
SAS.timesRomanAlias: symbol
```

Assigning this value to a font alias prevents the selection of any symbol fonts through the font selection dialog box, because they are specified as the Times Roman alias. △

The following table lists the SAS font-alias resource names. All of the resources listed are of the type String and have a default of NULL.

Table 4.3 SAS Font-Alias Resources

Resource Name	Class Name
SAS.timesRomanAlias	TimesRomanAlias
SAS.helveticaAlias	HelveticaAlias
SAS.courierAlias	CourierAlias
SAS.symbolAlias	SymbolAlias
SAS.avantGardeAlias	AvantGardeAlias
SAS.bookmanAlias	BookmanAlias
SAS.NewCenturySchoolbookAlias	newCenturySchoolbookAlias
SAS.palatinoAlias	PalatinoAlias
SAS.zapfChanceryAlias	ZapfChanceryAlias
SAS.zapfDingbatsAlias	ZapfDingbatsAlias

Example: Substituting the Lucida Font for Palatino

Suppose that your system does not have a Palatino font, but has the following Lucida font:

```
b&h-lucida-bold-r-normal-sans-
    10-100-75-75-p-66-iso8859-1
```

To substitute Lucida for Palatino, include the following line in your resource file:

```
SAS.palatinoAlias: lucida
```

Customizing Colors under OpenVMS

Default Color and Attribute Settings

SAS ships to all sites a default set of colors and attribute settings for the elements of all SAS windows. Although the same setting for each element is shipped to all sites, the implementation of that setting is determined by device type, logically and physically. Thus, settings might vary among sites and across operating environments.

Optionally, the SAS Installation Coordinator can create the catalog entry SASHELP.BASE.SAS.CPARMS. The color and attribute settings in this catalog become default for the site.

Methods for Customizing the Color Settings in Your SAS Session

As an individual user, you can customize the colors in your SAS session by using one of the following methods:

- Through the SASCOLOR window, as described in "Customizing Colors Using the SASCOLOR Window" on page 107. You can customize any window element for most SAS windows with the SASCOLOR window.
- With the COLOR command using the following syntax:

  ```
  color field-type <color | NEXT <highlight>>
  ```

  For a complete description of the COLOR command, see "COLOR Command" on page 251. The COLOR command affects only the specified element of the active window. Changes made with the COLOR command override changes entered through any of the other methods described here. To save your changes beyond your current session, do one of the following:

  - Issue the WSAVE command. The changes are saved to SASUSER.PROFILE.*window*.WSAVE.

    Note: Issuing the WSAVE ALL command will save all windows that support the WSAVE command. △

  - Select

    View ► Change display ► Save attributes

  The WSAVE command is not available for all SAS windows. For example, with SAS/FSP software, changes are saved either through the EDPARMS or the PARMS window. To determine whether WSAVE is available for a SAS window that is not part of the SAS windowing environment, refer to the product documentation.

Both the COLOR command and the WSAVE command override actions in the SASCOLOR window. That is, COLOR and WSAVE override the use of CPARMS colors for that particular window without affecting the CPARMS values for other SAS windows.

- By entering the color resource specifications yourself. You can enter specific RGB values or color names for any of the X resources that control color. For more information, see “Defining Color Resources” on page 107.

Customizing Colors Using the SASCOLOR Window

How to Open the SASCOLOR Window

You can use the SASCOLOR window to change the color and highlighting of specific elements of SAS windows. To open the SASCOLOR window, do one of the following:

- Select

  Tools ▶ Options ▶ Colors

  in the active window.
- Issue the SASCOLOR command in the command window.

Changing the Color of a Window Element

To change a color for a window element, complete the following steps:

1. Select the element name.
2. Select the color and attribute that you want assigned to the element.
3. Click OK to make the desired color change.

Click Cancel to ignore any changes you made and close the SASCOLOR window. To return all tools in the current toolbox to their default settings, click Defaults. When you click Save, your changes are saved to the catalog entry SASUSER.PROFILE.SAS.CPARMS.

Note: Close and reopen any active windows for new color settings to take effect. △

For more information about the SASCOLOR window, see the Base SAS section in SAS Help and Documentation.

Defining Color Resources

What Are CPARMS Resources?

You can define window colors and attributes by assigning values to SAS resources known as CPARMS. The CPARMS resources are divided into classes, each of which defines the color and attribute of a specific window element, such as the background in a secondary window or the border of a primary window.

Categories of Color Resources

Color resources fall into two categories:

foreground and background definitions
: These resources enable you to customize the RGB values that are used to define the 12 DMS colors. Since each color could be used as either a background or a foreground color, you can specify different RGB values or color names for each color for each usage. For example, you can specify that when blue is used as a foreground color that color #0046ED is used, and when blue is used as a background that CornflowerBlue is used. For more information, see "Specifying RGB Values or Color Names for Foreground and Background Resources" on page 108.

window element definitions
: These resources, which are referred to as CPARMS resources, enable you to specify which of the 12 DMS colors you want to use for each window element. For example, you can specify that message text is displayed in magenta. For more information, see "Defining Colors and Attributes for Window Elements (CPARMS)" on page 109.

The two types of resources work together. The CPARMS color values use the current foreground and background definitions. For example, the following resources specify that the background of your primary windows will be CornflowerBlue:

```
SAS.blueBackgroundColor: CornflowerBlue
SAS.cparmBackground: DmBlue
```

Specifying RGB Values or Color Names for Foreground and Background Resources

SAS uses **`SAS.systemBackground`**, **`SAS.systemForeground`**, and the resources listed in the following table to determine the colors to be used in the SAS windows:

`SAS.systemForeground`
: specifies the color for the foreground system color in the SASCOLOR window.

`SAS.systemBackground`
: specifies the color for the background system color the SASCOLOR window.

`SAS.systemSecondaryBackground`
: sets the system secondary background color and specifies the color for the secondary background system color in the SASCOLOR window.

You can specify color names such as MediumVioletRed or RGB values such as #0000FF for all of the foreground and background resources. For more information about RGB color values, refer to your X Window System documentation.

The following table lists all of the foreground and background color resources and their class names. All of these resources are of the type String.

Table 4.4 Foreground and Background Color Resources

Resource Name	Class Name
`SAS.systemForeground`	SystemForeground
`SAS.systemBAckground`	SystemBackground
`SAS.systemSecondaryBackground`	Background
`SAS.blackForegroundColor`	BlackForegroundColor
`SAS.blueForegroundColor`	BlueForegroundColor

Resource Name	Class Name
`SAS.brownForegroundColor`	BrownForegroundColor
`SAS.cyanForegroundColor`	CyanForegroundColor
`SAS.grayForegroundColor`	GrayForegroundColor
`SAS.greenForegroundColor`	GreenForegroundColor
`SAS.magentaForegroundColor`	MagentaForegroundColor
`SAS.orangeForegroundColor`	OrangeForegroundColor
`SAS.pinkForegroundColor`	PinkForegroundColor
`SAS.redForegroundColor`	RedForegroundColor
`SAS.whiteForegroundColor`	WhiteForegroundColor
`SAS.yellowForegroundColor`	YellowForegroundColor
`SAS.blackBackgroundColor`	BlackBackgroundColor
`SAS.blueBackgroundColor`	BlueBackgroundColor
`SAS.brownBackgroundColor`	BrownBackgroundColor
`SAS.cyanBackgroundColor`	CyanBackgroundColor
`SAS.grayBackgroundColor`	GrayBackgroundColor
`SAS.greenBackgroundColor`	GreenBackgroundColor
`SAS.magentaBackgroundColor`	MagentaBackgroundColor
`SAS.orangeBackgroundColor`	OrangeBackgroundColor
`SAS.pinkBackgroundColor`	PinkBackgroundColor
`SAS.redBackgroundColor`	RedBackgroundColor
`SAS.whiteBackgroundColor`	WhiteBackgroundColor
`SAS.yellowBackgroundColor`	YellowBackgroundColor

Defining Colors and Attributes for Window Elements (CPARMS)

You specify CPARMS resources just as you would specify any other SAS X resource in an X resource file. You specify CPARMS values either in your resource file or with the **`-xrm`** option, which can be used as a system option or on the SAS command line. (The **`-xrm`** option is also described in "XRESOURCES= System Option" on page 512.)

Use the following syntax to specify CPARMS values:

```
SAS.cparmResource: DmColorName|DmAttrName\
[+ DmColorName|DmAttrName]
```

Resource can be any of the CPARMS resources listed in the following table. All of these resources are of the type DmColor, and their default values are dynamic—that is, the default values are determined at run time.

Table 4.5 SAS CPARMS Resources

Resource Name	Specifies the color and attribute settings for . . .	Class Name	Default Color
`SAS.cparmBackground`	backgrounds within all primary windows displayed in a SAS session	CparmBackground	DmWhite
`SAS.cparmBanner`	a banner within a window	CparmForeground	DmBlack
`SAS.cparmBorder`	the border of a primary window	CparmBackground	DmBlack
`SAS.cparmByline`	BY lines written to the Output window	CparmForeground	DmBlue
`SAS.cparmColumn`	text labels for column information. You can use this resource within the SAS editor to identify editing lines and in spreadsheet windows to label spreadsheets.	CparmForeground	DmBlue/ Underline
`SAS.cparmCommand`	the command data entry field when menus are disabled.	CparmForeground	DmBlack
`SAS.cparmData`	general lines written to the Log window or the Output window	CparmForeground	DmBlack
`SAS.cparmError`	ERROR: lines that are written to the Log window or Output window	CparmForeground	DmRed
`SAS.cparmFootnote`	FOOTNOTE lines written to the Output window	CparmForeground	DmBlue
`SAS.cparmForeground`	all text fields within a SAS windowing environment window that can be edited	CparmBackground	DmBlack
`SAS.cparmHeader`	HEADER lines written to the Output window	CparmForeground	DmBlue
`SAS.cparmHelpLink`	links to additional levels of information in the HELP system	CparmForeground	DmGreen/ Underline
`SAS.cparmHelpMainTopic`	topic words or phrases in the HELP system	CparmForeground	DmBlack
`SAS.cparmHelpSubTopic`	topic words or phrases in the HELP system	CparmForeground	DmBlack
`SAS.cparmInfo`	text that is displayed in a window as an aid to the user, for example: `Press Enter to continue`	CparmForeground	DmBlack

Resource Name	**Specifies the color and attribute settings for . . .**	**Class Name**	**Default Color**
`SAS.cparmLabel`	text that precedes a widget. For example, the text **`Name:`** in the following example is a label: **`Name:`** ________________	CparmForeground	DmBlack
`SAS.cparmMark`	areas that have been selected for operations such as FIND, CUT, and COPY	CparmForeground	DmBlack/ DmReverse
`SAS.cparmMessage`	the message field	CparmForeground	DmRed
`SAS.cparmNote`	NOTE: lines that are written to the Log window or the Output window	CparmForeground	DmBlue
`SAS.cparmSecondaryBackground`	backgrounds in secondary windows	CparmForeground	DmGray
`SAS.cparmSecondaryBorder`	the border of a secondary window	CparmForeground	DmBlack
`SAS.cparmSource`	SAS source lines that are written to the Log window	CparmForeground	DmBlack
`SAS.cparmText`	text labels for row information. You can use this resource within the SAS editor to identify editing lines and in spreadsheet windows to label spreadsheet rows.	CparmForeground	DmBlue
`SAS.cparmTitle`	TITLE lines written to the Output window	CparmForeground	DmBlue
`SAS.cparmWarning`	WARNING lines written to the Log window or the Output window	CparmForeground	DmGreen

DmColorName can be any one of the following colors:

DmBLACK

DmBLUE

DmBROWN

DmCYAN

DmGRAY

DmGREEN

DmMAGENTA

DmORANGE

DmPINK

DmRED

DmWHITE

DmYELLOW

DmAttrName can be any one of the following attributes:

DmHIGHLIGHT

DmUNDERLINE

DmREVERSE

You can specify attribute names and color names in any order. If you specify more than one color name for a single class, then SAS uses the last color that you specified.

Example: Defining CPARMS

The following example specifies that all background colors are gray and all foreground colors are black:

```
SAS.cparmBackground: DmGRAY
SAS.cparmForeground: DmBLACK
```

You can add to these settings to make errors red with reverse video and warnings yellow with bolding and reverse video:

```
SAS.cparmError: DmRED + DmREVERSE
SAS.cparmWarning:
    DmHIGHLIGHT + DmYELLOW + DmREVERSE
```

You can further add to these settings by making the background of secondary windows white:

```
SAS.cparmSecondaryBackground: DmWHITE
```

Controlling Color Contrast

During interactive move/stretch operations, such as rubberbanding and dragging rectangles in SAS/INSIGHT software, you might find it hard to see the outline of the graphics primitive because of the lack of contrast between the primitive and the background. The XCONTRAST command makes the primitive visible against the background. The rendering performance and the aesthetic appearance of the primitive is compromised for the sake of visibility. You can enter XCONTRAST to act as a toggle, or you can specify XCONTRAST ON or XCONTRAST OFF.

With some color combinations, text fields, push buttons, and check boxes and other foreground categories might not be visible. The following resource makes these categories legible:

`SAS.dmsContrastCheck:  [True | False]`
: controls whether contrast mapping is applied to non-graphic foreground colors in a SAS window. The value True specifies that DMS foreground colors will be remapped if necessary to produce a contrast. The default value is False, which disables contrast checking. Some color usage based on graphic operations is not affected by this resource.

Controlling Menus under OpenVMS

Pull-down menus are controlled by the following resources:

`SAS.pmenuOn: [True | False]`
turns the menus on for the current SAS session, regardless of the information stored by the WSAVE command. You can use this resource to override the saved settings in your SASUSER.PROFILE catalog. The WSAVE state of an individual window takes precedence over the global state. The default is True. You can also use the PMENU ON and PMENU OFF commands to turn menus on and off.

`SAS.usePmenuMnemonics: [True | False]`
specifies whether mnemonics are attached to the menus for the current SAS session. The default is True.

Customizing Cut-and-Paste Operations under OpenVMS

Introduction to Marks and the Paste Buffer

The SAS interface to Motif uses the SAS concepts of marks and the paste buffer to provide the normal X Window System cut-and-paste behavior. The mark defines and highlights a region of text. The SAS interface to Motif supports two methods of marking text. The paste buffer retains a collection of text lines. In SAS, you must associate marks with a paste buffer by issuing a command such as STORE or CUT. This is different from other X applications, in which marks and paste are generally synonymous with each other.

The default definitions enable you to cut and paste between the SAS interface to Motif and other X window clients or between the SAS interface to Motif and the XPRIMARY buffer in OpenVMS.

Tasks That You Can Perform with Marked Text

You can do any of the following tasks with a marked area of text in many SAS windows:

- delete the text.
- delete and retain the text in a paste buffer.
- search the text for words or phrases.
- store the text in a paste buffer.
- use the text in an application to define a set of values that are operated on by a specified command.
- submit the marked text only.

Marking Text

Difference between Character and Block Marks

SAS supports the character mark and the block mark. The behavior of the character mark resembles text marking in most X Window System terminal emulators. The range of the character mark spans whole interior lines between the starting point and the ending point of the marked text. Interior lines are those that are between the lines containing the starting point and the ending point. By contrast, a block mark is a rectangular region that includes one corner at the starting point and one corner at the ending point of the mark.

Marking Text Using the MARK Command

The MARK command establishes a mode in the SAS window that lasts until you issue another MARK command.

To mark an area of text, complete the following steps:

1. Position the cursor by clicking at the beginning of the text that you want to mark.
2. Issue the MARK command.
3. Move the cursor to the end of the text that you want to mark and click.
4. Issue the MARK command a second time. Before you issue the second MARK command, the end point changes as you move the window's text cursor by using the keyboard arrow keys, tabbing, clicking the mouse, or scrolling through the window's contents. Mark highlighting also changes as you change the cursor position.

You can issue the MARK command from the command line, or you can assign it to a function key. If you want to select a rectangular block of text instead of a string of text, add the BLOCK argument to the MARK command. With the MARK command, you can select more than one area of text in the same window at the same time. To unmark the selected text, issue the UNMARK command.

Marking Text Using the Mouse

You can also use the mouse to select text by clicking and dragging the left mouse button (MB1) inside the SAS window. (The marks that are generated by this method are called drag marks.) You can use keyboard modifiers to change the behavior of the marking. When you end a drag mark by releasing MB1, SAS performs an end-of-mark action that might generate a STORE command to save the contents of the mark into a SAS paste buffer. This feature is controlled by the **`SAS.markPasteBuffer`** resource. You can clear marks in a SAS window by clicking MB1 inside the SAS window or by starting a new drag mark in the SAS window.

The SAS interface to Motif supports the following mouse button behavior:

MB1 press and move
: makes a SAS character mark starting at the point where the mouse button is depressed and marks an area with the mouse. The area that you mark is highlighted. Release MB1 to complete the mark.

  Note: Any existing marks in the same window are deleted when you press MB1. △

MB1 press and release
: frees existing drag marks in the window except those that were created by the MARK command. You can use MB1 to position the text cursor inside a SAS mark.

MB2 press
: generates a PASTE command at the location of the click, using the **`SAS.markPasteBuffer`** value as the name of the paste buffer if the resource is defined. If **`SAS.markPasteBuffer`** is not defined, press MB2 to generate a PASTE command with BUFFER=DEFAULT.

There are three modifier keys that can be used in conjunction with MB1 to produce the following results:

Unmodified
: character mark and end-of-mark action.

Shift
: extend mark and end-of-mark action.

CTRL
: block mark and end-of-mark action.

Mod1
: alters end-of-mark action to the opposite of normal behavior.

The normal end-of-mark action depends on the setting of the **`SAS.markPasteBuffer`** resource. If this resource is defined, the normal action is to generate a STORE BUFFER=<*name*> command to store the newly created mark to the named paste buffer. If this resource is not defined, the normal action is to suppress the generation of the STORE command; the marked area remains highlighted.

Paste Buffers

What Are Paste Buffers?

SAS *paste buffers* are named objects that retain a copy of selected text. Each buffer is identified by a name of up to eight characters; the name is not case sensitive. Most commands operating on a SAS paste buffer support the BUFFER= option that enables you to identify the paste buffer. This paste buffer name directs the SAS interface to Motif to interact with the standard X interclient data exchange mechanisms.

Paste buffers that are not associated with an X interclient mechanism are called *local paste buffers* because their contents are known only within the scope of the SAS session. Paste buffers associated with X inter-client data exchange mechanisms are called *extended paste buffers*.

Types of Paste Buffers

The SAS interface to Motif enables you to use X cut buffers and X selections to exchange information with other X clients. The paste buffer name determines whether the buffer has extended semantics in the context of the X data exchange mechanisms. The following list describes paste buffer names and their associations:

XPRIMARY
: is the paste buffer associated with the X primary selection (PRIMARY). XPRIMARY is the default buffer. DEFAULT is an alias for XPRIMARY. If you copy or cut text into the XPRIMARY buffer, the text is actually copied or cut into all four of the paste buffers.

XSCNDARY
: is the paste buffer associated with the secondary selection (SECONDARY).

XCLIPBRD
: is the paste buffer associated with the clipboard selection (CLIPBOARD). This paste buffer enables you to use the MIT X Consortium **`xclipboard`** client with SAS.

XTERM
: is the paste buffer associated with the exchange protocol used by the xterm client.

XCUT*n*
: is the paste buffer associated with the X cut buffer *n*, where the range of *n* is 0 to 7.

Manipulating Text Using Paste Buffers

If you want SAS to automatically copy selected text into your paste buffer every time you mark a region of text with the mouse, you should specify your paste buffer name in the **SAS.markPasteBuffer** resource. To generate a STORE command every time you mark a region of text with the mouse, define the following X resource for the SAS application:

```
SAS.markPasteBuffer: XPRIMARY
```

Since the DEFAULT paste buffer is aliased to XPRIMARY, you could also make the following declaration for **SAS.markPasteBuffer** to produce the same result:

```
SAS.markPasteBuffer: DEFAULT
```

The **markPasteBuffer** definition causes SAS to automatically issue a STORE command whenever you select text.

The STORE command, as well as the CUT and PASTE commands, support a BUFFER= option that specifies which buffer to use. When these commands are issued from function keys or menus whose definitions do not include the BUFFER= option, if the **SAS.markPasteBuffer** resource is not defined, these commands use BUFFER=DEFAULT. If this resource is defined, these commands use BUFFER=*buffer-name*.

You can customize your normal cut, copy, or paste keys to issue any of these commands with the BUFFER= option. For example, you can define a SAS **SAS.keyboardTranslations** binding for the **sas-do-command()** action that will be valid for the same set of operations in every SAS window and override the SAS **SAS.keyboardTranslations** definition for the **osfCopy** and **osfPaste** keys with the following specifications:

```
SAS.keyboardTranslations: #override\
<Key>osfCopy:
     sas-do-command("STORE BUFFER=XCLIPBRD") \n\
<Key>osfPaste:
     sas-do-command("PASTE BUFFER=XCLIPBRD")
```

For more information about customizing keys, see “Customizing Key Definitions under OpenVMS” on page 94.

When you cut or copy and paste text between SAS sessions using the XTERM, XPRIMARY, or XSCNDARY paste buffers, the color and attribute information is preserved. However, if you copy and paste the same text into an xterm window while using the vi editor, the color and attribute information is lost. If you change the definition for **SAS.defaultPasteBuffer** and **SAS.markPasteBuffer** to XCUT0, then you will not retain the text and attributes when you copy and paste text between two SAS sessions.

Note: When you use the xclipboard client, SAS text attributes are not preserved in exchanges made between SAS sessions. However, when you use the SAS XCLIPBRD paste buffer without a clipboard manager such as the xclipboard client, SAS text attributes are preserved in exchanges between SAS sessions. △

Exchanging Information Using Paste Buffers

You can use X Window paste buffers and X selections to exchange information with other X Window clients. The SAS paste-buffer interface allows this interaction for all paste-buffer interaction commands and operations. With the SAS interface to Motif, you can use the following paste buffers:

- XPRIMARY
- XSCNDARY
- XCLIPBRD
- XTERM
- XCUT*n*

For more information about these paste buffers, see "Paste Buffers" on page 115.

If you are not sure which X data exchange protocols your other X clients are using, you should use the XTERM paste buffer. You can specify your default paste buffer with the **SAS.defaultPasteBuffer** resource:

```
SAS.defaultPasteBuffer: XTERM
```

If you know that the X clients in your workstation environment all use the X PRIMARY selections to exchange data, you should use the XPRIMARY paste buffer:

```
SAS.defaultPasteBuffer: XPRIMARY
```

This specification uses both SAS and X resources more efficiently and provides for the on-demand transfer of data between clients.

You can also use the SAS XCLIPBRD paste buffer to interact with Motif clients that use the Motif clipboard mechanism for text exchanges. This clipboard mechanism makes it unnecessary to have a dedicated client such as xclipboard. For example, you can use XCLIPBRD to exchange text directly with the Motif xmeditor application when you select the **Cut**, **Copy**, or **Paste** items from the xmeditor **Edit** menu.

Customizing Session Workspace, Session Gravity, and Window Sizes under OpenVMS

SAS uses the following resources to determine the size of the session workspace, the gravity of the workspace, and the size of the windows.

Note: SAS requires at least 20 rows and 78 columns of internal window space. If you specify smaller dimensions for the **SAS.maxWindowHeight**, **SAS.maxWindowWidth**, **SAS.windowHeight**, or **SAS.windowWidth** resource, then SAS defaults to these minimum values. △

SAS.awsResizePolicy
controls the policy for resizing the application workspace (AWS) windows as interior window are added and removed. Possible values include the following:

grow
the AWS window will attempt to grow any time an interior window is grown or moved, in order to show all interior windows, but it will not shrink to removed dead areas.

fixed
the AWS window will attempt to size itself to the size of the first interior window and will not attempt any further size changes.

The default is grow.

SAS.maxWindowHeight
specifies the maximum height of a window. The unit of measure is specified by the **SAS.windowUnitType** resource. The default is 95.

SAS.maxWindowWidth
specifies the maximum width of a window. The unit of measure is specified by the **SAS.windowUnitType** resource. The default is 95.

SAS.noAWS: [True | False]
controls whether each of your application's windows appears in its own native window rather than in an application workspace (AWS). The default is False, which confines all windows displayed by an application to a single AWS window.

SAS.scrollBarSize
specifies the size of the scroll bars in pixels. The default is 17.

SAS.sessionGravity
specifies in which region of the screen that SAS attempts to place its windows. Possible values include the following:

NorthWestGravity

NorthGravity

NorthEastGravity

WestGravity

CenterGravity

EastGravity

SouthWestGravity

SouthGravity

SouthEastGravity

The default is dynamic, which means that the default value is determined at run time. For example, for the first SAS session that you invoke the default is NorthWestGravity. However, if you invoke a second SAS session while the first session is still running, the default for the second session is NorthEastGravity.

SAS.sessionGravityXOffset
specifies an X (horizontal) offset to be added when SAS attempts to place a window in the gravity region. The default is 0.

SAS.sessionGravityYOffset
specifies a Y (vertical) offset to be added when SAS attempts to place a window in the gravity region. The default is 0.

SAS.windowHeight
specifies the default height of a window. The unit of measure is specified by the **SAS.windowUnitType** resource. The default is 50.

SAS.windowUnitType
specifies the unit of measure for the **SAS.windowWidth**, **SAS.windowHeight**, **SAS.maxWindowWidth**, and **SAS.maxWindowHeight** resources. Possible values include the following:

character
specifies the number of rows and columns.

pixel
: specifies the number of pixels.

percentage
: specifies the percentage of the display.

The default is percentage.

`SAS.windowWidth`
specifies the default width of a window. The unit of measure is specified by the **`SAS.windowUnitType`** resource. The default is 67.

Specifying User-Defined Icons under OpenVMS

Why Specify User-Defined Icons?

You can add your own icons to the icons that are supplied with SAS. For example, if you want to use your own color icons in the toolbox, define the **`SAS.colorUiconPath`**, **`SAS.colorUiconCount`**, and **`SAS.sasUicon`*`x`*** resources. Then, when you are defining tools in the tool editor, your icons appear in the display of icons that you can choose for each tool.

How SAS Locates a User-Defined Icon

The resource name that is used to locate the icon bitmap filename for a user icon number *x* is **`SAS.sasUicon`*`x`***. For example, to define the filename MYICON for the user icon 1, you should define the resource:

```
SAS.sasUicon1: myicon
```

If the resource name is not defined, SAS generates a filename of the form **`sasui`*`nnn`*`.xbm`** or **`sasui`*`nnn`*`.xpm`**. The path elements from the **`SAS.uiconPath`** resource are searched in sequence until the icon file is found or until the search path is exhausted.

For example, the following set of X resources defines a collection of color icons:

```
SAS.colorUiconPath: MYDISK:[MYDIR1.PIXMAPS]
SAS.colorUiconCount: 7
SAS.sasUicon1: adsetup
SAS.sasUicon2: adverse
SAS.sasUicon3: altmenu
SAS.sasUicon4: batch
SAS.sasUicon5: is
SAS.sasUicon6: patgrps
SAS.sasUicon7: pctchg
```

The Motif interface will search for icon **`sasUicon1`** in a file named MYDISK:[MYDIR1.PIXMAPS]ADSETUP.XPM.

X Resources for Specifying User-Defined Icons

SAS uses the following resources to determine the number of user-defined icons that are available and their location.

SAS.colorUiconCount
specifies the number of user-defined color icons that are available for SAS to use. The default is 0.

SAS.colorUiconPath
specifies the file search path for locating user-defined color icon files. The default is NULL. This string resource can contain multiple directory paths to be searched for a SAS icon file stored in X PixMap (.XPM) format. Use a comma to separate individual directory path elements in the icon path string. For example, the following string first searches for icon files in the **MYDISK:[MYDIR1.PIXMAPS]** directory, then searches in the **MYDISK:[MYDIR2.PIXMAPS]** directory:

```
SAS.colorUiconPath : MYDISK:[MYDIR1.PIXMAPS],
                     MYDISK:[MYDIR2.PIXMAPS]
```

SAS.uiconCount
specifies the maximum number of user-defined icons that are available for use in SAS. The default is 0.

SAS.uiconPath
specifies the search path for locating bitmap files for user-defined icons. The default is NULL. This string resource can contain multiple directory paths to be searched for the existence of a particular icon file. These files are assumed to be in the X11 X Bitmap (.xbm) format. A comma delimits individual directory-path elements in the icon-path string.

For example, the following string first searches for bitmap files in the MYDISK:[MYDIR1.BITMAPS] directory, then in the MYDISK:[MYDIR2.BITMAPS] directory:

```
SAS.uiconPath: MYDISK:[MYDIR1.BITMAPS],
               MYDISK:[MYDIR2.BITMAPS]
```

The directory-path elements must contain the complete path syntax.

SAS.sasUicon*x*
associates a value with the filename of an X bitmap or pixmap file. The value of *x* is a number assigned to the file. The default is NULL. A file extension of .XBM or .XPM is automatically supplied.

Miscellaneous Resources under OpenVMS

You can also customize the following resources:

SAS.altVisualId: ***ID***
specifies a visual type ID. The default is NULL.

SAS.autoSaveInterval: ***minutes***
specifies how often (in minutes) the data from the Program Editor window should be saved. The default is 10.

SAS.autoSaveOn: [True | False]
specifies that data from the Program Editor window should be saved to a file at intervals specified by the **SAS.autoSaveInterval** resource. The default is True.

`SAS.confirmSASExit: [True | False]`
controls whether SAS displays the Exit dialog box when you issue the DLGENDR command or when you select

File ► Exit

The default is True.

`SAS.defaultCommandWindow: [True | False]`
specifies whether the command window is opened when you start your SAS session. The default is True.

`SAS.directory:` ***`directory-pathname`***
specifies the directory that you want when you first open a file selection dialog box. By default, the Open dialog box uses the current directory.

`SAS.helpBrowser:` ***`pathname`***
specifies the pathname of the World Wide Web browser to use for viewing the online help or when the WBROWSE command is issued. The default browser is **`SAS$BROWSER`**.

`SAS.insertModeOn: [True | False]`
controls the editing mode in SAS editor windows, either insert or overtype. The default is False (overtype).

`SAS.noDoCommandRecall: [True | False]`
specifies whether SAS commands submitted through the **`sas-do-command()`** Xt action routine should be recorded in the command recall buffer. The default value, True, causes these commands to be recorded.

`SAS.pattern:` ***`default-pattern`***
specifies the default pattern that you want to be used as the file filter when you first invoke the Open dialog box. This pattern is displayed in the text field at the top of the dialog box. By default, the Open dialog box uses the first filter in the **`File type`** list. The **`SAS.pattern`** resource has no effect on the **`File type`** field.

`SAS.selectTimeout:` ***`seconds`***
specifies how long (in seconds) SAS waits for the completion of a request to convert an X Toolkit selection. The default value, 60, is adequate in most cases.

`SAS.startSessionManager: [True | False]`
specifies whether SAS automatically starts the session manager when a new SAS session is started. Using your own host editor with SAS requires that the session manager be running. The default is True.

`SAS.startupLogo: [`*`xpm-filename`*` | None | ""]`
specifies the XPM file that you want SAS to display when it is initialized. If the string is empty (“ ”, which is the default), SAS uses the default logo.

`SAS.suppressMenuIcons: [True | False]`
specifies whether SAS will display any menu icons other than the check box and toggle button icons in cascade or pop-up menus. True suppresses the icons and improves how quickly the menus display on slower X servers. The default is False.

`SAS.suppressTutorialDialog: [True | False]`
specifies whether SAS displays the Getting Started Tutorial dialog box at the start of your SAS session. True suppresses the dialog box. You might want to suppress this dialog box if you have previously used SAS. The default is False.

`SAS.useNativeXmTextTranslations: [True | False]`
specifies whether any XmText widget translations are inherited by all instances of the Text, Combo Box, and Spin Box widgets used by the SAS X Motif user

interface. When the value is False, the SAS keys windows translations supercede any user or system-supplied XmText translations. The default value is False. See the XmText man page for more information about XmText resources.

SAS.VMSdelay: ***milliseconds***
controls how often SAS yields processing to the X windowing environment. During this time, the X windowing environment updates the user interface. Smaller values for this resource will increase responsiveness at the expense of increased CPU time. Valid values range from 50 - 10,000 milliseconds. The default delay is 1000 milliseconds, or 1 second.

SAS.wsaveAllExit: [True | False]
specifies whether SAS should issue the WSAVE ALL command when you end your session. This command saves the global settings, such as window color and window position, that are in effect for all windows that are currently open. The default is False.

Summary of X Resources for SAS under OpenVMS

The following table lists the resource and class names, type, and statically defined default values for many of the SAS X resources. For additional information about specific types of resources, see the following tables:

- □ "SAS Font-Alias Resources," Table 4.3 on page 105
- □ "Foreground and Background Color Resources," Table 4.4 on page 108
- □ "SAS CPARMS Resources," Table 4.5 on page 110

If no X resource value overrides the resource and class name, then the static default is chosen. Some X resources have a default of *dynamic* listed. This means that the default value is determined at run time.
An online example resource file is available for use. The filename is SAS$ROOT:SAS$XDEFAULTS.DAT.

Note: X resource names are case-sensitive. When you specify them in your resource files, be sure to use the correct capitalization. △

Table 4.6 X Resources Used by the SAS Interface to Motif

Resource Name	Class Name	Type	Default
SAS.altVisualId	AltVisualId	Integer	NULL
SAS.autoComplete	AutoComplete	Boolean	True
SAS.autoSaveInterval	AutoSaveInterval	Integer	10
SAS.autoSaveOn	AutoSaveOn	Boolean	True
SAS.awsResizePolicy	AWSResizePolicy	String	"grow"
SAS.colorUiconCount	UiconCount	Integer	0
SAS.colorUiconPath	UiconPath	String	NULL
SAS.colorUiconPath	UiconPath	String	NULL
SAS.commandsSaved	CommandsSaved	Integer	25
SAS.defaultCommandWindow	DefaultCommandWindow	Boolean	True

Resource Name	Class Name	Type	Default
SAS.defaultPasteBuffer	DefaultPasteBuffer	String	XPRIMARY
SAS.defaultToolBox	DefaultToolBox	Boolean	True
SAS.directory	Directory	String	NULL
SAS.DMSboldFont	Font	String	*dynamic*
SAS.dmsContrastCheck	DmsContrastCheck	Boolean	False
SAS.DMSFont	Font	String	*dynamic*
SAS.DMSfontPattern	DMSFontPattern	String	“-*-*-*-r-*–*-*-*-*-m-*-iso8859-1”
SAS.fontPattern	FontPattern	String	“*”
SAS.helpBrowser	helpBrowser	String	SAS$BROWSER
SAS.insertModeOn	InsertModeOn	Boolean	False
SAS.isToolBoxPersistent	IsToolBoxPersistent	Boolean	True
SAS.keyboardTranslations	KeyboardTranslations	Translation	*dynamic*
SAS.keysWindowLabels	KeysWindowLabels	String	*dynamic*
SAS.markPasteBuffer	MarkPasteBuffer	String	NULL
SAS.maxWindowHeight	WindowHeight	Dimension	95
SAS.maxWindowWidth	WindowWidth	Dimension	95
SAS.noAWS	NoAWS	Boolean	False
SAS.noDoCommandRecall	NoDoCommandRecall	Boolean	True
SAS.pattern	Pattern	String	NULL
SAS.pmenuOn	PmenuOn	Boolean	True
SAS.scrollBarSize	ScrollBarSize	Dimension	17
SAS.selectTimeout	SelectTimeout	Integer	60
SAS.sessionGravity	SASGravity	String	*dynamic*
SAS.sessionGravityXOffset	SASGravityOffset	Integer	0
SAS.sessionGravityYOffset	SASGravityOffset	Integer	0
SAS.startSessionManager	StartSessionManager	Boolean	True
SAS.startupLogo	StartUpLogo	String	" "
SAS.suppressMenuIcons	SuppressMenuIcons	Boolean	False
SAS.suppressTutorialDialog	SuppressTutorialDialog	Boolean	False
SAS.SystemFont	SystemFont	String	“-adobe-helvetica-medium-r-normal–12–*–*–*–*–*–*–*”
SAS.toolBoxAlwaysOnTop	ToolBoxAlwaysOnTop	Boolean	True
SAS.toolBoxTipDelay	ToolBoxTipDelay	Integer	750
SAS.uiconCount	UiconCount	Integer	0
SAS.uiconPath	UiconPath	String	NULL
SAS.useCommandToolBoxCombo	UseCommandToolBoxCombo	Boolean	True
SAS.useLargeToolBox	UseLargeToolBox	Boolean	False

Resource Name	Class Name	Type	Default
`SAS.useLargeToolBox`	UseLargeToolBox	Boolean	False
`SAS.useNativeXmTextTranslations`	UseNativeXmTextTranslations	Boolean	False
`SAS.useShowHideDecorations`	UseShowHideDecorations	Boolean	False
`SAS.useToolBoxTips`	UseToolBoxTips	Boolean	True
`SAS.VMSdisplay`	VMSdisplay	Integer	1000
`SAS.windowHeight`	WindowHeight	Dimension	50
`SAS.windowUnitType`	WindowUnitType	String	percentage
`SAS.windowWidth`	WindowWidth	Dimension	67
`SAS.wsaveAllExit`	wsaveAllExit	Boolean	False

CHAPTER 5

Using SAS Files

Introduction to SAS Files, Data Libraries, and Engines under OpenVMS

What Is a SAS File?

Your data can reside in different types of files, including SAS files and files that are formatted by other software products, such as database management systems. Under OpenVMS, a SAS file is a specially structured OpenVMS file. Although the OpenVMS operating environment manages the file for SAS by storing it, the operating system cannot process it because of the structure built into the file by SAS. For example, you can list the filename with the **dir** command, but you cannot use a system editor to edit the file. A SAS file can be permanent or temporary.

What Is a Data Library?

An OpenVMS directory can contain many different types of files, including SAS files. All SAS files in a directory that are accessed by the same engine belong to a *SAS data library*. Thus, under OpenVMS, a SAS data library is a logical concept rather than a physical one.

Any OpenVMS directory can become a SAS data library when SAS files are stored in that directory; a single OpenVMS directory can contain several SAS data libraries. (See "Multiple SAS Data Libraries in a Single Directory" on page 138.) Also, under OpenVMS, several directories can constitute a single SAS data library if a search-string logical name is assigned to the series of directories. You can have concatenated libraries using a LIBNAME statement or LIBNAME function. (See "Using a Search-String Logical Name to Concatenate SAS Data Libraries" on page 141.)

What Is a Libref?

SAS data libraries can be identified with *librefs*. A libref is a name by which you reference the directory in your application. For more information about how to assign a libref, see "Assigning Librefs under OpenVMS" on page 136.

What Is an Engine?

SAS files and SAS data libraries are accessed through *engines*. An engine is a set of routines that SAS must use to access the files in the data library. SAS can read from and, in some cases, write to the file by using the engine that is appropriate for that file type. For some file types, you need to tell SAS which engine to use. For others, SAS automatically chooses the appropriate engine. The engine that is used to create a SAS data set determines the format of the file.

For more information about engines, see Chapter 6, "Using SAS Engines," on page 153.

Additional Resources

For more information about SAS files, data libraries, and engines, see *SAS Language Reference: Concepts*.

Common Types of SAS Files in OpenVMS

What Are Data Sets?

Data sets consist of descriptor information and data values organized as a table of rows and columns that can be processed by one of the engines. The descriptor information includes data set type, data set label, the names and labels of the columns in the data set, and so on. A SAS data set can also include *indexes* for one or more columns.

SAS data sets are implemented in two forms:

□ If the data values and the data set's descriptor information are stored in one file, the SAS data set is called a *SAS data file*.

□ If the file simply contains information about where to obtain a data set's data values and descriptor information, the SAS data set is called a *SAS data view*.

The default engine processes the data set as if the data file (or data view) and the indexes were a single entity.

For more information, see "SAS Data Files (Member Type DATA)" on page 128 and "SAS Data Views (Member Type VIEW)" on page 128.

SAS Data Files (Member Type DATA)

The SAS data file is probably the most frequently used type of SAS file. These files have the extension **`.sas7bdat`**. SAS data files are created in the DATA step and by some SAS procedures. There are two types of data files:

□ *Native data files* store data values and their descriptor information in files formatted by SAS. These are the traditional SAS data sets familiar from previous versions of SAS.

  Native SAS data files created by the default engine can be indexed. An *index* is an auxiliary file created in addition to the data file it indexes. The index provides fast access to observations within a SAS data file by a variable or key. Under OpenVMS, indexes are stored as separate files but are treated as integral parts of the SAS data file by SAS.

  CAUTION:

  Do not remove index files using OpenVMS commands. Removing the index file can damage your SAS data set. Also, do not change its name or move it to a different directory. Use the DATASETS procedure to manage indexes. △

□ *Interface data files* store data in files that have been formatted by other software and that SAS can only read. See "The OSIRIS and SPSS Engines under OpenVMS" on page 167 for more information.

SAS Data Views (Member Type VIEW)

A SAS data view contains only the information needed to derive the data values and the descriptor information. Depending on how the SAS data view is created, the actual data can be in other SAS data sets or in other vendors' files.

Views can be of two kinds:

□ *Native SAS data views* contain information about data in one or more SAS data files or SAS data views. This type of view is created with the SQL procedure or DATA step.

- *Interface SAS data views* contain information about data formatted by other software products, for example, a database management system. The ACCESS procedure in SAS/ACCESS software, for example, creates such a view.

What Are Catalogs?

Catalogs are a special type of SAS file that can contain multiple entries. Many different types of entries can be kept in the same SAS catalog. For example, catalogs can contain entries created by SAS/AF and SAS/FSP software, windowing applications, key definitions, SAS/GRAPH graphs, and so on.

Catalogs have the SAS member type of CATALOG.

What Are Stored Program Files?

Stored program files are compiled DATA steps generated by the Stored Program Facility. For details on the Stored Program Facility, see *SAS Language Reference: Dictionary*.

Stored program files have the SAS member type of PROGRAM.

What Are Access Descriptor Files?

Access descriptor files describe the data formatted by other software products such as the Oracle database management system. Descriptor files created by the ACCESS procedure in SAS/ACCESS software have the SAS member type of ACCESS.

The WORK Data Library under OpenVMS

The Importance of Disk Space in the WORK Library

Disk space is the aspect of the WORK library that is most likely to require your consideration. If you have many large temporary SAS data sets, or if you use a procedure that has many large utility files (for example, a PROC FREQ step with a complex TABLES statement that you run against a large SAS data set), you might run out of disk space in the WORK library. If you run out of disk space in batch mode, your PROC or DATA step terminates prematurely and issues a message similar to the one shown in the following output. In an interactive session, a dialog window asks you to specify what action to take.

Output 5.1 Insufficient WORK Space Message

```
ERROR: Insufficient space in file WORK.DATASET.DATA.
   NOTE: The SAS System stopped processing this step because of errors.
   NOTE: SAS set option OBS=0 and will continue to check statements.
         This may cause NOTE: No observations in data set.
   WARNING: The data set WORK.DATASET may be incomplete.  When this step
            was stopped there were 22360 observations and 4 variables.
   ERROR: Errors printed on page 1.
```

Methods of Increasing Disk Space

To resolve the problem of insufficient WORK space, ask your system administrator to increase the disk quota that has been assigned to you, or ask for the disk to be cleaned up. Following are several methods of increasing your WORK space:

- □ Designate a disk with more space as your WORK library. (See "Changing the Location of the WORK Library" on page 130.)
- □ Delete each temporary SAS data set as soon as you no longer need it. (See "Deleting Temporary SAS Data Sets" on page 130.)
- □ Direct the temporary SAS data sets to a different SAS data library so that disk space in the WORK library is conserved for items that must be stored there. (See "Directing Temporary SAS Data Sets to the USER Library" on page 131.)
- □ Reduce the version limit on the directory in which the WORK library is created.

You can also combine these methods.

Changing the Location of the WORK Library

By default, a subdirectory of the current directory contains the WORK data library. The name of the subdirectory that SAS creates for your WORK data library is SAS$WORK*current-pid*, where *current-pid* is the unique 8-byte process-identification value that is assigned by OpenVMS. By default, this directory is created as a subdirectory of the directory that is referenced by the OpenVMS logical name SAS$WORKROOT. SAS$WORKROOT refers to SYS$DISK:[ ] by default, but your system manager might have redefined it. The default may be changed when SAS is installed by your system manager.

You can change the location of the WORK data library either by redefining the OpenVMS logical name SAS$WORKROOT or by specifying the WORK= system option. For example, the following SAS command tells SAS to create the WORK subdirectory in the directory DISK:[XDIR]:

```
$ SAS91/WORK=DISK:[XDIR]
```

When SAS creates the WORK subdirectory, it also creates an OpenVMS process-level logical name, SAS$WORKLIB, that references the WORK data library. You can use this logical name within the SAS session to reference files in the WORK subdirectory. It remains defined after the SAS session terminates.

Deleting Temporary SAS Data Sets

Under OpenVMS, *temporary SAS data set* means a data set that is stored in a temporary SAS work library. That is, you cannot designate the data set itself as temporary, but the data set takes on the attribute of the library in which it is stored.

One simple way to conserve space in the WORK library is to delete each temporary SAS data set with a PROC DATASETS step after you no longer need it. However, there are two problems with this method.

- □ You can cause errors in a job by deleting a SAS data set before the job is finished with it.
- □ If you need several very large temporary SAS data sets in your job at the same time, you might run out of space before you reach a point at which you can delete any SAS data sets.

Directing Temporary SAS Data Sets to the USER Library

An alternative to deleting the temporary SAS data sets is to direct them to a different SAS data library. You can use the USER= system option to store temporary data sets in the USER library rather than in the WORK library. Unlike the WORK library, when you use the USER library to store temporary files, these files are not automatically deleted when SAS terminates.

Note: Utility data sets that are created by SAS procedures continue to be stored in the WORK library. However, any data sets that have one-level names and that are created by your SAS programs will be stored in the USER library. △

Example: Using the USER= System Option

The following example illustrates the use of the USER= system option. The numbered lines are explained following the code.

```
filename giant 'mydisk:[survey]tvdata.dat';
libname result 'mydisk:[sasdata]';
❶ libname temp 'disk2:[temp]';
❷ options user=temp;
❸ data totalusa;
    infile giant;
    input home_id region income viewers cable;
    if home_id=. then delete;
   run;

❹ proc freq;
    tables region*income*viewers*cable
❺ / noprint out=result.freqdata;
   run;
```

❶ The LIBNAME statement associates the libref TEMP with the directory DISK2:[TEMP].

❷ In the OPTIONS statement, the USER= system option designates the TEMP libref as the temporary SAS data library. Any data sets that have one-level names and that are created by your SAS program will be stored in this library.

❸ A one-level name is used in the DATA statement. When the DATA step is processed, the SAS data set TEMP.TOTALUSA is created.

❹ Because the large TOTALUSA data set was directed to the TEMP library, there is more space available in the WORK library for the utility files that the FREQ procedure requires.

❺ The SAS data set FREQDATA contains the results of the FREQ procedure. A two-level name is used to store FREQDATA in the permanent SAS data library MYDISK:[SASDATA].

Note: You can also assign the USER libref directly by using the LIBNAME statement as follows:

```
libname user '[mydir]';
```

△

You can specify the USER= system option in the SAS command, as in the following example:

```
$ SAS91/USER=[MYDIR]
```

System Options That Control the WORK Data Library

Two system options control the creation and deletion of the WORK subdirectory. By default, the WORK subdirectory is deleted at the end of each SAS session, and a new one is created at the beginning of the next session. The WORKTERM system option controls the deletion of the WORK subdirectory, and the WORKINIT system option controls the creation of the new subdirectory.

The WORKTERM and WORKINIT system options are valid in all operating environments and are documented in *SAS Language Reference: Dictionary*.

The WORKINIT System Option

The default value of the WORKINIT system option is WORKINIT, and SAS automatically creates a WORK subdirectory as it initializes. If you specify NOWORKINIT, SAS looks for an existing WORK subdirectory in the current directory and uses it, as is, if it exists. If it does not exist, one is created. You can specify the WORKINIT system option in the SAS command or in a configuration file.

If you have logged out of your OpenVMS process since the previous WORK subdirectory was saved, SAS cannot find the WORK data library even if you specify NOWORKINIT, so it creates a new WORK data library. This is because your OpenVMS process ID has changed and the subdirectory name includes the OpenVMS process ID. In this case, the old WORK data library still exists (it was not written over), and you can assign a new libref to the old WORK subdirectory (SAS$WORK*old-pid*) after you get into your SAS session and use the files through the new libref. Search the default directory for the old SAS session to find the old WORK subdirectory name. You can use the X statement within your current SAS session to perform this directory search.

The WORKTERM System Option

The WORKTERM option controls whether the WORK subdirectory is deleted at the end of your SAS session. The default value is WORKTERM. If you specify NOWORKTERM, the WORK subdirectory is not deleted at the end of the session and remains available for use with the next SAS session. Remember, however, that you must specify NOWORKINIT in the next invocation of SAS in order to reuse the WORK subdirectory that you saved.

The CLEANUP Tool

When to Use the CLEANUP Tool

Under OpenVMS, the CLEANUP tool is available to conveniently delete the WORK data library or a utility file directory that was assigned by the UTILLOC system option. When a SAS session terminates normally, the WORK library and any utility file directories are deleted automatically (this is the default action). However, if your SAS session terminates abnormally, the WORK library and the utility file directories might not be deleted properly. To delete the WORK data library or a utility file directory, use the CLEANUP tool.

CAUTION:

Do not use the CLEANUP tool if your default directory is also the default directory for a SAS batch job, and a SAS batch job is currently running. If you inadvertently delete the WORK subdirectory that was created for a batch job, the job abends. Also, never issue the CLEANUP command from an OpenVMS subprocess. △

If the CLEANUP tool is not available at your site, contact your SAS Support Consultant.

How to Delete Files with the CLEANUP Tool

To access the CLEANUP tool

1 Create a DCL symbol that points to the executable image. This symbol or foreign command can be added to the SAS91.COM file. The symbol CLEANUP is used in the following example:

```
$ CLEANUP == "$SAS$ROOT:[SASEXE]CLEANUP.EXE"
```

2 Issue the CLEANUP command from your DCL prompt to delete WORK data libraries from one or more directories. For syntax information, see "Syntax Variations of the CLEANUP Command" on page 133.

For each WORK data library that exists in the specified directory, the CLEANUP tool issues the question

```
OK to delete
    device:[dir]SAS$WORKnnnnnnnn.DIR;1  [YES]?
```

where ***device*:[*dir*]** is the name of the disk and directory to which you were attached when you invoked SAS, and **SAS$WORK*nnnnnnnn*.DIR;1** is the subdirectory that contains the WORK library. YES is the default response, so to execute the CLEANUP command, press the Return key. When the CLEANUP tool executes, it lists the names of the files being deleted. If the specified directory contains more than one WORK subdirectory, the CLEANUP tool then issues the previous question for the next WORK data library.

Note: This behavior is the same if you are deleting a utility file directory. △

Syntax Variations of the CLEANUP Command

The following are some syntax variations to be aware of:

To clean the current directory of work files, type

```
$ CLEANUP
```

To clean work files from [.TEMP], type

```
$ CLEANUP [.TEMP]
```

To clean work files from an entire directory tree, type

```
$ CLEANUP [...]
```

The CLEANUP command accepts the following qualifiers:

/LOG | /NOLOG

/LOG is the default. This causes the CLEANUP tool to issue a message showing each file as it is deleted, and it shows how many directories were deleted. If you specify /NOLOG, no messages are issued unless the CLEANUP tool encounters an error while trying to delete one or more files.

/CONFIRM | /NOCONFIRM
/CONFIRM is the default. This causes the CLEANUP tool to prompt you for each directory to be deleted. The default is Y for yes if you press RETURN. If you do not want to be prompted, or if you are submitting the command from a batch job, then use /NOCONFIRM.

/DATE=dd-mm-yy
This qualifier deletes all SAS work directories created on or before the specified date.

Note: The /V5 | /NOV5 and /V6 | /NOV6 options for the CLEANUP command are no longer supported. △

The SASUSER Data Library

What Is the SASUSER Library?

SAS assigns a data library that has the libref SASUSER. The SASUSER library contains a SAS catalog that enables you to customize certain features of SAS while your SAS session is running and to save these changes. For example, in Base SAS software, any saved changes that you make to function key settings or to window attributes are stored in a catalog named SASUSER.PROFILE.

Note: If SASUSER.PROFILE does not exist and SASHELP.PROFILE (in the SASHELP data library) does exist, SAS copies SASHELP.PROFILE to SASUSER.PROFILE before invoking a SAS session. △

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, 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 during a SAS windowing environment session. For information about the FORM subsystem, see "Host-Specific Frames of the Form Window" on page 272 and *SAS Language Reference: Concepts*.

Under OpenVMS, the SASUSER= system option specifies the location of the SASUSER data library. The default value of the SASUSER= system option is the value of the SAS$USER logical name. This logical name is defined by the SAS91.COM file. By default, the SAS$USER logical name points to the SASUSER91 subdirectory of the SYS$LOGIN directory. (SYS$LOGIN is your default login directory.) For more information about how to change the location of this library, see "SASUSER= System Option" on page 492.

Creating Your Own SASUSER Libraries

By creating your own SASUSER libraries, you can customize SAS 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 tell SAS which library to use as your SASUSER library, use the SASUSER= system option when you invoke SAS. For example, if you want to designate a directory named MYSUSER as your SASUSER library, you would use the following command:

```
$ SAS91/SASUSER=DISK:[MYSUSER]
```

Any profile changes that you make during your session are saved in the SAS catalog SASUSER.PROFILE, which is a file in the MYSUSER directory. These changes will be retained when you end your SAS session.

Compatibility of Existing SAS Files with SAS 9.1

Compatibility of Version 7 and Version 8 SAS Files

Supported File Types in SAS 9.1

Starting in SAS 9, SAS is built to take advantage of the OpenVMS Alpha 64–bit architecture. You can access all of your Version 7 and Version 8 SAS files (except SAS catalogs) in SAS 9.1. (For more information about SAS catalogs, see "Unsupported File Types in SAS 9.1" on page 135.) Since these files are compatible with SAS 9.1, they are referred to as *native files*. For a list of the supported processing for each native file type, see the SAS 9 compatibility documentation in the Migration Community at **support.sas.com/rnd/migration**.

Although these file types are supported in SAS 9.1, you might want to convert your Version 7 and Version 8 data libraries to the SAS 9 format. SAS 9.1 does not support output or update processing for all native file types. Converting your data libraries enables you to have input, output, and update processing on all file types, and you can take advantage of the new SAS 9 features. To convert these SAS files, use the MIGRATE procedure.

Unsupported File Types in SAS 9.1

You cannot access your Version 7 or Version 8 SAS catalogs in SAS 9.1. Since these files are incompatible with SAS 9.1, they are referred to as *foreign files*. To use your Version 7 or Version 8 catalogs in SAS 9.1, use the MIGRATE procedure with the SLIBREF= option to convert these files to the SAS 9.1 format. For more information about the MIGRATE procedure, see the Migration Community at **support.sas.com/rnd/migration**.

Compatibility of Version 6 SAS Files

Since Version 6 files are not compatible with SAS 9.1, they are referred to as foreign files. SAS 9.1 only supports input processing for Version 6 data files using the V6 read-only engine. This engine does not support output or update processing, and indexes are not supported. To convert your all of your Version 6 files to the SAS 9.1 format, use the MIGRATE procedure with the SLIBREF= option.

For more information about the compatibility of Version 6 files and the MIGRATE procedure, see the Migration Community at **support.sas.com/rnd/migration**.

Note: See *SAS/CONNECT User's Guide* for information about accessing Version 6 SAS files if you use Remote Library Services to access SAS files on a server. △

Accessing SAS Files under OpenVMS

Difference in Accessing Files in Version 6 and SAS 9.1

In order to access an individual SAS file in Version 6 of SAS, you had to first assign a libref or an OpenVMS logical name to the SAS data library. You could then refer to individual SAS files as *libref.member* (or *logical-name.member*), where *member* is the filename of the individual SAS file.

In SAS 9.1, you can still use librefs or logical names as a convenient way of referring to a SAS data library in SAS programs. However, you can also fully specify individual SAS files in most SAS statements and procedures that access SAS files. If portable SAS code is an issue, then using librefs is the recommended method.

Advantages of Using Librefs Rather than OpenVMS Logical Names

Although you can use an OpenVMS logical name to identify a SAS data library to SAS, you might want to use a SAS libref instead for the following reasons:

- □ You cannot assign an engine nor specify any engine/host options with the DCL DEFINE command. SAS uses the procedure described in “How SAS Assigns an Engine When No Engine Is Specified” on page 147 to determine which engine to use. However, it is more efficient to specify an engine explicitly in a LIBNAME statement. Also, the following SAS engines must be specified in a LIBNAME statement because they are not assigned by default: XPORT, SPSS, OSIRIS, and REMOTE.
- □ OpenVMS logical names are not included in the list that is produced by the LIBNAME LIST statement until after they have been used as librefs in your SAS session. (See “Listing Your Current Librefs under OpenVMS” on page 136.)

Assigning Librefs under OpenVMS

Listing Your Current Librefs under OpenVMS

As in other operating environments, you can view your current librefs using the following methods:

- □ the LIBNAME statement. The syntax for this statement is the following:

  LIBNAME _ALL_ LIST;

- □ the LIBNAME window. To open the LIBNAME window, enter **`libname`** in the command line.
- □ the SAS Explorer window. To see information about your currently assigned SAS data libraries, complete the following steps:
  1. From the tree structure, select **`Libraries`** to list all assigned librefs.
  2. Select **`View`** and then select **`Details`** to list attributes of the assigned librefs.

- the Properties dialog box. Select the libref. With the cursor on the highlighted libref, click and hold the right mouse button (MB3). A pop-up menu opens. Select **`Properties`**.

OpenVMS logical names that you have assigned to SAS data libraries are also listed, but only after you have used them as librefs in your current SAS process. (See “Using an OpenVMS Logical Name as a Libref” on page 140.)

Methods for Assigning Librefs

You can use any of the following methods to assign a SAS libref:

- the LIBNAME statement
- the LIBNAME function
- the LIBASSIGN command
- the LIBNAME window
- the SAS Explorer window .

A libref assignment remains in effect for the duration of the SAS job, session, or process unless you either clear the libref or use the same libref in another LIBNAME statement or LIBNAME function.

If you assign a libref from a SAS process, that libref is valid only within that SAS process.

If you clear a libref from within a SAS process, that libref is not cleared from other SAS processes. For information about clearing librefs, see “Clearing Librefs under OpenVMS” on page 139.

Using the LIBNAME Statement

The LIBNAME statement identifies a SAS data library to SAS, associates an engine with the library, enables you to specify options for the library, and assigns a libref to it. For details about LIBNAME statement syntax, see “LIBNAME Statement” on page 420.

Using the LIBNAME Function

The LIBNAME function takes the same arguments and options as the LIBNAME statement. For more information about the LIBNAME function, see “LIBNAME Function” on page 340.

Using the LIBASSIGN Command

Perform the following steps to assign a libref using the LIBASSIGN command:

1. Issue the LIBASSIGN command in the command window. The New Library dialog box opens.
2. Specify the libref in the **`Name`** field.
3. Specify an engine for the libref in the **`Engine`** field by selecting the default engine or another engine from the drop-down menu. Depending on the engine that you specify, the fields in the **`Library Information`** area might change.
4. Click the **`Enable at startup`** box to assign this libref when you invoke SAS.
5. Specify the necessary information for the desired SAS data library in the **`Library Information`** area. Depending on the engine selected, there may or may not be a **`Path`** field available for input.

6 Specify LIBNAME options in the **`Options`** field. These options can be specific to your host or engine, including options that are specific to a SAS engine that accesses another software vendor's relational database system.

7 Click OK.

Using the LIBNAME Window

Perform the following steps to assign a libref from the LIBNAME window:

1 Issue the LIBNAME command in the command window. The LIBNAME window opens.

2 From the **`File`** pull-down menu, select **`New`**. The New Library dialog box opens.

3 Fill in the fields in the New Library dialog box, described in "Using the LIBASSIGN Command" on page 137.

4 Click OK.

Using the SAS Explorer Window

Perform the following steps to assign a libref from the SAS Explorer window:

1 From the **`File`** pull-down menu, select **`New`** when the Libraries node in the tree structure is active. The New dialog box opens.

2 Select **`Library`**, and then click OK. The New Library dialog box opens.

3 Fill in the fields in the New Library dialog box, described in "Using the LIBASSIGN Command" on page 137.

4 Click OK.

Multiple SAS Data Libraries in a Single Directory

A SAS data library consists of all the SAS files in the same OpenVMS directory (or in a group of directories—see "Using a Search-String Logical Name to Concatenate SAS Data Libraries" on page 141) that are accessed by the same engine. If a directory contains SAS files that are accessed by different engines, then you have more than one SAS data library in the directory, and you should therefore have a different libref for each engine-directory combination. (You cannot assign the same libref to more than one engine-directory combination. The second assignment merely overrides the first assignment.)

Example: Assigning Librefs to Two Engines in the Same Directory

Suppose that the directory [MYDIR] contains SAS files that were created by the V9 engine as well as SAS files that were created by the CONCUR engine. You could use the following LIBNAME statements to assign different librefs to the two engines:

```
libname one v9 '[mydir]';
libname two concur '[mydir]';
```

Data sets that are subsequently referenced by the libref ONE are created and accessed using the V9 engine. Data sets that are referenced by the libref TWO are created and accessed using the CONCUR engine. You can then concatenate librefs ONE and TWO and access all files:

```
libname concat (one two);
```

Multiple Librefs for a Single SAS Data Library

You can assign multiple librefs to the same SAS data library (or engine-directory combination), and you can use those librefs interchangeably.

Example: Assigning Two Librefs to the Same Data Library

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

The following LIBNAME statements assign the librefs MYLIB and INLIB to the same SAS data library:

```
libname mylib v9 '[mydir.datasets]';
libname inlib v9 '[mydir.datasets]';
```

Because the engine names and SAS data library specifications are the same, the librefs MYLIB and INLIB are identical and interchangeable.

Clearing Librefs under OpenVMS

Syntax for Clearing a Libref with the LIBNAME Statement or LIBNAME Function

To disassociate a libref from a SAS data library, use the following forms of the LIBNAME statement or the LIBNAME function, where *libref* is the libref of the data library that you want to clear:

LIBNAME statement:

LIBNAME *libref* <CLEAR>;

LIBNAME function:

LIBNAME(*libref*)

In both cases, the libref is cleared only if there are no open files that are associated with that libref, and the libref is cleared only for the SAS process or job from which you submit the LIBNAME statement or function.

How to Clear Librefs with the SAS Explorer Window

You can also use the SAS Explorer window to clear librefs, as follows:

1 With the tree structure activated, select the libref from the Libraries node.
2 With the cursor on the highlighted libref, click and hold the right mouse button (MB3).
3 A pop-up menu opens.
4 Select **`Delete`**.

Assigning OpenVMS Logical Names

How to Assign an OpenVMS Logical Name

There are some advantages to using the LIBNAME statement to identify your SAS data libraries to SAS. (See "Advantages of Using Librefs Rather than OpenVMS Logical Names" on page 136.) However, you can also use an OpenVMS logical name for the same purpose. To assign an OpenVMS logical name, use the DCL DEFINE command.

Note: Because you cannot specify an engine name in the DCL DEFINE command, SAS uses the procedure described in "How SAS Assigns an Engine When No Engine Is Specified" on page 147 to determine which engine to use. △

To use an OpenVMS logical name to refer to a SAS data library, you must define the logical name either outside SAS or from your SAS session using the X statement.

Example: Defining a Logical Name with the X Statement

You can assign the OpenVMS logical name MYLIB to the directory [MYDIR] in either of the following ways:

- **`$ DEFINE MYLIB [MYDIR]`**
- **`$ x 'define mylib [mydir]';`**

Using an OpenVMS Logical Name as a Libref

After assigning an OpenVMS logical name to a directory, you can use the logical name in a SAS job in the same way you would use a libref. Because the OpenVMS logical name is being used as a SAS name, it must follow the SAS naming conventions. For details about SAS naming conventions, see *SAS Language Reference: Concepts*.

The first time an OpenVMS logical name is used in this manner, SAS assigns it as a libref for the SAS data library. The logical name is not listed by the LIBNAME LIST statement or listed in the Explorer window until after you have used it in a SAS statement. (See "Listing Your Current Librefs under OpenVMS" on page 136.)

Note: OpenVMS logical names that are defined in a subprocess are not recognized by the current SAS session. However, OpenVMS logical names that are defined in the OpenVMS parent process are available for use during the current session. For information about how to use the X statement or the X command to define an OpenVMS logical name in the OpenVMS parent process, see "Issuing DCL Commands during a SAS Session" on page 43. △

Examples: Using a Logical Name as a Libref in a DATA Step and Procedure

If you assigned the OpenVMS logical name MYLIB to a SAS data library, you could then use MYLIB as a libref in a SAS DATA step:

```
data mylib.a;
   set mylib.b;
run;
```

Similarly, you could use the logical name as a libref in a SAS procedure:

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

Using an OpenVMS Logical Name in the LIBNAME Statement

Associating an Engine with an OpenVMS Logical Name

Because you cannot specify an engine in the DCL DEFINE command, you might want to use the LIBNAME statement to specify an engine for a SAS data library to which you previously assigned an OpenVMS logical name. You can use the logical name in place of the libref in a LIBNAME statement, as in this example, which associates the BASE engine with the logical name MAIL:

```
libname mail base;
```

Associating a Libref and Engine with a Logical Name

If you specify the logical name in place of the *SAS-data-library* argument of the LIBNAME statement, then you can associate both a libref and an engine with the logical name. The following example associates the libref IN and the BASE engine with the data library that is referred to by the logical name MAIL:

```
libname in base 'mail';
```

Specifying Library or Engine/Host Options with a Logical Name

You can also use the LIBNAME statement to specify library options that are valid in all operating environments, or engine/host options for a SAS data library to which you previously assigned an OpenVMS logical name. The following LIBNAME statement associates the libref MAIL and the V8TAPE engine with a path that includes the logical name MYDISK. It also specifies the portable library option ACCESS=:

```
libname mail v8tape 'mydisk:[mylib]'
   access=readonly;
```

Using a Search-String Logical Name to Concatenate SAS Data Libraries

If you have several directories that you want to use as a single SAS data library, you can define an OpenVMS search-string logical name to the list of libraries, and then use that logical name in your SAS programs. The list of libraries can include both directories and other logicals.

Order in Which SAS Opens Files

Files that are opened for input or update are opened from the first directory in which they are found. Files that are created or opened for output are always created in the first directory in the search list. For example, if a filename that you specify exists in both [DIR1] and [DIR3], SAS opens the file that is in [DIR1].

Example 1: Assigning a Search-String Logical Name with the X Statement

The following X statement assigns the search-string logical name MYSEARCH to the directories [DIR1], [DIR2], [DIR3], and MYLIB2:

```
x 'define mysearch [dir1],[dir2],[dir3],mylib2';
```

When you reference the data set MYSEARCH.TEST1, SAS searches [DIR1], [DIR2], [DIR3], and then the directory pointed to by MYLIB2 for the TEST1 data set:

```
data new;
   set mysearch.test1;
   if total>10;
run;
```

Example 2: Using a LIBNAME Statement

You could also use a LIBNAME statement to assign the libref INLIBS to this series of directories. You use the search-string logical name as the *SAS-data-library* specification:

```
libname inlibs 'mysearch';
```

Example 3: Specifying a Search-String Logical Name in SAS Explorer

From the SAS Explorer's New Library dialog box, you can also specify a search-string logical name to assign a libref. To do this, type the search-string logical name in the **`Path`** field.

Additional Documentation

For additional examples of how SAS files in concatenated SAS data libraries are accessed, see "Accessing Files in Concatenated SAS Data Libraries under OpenVMS" on page 143.

For more information about search-string logical names, refer to *OpenVMS User's Manual*.

Concealed Logical Names

By default, SAS translates concealed logical names to their full physical specifications when they are used in LIBNAME statements. For example, consider the following definition for the logical name MYDISK:

```
$ DEFINE/TRANSLATION=CONCEALED -
_$ MYDISK $1$DUA100:[MYDISK.]
```

SAS translates the MYDISK concealed logical name to its full physical specification, resulting in the following libref definition:

```
1? LIBNAME MYLIB 'MYDISK:[MYDIRECTORY]';
Note: Libref MYLIB was successfully assigned
as follows:
Engine:  V9
Physical Name: $1$DUA100:[MYDISK.MYDIRECTORY]
```

Note: The EXPANDLNM system option controls whether concealed logical names are expanded and displayed. Use the NOEXPANDLNM form of this option if you do not want your concealed logical names to be expanded and displayed. For more information, see "EXPANDLNM System Option" on page 461. △

Accessing Files in Concatenated SAS Data Libraries under OpenVMS

Order in Which Concatenated Directories Are Accessed

SAS uses a set of rules to determine the order in which concatenated directories are accessed. The rules differ depending on whether you are opening a SAS file for input, update, or output:

- When a SAS file is accessed for *input* or *update*, the first file found by that name is the one that is accessed. In the following example, if the data set SPECIES exists in both the [MYDIR] and [MYDIR.DATASETS] directories, the one in the [MYDIR] directory is printed:

  ```
  x 'define mysearch [mydir],[mydir.datasets]';
  libname mylib 'mysearch';
  proc print data=mylib.species;
  run;
  ```

  The same would be true if you used the FSEDIT procedure to open the SPECIES data set for update.

- When a SAS file is accessed for *output*, it is always written to the first directory, if that directory exists. If the first directory does not exist, then an error message is displayed and SAS stops processing this step, even if a second directory exists. In the following example, SAS writes the SPECIES data set to the first directory, [MYDIR]:

  ```
  x 'define mysearch [mydir], sas$samp:[sasdata]';
  libname mylib 'mysearch';
  data mylib.species;
     x=1;
     y=2;
  run;
  ```

  If a copy of the SPECIES data set exists in the second directory, it is not replaced.

Accessing Data Sets That Have the Same Name

If you create a new SAS data set from a data set that has the same name, the DATA statement uses the output rules and the SET statement uses the input rules. In this example, the SPECIES data set originally exists only in the second directory, MYDISK:[MYDIR].

```
x 'define mysearch sys$disk:[sas],mydisk:[mydir]';
libname test 'mysearch';
data test.species;
   set test.species;
   if value1='y' then
      value2=3;
run;
```

The DATA statement opens SPECIES for output according to the output rules, which indicate that SAS opens a data set in the first of the concatenated directories (SYS$DISK:[SAS]).

The SET statement opens the existing SPECIES data set in the second directory(MYDISK:[MYDIR]), according to the input rules. Therefore, the original

SPECIES data set is not updated. After the DATA step is processed, two SPECIES data sets exist, one in each directory.

Accessing SAS Files on Tape under OpenVMS

DCL Commands for Tape Access

In order to write to a tape in a SAS job, you can issue the following DCL commands to allocate the tape drive and mount the appropriate tape volume. You must issue these commands in the order shown:

```
$ ALLOCATE tape-device:
$ INITIALIZE tape-device:  volume-label
$ MOUNT tape-device:  volume-label
```

Note: If you are writing SAS files to tape with the TAPE engine, you must mount the tape as a labeled Files-11 tape. A labeled Files-11 tape has header information preceding each file. An unlabeled, or foreign, tape does not have this header information. The TAPE engine can process only labeled Files-11 tapes. For more information about Files-11 tapes, refer to *Guide to OpenVMS Files and Devices*. △

CAUTION:
Issue the INITIALIZE command only if you are writing to a tape for the first time. When a tape is initialized, any files that were previously stored on the tape are no longer accessible. Therefore, use the ALLOCATE and MOUNT commands when you want to read from a tape or write additional files to a tape; do not reinitialize the tape. △

The volume label that you specify in the INITIALIZE command must be used subsequently in the MOUNT command in order to access the tape. After you have issued the appropriate commands to access the tape, you must then use the LIBNAME statement to associate a libref with the tape.

When your SAS job finishes, issue the following commands to release the tape drive from your terminal session:

```
$ DISMOUNT tape-device:
$ DEALLOCATE tape-device:
```

Any of these commands can also be issued in the X statement. However, if you use the X statement, you must issue the INITIALIZE command before the ALLOCATE command. The reverse order is not supported when you use the X statement.

Accessing Multivolume Tapes

When creating SAS files on multivolume tapes, you must initialize the tapes *before* you write the files to the tapes. If you do not initialize the tapes first, the operating environment will not recognize them as part of the same volume set. When you mount the first volume of the set, use the following MOUNT command:

```
$ MOUNT/INITIALIZE=CONTINUATION -
_$ tape-device: label
```

This command instructs the OpenVMS system to add a continuation number to each label as it creates the multivolume set. For example, if you have a series of tapes initialized to MYTAPE and use drive MUA0:, use the following command:

```
$ MOUNT/INITIALIZE=CONTINUATION MUA0: MYTAPE
```

When the first volume is filled, the operating environment prompts the operator to mount MYTA02. The OpenVMS system adds a sequencing number to the tape label. As tape labels are limited to six characters, the original label, if it exceeds this number, can be truncated when the continuation number is added.

Reading and Writing SAS Files on Tape

In addition to the appropriate DCL commands, use the LIBNAME statement or the New Library dialog box to associate a libref with the tape when reading or writing SAS files. The following is an example of the LIBNAME statement:

```
libname sample tape 'mua0:';
```

Then use the libref SAMPLE in the appropriate SAS statements to refer to the tape. The following is an example:

```
data sample.oldstat;
   set status;
run;
```

A libref associated with a tape drive signals that the file to be read or written is in sequential format.

Note: You can also write SAS files in sequential format on disk if you define the libref to a disk location, but use the sequential engine (TAPE) in the LIBNAME statement or in the New Library dialog box. △

The tape can contain one or more SAS files. When you read or write a file on tape, you use a two-level name; the first level is a libref that refers to the tape, and the second level names the SAS file to be read or written. The following is an example of the LIBNAME statement:

```
libname mytape 'mua0:';
data diskds1;
   set mytape.ds1;
run;
```

This program reads a data set with the filename DS1.SAS7SDAT from the tape referenced by the libref MYTAPE.

You can write SAS files with duplicate names to the same tape. For example, you can have more than one SAS data set named DS1 on a tape. When you read the data set named DS1, the first (and possibly the oldest) version of DS1 found on the tape is the version read. The first version found depends on the current position of the tape.

Copying Files to Tape

Advantage to Copying Existing SAS Files Using the COPY Procedure

Use the COPY procedure to copy existing SAS files from disk to tape. The following is an example:

```
libname mydisk '[dir1]';
libname mytape tape 'mua0:';
```

```
proc copy in=mydisk out=mytape;
run;
```

This procedure is often simpler to use than the DCL COPY command when moving SAS files to tape. Also, SAS log notes document the files copied. You can also use the DCL DIRECTORY command to list the SAS files on a labeled tape after it has been created.

When you use the DCL COPY command to move sequential format files created on disk to tape, you must create the files with a page size of 512 bytes and mount the tape with a block size of 512 bytes.

The following example creates a sequential format data set on disk. It then shows how to copy it to tape and access it from within SAS.

1 Create the data set on disk using the sequential engine, with a page size of 512 bytes.
2 Use the BUFSIZE= data set option to set the page size:

```
libname seqdisk tape '[dir]';
data seqdisk.a(bufsize=512);
   ...  more DATA step statements ...
run;
```

3 Mount the tape with a block size of 512 bytes and copy the file to tape by issuing the following commands:

```
$ MOUNT/BLOCKSIZE=512 MUA0: MYTAPE
$ COPY A.SAS7SDAT MYTAPE:
```

You can now access this data set directly from within SAS, as in the following statements:

```
libname seq tape 'mua0:';
proc contents data=seq.a;
run;
```

Advantage to Creating a Data Set with the TAPE Engine

If you can, it is far more efficient to create the data set on tape within SAS, using the TAPE engine. Use the DCL COPY command only when you have no other alternative. The advantage of using the TAPE engine instead of the DCL COPY command is that when you use the TAPE engine, you can use larger page sizes and block sizes. This means that I/O is more efficient because you can process the data in larger chunks.

To convert the data sets currently in disk format to sequential format before using the COPY command to move them to tape, you can use the following steps:

```
libname mydisk '[dir1]';
libname mytape tape '[dir2]';
data mytape.a;
   set mydisk.a;
run;
```

If you store the files on an unlabeled tape, they must be restored to disk before SAS can access them.

How SAS Assigns an Engine When No Engine Is Specified

Advantage to Assigning an Engine

It is always more efficient to explicitly specify the engine name than to ask SAS to determine which engine to use. To assign an engine name, you can use any of the following:

- □ LIBNAME statement
- □ LIBNAME function
- □ LIBASSIGN command in the command window. If you use the LIBASSIGN command the `Default` engine—that is, BASE—is listed in the `Engine` field of the New Library dialog box; when you select OK, you automatically select this default engine.

Rules SAS Uses to Determine Engine When No Engine Is Specified

If you do not assign an engine name, SAS looks at the OpenVMS file types of the files that exist in the specified directory and uses the following rules to determine which engine to assign:

- □ If the directory contains SAS data sets from only one of the native library engines that are supported, then that engine is assigned to the libref.
- □ If the directory contains no SAS data sets, then the default engine is assigned to the libref. The default engine is determined as follows:
  - □ For SAS data libraries on disk, the default engine is determined by the value of the ENGINE= system option. By default, the ENGINE= system option is set to V9. However, you can change the value of this system option if you prefer to use a different engine as the default engine for disk libraries. Other valid values are V8, V6, and CONCUR. For more information about the ENGINE= system option, see "ENGINE= System Option" on page 460 and *SAS Language Reference: Dictionary*.
  - □ For sequential-format SAS data libraries (either on tape or disk), the default engine is determined by the value of the SEQENGINE= system option. By default, SEQENGINE= is set to TAPE. The other valid values are V9TAPE and V8TAPE.
- □ A directory that contains SAS data sets from more than one engine is called a *mixed-mode library*. SAS assigns the default engine to mixed-mode libraries.

Sharing Data between OpenVMS Platforms

What Are Nonnative Files?

SAS files that were created in an OpenVMS operating environment other than the one on which the user is currently running are described as *nonnative*. For example, data sets that were created on the VAX platform are defined as nonnative when they are moved to an Alpha platform.

How to Convert Nonnative Data

Nonnative data must be converted before it can be accessed. There are two ways to convert nonnative data:

- □ convert the data “transparently” between the OpenVMS VAX format and the OpenVMS Alpha format each time you access the file. This method causes performance degradation.
- □ convert the data to the local format one time only. This method is more efficient, eliminating the need to convert the data each time you access it.

Limitations of One-Time-Only Conversions

A limitation of the one-time-only conversion is that the OpenVMS VAX platform supports a minimum numeric variable length of 2 bytes. The OpenVMS Alpha platform supports a minimum numeric variable length of 3 bytes. Therefore, using this method to move data from the VAX platform, which supports 2-byte numeric storage, to the Alpha platform, which supports 3-byte numeric storage, is not permitted. Instead, to move data from the VAX platform to an Alpha platform, you must use the VAXTOAXP procedure. Consequently, there is a potential loss of numeric precision when you move data from a VAX platform to an Alpha platform. For more information, see Chapter 10, “Data Representation,” on page 233. For more information about the VAXTOAXP procedure, see “VAXTOAXP Procedure” on page 391.

Note: Starting in Version 8, the VAXTOAXP procedure increased, by one character, VAX numeric variables that are two to seven characters in length to minimize loss of precision. △

Example: How to Convert a File Using SAS Code

The following is an example of how you can convert a file:

```
data a;
   set b;
run;
```

This code reads file B, which is in nonnative format, and creates a native version A.

Multiuser Access to SAS Files under OpenVMS

Under certain circumstances, a SAS file can be accessed by more than one user concurrently. This feature enables different users, or the same user from different processes, to access the same SAS file at the same time without conflict. However, to prevent problems of integrity or data conflict, multiple accesses of data are sometimes blocked. The following rules summarize the conditions for allowing or disallowing multiple access to the same SAS file with any engine except the CONCUR engine:

- □ If a file is open for input, another user can also open that file for input. The same process can also open the file for output, but all other access is denied.
- □ If a file is opened for update, all other access is denied.
- □ If a file is opened for output, the same process can also open the file for input if the file previously existed, but all other access is denied.

The one exception to these rules is when an OpenVMS search-string logical name is used as the physical path of a LIBNAME statement. In this case, when a SAS file is opened for input, another user can open that file for input. If the file is opened for update or output, all other access is denied, including access by the same process.

Under OpenVMS, the concurrency engine (CONCUR) allows concurrent read and write access to native data sets. For details, see "The CONCUR Engine under OpenVMS" on page 160.

Estimating the Size of a SAS Data Set under OpenVMS

Estimating the Amount of Disk Space for a Data Set

To obtain a rough estimate of how much space you need for a disk-format SAS data set that was created by the V9 engine, follow these steps:

Note: This procedure is valid only for *uncompressed* native SAS data files that were created with the V9 engine. △

1. Use the CONTENTS procedure to determine the size of each observation. (See "Determining Observation Length with PROC CONTENTS" on page 149.)
2. Multiply the size of each observation by the number of observations.
3. Add 10 percent for overhead.

Determining Observation Length with PROC CONTENTS

To determine the length of each observation in a SAS data set, you can create a SAS data set that contains one observation. Then run the CONTENTS procedure to determine the observation length. The following program produces a SAS data set plus PROC CONTENTS output:

```
data oranges;
   input variety $ flavor texture looks;
   total=flavor+texture+looks;
   datalines;
navel 9 8 6
;
proc contents data=oranges;
run;
```

The following is the output:

Output 5.2 CONTENTS Procedure Output

```
                           The CONTENTS Procedure

Data Set Name        WORK.ORANGES                       Observations         1
Member Type          DATA                               Variables            5
Engine               V9                                 Indexes              0
Created              Monday, May 12, 2003 01:46:21      Observation Length   40
Last Modified        Monday, May 12, 2003 01:46:21      Deleted Observations 0
Protection                                              Compressed           NO
Data Set Type                                           Sorted               NO
Label
Data Representation ALPHA_VMS_64
Encoding            latin1  Western (ISO)

                   Engine/Host Dependent Information

  Data Set Page Size          8192
  Number of Data Set Pages    1
  First Data Page             1
  Max Obs per Page            203
  Obs in First Data Page      1
  Number of Data Set Repairs  0
  Filename                    SASDISK:[SASDEMO.SAS$WORK2040F93A]ORANGES.SAS7BDAT
  Release Created             9.0101B0
  Host Created                OpenVMS
  File Size (blocks)          17


               Alphabetic List of Variables and Attributes

                    #    Variable    Type    Len

                    2    flavor      Num       8
                    4    looks       Num       8
                    3    texture     Num       8
                    5    total       Num       8
                    1    variety     Char      8
```

To determine observation length, the only values that you need to pay attention to are the following

Observation Length
: is the record size in bytes.

Compressed
: has the value NO if records are not compressed, and either CHAR or BINARY if records are compressed. If the records are compressed, do not use the procedure given in “Estimating the Size of a SAS Data Set under OpenVMS” on page 149.

  For an explanation of the CHAR and BINARY values, see “COMPRESS System Option” in *SAS Language Reference: Dictionary*. For more information about compressing data files, see *SAS Language Reference: Concepts*.

Optimizing Page Size

The procedure output shown in Output 5.2 provides values for the physical characteristics of Work.Oranges that are useful when selecting an optimal page size. Some values, such as the page size and the number of observations per page for uncompressed SAS data sets, are **`Engine/Host Dependent Information`**. To determine the optimal page size for a data set, the following values are important:

Observations
: is the number of observations in the data set that have not been deleted or flagged for deletion.

Observation Length
: is the record size in bytes.

Compressed
: has the value NO if records are not compressed, and either CHAR or BINARY if records are compressed.

  For an explanation of the CHAR and BINARY values, see "COMPRESS System Option" in *SAS Language Reference: Dictionary*. For more information about compressing data files, see *SAS Language Reference: Concepts*.

Data Set Page Size
: is the page size, expressed in bytes.

Number of Data Set Pages
: is the number of pages for the data set.

First Data Page
: is the page number of the page containing the first observation for noncompressed files. Descriptor information is stored before the observations in the file.

Max Obs per Page
: is the maximum number of observations a page can hold for noncompressed files.

Obs in First Data Page
: is the number of observations in the first page for noncompressed files.

Note: First Data Page, Max Obs per Page, and Obs in First Data Page are only provided by the CONTENTS procedure for a noncompressed data set. These values have little meaning for a compressed data set because each observation could be a different size. △

The following values change based on the number of observations in the data set:

- Observations
- Number of Data Set Pages
- Obs in First Data Page. This value changes until there are enough observations to fill the first data page.

For a single page size, the other values do not change.

Experimenting with Buffer Size to Set an Optimal Page Size

Using the CONTENTS procedure information, you can experiment with default page size and various BUFSIZE= values to select an optimal page size—one that optimizes your most valuable resource. For example, if you want to maximize the number of I/Os performed on a data set, increase the BUFSIZE= value. This increases the Max Obs per Page value given by the CONTENTS procedure. However, increasing the buffer size does not maximize use of disk space and is probably only useful for large data sets, where performance is an important issue.

For smaller data sets, you might want to optimize your use of disk space rather than the number of I/Os performed. For example, if you run the DATA step used earlier with a BUFSIZE= value of 512, the data set takes up only 6 disk blocks instead of 18. For a small data set, this is more efficient because the number of I/Os is not a significant factor.

When varying the BUFSIZE= value, decide which computer resources you want to optimize first, then experiment until you get the result you want.

Generation Data Sets under OpenVMS

Generation data sets are not supported in the OpenVMS operating environment. The GENMAX= and GENNUM= data set options described in *SAS Language Reference: Dictionary* are not supported under OpenVMS.

CHAPTER
6

Using SAS Engines

Overview of the SAS Engine

The SAS engine is used to create SAS data libraries on disk and to read from, write to, or update those libraries. These engines support indexing and compression of observations.

Valid SAS engines in SAS 9.1 are: V9, V8, V7, and V6. The V9 engine is the default engine for new SAS data libraries, unless the default engine has been changed with the ENGINE= system option. For more information, see "ENGINE= System Option" on page 460.

The V6 engine is a read-only engine. For more information about this engine, see "The V6 Engine under OpenVMS" on page 159.

Note: Starting in SAS System 9, SAS is a 64-bit application. Previous releases of SAS have been 32-bit. Consequently, the V9 engine cannot read the 32-bit SAS files created in previous versions of SAS. For more information, see "Compatibility of Existing SAS Files with SAS 9.1" on page 135. △

Overview of the TAPE Engine under OpenVMS

Differences between the SAS Engine and the TAPE Engine

In contrast to the SAS engine, the TAPE engine does not support indexing and compression of observations. Also, you cannot have a mixed mode, sequential-format SAS data library; you can store only SAS System 9 or Version 8 sequential SAS data sets on one tape, not some of each.

Note: For information about accessing SAS files on tape, see "Accessing SAS Files on Tape under OpenVMS" on page 144. △

When to Use the TAPE Engine

Use the TAPE engine to create sequential-format SAS data libraries either on disk or on tape and to access files in sequential data libraries. The primary purpose of this engine is to enable you to back up your SAS data sets, catalogs, or whole data libraries.

With this engine, it is possible to back up applications that contain both SAS data sets and SAS catalogs.

Limitations of the TAPE Engine

The TAPE engine has the following limitations:

- Because the TAPE engine is a sequential engine, it cannot be used with the POINT= option of the SET statement nor with the FSBROWSE, FSEDIT, and FSVIEW procedures. If you want to use these features of the SAS language with sequential SAS data sets, then use the COPY procedure to copy them to a disk-format SAS data library. (See "Copying Files to Tape" on page 145)
- In a single DATA step or PROC step, you can use only one SAS data set from a particular sequential SAS data library.

Engines Available under OpenVMS

The following table lists the engines that are available under OpenVMS in SAS 9.1 and tells you where to look for more information about each engine. The preferred name of each engine is listed first, followed by acceptable nicknames, if any.

Table 6.1 SAS Engines under OpenVMS

Engine Name (Alias)	Description	See...
V9 (BASE)	accesses SAS System 9 and SAS 9.1 files on disk	*SAS Language Reference: Concepts*
V9TAPE (TAPE)	accesses SAS System 9 and SAS 9.1 sequential-format SAS files	*SAS Language Reference: Concepts*
V8	accesses Version 8 SAS files on disk	*SAS Language Reference: Concepts*
V8TAPE	accesses Version 8 sequential- format SAS files	*SAS Language Reference: Concepts*
V7	accesses Version 7 SAS files on disk	*SAS Language Reference: Concepts*
V7TAPE	accesses Version 7 sequential-format SAS files	*SAS Language Reference: Concepts*
V6	reads Version 6 SAS data files on disk	"The V6 Engine under OpenVMS" on page 159
CONCUR	provides concurrent update access to SAS data sets	"The CONCUR Engine under OpenVMS" on page 160
ORACLE	accesses ORACLE database files	"The DBMS Interface Engine" on page 167
SQLVIEW	accesses data views that are described by the SQL procedure	*SAS Guide to the SQL Procedure: Usage and Reference*
XPORT	accesses transport files	*Moving and Accessing SAS Files*

Engine Name (Alias)	Description	See...
OSIRIS	provides read-only access to OSIRIS files	"The OSIRIS and SPSS Engines under OpenVMS" on page 167
SPSS	provides read-only access to SPSS files	"The OSIRIS and SPSS Engines under OpenVMS" on page 167

File Types Created by Each Engine

For information about the OpenVMS file types that SAS uses for SAS files, see "OpenVMS File Types Used by SAS" on page 12.

How to Select an Engine under OpenVMS

Introduction to Selecting an Engine

Generally, SAS automatically determines the appropriate engine to use for accessing the files in the library. If you want to create a new library with an engine other than the default engine, you can override the automatic selection.

The LIBNAME Statement or LIBASSIGN Command

To change the current engine, you can complete either of the following tasks:

- specify the SAS engine as the value of the *engine* argument in the LIBNAME statement or LIBNAME function. Valid values include V9, V8, V7, and V6.

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

- specify a TAPE engine in the **`Engine`** field of the New Library dialog box. You can open the New Library dialog box by issuing the LIBASSIGN command in the command window. Values include V9TAPE, V8TAPE, and V7TAPE.

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

SAS Selects the Engine for an Existing Data Library

For an existing SAS data library on disk that contains only SAS 9.1 data sets, do not specify a value for *engine* in the LIBNAME statement or LIBNAME function, or select **`Default`** as the type in the **`Engine`** field of the New Library dialog box. SAS automatically selects the V9 engine. SAS also selects the V9 engine automatically if you use the DCL DEFINE command to assign an OpenVMS logical name to an existing

SAS 9.1 data library on disk and then use that logical name as a libref in a SAS file specification.

The ENGINE= System Option

Set the value of the ENGINE= system option to the value of the engine that you want to use. This option tells SAS which engine to use as the default when no engine is specified and there are no existing data sets, or when the directory is in mixed mode.

For more information, see "ENGINE= System Option" on page 460.

The SEQENGINE= System Option

Set the value of the SEQENGINE= system option to the TAPE engine that you want to use. This option tells SAS which sequential engine to use as the default when no engine is specified and there are no existing SAS data sets.

Member Types Supported for V9, V8, and V7 Engines

The V9, V8, and V7 engines support files with the following member types:

ACCESS	ITEMSTOR
AUDIT	MDDB
BACKUP	PROGRAM
CATALOG	PUTILITY
DATA	SASODS
DMDB	UTILITY
FDB	VIEW
INDEX	

These member types are also supported by the V9TAPE, V8TAPE, and V7TAPE engines.

Difference between SAS 9 and Previous Releases

The V9 and V9TAPE engines differ slightly from previous SAS engines. These engines support long format and informat names. For more information about compatibility between releases, see *SAS Language Reference: Concepts*.

Note: Starting in SAS 9, SAS is a 64-bit application. Previous releases of SAS have been 32-bit. Consequently, the V9 engine cannot read the 32-bit SAS files (excluding files of member type DATA) that were created in previous versions of SAS. For more information, see "Compatibility of Existing SAS Files with SAS 9.1" on page 135. △

Engine/Host Options for the V9, V8, and V7 Engines

These engines provide several engine/host options that control the creating and access of SAS data sets. Most of the following options correspond to options that are available through OpenVMS Record Management Services (RMS).

You can use the following engine/host options with the V9, V8, and V7 engines:

ALQ=
: specifies the number of OpenVMS disk blocks to allocate initially to a data set when it is created. The value can range from 0 to 2,147,483,647. If the value is 0, the minimum number of blocks that is required for a sequential file is used. OpenVMS RMS always rounds the value up to the next disk cluster boundary.

  The ALQ= option (allocation quantity) corresponds to the FAB$L_ALQ field in OpenVMS RMS. For additional details, see "ALQ= Data Set Option" on page 282 and *Guide to OpenVMS File Applications*.

ALQMULT=
: specifies the number of pages that are preallocated to a file when it is created. The value can range from 1 to 128. The default value is 10. The ALQMULT= option is related to the ALQ= option.

  For additional details, see "ALQMULT= Data Set Option" on page 283.

BUFSIZE=
: specifies the size of the internal I/O buffer used for output data sets. The value can range from 0 to the maximum allowed under OpenVMS. The engine tries to use a value in the range of 8,192 to 32,768 if possible. The BUFSIZE= option must be specified in increments of 512.

  For additional details, see "BUFSIZE= Data Set Option" on page 285.

CACHENUM=
: specifies the number of I/O data caches used per SAS file. The value can range from 1 to 16. The default value is 5. The CACHENUM= option is used in conjunction with the CACHESIZE= option.

  For additional details, see "CACHENUM= Data Set Option" on page 286.

CACHESIZE=
: controls the size (in bytes) of the data cache used to buffer I/O pages. The value can range from 0 to 65,024. By default, the chosen value is an even multiple of the file's page size. A value of 0 specifies to use no data cache. Memory is consumed for the data cache, and multiple caches can be used for each data set opened. The disadvantage of large CACHESIZE= values is large consumption of memory. The advantage of large CACHESIZE= values is a reduction in the number of I/Os required to read from or write to a file.

  The CACHESIZE= and BUFSIZE= options are similar, but they have important differences. The BUFSIZE= option specifies the file's page size, which is permanent. It can only be set on file creation. The CACHESIZE= option is the size of the internal memory cache used for the life of the current open, so it can change any time the file is opened. Also, BUFSIZE= cannot be used as an engine/host option; it is only valid as a data set option.

  For additional details, see "CACHESIZE= Data Set Option" on page 287.

CNTLLEV=
: specifies the level of shared access allowed to SAS data sets. Users can be given both read and write access to a data set that is opened for input only. By default, only shared read access is allowed.

  For additional details, see "CNTLLEV= Data Set Option" on page 288.

DEQ=

specifies the number of OpenVMS disk blocks to add each time OpenVMS RMS automatically extends a data set during a write operation. The value can range from 0 to 65,535. OpenVMS RMS always rounds the value up to the next disk cluster boundary. A large value can result in fewer file extensions over the life of the file; a small value results in numerous file extensions over the life of the file. A file with numerous file extensions that may be noncontiguous slows record access.

If the value specified is 0, OpenVMS RMS uses the default value for the process.

The DEQ= option (default file extension quantity) corresponds to the FAB$W_DEQ field in OpenVMS RMS. For additional details, see "DEQ= Data Set Option" on page 289 and *Guide to OpenVMS File Applications*.

DEQMULT=

specifies the number of pages to extend a SAS file. The value can range from 1 to 128. The default value is 5.

For additional details, see "DEQMULT= Data Set Option" on page 290.

The V6 Engine under OpenVMS

When to Use the V6 Engine

Starting in SAS System 9, the V6 engine is read-only. You use this engine to read Version 6 libraries. The V6 data libraries are disk-format data libraries, probably the most common type of libraries. With this engine, you will not be able to write directly to these libraries. For more information about the V6 engine, see *SAS Language Reference: Concepts*.

Member Types Supported

Because the V6 engine is read-only, it supports only the DATA member type. This engine does not support indexing.

Engine/Host Options for the V6 Engine

The V6 engine provides one engine/host option that controls the access of SAS data sets. This option corresponds to an option that is available through OpenVMS Record Management Services (RMS).

You can use the following engine/host option with the V6 engine:

CACHESIZE=

controls the size (in bytes) of the data cache used to buffer I/O pages. The value can range from 0 to 65,024. By default, the chosen value is an even multiple of the file's page size. A value of 0 specifies to use no data cache. Memory is consumed for the data cache, and multiple caches can be used for each data set opened. The disadvantage of large CACHESIZE= values is large consumption of memory. The advantage of large CACHESIZE= values is a reduction in the number of I/Os required to read from or write to a file.

The CACHESIZE= and BUFSIZE= options are similar, but they have important differences. The BUFSIZE= option specifies the file's page size, which is permanent. It can only be set on file creation. The CACHESIZE= option is the size of the internal memory cache that is used for the life of the current open, so it can change any time the file is opened. Also, BUFSIZE= cannot be used as an engine/host option; it is only valid as a data set option.

For additional details, see "CACHESIZE= Data Set Option" on page 287.

Data Set Options Supported by the V6 Engine under OpenVMS

For a list of the data set options that the V6 engine recognizes, see "Summary Table of SAS Data Set Options under OpenVMS" on page 278. The engine/host options discussed in "Engine/Host Options for the V6 Engine" on page 159 can also be used as data set options when you use the V6 engine.

The CONCUR Engine under OpenVMS

What Is the CONCUR Engine?

The concurrency (CONCUR) engine allows concurrent read and write access to data sets. Note that the concurrency engine supports only SAS data sets. It does not support SAS files of member types other than DATA, such as INDEX or CATALOG.

Differences between the CONCUR Engine and the V9 Engine

In contrast to the V9 engine, the CONCUR engine does not support indexing and compression of observations. The CONCUR engine can only access files within a single machine or OpenVMS cluster; access to SAS data sets on other operating environments and concurrent read/write access to SAS data sets across DECnet are features that are provided by SAS/SHARE software. For more information about using SAS/SHARE software, refer to *SAS/SHARE User's Guide*. The CONCUR engine is optimized for random concurrent access, while the V9 engine is better suited to sequential access. So, for example, if you intend to use the FSEDIT procedure or the POINT= option in the SET statement to access your data randomly, the CONCUR engine might be the best choice for you, even if you do not need any of the concurrent access capabilities.

Version 8 SAS introduced support for several new features related to data sets. The CONCUR engine supports many of these features: member names with lengths up to 32 characters; variable names with lengths up to 32 characters; and member or variable labels with lengths up to 256 characters. Note that while the CONCUR engine supports the creation and access of Version 6 format files, the long character strings are not allowed when accessing or creating a Version 6 concurrency engine file. For more information about support for these longer character strings, see *SAS Language Reference: Concepts*.

How to Select the CONCUR Engine

There are three ways to select the CONCUR engine:

- □ Specify CONCUR as the value of the *engine* argument in the LIBNAME statement or LIBNAME function, or specify CONCUR in the **Engine** field of the New Library dialog box.

- □ If you are sure your SAS data library contains only SAS data sets created with the CONCUR engine, do not specify a value for *engine* in the LIBNAME statement or LIBNAME function, or select **`Default`** as the type in the **`Engine`** field of the New Library dialog box. SAS selects the CONCUR engine automatically.
- □ Set the value of the ENGINE= system option to CONCUR. This option indicates the default engine when either no engine is specified and there are no existing SAS data sets or the directory is in mixed mode.

Record-Level Locking and File-Sharing with the CONCUR Engine

The CONCUR engine creates and accesses SAS data sets in an acceptable format to allow record-level locking and file-sharing.

CAUTION:
SAS data sets that are created with the CONCUR engine are not interchangeable with SAS data sets that are accessed and created with any other engine. If you plan to share a particular SAS data set, create it using the CONCUR engine. △

If you have a SAS data set that you want to share after it is created, you can copy it, using the CONCUR engine as the output engine. Then it will be in the correct format for sharing. For example, if you want shared update access to a data set that was created using the V9 engine, you can use the following statements to convert it:

```
libname inlib v9 '[mydir.base]';
libname outlib concur '[mydir.share]';
proc copy in=inlib out=outlib;
run;
```

After you run this SAS program, all SAS data sets that are created with the V9 engine in the data library that is referenced by INLIB are copied to the data library referenced by OUTLIB using the CONCUR engine. To create data sets using the CONCUR engine, your directory must have a version limit greater than 1.

Member Types Supported

The CONCUR engine supports the SAS 9.1 member type DATA.

Engine/Host Options for the CONCUR Engine

Several concurrency engine options control the creation and access of SAS data sets. Most of these options have direct correlation to options available through OpenVMS Record Management Services (RMS). The CONCUR engine creates relative organization files with record-level locking enabled.

Note: Data sets created with the CONCUR engine have a maximum observation length of 32K. △

You can use the following engine/host options with the CONCUR engine:

ALQ=
: specifies the number of OpenVMS disk blocks to allocate initially to a data set when it is created. The value can range from 0 to 2,147,483,647. If the value is 0, the minimum number of blocks required for a sequential file is used. The ALQ= option defaults to the bucket size. OpenVMS RMS always rounds the value up to the next disk cluster boundary.

The ALQ= option (allocation quantity) corresponds to the FAB$L_ALQ field in OpenVMS RMS. For additional details, see "ALQ= Data Set Option" on page 282 and *Guide to OpenVMS File Applications*.

BKS=

specifies the number of OpenVMS disk blocks in each bucket of the file. The value can range from 0 to 63. If the value is 0, the bucket size used is the minimum number of blocks needed to contain a single observation. The default value is 32.

When deciding on the bucket size to use, consider whether the file is usually accessed randomly (small bucket size), sequentially (large bucket size), or both (medium bucket size). The bucket size is a permanent attribute of the file, so this option applies to output files only.

The BKS= option (bucket size) corresponds to the FAB$B_BKS field in OpenVMS RMS or the FILE BUCKET_SIZE attribute when using File Definition Language (FDL). For additional details, see "BKS= Data Set Option" on page 284 and *Guide to OpenVMS File Applications*.

DEQ=

specifies the number of OpenVMS disk blocks to add each time OpenVMS RMS automatically extends a data set during a write operation. The value can range from 0 to 65,535. OpenVMS RMS always rounds the value up to the next disk cluster boundary. A large value can result in fewer file extensions over the life of the file; a small value results in numerous file extensions over the life of the file. A file with numerous file extensions that may be noncontiguous slows record access.

If the value specified is 0, OpenVMS RMS uses the default value for the process. The DEQ= option defaults to the bucket size.

The DEQ= option (default file extension quantity) corresponds to the FAB$W_DEQ field in OpenVMS RMS. For additional details, see "DEQ= Data Set Option" on page 289 and *Guide to OpenVMS File Applications*.

FILEFMT=

specifies the file format, or version of the engine, to use. Allowed values are 606, 607, 801, and 901. The default value is 801. There was an internal file format change between Release 6.06 and Release 6.07, and again between Version 6 and Version 8. The Version 8 and SAS 9 formats are identical. The concurrency (CONCUR) engine can create and access all versions of the file format. When you access a file for input or update, the CONCUR engine detects the correct version of the existing file. When you create a new file, the CONCUR engine defaults to creating a Version 8 format file unless overridden by the FILEFMT= option.

The following example shows how to create a file in Release 6.07 format:

```
libname clib concur '[]';
data clib.v607 (filefmt=607);
...  more SAS statements ...
run;
```

MBF=

specifies the number of I/O buffers you want OpenVMS RMS to allocate for a particular file. The value can range from 0 to 127, and it represents the number of buffers to use. By default, this option is set to 2 for files opened for update and 1 for files opened for input or output. If the value 0 is specified, the process' default value is used.

The MBF= option (multibuffer count) corresponds to the RAB$B_MBF field in OpenVMS RMS or the CONNECT MULTIBUFFER_COUNT attribute when using FDL. For additional details, see "MBF= Data Set Option" on page 293 and *Guide to OpenVMS File Applications*.

Data Set Options Supported by the CONCUR Engine

The CONCUR engine recognizes all data set options that are documented in *SAS Language Reference: Dictionary* except the FILECLOSE=, COMPRESS=, and REUSE options. Of special importance to the CONCUR engine is the portable data set option CNTLLEV=. (For details, see "CNTLLEV= Data Set Option" on page 288.) Other data set options that are likely to be useful include LOCKREAD= and LOCKWAIT=. (For details, see "LOCKREAD= Data Set Option" on page 292 and "LOCKWAIT= Data Set Option" on page 293.) For more information, refer to *SAS Language Reference: Dictionary*.

The engine/host options that are discussed in "Engine/Host Options for the CONCUR Engine" on page 161 can also be used as data set options when you use the CONCUR engine. For details, see "Specifying Data Set Options" on page 277.

System Option Values Used by the CONCUR Engine

The CONCUR engine does not use the values of any SAS system options.

DECnet Access

The CONCUR engine supports both creation and reading of files across DECnet, but not the updating of files across DECnet. You are allowed to create and read files because the engine uses multistreaming only when the file is opened for update. Support of DECnet access means you can now specify a node name in the physical pathname of your SAS data library, as long as you do not plan to update the data sets stored in the data library. The following is an example:

```
libname mylib concur 'mynode::bldgc:[testdata]';
```

Passwords

The CONCUR engine supports SAS passwords. The syntax and behavior is the same as passwords used with the V9 engine.

Internals of a Concurrency Engine Data Set

Contents and Organization of a Concurrency Engine Data Set

If you are familiar with OpenVMS RMS, it might be helpful to know the internal file format of a concurrency engine data set. A concurrency engine data set is a relative format file. The record length is determined by the length of one observation, with a minimum length of 8 bytes. Because the data set is a relative format file, the maximum observation length of a concurrency engine data set is 32,767 bytes. The first portion of the file contains header records that provide information to the engine concerning the number of observations in the file, the number of variables, some positioning information to optimize access, the date and time, SAS software release, operating environment the data set was created on, and so forth.

Following the header information is information pertaining to each individual variable in the file. A NAMESTR is stored for each variable on the data set. The NAMESTR includes the variable name, type, label, and size. Multiple NAMESTRs are stored in a single record, up to the maximum number of NAMESTRs that the record length accommodates.

After the NAMESTRs, the observations begin. There is always one observation per record. With one exception, the record length is the observation length. If the observation length is less than 8 bytes, the record length defaults to 8. If you delete a record in a relative format file, the record still exists in the file, but it is marked as deleted.

Note: In a concurrency engine data set, a data set of deleted observations takes the same amount of disk space as a data set of valid observations. To remove the deleted observations, you must use the COPY procedure and copy the data set to a new data set type, such as a data set created with the V9 or V9TAPE engine. △

Notes on File-Sharing Capabilities

Although all record-level locking capabilities are provided through the use of OpenVMS RMS features, some file-sharing capabilities are provided by OpenVMS RMS and some are provided by the engine itself. The engine can correctly set the share options of a file when the file is opened for input or update, because SAS uses the name of the existing data set directly. However, output data sets are created with a temporary name and then renamed to the actual data set name after the data set is closed. This ensures the integrity of existing data sets of the same name in case an error occurs during creation of the new data set. Therefore, the engine must handle all file-sharing issues that disallow sharing of output files. This is done through the locking of specific filenames, which is why your directory must have a version limit of at least 2 to create concurrency engine data sets.

Optimizing the Performance of the CONCUR Engine

Introduction to Optimizing Engine Performance

Engine performance is often a trade-off between various factors. You can optimize the performance of the CONCUR engine in your operating environment. By controlling the size and number of buffers, you can specify how SAS accesses your data. By specifying the data set options, you can control the level and amount of data that is accessed. The amount of disk space available for these operations also effects engine performance.

Controlling the Size and Number of Buffers

Depending on the type of record access your SAS application performs, you need to consider both the size of buffers (bucket size) and the number of buffers (multibuffer count). For complete details about specifying the size and number of buffers, see “BKS= Data Set Option” on page 284 and “MBF= Data Set Option” on page 293.

The two extremes of record access are records that are accessed completely sequentially or completely randomly. For example, many SAS procedures typically access data sets sequentially, processing the records from first to last. On the other hand, you might access observations in a completely random order when using the FSEDIT procedure to edit or browse observations in a data set.

There are also cases in which records are accessed randomly but might be reaccessed frequently. One example is an application that uses a data set in which particular observations contain information that is referred to frequently. Again, using the FSEDIT procedure as an example, the data set can be designed in such a way that you must access the first observation followed by observation 200, then the first observation again followed by observation 300, and so on.

Finally, there are cases in which records are accessed randomly, but then adjacent records are likely to be accessed. An application can use the POINT= option in a SET statement to selectively input the first 10 observations out of every 100 observations.

Most often, an application accesses a data set by a combination of several of these methods. The following list gives suggestions for the number of buffers and bucket size you should use for each method:

completely sequential or random access
: is most efficient with a single buffer. However, the bucket size differs:

  random access
  : is more efficient with a smaller bucket size.

  sequential access
  : is more efficient with a larger bucket size.

random access with reaccessed records
: is most efficient with multiple buffers to keep the reaccessed records in the buffer cache. You should use a small bucket size in this instance.

random access with subsequent adjacent access
: is most efficient with a single buffer. However, use a larger bucket size so that more records are stored in the buffer cache. This increases the probability that the required records have been read into memory with a single I/O.

If your program accesses the data set by several methods, you must find a compromise between the number of buffers and bucket sizes. This is what SAS attempts to do with the defaults, because the intended use of the file is unknown. Because you know the intended use of your CONCUR engine data sets, you can improve the CONCUR engine's performance by optimizing the buffer settings.

Using Portable Data Set Options

Several data set options are portable options that are available for all engines, but they are particularly useful in conjunction with the concurrency engine.

CNTLLEV=
: specifies the level of access (control level) to the data set, whether concurrent or exclusive. If you decide to create a concurrency engine data set to take advantage of its random access optimizations, but you do not need to provide for concurrent access at this time, you can use the CNTLLEV= data set option to further improve performance. By default, when using the concurrency engine, data sets that are opened for input allow shared read access, data sets that are opened for output allow no sharing, and data sets that are opened for update allow shared update access. When sharing is allowed, record-level locking is enabled. When you do not need this feature, you can reduce the overhead of record locking by using CNTLLEV=MEM to disable the sharing.

  The CNTLLEV= data set option takes one of two values:

MEM	specifies that the application requires exclusive access to the data set. Member-level control restricts any other application from accessing the data set until the step has completed.
REC	specifies that concurrent access is allowed and OpenVMS RMS record-level locking is enabled. This option entails more processing overhead and should be used only when necessary.

Each SAS procedure specifies a required control level to the engine, depending on the intended access of the observations. If you use CNTLLEV=REC and the SAS procedure requires member-level control to ensure the integrity of the data during processing, a warning is written to the SAS log indicating that inaccurate or unpredictable results can occur if the data set is being updated by another process during the analysis.

A common example of improving performance by overruling the CNTLLEV default of the procedure is with the FSEDIT procedure, which uses a default of CNTLLEV=REC. A session using the FSEDIT procedure with a concurrency engine data set does not need to incur the overhead of record-level locking if concurrent access is not required. By using the data set option CNTLLEV=MEM, the application tells the engine to override the control level specification of the procedure because exclusive access at the member level is desired. This disables record-level locking, decreases the overhead for processing the data set, and improves performance. In tests using the SET statement to input a concurrency engine data set, using the CNTLLEV=MEM option caused the step to run in one-third the CPU time as the same step using the CNTLLEV=REC option.

For syntax and usage examples for the CNTLLEV= data set option, see "CNTLLEV= Data Set Option" on page 288 and *SAS Language Reference: Dictionary*.

FIRSTOBS= and OBS=

specify a beginning and ending observation to subset your data set.

The value of the FIRSTOBS= data set option specifies the first observation that should be included for processing in the SAS DATA step. Some engines have to read the records sequentially, discarding them until the requested observation is reached. Because a concurrency engine data set is a relative format file, the engine can directly access the beginning observation without having to first read any other observations in the file.

Using the OBS= data set option to specify the last observation that you want to process can improve performance by terminating the input of observations without having to read records until the end-of-file character is reached.

For more information about the FIRSTOBS= and OBS= data set options, see *SAS Language Reference: Dictionary*.

Using the POINT= Option

You can use the POINT= option in a SET statement to access contiguous ranges of observation. For example, with the POINT= option, the SAS program can read observations 10 through 50, then observations 90 through 150, and so on. Obviously, only reading the records that you actually need improves performance by decreasing the number of records you must access. Due to the physical format of a concurrency engine data set, the engine can access the required records directly.

Disk Space Usage

For most data sets, the disk space that is required for a CONCUR engine data set and a V9 engine data set are comparable. However, for data sets in which the number of observations is greater than the number of variables, concurrency engine data sets are usually smaller. An exception to this is a concurrency engine data set that has many variables and only a few observations; in this case, space might be wasted.

However, there is a file format for both uncompressed and compressed data sets that makes the V9 engine disk space usage more efficient.

Performance Comparisons

Performance is a main concern for many applications, so it is useful to know how the CONCUR engine compares to the V9 engine when various features of SAS are used:

Creating data sets
: When you compare the creation and sequential input of data sets using each engine, the V9 engine tends to be faster when the data sets are small. However, as the size of the data set increases, the V9 and CONCUR engines are comparable in CPU time used. In all cases, the page faults that are incurred for the CONCUR engine are substantially less than for the V9 engine.

Accessing existing data sets
: When you compare random access of an existing file using both engines, the concurrency engine is much faster. When you use a large bucket size in the concurrency engine, with a comparable page size in the V9 engine, the concurrency engine takes approximately one-half as much CPU time. When the bucket size and page size are small, the concurrency engine takes about one-third as much CPU time. Again, page faults for the concurrency engine are substantially less.

The DBMS Interface Engine

To use the Oracle engine, your site must license the corresponding SAS/ACCESS interface. You can specify this engine in the LIBNAME statement, the LIBNAME function, or the New Library dialog box, just as you do with the other engines. The Oracle engine has DBMS-specific options that you can specify. For complete information about using this engine to access DBMS data, see *SAS/ACCESS for Relational Databases: Reference* and *SAS/ACCESS Supplement for Oracle*.

The OSIRIS and SPSS Engines under OpenVMS

When Can You Use the OSIRIS and SPSS 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:

OSIRIS	accesses OSIRIS files.
SPSS	accesses SPSS and SPSS-X system files from (Release 9) or earlier and portable 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 at once.

Restrictions on the Use of These Engines

Because these are sequential engines, they cannot be used with the POINT= option of the SET statement or with the FSBROWSE, FSEDIT, or FSVIEW procedures in SAS/FSP software. However, you can use the COPY procedure, the DATASETS procedure, or a DATA step to copy an OSIRIS or SPSS file to a SAS data set, and then use either POINT= or SAS/FSP to browse or edit the file. Also, some procedures (such as the PRINT procedure) issue a warning message indicating that the engine is sequential.

Accessing OSIRIS Files

Although OSIRIS runs only under z/OS and CMS, the SAS OSIRIS engine accepts an z/OS data dictionary from any other operating environment that is running SAS. 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. (Alternately, you can select **`Default`** as the type in the **`Engine`** field of the New Library dialog box.) Specify the OSIRIS engine in the LIBNAME statement as follows:

LIBNAME *libref* OSIRIS '*data-filename*'

DICT= '*dictionary-filename*';

where

libref
: is a SAS libref.

OSIRIS
: is the OSIRIS engine.

data-filename
: is the physical name of the data file.

dictionary-filename
: is the physical filename of the dictionary file. The dictionary filename can also be a fileref or an OpenVMS logical name. However, if you use a fileref or an OpenVMS logical name for the *dictionary-filename*, do not use quotation marks.

You do not need to use a LIBNAME statement before running the CONVERT procedure if you are using PROC CONVERT to convert an OSIRIS file to a SAS data file. (For more information, see “CONVERT Procedure” on page 377.)

Note that the LIBNAME statement has no engine/host options for the SPSS engine.

If you previously assigned a fileref or an OpenVMS logical name to the OSIRIS file, then you can omit the *data-filename* in the LIBNAME statement. However, you must still use the DICT= option, because the engine requires both files. (For details, see “Example: Accessing OSIRIS Files” on page 169.)

You can use the same dictionary file with different data files. Enter a separate LIBNAME statement for each data file.

Referencing OSIRIS Files

OSIRIS data files do not have individual names. Therefore, for these files you can use a member name of your choice in SAS programs. 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.

Example: Accessing OSIRIS Files

Suppose you want to read the OSIRIS data file TEST1.DAT, and the dictionary file is TEST1.DIC. The following statements assign a libref to the data file and then run PROC CONTENTS and PROC PRINT on the file:

```
libname mylib osiris 'test1.dat' dict='test1.dic';
proc contents data=mylib._first_;
run;

proc print data=mylib._first_;
run;
```

Accessing SPSS Files

The SPSS engine supports portable file (export) 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.

This engine can read only SPSS export files from any operating environment that were created by using the SPSS EXPORT command.

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. (Alternately, you can select **`Default`** as the type in the **`Engine`** field of the New Library dialog box.) Specify the SPSS engine in the LIBNAME statement as follows:

LIBNAME *libref* SPSS '*filename*';

where

libref
is a SAS libref.

SPSS
is the SPSS engine.

file-specification
is the physical filename.

You do not need to use a LIBNAME statement before running the CONVERT procedure if you are using PROC CONVERT to convert an SPSS file to a SAS data file. (For more information, see the procedure “CONVERT Procedure” on page 377.)

Note that the LIBNAME statement has no engine/host options for the SPSS engine.

If you previously assigned a fileref or an OpenVMS logical name to the SPSS file, then you can omit the *file-specification* in the LIBNAME statement. SAS uses the physical filename that is associated with the fileref or logical name. (For details, see “Example: Accessing SPSS Files” on page 170.)

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.

Example: Accessing SPSS Files

Suppose you want to read the SPSS file MYSPSSX.POR. The following statements assign a libref to the file and then run PROC CONTENTS and PROC PRINT on the file:

```
libname mylib spss 'myspssx.por';
proc contents data=mylib._first_;
run;

proc print data=mylib._first_;
run;
```

CHAPTER
7

Using External Files and Devices

Introduction to Using External Files and Devices under OpenVMS

What Are External Files?

External files are files whose format is determined by the operating environment rather than by SAS. These files are not managed by SAS. External files include raw data files, files that contain SAS programming statements, and procedure output files.

Techniques for Accessing External Files

The following SAS statements and functions are used to access external files on disk or tape:

FILENAME statement and FILENAME function
: associate a fileref with an external file that you want to use for input or output. (For more information, see “FILENAME Statement” on page 397 and “FILENAME Function” on page 322.)

INFILE statement
: opens an external file for reading data lines. (For more information, see “INFILE Statement” on page 417.)

FILE statement
: opens an external file for writing data lines. (For more information, see “FILE Statement” on page 395.)

%INCLUDE statement
: opens an external file for reading SAS statements. (For more information, see “%INCLUDE Statement” on page 415.)

You also specify external files in various windowing environment fields (for example, as a file destination in the Results window or as a source input in an INCLUDE command).

Identifying External Files to SAS

How to Identify an External File to SAS

To access an external file, you must tell SAS how to find the file. Depending on the context, you can use any of the following specifications to identify an external file to SAS:

- a fileref that was assigned with the FILENAME statement, the FILENAME function, or with the SAS Explorer window
- an OpenVMS logical name that was assigned with the DCL DEFINE (or ASSIGN) command
- an OpenVMS pathname enclosed in single or double quotation marks
- aggregate syntax
- a single filename without quotation marks (a file in the default directory).

Order of Precedence for External File Specifications

It is possible (though generally not advisable) to use the same text string as a filename, a fileref, and an OpenVMS logical name. If an external file specification is a valid SAS name and is not enclosed in quotation marks, then SAS uses the following order of precedence to interpret the text string and locate the external file:

1. If you have defined the text string as a SAS fileref, then SAS uses the file that the fileref refers to.
2. If the text string is not a fileref, then SAS looks to see whether you have defined it as an OpenVMS logical name. If so, it uses the file that the logical name refers to.
3. If the text string is neither a fileref nor an OpenVMS logical name, then SAS looks for a file by that name in your default directory.

Assigning Filerefs

Use the FILENAME statement, the FILENAME function, or the SAS Explorer window to assign a fileref to an external file. For more information, see the following:

- "FILENAME Statement" on page 397
- "FILENAME Function" on page 322
- "SAS Windowing Environment under OpenVMS" on page 22.

Assigning OpenVMS Logical Names to External Files

You can use an OpenVMS logical name as a file specification. Use the DCL DEFINE command to associate a logical name with an external file.

When you assign an OpenVMS logical name to an external file, you cannot use the pound sign (#) or the at sign (@) because these characters are not valid in OpenVMS logical names. (By contrast, if you use the FILENAME statement to assign a fileref, you can use these characters because filerefs follow SAS naming conventions.) Also, using the DCL DEFINE command to define an OpenVMS logical name does not enable you to specify the keywords or options that are available with the FILENAME statement and the FILENAME function.

Remember that you can use the SAS X statement or X command to issue a DCL DEFINE command from within a SAS program or a SAS process. (For details, see "Issuing DCL Commands during a SAS Session" on page 43.)

Note: If you use the SAS X statement or X command to issue the DCL DEFINE command, then you want to use the method described in "Issuing a Single DCL Command Using the X Statement" on page 44 (which executes the command in the parent OpenVMS process), not the method described in "Issuing Several DCL Commands Using the X Statement" on page 46 (which executes multiple DCL commands in an OpenVMS subprocess). OpenVMS logical names that are defined in a subprocess are not recognized by the current SAS process. By contrast, OpenVMS logical names that are defined in the OpenVMS parent process are available for use during the current SAS process. △

Examples: Using Logical Names to Access External Files

Suppose you want to read a data file named [YOURDIR]EDUC.DAT, and you decide to use an OpenVMS logical name to access the file. You can issue the DCL DEFINE command before you invoke SAS. The following is an example:

```
$ DEFINE INED [YOURDIR]EDUC.DAT
```

Alternatively, you can use the SAS X statement to issue a DCL DEFINE command in your SAS program:

```
x 'define ined [yourdir]educ.dat';
```

Either of these methods properly associates the OpenVMS logical name INED with the file [YOURDIR]EDUC.DAT. You can then use INED as the file specification in the INFILE statement:

```
infile ined;
```

You can use the same methods to *write* to an external file. For example, use an X statement to issue a DCL DEFINE command as follows:

```
x 'define outfile [yourdir]scores.dat';
```

Then use the OpenVMS logical name OUTFILE as the file specification in the following FILE statement:

```
file outfile;
```

Using OpenVMS Pathnames to Identify External Files

If you use an OpenVMS pathname as an external file specification, you must enclose the file specification in single or double quotation marks. The file specification must be a valid OpenVMS pathname to the external file that you want to access; therefore, the level of specification depends on your location in the directory structure. The number of characters in the quoted string must not exceed the maximum filename length that OpenVMS allows (255 characters).

Here are some examples of valid file specifications:

```
infile 'node2::device:[dir1.subdir1]food.dat';
file '[mydir]prices.dat';
```

To access a particular version of a file, include the version number in the quoted file specification. If you omit the version number, then SAS uses the most recent version when reading, and it creates a new version when writing. To append records to the end of an existing file, use the MOD option in the FILE statement, type APPEND in windowing environment filename fields, or use the FAPPEND function. For example, the following FILE statement appends data lines to the file PRICES.DAT;1:

```
file 'prices.dat;1' mod;
```

Using Wildcard Characters in External File Specifications

You can use the following wildcard characters inside a SAS job wherever a quoted-string file specification is allowed, except that you cannot use them in a FILE statement.

* (asterisk)
  matches all files.

% (percent sign)
  matches any character.

. . . (ellipsis)
  searches all subdirectories.

The following are some examples of valid uses of wildcard characters:

- **`filename myfile '*.data';`**
- **`%include '*.sas';`**
- **`infile 'test%.dat';`**
- **`infile '[data...]*.test_data';`**

The special characters # (pound sign) and @ (at sign) cannot be used in external file specification because they are not valid in filenames created with the ODS-2 syntax.

Specifying Concatenated Files

Under OpenVMS, you can specify concatenations of files when reading and writing external files from within SAS. Concatenated files consist of two or more file specifications, enclosed in quotation marks and separated by commas. You can include wildcard characters in the file specifications.

The usual rules for OpenVMS version-numbering apply. You cannot use a percent symbol (%) in the version number field.

The following are some examples of valid concatenation specifications:

- **`filename allsas 'one.sas, two.sas, three.sas';`**
- **`filename alldata 'test.data1, test.data2, test.data3';`**
- **`%include 'one.sas, two.sas';`**
- **`infile '[area1]alldata.dat,[area2]alldata.dat';`**
- **`infile 'test*.dat, in.dat';`**

Using Aggregate Syntax to Identify External Files

You can also use aggregate syntax to access individual files. To do so, assign a SAS fileref or an OpenVMS logical name to a directory, and specify the individual filename in parentheses. For example, suppose you use the following FILENAME statement to associate the fileref MYFILE with the directory [MYDIR]:

```
filename myfile '[mydir]';
```

To access a file named SCORES02.DAT in that directory, you could use the following INFILE statement:

```
infile myfile(scores02);
```

By default, the INFILE statement appends a file type of .DAT to the SCORES02 filename if a filetype is not specified. (For more information about default file types, see “Default File Types” on page 177.)

If you want to specify a different file type, then enclose the file specification in quotation marks, as in the following example:

```
infile myfile('scores02.new');
```

Identifying OpenVMS Text Libraries

Aggregate syntax is also used to identify OpenVMS text libraries. An OpenVMS text library has a default file type of .TLB and can store frequently used text files. For example, if you have several related files of data, you might want to store them in one OpenVMS text library. OpenVMS text libraries are also commonly used as SAS autocall libraries, which store SAS macros. For more information, see “Autocall Libraries under OpenVMS” on page 520.

To access a file in an OpenVMS text library, complete the following steps:

- □ Assign a fileref or OpenVMS logical name to the text library.
- □ Specify the fileref or logical name in an INFILE or FILE statement, followed by the filename in parentheses.

For example, you can use the following FILENAME statement to assign a fileref to an OpenVMS text library:

```
filename mytxtlib '[mydir]mydata.tlb';
```

Then, assuming that you want to use a library member named SCORES01, you can use the following INFILE statement:

```
infile mytxtlib(scores01);
```

Note: The file-type rules for OpenVMS text library syntax differ from the rules for directory-based aggregate syntax. When referring to a member of an OpenVMS text library, do not specify a file type. If you do, the file type is ignored. For example, in the following statements the fileref TEST refers to an OpenVMS text library:

```
filename test 'mylib.tlb';
data _null_;
   file test(one.dat);
   put 'first';
run;
```

The file type .DAT is ignored, and the FILE statement writes member ONE to the text library, not to ONE.DAT. Wildcard characters are not allowed in filenames when you are using OpenVMS text-library syntax. △

Identifying an External File That Is in Your Default Directory

As explained in “Order of Precedence for External File Specifications” on page 173, if an external file specification is a valid SAS name and is neither quoted nor a previously defined fileref or OpenVMS logical name, then SAS opens a file by that name in your default directory. Therefore, you cannot use the special characters # or @ in the external file specification, because these characters are not valid in OpenVMS filenames.

The specification must be a filename only; do not include the file type. SAS uses a default file type depending on whether you are reading or writing data lines or reading SAS statements, as indicated in "Default File Types" on page 177.

The following INFILE statement reads the data file FOOD.DAT from the default directory (FOOD has not been defined as a SAS fileref nor as an OpenVMS logical name):

```
infile food;
```

When SAS encounters this statement, it searches the default directory for a file named FOOD.DAT. Records are read from FOOD.DAT according to subsequent INPUT statement specifications.

The following FILE statement writes data lines to the file PRICES.DAT in the default directory (PRICES has not been defined as a SAS fileref nor as an OpenVMS logical name):

```
file prices;
```

When SAS encounters this statement, it writes to a file named PRICES.DAT in the default directory. Data lines are written to PRICES.DAT according to subsequent PUT statement specifications.

Default File Types

By default, SAS uses the OpenVMS file type .DAT with both the INFILE and FILE statements. Therefore, if you want to read from or write to an existing file in the default directory when specifying only the filename, the file type must be .DAT; otherwise, SAS cannot locate the file, and it issues an error message.

The default file types are different if you are using windowing environment commands. The following table lists the default file types for SAS statements and commands. Be sure to include the file type in a quoted file specification unless you are sure that the SAS default is correct.

Table 7.1 Default File Types for Commands and Statements

Reference	File Type	Window
FILE command	.SAS	Program Editor
FILE command	.LOG	Log
FILE command	.LIS	Output
INCLUDE command	.SAS	Program Editor
FILE statement	.DAT	Program Editor
%INCLUDE statement	.SAS	Program Editor
INFILE statement	.DAT	Program Editor

Reading and Writing SAS Print Files under OpenVMS

Default Print File Format

FORTRAN is the default file format for SAS print files. You can change the default for the entire session or for specific files by using the CC= system option. This option can be used in the FILENAME statement, in the FILENAME function, or as a system option.

Note: The FILE command generates a nonprint file, whereas the PRINT command generates a print file. △

To specify the carriage-control format, use either the CC= external I/O statement option (see "Host-Specific External I/O Statement Options" on page 402 in the FILENAME statement) or the CC= system option (see "CC= System Option" on page 452). You can also use the FILECC system option to control how SAS treats the data in column 1 of a print file (see "FILECC System Option" on page 461).

When you write to a print file with FORTRAN carriage control, SAS shifts all column specifications in the PUT statement one column to the right to accommodate the carriage-control characters in column 1.

A nonprint file that is written by SAS contains neither carriage-control characters nor titles. Whether you create a print or nonprint file, SAS provides default values for some characteristics of the file; these defaults are adequate in most cases. Table 7.2 on page 178 lists the defaults for print and nonprint files.

Table 7.2 Default File Attributes for SAS Print and Nonprint Files

Attribute	Print File (Batch)	Print File (Interactive)	Nonprint File
Maximum record size	132	80	32,767
RECFM=	V	V	V
CC=	FORTRAN	FORTRAN	CR

Print Files Created by Command Files

When you run a SAS program from a command-procedure file with the DCL command qualifier OUT= and also specify the SAS system option ALTLOG=SYS$OUTPUT, you must also use the CC= system option to correctly set the print-file format.

The default print-file format is FORTRAN. However, the DCL command qualifier OUT= creates a VFC format file. Unless you also specify either CC=FORTRAN or CC=CR in your SAS command, your output or listing will lack the first column of data.

The following is an example that generates the correct results:

□ Your command-procedure file should look something like this:

```
$ SAS/ALTLOG=SYS$OUTPUT/CC=CR MYPROG.SAS
```

□ If your command file is named MY.COM, then you can run your SAS program by entering the following command:

```
$ @MY.COM/OUT=OUT.LOG
```

These commands send the log to the SYS$OUTPUT destination, and a copy of the log (including the first column of data) is stored in the file OUT.LOG.

For more information about command-procedure files, see "Invoking SAS from a Command Procedure File" on page 24, "Command Procedures" on page 15, and *OpenVMS User's Manual*.

Displaying Information about External Files under OpenVMS

As in other operating environments, you can use the following form of the FILENAME statement under OpenVMS to list the attributes of all the external files that are assigned for your current SAS process:

FILENAME _ALL_ LIST;

You can use the FINFO function, the FILENAME window, or the SAS Explorer window to see information about your currently assigned external files. For details, see "FINFO Function" on page 328.

OpenVMS logical names that you have assigned to external files are also listed, but only after you have used them as filerefs in your current SAS process.

Accessing External Files on Tape under OpenVMS

Note on Tape Specifications

You cannot use wildcards in tape specifications, nor can you use concatenated tape specifications.

DCL Commands for Tape Access

Use the following DCL commands to request and then release the tape drive and volume for your SAS job or session. You can issue these commands either before you invoke SAS or in the X statement after you invoke SAS.

ALLOCATE *device-name<logical-name>*
: requests exclusive use of the tape drive on which the tape volume is physically mounted, and it optionally establishes *logical-name*. This command is not required; however, you do not have exclusive use of your device until you issue the ALLOCATE command.

INITIALIZE *</qualifier> device-name volume-label*
: initializes the tape and specifies a label to assign to the tape. Use the INITIALIZE command only when you are writing to a tape for the first time. For more information about initializing tapes, refer to *Guide to VMS Files and Devices*.

MOUNT *</qualifier> device-name <volume-label>*
: requests that the tape be mounted on the tape drive identified by *device-name*. If the tape is treated as ANSI-labeled, then you must include the volume label of the mounted tape. The syntax of the MOUNT command for a labeled tape is

$ MOUNT *device-name volume-label*

where *volume-label* has a maximum length of six characters.

If the tape is unlabeled, then you must include the /FOREIGN qualifier and the device name. The syntax of the MOUNT command for an unlabeled tape is

$ MOUNT/FOREIGN *device-name*

You do not need to use *volume-label* when requesting an unlabeled tape.

If you are requesting an unlabeled tape, you can issue the following form of the MOUNT command, which tells the computer operator which tape to mount:

$ MOUNT/ASSIST/COMMENT=
  "*instructions*" *device-name*

where *instructions* tell the computer operator which tape to mount, and *device-name* identifies the tape drive.

If you are writing or reading records of a different length than the default block size, you can use the /BLOCKSIZE= qualifier to specify the block size. For example, in the following form of the MOUNT command, *xxxx* specifies the appropriate block size for an unlabeled tape:

$ MOUNT/FOREIGN/BLOCKSIZE=
  xxxx device-name

After you issue the MOUNT command for a labeled or unlabeled tape, your keyboard locks until the MOUNT command executes (that is, until the operator mounts the tape). This command is required.

SET MAGTAPE </*qualifier*> *device-name*
assigns special characteristics to a tape device. Qualifiers include the following:

/DENSITY=
sets the density of 800, 1,600, or 6,250 bpi (bytes per inch) for foreign tape operations.

/REWIND
rewinds the tape.

/SKIP=FILES: *n*
specifies the number of files (*n*) to skip over on an unlabeled tape.

DISMOUNT </NOUNLOAD> *device-name*
dismounts a labeled or unlabeled tape. When you issue the DISMOUNT command, the tape is physically unloaded by default. In order to mount and use the tape again, operator intervention is required. Use the /NOUNLOAD qualifier to prevent the default unload operation.

DEALLOCATE *device-name*
releases the tape drive from your job or session.

In each of these commands, *device-name* can be either the name of a tape drive at your site (for example, MUA0:) or a logical name pointing to the tape drive.

After you issue commands to request the device and tape volume, use the DCL DEFINE command, the SAS FILENAME statement, or the FILENAME function to associate an OpenVMS logical name or SAS fileref with the external file on tape. For a labeled tape, specify a file in one of the following two forms:

- FILENAME *fileref* 'tapedevice:*filename.filetype*';
- $ DEFINE *logical-name* tapedevice:*filename.filetype*

For an unlabeled tape, specify a file in one of the following two forms:

- FILENAME *fileref* 'tapedevice';
- $ DEFINE *logical-name* tapedevice

You can also use the SAS X statement to issue the DEFINE command.

The OpenVMS logical name or SAS fileref that is assigned to the tape device is then used as the file specification in the INFILE or FILE statement.

Note: In these examples, it is assumed that the OpenVMS logical name definition for tapedevice includes a colon in the device specification, such as the following:

```
$ DEFINE TAPEDEVICE MUA0:
```

If your OpenVMS logical name definition does not include a colon, then you must specify the colon when you use TAPEDEVICE, as in the following:

```
filename fileref 'tapedevice:';
```

△

Order of Tape Access Commands

When you use the SAS X statement to issue the tape-access commands, specify the commands in the following order:

INITIALIZE

ALLOCATE

MOUNT

This order differs from the order that you use when you issue the same commands from the DCL prompt.

If you do not use this order, and you allocate the tape before you initialize it, a message warns you that the device has already been allocated to another user when you try to initialize the tape.

When you issue the tape-access commands from the DCL prompt, specify them in the following order:

ALLOCATE

INITIALIZE

MOUNT

Using Multivolume Tapes

If you plan to write to several tapes in a set, you must initialize all the tapes before you start your job. Then use the /INITIALIZE=CONTINUATION qualifier in the first MOUNT command, as in the following example:

```
$ ALLOCATE TAPEDEVICE
$ INITIALIZE TAPEDEVICE TAPELIB
$ MOUNT/INITIALIZE=CONTINUATION TAPEDEVICE TAPELIB
$ SAS
   . . . more SAS statements . . .
```

The /INITIALIZE=CONTINUATION qualifier guarantees that the appropriate number is added to the label as the OpenVMS system mounts the subsequent volumes. For example, the following MOUNT command first creates a tape labeled MYTAPE. Subsequent tapes are labeled MYTA02, MYTA03, MYTA04, and so on:

```
$ MOUNT/INITIALIZE=CONTINUATION $2$MUA2: MYTAPE
```

When you issue a request to mount the next relative volume, the operator issues the reply with the /INITIALIZE_TAPE=*request-number* option. For example, if you issue the following request:

```
Request 69 from user SMITH. Mount relative volume
MYTA02 on $2$MUA2:
```

the operator performs the following steps:

1. Mounts an initialized tape on the drive.
2. Issues the following command:

   ```
   $ REPLY/INITIALIZE_TAPE=69
   ```

   which sends the following message to user SMITH:

   ```
   Mount request 69 satisfied by operator
   ```

As this example illustrates, some coordination is required between the user and the operator when multivolume tapes are used. Contact your system manager for more information about this topic.

Writing to a Labeled Tape

The following example illustrates a SAS program (submitted in an interactive line mode session) that writes to a labeled tape for the first time:

```
$ ALLOCATE TAPEDEVICE
$ INITIALIZE TAPEDEVICE LABEL1
$ MOUNT TAPEDEVICE LABEL1
$ DEFINE OUTTAPE TAPEDEVICE:EXPGIFTS.DAT
$ SAS
   . . . notes and messages to SAS log . . .
1? data _null_;
2? input gift $ price;
3? file outtape;
4? if price>100 then
5? put gift price;
6? datalines;
7> watch 250.00
8> clown 35.31
   . . . more data lines . . .
15> ;
   . . .  notes and messages to SAS log . . .
16? x 'dismount tapedevice';
17? x 'deallocate tapedevice';
18?
```

This program writes the file EXPGIFTS.DAT to the tape that is identified by the label LABEL1. (The tape is referenced by the fileref OUTTAPE in the FILE statement.) After the write operation, the tape remains positioned at the end of the first file, ready to write another file. When you issue the DISMOUNT and DEALLOCATE commands, the tape is rewound and physically unloaded, and the drive and tape are released from your SAS session.

The default block size for an ANSI-labeled tape is 2,048 bytes.

Writing to an Unlabeled Tape

When you are writing to an unlabeled tape, you must use the /FOREIGN qualifier in the MOUNT command:

```
$ MOUNT/FOREIGN TAPEDEVICE
```

You must also use special values for the RECFM= and LRECL= options in the FILE statement. To write to an unlabeled tape from the DATA step, you must indicate the tape format by using RECFM=D. If you do not use RECFM=D for this type of access, the results are unpredictable.

You must also use the LRECL= option to indicate the length of each record. If the records that you are writing are variable-length records, then use a value for the LRECL= option that is the maximum record length. The minimum LRECL= value is 14. This minimum value is the only restriction on the LRECL= value for unlabeled tapes.

Example: Writing to an Unlabeled Tape

```
$ ALLOCATE TAPEDEVICE
$ INITIALIZE TAPEDEVICE
$ MOUNT/FOREIGN TAPEDEVICE
$ DEFINE OUTTAPE TAPEDEVICE
$ SAS
  . . . notes and messages to SAS log . . .
1? data _null_;
2? input gift $ price;
3? file outtape recfm=d lrecl=80;
4? if price>100 then
5? put gift price;
6? datalines;
7> watch 250.00
8> clown 35.31
  . . . more data lines . . .
15> ;
  . . . notes and messages to SAS log . . .
16? x 'dismount outtape';
17? x 'deallocate outtape';
18?
```

Changing the Default Block Size

The default block size for an unlabeled tape is 512 bytes. If you want to write a record that is longer than the default block size, you must increase the block size by using the /BLOCKSIZE qualifier in the MOUNT command. For example, the following command increases the block size to 8000 bytes for an unlabeled tape:

```
$ MOUNT/FOREIGN/BLOCKSIZE=8000 TAPEDEVICE LABEL1
```

If you attempt to write a record that is longer than the block size, you receive the following error message:

```
ERROR: Tape block size less than LRECL specified.
```

Reading from a Labeled Tape

When SAS reads a file from a labeled tape, it searches for a filename on the tape that matches the filename used in the DEFINE command or FILENAME statement. The following example illustrates reading an external file from a labeled tape to create a SAS data set:

```
$ ALLOCATE TAPEDEVICE
$ MOUNT TAPEDEVICE LABEL1
$ DEFINE INTAPE TAPEDEVICE:EXPGIFTS.DAT
$ SAS
  . . . notes and messages to SAS log . . .
1? data expenses;
2?    infile intape;
3?    input gift $ price;
4? run;
  . . . notes and messages to SAS log . . .
5? x 'dismount tapedevice';
6? x 'deallocate tapedevice';
7?
```

The DATA step in this example reads a file named EXPGIFTS.DAT, which is located on the tape identified by the label LABEL1. (The file is referenced by the fileref INTAPE in the INFILE statement.) After the read operation, the tape is positioned at the start of the next file.

Reading from an Unlabeled Tape

When you read from an unlabeled tape, you must position the tape to the appropriate file because there is no filename for which to search. Remember that the DEFINE command or FILENAME statement for an unlabeled tape includes only the OpenVMS logical name or fileref, plus the name of the tape device. If you specify a filename, it is ignored.

Here are two ways of positioning a tape to the correct file:

- Use null DATA steps to position the tape to the file you want.
- Use the /SKIP=FILES: *n* qualifier in the SET MAGTAPE command, where *n* is the number of files to skip.

Required Options to Read from an Unlabeled Tape from the DATA Step

To read from an unlabeled tape from the DATA step, you must indicate the tape format by using RECFM=D. If you do not use RECFM=D for this type of access, the results are unpredictable.

You must also use the LRECL= option to indicate the length of each record. If the records that you are accessing are variable-length records, then use a value for the LRECL= option that is the maximum record length. The minimum LRECL= value is 14. This minimum value is the only restriction on the LRECL= value for unlabeled tapes.

Example 1: Using a Null DATA Step to Position the Tape

The following example illustrates using a null DATA step to skip the first file on an unlabeled tape so that the second DATA step can read the next file:

```
$ ALLOCATE TAPEDEVICE
$ MOUNT/FOREIGN TAPEDEVICE
$ DEFINE MYTAPE TAPEDEVICE
$ SAS
  . . . notes and messages to SAS log . . .
1? data _null_;
2?    infile mytape recfm=d lrecl=80;
3?    input;
4? run;
  . . . notes and messages to SAS log . . .
5? data prices;
```

```
6?    infile mytape recfm=d lrecl=80;
7?    input name $ x y z;
8?    prod=x*y;
9?    if prod<z then output;
0? run;
  . . . notes and messages to SAS log . . .
5? x 'dismount mytape';
6? x 'deallocate mytape';
7?
```

Example 2: Using the SET MAGTAPE Command to Position the Tape

This example illustrates how to read the second file from the tape that is referenced by the OpenVMS logical name MYTAPE by using the SET MAGTAPE command with the /SKIP=FILES: *n* qualifier:

```
$ ALLOCATE TAPEDEVICE
$ MOUNT/FOREIGN TAPEDEVICE
$ DEFINE MYTAPE TAPEDEVICE
$ SAS
  . . . notes and messages to SAS log . . .
1? x 'set magtape mytape/skip=files:1';
2? data prices;
3?    infile mytape recfm=d lrecl=80;
4?    input name $ x y z;
5?    prod=x*y;
6?    if prod<z then output;
7? run;
  . . . notes and messages to SAS log . . .
8? x 'dismount mytape';
9? x 'deallocate mytape';
10?
```

Accessing Remote External Files under OpenVMS

How to Access a Remote File across DECnet

SAS supports access to external files across DECnet. You can create or read external files on any OpenVMS machine to which you have access in your DECnet network.

An external file that resides on another OpenVMS node can be specified in any statement that contains a quoted file specification. You can also define an OpenVMS logical name to point to a file on another node and then use the OpenVMS logical name in your SAS session as described in "Assigning OpenVMS Logical Names to External Files" on page 173. You can also use the FILENAME statement to assign a fileref to a remote external file. Within the quoted string, DEFINE command, or FILENAME statement, use the same syntax that you would use in any OpenVMS file specification to access a target node.

Note: The MBC= and MBF= external I/O statement options are not supported across DECnet. △

Example 1: Accessing a Remote File

To access the file TEST.DAT on node VMSNODE, specify the following FILENAME statement:

```
filename mine 'vmsnode::mydisk:[mydir]test.dat';
```

Example 2: Including the User Name and Password in the File Specification

To include a user name and password of an account on the target node as part of the file specification, use the following FILENAME statement:

```
filename mine 'vmsnode "user-id
           password"::mydisk:[mydir]test.dat';
```

Additional Documentation on DECnet Access

For more information about DECnet access and file specification syntax, refer to *DECnet for OpenVMS Guide to Networking* and *DECnet for OpenVMS Networking Manual*.

Reading from and Writing to OpenVMS Commands (Pipes)

What Are Pipes?

Under OpenVMS, you can use the FILENAME statement to assign filerefs to a pipe. Pipes enable your SAS application to receive input from any OpenVMS command that writes to SYS$OUTPUT and to write input to any OpenVMS command that reads from SYS$INPUT.

Note: The PIPE device cannot be used from a captive account. For more information, see "Limitations of Using a Captive Account" on page 47. △

Syntax for Assigning Filerefs to a Pipe

Use the following FILENAME statement syntax to assign filerefs to a pipe:

FILENAME *fileref* PIPE '*OpenVMS-command*' <options>

fileref
: is the name by which you reference the pipe from SAS.

PIPE
: identifies the device type as an OpenVMS pipe.

'OpenVMS-command'
is the name of one or more OpenVMS commands to which you want to route output or from which you want to read input. The command must be enclosed in single or double quotation marks.

options
control how the external file is processed. See "FILENAME Statement" on page 397 for more information.

Note: Only the LRECL= host external I/O option is supported with the PIPE device. △

Whether you are using the OpenVMS command as input or output depends on whether you are using the fileref for reading or writing. For example, if the fileref is used in an INFILE statement, SAS assumes that the input is coming from an OpenVMS command. If the fileref is used in a FILE statement, SAS assumes that the output is going to an OpenVMS command.

Using the Fileref for Reading

When the fileref is used for reading, the specified OpenVMS command executes, and any output that is sent to SYS$OUTPUT or SYS$ERROR is read through the fileref. SYS$INPUT is connected to the null device.

Example 1: Sending the Output of the DIRECTORY Command to a SAS DATA Step

The following SAS program uses the PIPE device-type keyword to send the output of the DIRECTORY command to a SAS DATA step. The resulting SAS data set contains the filename, file type, version, and date and time information about each file in the default directory.

```
filename dir_list pipe 'directory/date';

data sasjobs;
   infile dir_list pad;
   length fname $ 80;
   input fname $ char80.;
run;

proc print data=sasjobs;
run;
```

The DIRECTORY/DATE command retrieves information about the files in the current directory. The FILENAME statement connects the output of the DIRECTORY command to the fileref DIR_LIST. The DATA step creates a data set named SASJOBS from the INFILE statement; SASJOBS points to the input source. The INPUT statement reads the first 80 characters in each input line.

Example 2: Using the SYS$INPUT Fileref to Read Input through a Pipe

In the following example, the SYS$INPUT fileref is used to read input through a pipe into the SAS command. The SAS command executes the SAS program. The program in the previous example has been changed and stored in the file DIR.SAS. By placing the piping operation outside the SAS program, you can change the information that is passed to the program through the command without having to modify the program itself.

```
data sasjobs
   infile SYS$INPUT;
   length fname $ 80;
   input fname $ char80.;
run;

proc print data=sasjobs;
run;
```

To run the program, use the OpenVMS PIPE command to send the output of the DIR/DATE command to the SAS command:

```
$pipe dir/date | sas dir
```

The output is stored in DIR.LIS and the log is stored in DIR.LOG. See "Overriding the Default Log and Output Destinations under OpenVMS" on page 196 for more details about routing SAS log and procedure output.

Using the Fileref for Writing

When the fileref is used for writing, the output from SAS is read in by the specified OpenVMS command, which then executes.

Example: Sending Data to an External File via a Pipe

In the following example, the OpenVMS CREATE command takes its input from the CXTFILE fileref and the file LIST.TXT is created in the default directory. The file LIST.TXT contains one record:

```
Mary 39 jacks
```

The code creates the data in a SAS program and sends the data to an external file via PIPE:

```
filename extfile pipe 'create list.txt';
data a;
   input name $ num toy$;
   file extfile;
   put _infile_;
   cards;
Mary   39   jacks
;
```

Sending Electronic Mail Using the FILENAME Statement (E-MAIL)

Advantages to Sending E-Mail from within SAS

SAS lets you send electronic mail using SAS functions in a DATA step or in SCL. Sending e-mail from within SAS enables you to

- □ use the logic of the DATA step or SCL to subset e-mail distribution based on a large data set of e-mail addresses.
- □ send e-mail automatically upon completion of a SAS program that you submitted for batch processing.
- □ direct output through e-mail based on the results of processing.

Initializing Electronic Mail

By default, SAS uses SMTP (Simple Mail Transfer Protocol) to send e-mail. SMTP, unlike the VMS e-mail facility, supports attachments. This default is specified by the EMAILSYS system option. For information on how to change the e-mail protocol, see "EMAILSYS= System Option" on page 458.

Before you can send e-mail from within SAS, your system administrator might need to set the EMAILHOST system option to point to the SMTP server. For more information about the EMAILHOST system option, see *SAS Language Reference: Dictionary*.

Components of the DATA Step or SCL Code Used to Send E-Mail

In general, a DATA step or SCL code that sends electronic mail has the following components:

- □ a FILENAME statement with the EMAIL device-type keyword.
- □ options specified on the FILENAME or FILE statements indicating the e-mail recipients and subject.
- □ PUT statements that contain the body of the message.
- □ PUT statements that contain special e-mail directives (of the form !EM_*directive*!) that can override the e-mail attributes (TO, CC, SUBJECT) or perform actions (such as SEND, ABORT, and start a NEWMSG).

Syntax of the FILENAME Statement for E-Mail

To send electronic mail from a DATA step or SCL, issue a FILENAME statement using the following syntax:

FILENAME *fileref* EMAIL '*address*' <*e-mail-options*>

where

fileref
: is a valid fileref.

EMAIL
: specifies the EMAIL device type, which provides the access method that enables you to send electronic mail programmatically from SAS.

'*address*'
: is the destination e-mail address of the user to whom you want to send e-mail. You must specify an address here, but you can override its value with the TO= e-mail option.

e-mail-options
: can be any of the following:

TO=*to-address*
: specifies the primary recipients of the electronic mail. If an address contains more than one word, you must enclose it in quotation marks. To specify more than one address, you must enclose the group of addresses in parentheses, enclose each address in double quotation marks, and separate each address with a space. For example, **`to='joe@someplace.org'`** and **`to=("joe@smplc.org" "jane@diffplc.org")`** are valid TO values.

Note: You can send an e-mail without specifying a recipient in the TO= option as long as you specify a recipient in either the CC= or BCC= option. △

CC=*cc-address*
: specifies the recipients you want to receive a copy of the electronic mail. If an address contains more than one word, you must enclose it in quotation marks. To specify more than one address, you must enclose the group of addresses in parentheses, enclose each address in quotation marks, and separate each address with a space. For example, **`cc='joe@someplace.org'`** and **`cc=("joe@smplc.org" "jane@diffplc.org")`** are valid CC values.

BCC=*bcc-address*
: specifies the recipients you want to receive a blind copy of the electronic mail. The BCC field does not appear in the e-mail header, so that these e-mail addresses cannot be viewed by other recipients.

If an address contains more than one word, you must enclose it in quotation marks. To specify more than one address, you must enclose the group of addresses in parentheses, enclose each address in quotation marks, and separate each address with a space. For example, **`bcc='joe@someplace.org'`** and **`bcc=("joe@smplc.org" "jane@diffplc.org")`** are valid BCC values.

Note: The BCC option is only valid when using SMTP. The VMS e-mail facility does not support this option. △

SUBJECT='*subject*'
: specifies the subject of the message. If the subject text is longer than one word (that is, it contains at least one blank space), you must enclose it in quotation marks. You also must use quotation marks if the subject contains any special characters. For example, **`subject=Sales`** and **`subject="June Report"`** are valid SUBJECT values. Any subject text not enclosed in quotation marks is converted to uppercase.

ATTACH='*filename*' | ATTACH = ('*filename*' *attachment-options*)
: specifies the physical name of the file(s) to be attached to the message and any options to modify the attachment specifications. Enclose *filename* in quotation marks. To attach more than one file, enclose the group of filenames in parentheses. For example, valid file attachments are **`attach='DISK1:[MYDIR]OPINION.TXT'`** and **`attach=("june2003.txt" "july2003.txt")`**.

By default, SMTP e-mail attachments are truncated at 256 characters. To send longer attachments, you can specify the LRECL= and RECFM= options from the FILENAME statement as *attachment-options*. For more information about the LRECL= and RECFM= options, see "Host-Specific External I/O Statement Options" on page 402.

For more information about the options that are valid when you are using SMTP, see "FILENAME Statement, EMAIL (SMTP) Access Method" in *SAS Language Reference: Dictionary*.

Specifying E-Mail Options in the FILE Statement

You can also specify the *e-mail-options* in the FILE statement inside the DATA step. Options that you specify in the FILE statement override any corresponding options that you specified in the FILENAME statement.

Defining the Body of the Message

In your DATA step, after using the FILE statement to define your e-mail fileref as the output destination, use PUT statements to define the body of the message.

Specifying E-Mail Directives in the PUT Statement

You can also use PUT statements to specify e-mail directives that changes the attributes of your electronic message or perform actions with it. Specify only one directive in each PUT statement; each PUT statement can contain only the text associated with the directive it specifies.

The directives that change the attributes of your message are the following:

!EM_TO! *addresses*
: replaces the current primary recipient addresses with *addresses*. In the PUT statement, specify *addresses* without single quotation marks.

!EM_CC! *addresses*
: replaces the current copied recipient addresses with *addresses*. In the PUT statement, specify *addresses* without single quotation marks.

!EM_BCC! *addresses*
: Replace the current blind copied recipient addresses with *addresses*. In the PUT statement, specify *addresses* without single quotation marks.

!EM_SUBJECT! *subject*
: replaces the current subject of the message with *subject*.

The directives that perform actions are the following:

!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 sends the message when it encounters the directive, *and* again at the end of the DATA step.

!EM_ABORT!
: aborts the current message. You can use this directive to stop SAS 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, and the message body.

Example: Sending E-Mail from the DATA Step

Suppose that you want to tell your coworker Jim, whose user ID is JBrown, about some changes you made to your Config.sas file. If your e-mail program handles alias names, you could send it by submitting the following DATA step:

```
filename mymail email 'JBrown'
         subject='My CONFIG.SAS file';

data _null_;
  file mymail;
  put 'Jim,';
  put 'This is my CONFIG.SAS file.';
  put 'I think you might like the
       new options I added.';
run;
```

The following example sends a message to multiple recipients. It specifies the *e-mail-options* in the FILE statement instead of the FILENAME statement:

```
filename outbox email 'ron@acme.com';

data _null_;
  file outbox

        /* Overrides the value in  */
        /* the filename statement. */
     to=("ron@acme.com" "lisa@acme.com")

     cc=("margaret@yourcomp.com"
         "lenny@laverne.abc.com")
     subject='My SAS output';
  put 'Folks,';
  put 'Take a look at 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 control which recipients get which messages. For example, suppose you want to notify members of two different departments that their customized reports are available. If your e-mail program handles alias names, your DATA step might look like the following:

```
filename reports email 'Jim';

data _null_;
  file reports;
  infile cards eof=lastobs;
  length name dept $ 21;
  input name dept;

     /* Assign the TO attribute        */
  put '!EM_TO!' name;

     /* Assign the SUBJECT attribute   */
  put '!EM_SUBJECT! Report for ' dept;
```

```
    put name ',';
    put 'Here is the latest report for ' dept '.';
    if dept='marketing' then
      put 'ATTN: Sales Representatives';
    else
      put 'For Your Information';

       /* Send the message             */
    put '!EM_SEND!';

       /* Clear the message attributes */
    put '!EM_NEWMSG!';

    return;

       /* Abort the message before the */
       /* Run statement causes it to   */
       /* be sent again.               */
  lastobs: put '!EM_ABORT!';

    datalines;
  Susan          marketing
  Jim            marketing
  Rita           development
  Herb           development
  ;
  run;
```

The resulting e-mail 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. △

Example: Sending E-Mail Using SCL Code

The following example is the SCL code behind a frame entry design for e-mail. The frame entry includes several text entry fields that let the user enter information:

mailto	the user ID to send mail to
copyto	the user ID to copy (CC) the mail to
subject	the subject of the mail message
line1	the text of the mail message

The frame entry also contains a pushbutton called 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_SUBJECT! '||subject);
         rc = fwrite(fid);

         closerc = fclose(fid);
      end;
   end;
return;

cancel:
   call execcmd('end');
return;
```

CHAPTER
8

Routing the SAS Log and SAS Procedure Output

Overview to Routing Log and Procedure Output

For each SAS job, process, or session, SAS automatically creates the SAS log file and the WORK data library. (For a discussion of the WORK data library, see “The WORK Data Library under OpenVMS” on page 129.) If procedures in the SAS program produce printed output, then SAS also creates the procedure output file. If they are stored as disk files, the SAS log and procedure output files usually have file types of .LOG and .LIS, respectively.

The SAS log and procedure output files have default destinations, but you can set the output destinations (terminal, printer, or disk file) from the various modes of running SAS.

Attributes of the SAS Log and Procedure Output Files

The physical line size (number of columns per line) and the page size (number of lines per page) of the SAS log and procedure output files depend on the destination of the file. If these files appear on your display, then the default line size and page size are derived from the size of your display. For example, on a display device, the default line size is dependent on the window size determined by X resources.

If these files are sent to the system printer or written to a disk file (.LOG or .LIS), then the default line size is 132 characters, and the default page size is 60 lines. You can change these defaults with the LINESIZE= and PAGESIZE= system options. The value of LINESIZE= can range from 64 to 256; the value of PAGESIZE= can range from 15 to 32,767.

Note: You can change the line size or page size either when you invoke SAS or during your session with the OPTIONS statement. △

The .LOG and .LIS files have the following OpenVMS file attributes:

- file organization: sequential
- record format: variable length
- record attributes: FORTRAN carriage control.

Overriding the Default Log and Output Destinations under OpenVMS

Each method of running SAS has a default destination for the SAS log and procedure output files, but you can override these defaults with either SAS system options (when you invoke SAS) or the PRINTTO procedure (while you are running SAS).

Controlling Output Destinations Using SAS System Options

Two system options control the destination of the SAS log: LOG= and ALTLOG=. Two similar options control the destination of procedure output: PRINT= and ALTPRINT=. The LOG= and PRINT= system options change the default destination of the SAS log and procedure output; the output does not appear at the original default destination. The ALTLOG= and ALTPRINT= system options send a *copy* of the output to the new destination; the output also appears at the original default destination. These options can only be specified when you invoke SAS or a new SAS process.

Controlling Output Destinations Using the PRINTTO Procedure

If you want to reroute the SAS log or the procedure output after you enter your SAS session, you can use the PRINTTO procedure with the LOG= and PRINT= statement options. Unlike the ALTLOG= and ALTPRINT= system options, the PRINTTO procedure does not send the output to both the new and default destinations; only the specified destination receives output. You must use the PROC PRINTTO statement before the SAS log entries or procedure output you want to route are generated. When you want the output to revert to the default destination, use a PROC PRINTTO statement with no statement options.

Routing Output in the SAS Windowing Environment

Default Output Destination in the Windowing Environment

In the windowing environment, the SAS log is automatically routed to the Log window, and the procedure output is automatically routed to the Output window.

Notes on Routing Output in the Windowing Environment

The LOG= and PRINT= system options are ignored in the windowing environment.

When you send your log or procedure output to a printer from the SAS windowing environment, you can use the FSFORM command to invoke the FORM window to set your default printer destination, page format, and so on. For more information about the OpenVMS specifics of the FSFORM command, see "Host-Specific Frames of the Form Window" on page 272. For general information about the FSFORM command, refer to SAS Help and Documentation.

Routing the Log to a Printer

To send the SAS log to a printer from the windowing environment, choose from the following methods:

PRINT
: This command, issued from the command line of the Log window, sends the contents of the Log window to the queue of the default system printer (SYS$PRINT).

  You can also use the PRTFILE command, which is described in "Using the PRTFILE Command under OpenVMS" on page 205.

$ SAS/ALTLOG=SYS$PRINT
: This SAS command sends a copy of the SAS log to the SYS$PRINT printer queue and to the default destination (Log window). If you want to send the copy to a different printer, you must redefine the SYS$PRINT logical name.

PROC PRINTTO LOG=*fileref*;
: This procedure statement sends any following SAS log entries to the default system printer during a SAS session. You must have defined *fileref* in a FILENAME statement or function with the PRINTER device-type keyword. For more information, see "PRINTTO Procedure" on page 385 and "Device-Type Keywords" on page 400 in the FILENAME statement.

Routing the Log to a Disk File

To send the SAS log to a disk file from the windowing environment, choose from the following methods:

FILE *file-specification*
: This command, issued from the command line of the Log window, sends a copy of the window's contents to the file associated with *file-specification*.

  For more information about the FILE command, see "FILE Command" on page 258.

$ SAS/ALTLOG=*file-specification*
: This SAS command sends a copy of the SAS log to the disk file *file-specification*, as well as to the default destination (Log window). The following is an example of this command:

```
$ SAS/ALTLOG=MYLOG.LOG
```

PROC PRINTTO LOG=*file-specification*;
: This procedure statement sends any following SAS log entries to the disk file associated with *file-specification* during a SAS session. The value for *file-specification* can be any valid external file specification discussed in "Identifying External Files to SAS" on page 173.

Routing Procedure Output to a Printer

To send the procedure output to a printer from the windowing environment, choose from the following methods:

PRINT
: This command, issued from the command line of the Output window, sends the contents of the Output window to the queue of the default system printer (SYS$PRINT). See your system manager for the location of your default printer.

  You can also use the PRTFILE command. For more information, see "Using the PRTFILE Command under OpenVMS" on page 205.

P selection-field command
: When issued from the Results window, this selection-field command sends the procedure output to the default system printer. Also, you can edit your output from the Results window and then send the modified output to the printer. For more information about the Results window, refer to SAS Help and Documentation.

$ SAS/ALTPRINT=SYS$PRINT
: This SAS command sends a copy of the procedure output to the SYS$PRINT printer queue and to the default destination (Output window). If you want to send the procedure output to a different printer, you must redefine the SYS$PRINT logical name.

PROC PRINTTO PRINT=*fileref*;
: This procedure statement sends any following procedure output to the default system printer during a SAS session. You must have defined *fileref* in a FILENAME statement or function with the PRINTER device-type keyword. For more information, see "PRINTTO Procedure" on page 385 and "Device-Type Keywords" on page 400 in the FILENAME statement.

Routing Procedure Output to a Disk File

To send the procedure output to a disk file from the windowing environment, choose from the following methods:

FILE *file-specification*
: When issued from the command line of the Output window, this command sends a copy of the window's contents to the file associated with *file-specification*. For more information about the FILE command, see "FILE Command" on page 258.

F selection-field command
: When issued from the Results window, this selection-field command brings up a requestor window that asks for the filename and enables you to specify attributes such as REPLACE or APPEND. Also, you can edit your procedure output from the Results window and then send the modified output to a file. For more information about the Results window, see SAS Help and Documentation.

$ SAS/ALTPRINT=*file-specification*
: This SAS command sends a copy of the procedure output to the disk file *file-specification* and to the default destination (Output window). The following is an example of this command:

```
$ SAS/ALTPRINT=MYPROG.LIS
```

PROC PRINTTO PRINT=*file-specification*;
: This procedure statement sends any following procedure output to the disk file associated with *file-specification* during a SAS session. The value for *file-specification* can be any valid external file specification discussed in "Identifying External Files to SAS" on page 173.

Routing Output in Interactive Line Mode

Default Output Destination in Interactive Line Mode

If you run your SAS program in interactive line mode, the SAS log and procedure output appear on the display by default. SAS statements from your program, the SAS log, and procedure output (if the program produces any) are interleaved on the display according to the order of DATA and PROC steps in your program.

Routing the Log to a Printer

To send the SAS log to a printer in interactive line mode, choose from the following methods:

$ SAS/NODMS/LOG=SYS$PRINT
: This SAS command sends the SAS log to the SYS$PRINT printer queue instead of the default destination (the display). If you want to send the log to a different printer, you must redefine the SYS$PRINT logical name.

$ SAS/NODMS/ALTLOG=SYS$PRINT
: This SAS command sends a copy of the SAS log to the SYS$PRINT printer queue and to the default destination (the display). If you want to send the log to a different printer, you must redefine the SYS$PRINT logical name.

PROC PRINTTO LOG=*fileref*;
This procedure statement sends any following SAS log entries to the default system printer during a SAS session. You must have defined *fileref* in a FILENAME statement or function with the PRINTER device-type keyword. For more information, see "PRINTTO Procedure" on page 385 and "Device-Type Keywords" on page 400 in the FILENAME statement.

Routing the Log to a Disk File

To send the SAS log to a disk file in interactive line mode, choose one of the following methods:

$ SAS/NODMS/LOG=*file-specification*
This SAS command sends the SAS log to the disk file *file-specification* instead of the default destination (the display). The following is an example of this command:

```
$ SAS/NODMS/LOG=MYLOG.LOG
```

$ SAS/NODMS/ALTLOG=*file-specification*
This SAS command sends a copy of the SAS log to the disk file *file-specification* and to the default destination (the display). The following is an example of this command:

```
$ SAS/NODMS/ALTLOG=MYLOG.LOG
```

PROC PRINTTO LOG=*file-specification*;
This procedure statement sends any following SAS log entries to the disk file associated with *file-specification* during a SAS session. The value for *file-specification* can be any valid external file specification discussed in "Identifying External Files to SAS" on page 173.

Routing Procedure Output to a Printer

To send the procedure output to a printer in interactive line mode, choose from the following methods:

$ SAS/NODMS/PRINT=SYS$PRINT
This SAS command sends the procedure output to the SYS$PRINT printer queue instead of to the default destination (the display). If you want to send the procedure output to a different printer, you must redefine the SYS$PRINT logical name.

$ SAS/NODMS/ALTPRINT=SYS$PRINT
This SAS command sends a copy of the procedure output to the SYS$PRINT printer queue and to the default destination (the display). If you want to send the procedure output to a different printer, you must redefine the SYS$PRINT logical name.

PROC PRINTTO PRINT=*fileref*;
This procedure statement sends any following procedure output to the default system printer during a SAS session. You must have defined *fileref* in a FILENAME statement or function with the PRINTER device-type keyword. For more information, see "PRINTTO Procedure" on page 385 and "Device-Type Keywords" on page 400 in the FILENAME statement.

Routing Procedure Output to a Disk File

To send the procedure output to a disk file in interactive line mode, choose from the following methods:

$ SAS/NODMS/PRINT=*file-specification*
: This SAS command sends the procedure output to the disk file *file-specification* instead of to the default destination (the display). The following is an example of this command:

```
$ SAS/NODMS/PRINT=MYPROG.LIS
```

$ SAS/NODMS/ALTPRINT=*file-specification*
: This SAS command sends a copy of the procedure output to the disk file *file-specification* and to the default destination (the display). The following is an example:

```
$ SAS/NODMS/ALTPRINT=MYPROG.LIS
```

PROC PRINTTO PRINT=*file-specification*;
: This procedure statement sends any following procedure output to the disk file associated with *file-specification* during a SAS session. The value for *file-specification* can be any valid external file specification discussed in "Identifying External Files to SAS" on page 173.

Routing Output in Noninteractive Mode

Default Output Destination in Noninteractive Mode

In noninteractive mode, the default destination for the log is the disk file *program-name*.LOG, where *program-name* is the name of the file that contains the submitted SAS statements. The default destination for the procedure output is a disk file named *program-name*.LIS. For example, if you run your SAS program in noninteractive mode using the following command, the SAS log is automatically directed to a file named PROGNAME.LOG and the procedure output is written to a file named PROGNAME.LIS:

```
$ SAS PROGNAME
```

Both files are written in the default directory.

Routing the Log to a Display

To send the SAS log to a display in noninteractive mode, choose from the following methods:

$ SAS/LOG=SYS$OUTPUT *program-name*
: This SAS command sends the SAS log to your display instead of the default destination (*program-name*.LOG file).

$ SAS/ALTLOG=SYS$OUTPUT *program-name*
: This SAS command sends a copy of the SAS log to your display and to the default destination (*program-name*.LOG file).

PROC PRINTTO LOG=*fileref*;
This procedure statement sends the SAS log to your display during a noninteractive job. You must have defined *fileref* in a FILENAME statement or function with the TERMINAL device-type keyword. For more information, see “PRINTTO Procedure” on page 385 and “Device-Type Keywords” on page 400 in the FILENAME statement.

Routing the Log to a Printer

To send the SAS log to a printer in noninteractive mode, choose from the following methods:

$ SAS/LOG=SYS$PRINT *program-name*
This SAS command sends the SAS log to the SYS$PRINT printer queue instead of the default destination (*program-name*.LOG file). If you want to send the log to a different printer, you must redefine the SYS$PRINT logical name.

$ SAS/ALTLOG=SYS$PRINT *program-name*
This SAS command sends a copy of the SAS log to the SYS$PRINT printer queue and to the default destination (*program-name*.LOG file). If you want to send the log to a different printer, you must redefine the SYS$PRINT logical name.

PROC PRINTTO LOG=*fileref*;
This procedure statement sends the SAS log to a printer during a noninteractive job. You must have defined *fileref* in a FILENAME statement or function with the PRINTER device-type keyword. For more information, see “PRINTTO Procedure” on page 385 and “Device-Type Keywords” on page 400 in the FILENAME statement.

You can also use the DCL PRINT command to send the *program-name*.LOG file to the printer after a noninteractive job finishes.

Routing the Log to a Disk File

To send the SAS log to a disk file in noninteractive mode, choose one of the following methods:

$ SAS/LOG=*file-specification program-name*
This SAS command sends the SAS log to the file *file-specification* instead of the default destination (*program-name*.LOG file). The following is an example of this command:

```
$ SAS/LOG=MYLOG.LOG PROG1
```

$ SAS/ALTLOG=*file-specification program-name*
This SAS command sends a copy of the SAS log to the disk file *file-specification* and to the default destination (*program-name*.LOG file). The following is an example of this command:

```
$ SAS/ALTLOG=MYLOG.LOG PROG1
```

PROC PRINTTO LOG=*file-specification*;
This procedure statement sends any following SAS log entries to the disk file associated with *file-specification* during a noninteractive job. The value for *file-specification* can be any valid external file specification, as discussed in “Identifying External Files to SAS” on page 173.

Routing Procedure Output to a Display

To send the procedure output to a display in noninteractive mode, choose from the following methods:

$ SAS/PRINT=SYS$OUTPUT *program-name*
: This SAS command sends the procedure output to your display instead of the default destination (*program-name*.LIS file).

$ SAS/ALTPRINT=SYS$OUTPUT *program-name*
: This SAS command sends a copy of the procedure output to your display and to the default destination (*program-name*.LIS file).

PROC PRINTTO PRINT=*fileref*;
: This procedure statement sends the procedure output to your display during a noninteractive job. You must have defined *fileref* in a FILENAME statement or function with the TERMINAL device-type keyword. For more information, see “PRINTTO Procedure” on page 385 and “Device-Type Keywords” on page 400 in the FILENAME statement.

Routing Procedure Output to a Printer

To send the procedure output to a printer in noninteractive mode, choose from the following methods:

$ SAS/PRINT=SYS$PRINT *program-name*
: This SAS command sends the procedure output to the SYS$PRINT printer queue instead of the default destination (*program-name*.LIS file). If you want to send the procedure output to a different printer, you must redefine the SYS$PRINT logical name.

$ SAS/ALTPRINT=SYS$PRINT *program-name*
: This SAS command sends a copy of the procedure output to the SYS$PRINT printer queue and to the default destination (*program-name*.LIS file). If you want to send the procedure output to a different printer, you must redefine the SYS$PRINT logical name.

PROC PRINTTO PRINT=*fileref*;
: This procedure statement sends the procedure output to a printer during a noninteractive job. You must have defined *fileref* in a FILENAME statement or function with the PRINTER device-type keyword. For more information, see “PRINTTO Procedure” on page 385 and “Device-Type Keywords” on page 400 in the FILENAME statement.

You can also use the DCL PRINT command to send the *program-name*.LIS file to the printer after a noninteractive job finishes.

Routing Procedure Output to a Disk File

To send the procedure output to a disk file in noninteractive mode, choose one of the following methods:

$ SAS/PRINT=*file-specification program-name*
This SAS command sends the procedure output to the disk file *file-specification* instead of the default destination (*program-name*.LIS file). The following is an example of this command:

```
$ SAS/PRINT=MYPROG.LIS PROG1
```

$ SAS/ALTPRINT=*file-specification program-name*
This SAS command sends a copy of the procedure output to the file *file-specification* and to the default destination (*program-name*.LIS file). The following is an example of this command:

```
$ SAS/ALTPRINT=MYPROG.LIS PROG1
```

PROC PRINTTO PRINT=*file-specification*;
This procedure statement sends any following procedure output to the disk file associated with *file-specification* during a noninteractive job. The value for *file-specification* can be any valid external file specification discussed in "Identifying External Files to SAS" on page 173.

Routing Output in Batch Mode

Default Output Destination in Batch Mode

The default for handling output in batch mode is similar to noninteractive mode. When you invoke SAS in batch mode, the SAS log is written to a file with OpenVMS file type .LOG, and the procedure output is written to a file with OpenVMS file type .LIS in the default directory of the command procedure within which SAS was invoked. Typically, the default directory for a batch job is the SYS$LOGIN directory. You can change the default by using a SET DEFAULT command in the BATCH command file. The filename for the .LOG and .LIS files is the name of the SAS program file that you specified in the SAS command.

In addition to the .LOG and .LIS files that are created for SAS output, the OpenVMS system also creates an OpenVMS log file in batch mode. The OpenVMS batch log is named *command-file*.LOG, where *command-file* is the command procedure that you submitted for execution. Do not confuse the OpenVMS log with the SAS log. Both have the OpenVMS file type .LOG, but the OpenVMS log contains commands and messages that are generated by OpenVMS when it processes any batch job, including a SAS batch job. The SAS log contains statements and messages that are generated by SAS.

CAUTION:

Do not give your SAS program and the command procedure the same name. This causes confusion when the OpenVMS and SAS logs are created. If this does occur, the OpenVMS log is created first (for example MYPROG.LOG;1) and the SAS log is created second (MYPROG.LOG;2). If you cannot keep more than one version of a file (perhaps because file version limits are in effect), the OpenVMS batch log is overwritten with the SAS log. △

Routing Log and Procedure Output to a Printer

You can send the SAS log and procedure output to a printer instead of to the default .LOG and .LIS files. To redirect the SAS log and procedure output to the queue of the system printer, use SYS$PRINT as the value for the LOG=, ALTLOG=, PRINT=, and ALTPRINT= system options, where appropriate. You can also use the DCL PRINT command to send the .LOG and .LIS files to the printer after a batch job has finished.

Using the PRTFILE Command under OpenVMS

The PRTFILE command enables you to change the control information for a file that you are routing to a printer. For example, if you want to send a file to a printer queue other than the default, submit the following FILENAME statement:

```
filename woutput printer queue=myqueue;
```

Then you can issue the following series of commands from the command line of a window to send the contents of the window to the MYQUEUE printer queue:

```
prtfile woutput
print
free
```

After you issue the PRTFILE command, a note in the SAS log indicates that the output was sent to a file named SAS *nnnn.DAT*. This is a temporary file that is deleted when you issue the PRINT command.

As another example, the following FILENAME statement associates the fileref MYFILE with the external file [MYDIR]SPECIAL.SAS and specifies that the carriage-control format is FORTRAN:

```
filename myfile '[mydir]special.sas' cc=fortran;
```

Then the following series of commands from the command line of a window sends the contents of the window to the external file SPECIAL.SAS:

```
prtfile woutput
print myfile
free
```

Note: Do not use the PRTFILE command with the FSFORM command. For information about the FSFORM command, see “Host-Specific Frames of the Form Window” on page 272. △

CHAPTER

9

Accessing External Shareable Images from SAS

Overview of Shareable Images in SAS

What is a Shareable Image?

Shareable images are executable files that contain one or more routines written in any of several programming languages. A shareable image is created when you use the /SHAREABLE qualifier with the **LINK** command. Shareable images are a mechanism for storing useful routines that might be needed by many applications. When an application needs a routine that resides in a shareable image, it loads the shareable image and invokes the routine.

Invoking Shareable Images from within SAS

SAS provides routines and functions that let you invoke these external routines from within SAS. You can access the shareable image 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, MODULEC, MODULEI, MODULEIN, and MODULEIC) to invoke a routine that resides in an external shareable image. This documentation refers to the MODULE family of call routines and functions generically as the MODULE function.

Steps for Accessing an External Shareable Image

The following are the steps for accessing an external shareable image routine:

1 Create a text file that describes the shareable image routine you want to access, including the arguments it expects and the values it returns (if any). This attribute file must be in a special format, as described in "The SASCBTBL Attribute Table" on page 208.

2 Use the FILENAME statement to assign the SASCBTBL fileref to the attribute file you created.

3 In a DATA step or SCL code, use a call routine or function (MODULE, MODULEN, or MODULEC) to invoke the shareable image routine. The specific function 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 MODULE function is described in "MODULE Function" on page 341.

CAUTION:
Only experienced programmers should access external routines in shareable images. By accessing a function in an external shareable image, you transfer processing control to the external function. If done improperly, or if the external function is not reliable, you might lose data or have to reset your computer (or both). △

The SASCBTBL Attribute Table

How the MODULE Function Works

Because the MODULE function invokes an external function that SAS knows nothing about, you must supply information about the function's arguments so that the

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 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 you can invoke with the MODULE function. The table defines how the MODULE function should interpret supplied arguments when it is building a parameter list to pass to the called routine.

The MODULE function locates the table by opening the file that is referenced by the SASCBTBL fileref. If you do not define this fileref, the MODULE routines simply call the requested shareable image routine without altering the arguments.

CAUTION:

Using the MODULE functions without defining an attribute table can cause SAS to crash or force you to reset your computer. You need to use an attribute table for all external functions that you want to invoke. △

Syntax of the Attribute Table

The attribute table should contain the following:

- a description in a ROUTINE statement for each shareable image routine you intend to call
- descriptions in ARG statements for each argument associated with that routine.

At any point in the attribute table file, you can create a comment using an asterisk (*) as the first nonblank character of a line or after the end of a statement (following the semicolon). You must end the comment with a semicolon.

ROUTINE Statement

The syntax of the ROUTINE statement is

ROUTINE *name* MINARG=*minarg* MAXARG=*maxarg*
<CALLSEQ=BYVALUE | BYADDR>
<TRANSPOSE=YES | NO> <MODULE=*shareable-image-name*>
<RETURNS=SHORT | USHORT | LONG | ULONG | DOUBLE | DBLPTR >;

The following are descriptions of the ROUTINE statement attributes:

ROUTINE *name*

starts the ROUTINE statement. You need a ROUTINE statement for every shareable image function that you intend to call. The value for *name* must match the routine name or ordinal you specified as part of the '*module*' argument in the MODULE function, where *module* is the name of the shareable image (if not specified by the MODULE attribute), followed by a comma, and then the routine name or ordinal. For example, in order to specify **`KERNEL32,GetPath`** in the MODULE function call, the ROUTINE *name* should be **`GetPath`**.

The *name* argument is required for the ROUTINE statement.

MINARG=*minarg*
: specifies the minimum number of arguments to expect for the shareable image routine. In most cases, this value will be the same as MAXARG; but some routines do allow a varying number of arguments. This is a required attribute.

MAXARG=*maxarg*
: specifies the maximum number of arguments to expect for the shareable image routine. This is a required attribute.

CALLSEQ=BYVALUE | BYADDR
: indicates the calling sequence method used by the shareable image routine. Specify BYVALUE for call-by-value and BYADDR for call-by-address. The default value is BYADDR.

  FORTRAN and COBOL are call-by-address languages. C is usually call-by-value, although a specific routine might be implemented as call-by-address.

  The 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 shareable image routine. This attribute applies only to routines called from within PROC IML with MODULEI, MODULEIC, and MODULEIN.

  TRANSPOSE=YES is necessary when you are calling a 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 will expect this matrix as 10, 13, 11, 14, 12, 15.

  The default value is NO.

MODULE=*shareable-image-name*
: names the executable module (the shareable image) in which the routine resides. The MODULE function searches the directories named by the SAS$LIBRARY environment variable. If you specify the MODULE attribute here in the ROUTINE statement, then you do not need to include the module name in the *module* argument of the MODULE function (unless the shareable image routine name you are calling is not unique in the attribute table). The MODULE function is described in “MODULE Function” on page 341.

  You can have multiple ROUTINE statements that use the same MODULE name. You can also have duplicate routine names that reside in different shareable images.

RETURNS=SHORT | USHORT | LONG | ULONG | DOUBLE | DBLPTR
: specifies the type of value that the shareable image routine returns. This value will be converted as appropriate, depending on whether you use MODULEC (which returns a character) or MODULEN (which returns a number). The following are the possible return value types:

  SHORT
  : short integer.

USHORT
: unsigned short integer.

LONG
: long integer.

ULONG
: unsigned long integer.

DOUBLE
: double-precision floating point number.

DBLPTR
: pointer to a double-precision floating point number (instead of using a floating point register). Consult the documentation for your shareable image routine to determine how it handles double-precision floating point values.

If you do not specify the RETURNS attribute, you should invoke the routine with only the MODULE and MODULEI call routines. You will get unpredictable values if you omit the RETURNS attribute and invoke the routine using the MODULEN/MODULEIN or MODULEC/MODULEIC functions.

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 that the arguments will be specified within the MODULE routines.

The syntax for each ARG statement is

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. This a required attribute. Define the arguments in ascending order, starting with the first routine argument (ARG 1).

NUM | CHAR
: defines the argument as numeric or character. This is a required attribute.

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 shareable image routine. If you specify OUTPUT, the argument is *not* converted, but is updated with an outgoing value from the shareable image routine. If you specify UPDATE, the argument is converted, passed to the shareable image 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 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 would specify:

```
call module('XYZ',1,,3);
```

CAUTION:

Be careful when using NOTREQD; the shareable image 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, your system is likely to crash. △

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 which 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 MODULE function encounters another FDSTART argument.

FORMAT=*format*

names the format that presents the argument to the shareable image routine. Any SAS supplied formats, 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, since format specification is the primary purpose of the ARG statements in the attribute table.

CAUTION:

Using an incorrect format can produce invalid results or cause a system crash. △

The Importance of the Attribute Table

The MODULE function relies heavily on the accuracy of the information in the attribute table. If this information is incorrect, unpredictable results can occur (including a system crash).

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.

Now suppose you call **xyz** using the 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, this might also cause you to lose data or cause your system to crash.

Also, note that the PEEKLONG and PEEKCLONG functions rely on the validity of the pointers you supply. If the pointers are invalid, it is possible that SAS could crash. For example, this code would cause a crash:

```
data _null_;
   length c $10;
     /* trying to copy from address 0!!!*/
   c = peekclong(0,10);
run;
```

Note: SAS does not support return types for 64-bit pointers. △

Special Considerations When Using External Shareable Images

32-Bit and 64-Bit Considerations

Compatibility between Your Shareable Images and SAS

Starting in SAS System 9, SAS is a 64-bit application that runs on an operating system that is 64-bit enabled. When you call external routines in shareable images using the MODULE functions, the shareable image needs to be of the same bit family as the version of SAS you are running. If you are running SAS 9.1, then the shareable image needs to be 64-bit. If you are using a previous release of SAS, then the shareable image needs to be 32-bit.

For information about how to compile and link to a 64-bit shareable image, see "Using PEEKLONG Functions to Access Character String Arguments" on page 214.

Note: SAS does not support return types for 64-bit pointers. △

Memory Storage Allocated by the Shareable Image

When specifying your SAS format and informat for each routine argument in the FORMAT attribute of the ARG statement, you need to consider the amount of memory storage the external shareable image allocates for the parameters that it receives and returns. The data types of the external routine will determine the SAS format and informat to be used in the SASCBTBL attribute table. To determine how much storage is being reserved for the input and return parameters of the routine in the external shareable image, you can use the **`sizeof()`** C function.

The following table lists the typical memory allocations for C data types for 32-bit and 64-bit systems.

Table 9.1 Memory Allocations for C Data Types

	32-Bit System Size		64-Bit System Size	
Type	Bytes	Bits	Bytes	Bits
char	1	8	1	8
short	2	16	2	16
int	4	32	4	32
long	4	32	4	32
long long	8	64	8	64
float	4	32	4	32
double	8	64	8	64
pointer	4	32	8	64

For information about the SAS formats to use for your data types, see "Specifying Formats and Informats to Use with MODULE Arguments" on page 220.

Naming Considerations When Using Shareable Images

SAS automatically loads external shareable images that conform to the following naming conventions:

- the name is eight characters or less
- the name does not contain a period.

If the name of your external shareable image is greater than eight characters or contains a period, then you can create a logical name to point to the destination of the shareable image. The following code shows how to define the logical name LIBCLNK:

```
$ define libclnk $1$disk:[tmp]libraryclink.exe
```

After the new logical name is created, you can update the MODULE= statement in the attribute table. In the following example, MODULE= is set to the name of the new logical name, LIBCLNK.

```
routine name minarg=2 maxarg=2 returns=short module=libclink;
arg 1 char output byaddr fdstart format=$cstr9.;
arg 2 char output                format=$cstr9.;
```

Using PEEKLONG Functions to Access Character String Arguments

Since the SAS language does not provide pointers as data types, you can use the SAS PEEKLONG functions to access the data stored at these address values.

For example, the following C program demonstrates how the address of a pointer is supplied, and how it can set the pointer to the address of a static table containing the contiguous integers 1, 2, and 3. It also calls the **useptr** routine in the **vmslib** shareable image on a 64-bit operating system.

```
#include <stdarg.h>
#include <stdio.h>

static struct MYTABLE
   {
```

```
   int value1;
   int value2;
   int value3;
   }

mytable = {1,2,3};

useptr(toset)
char **toset;
   {
   *toset = (char *)&mytable;
   }
```

The following code shows how the C source code is then compiled and linked using a DCL command file, such as VMSLIB.COM.

```
$!Compiles are required to use /float=IEEE because SAS treats
$!floats as IEEE S or D-Floats on OpenVMS Alpha.
$ cc/decc/float=ieee/obj=vmslib.o/pointer=64 vmslib.c
$ open/write optfile vmslib.opt
$ write optfile ''symbol_vector=(useptr=procedure)''
$ write optfile ''vmslib.o''
$ close optfile
$ link/exe=vmslib.exe/share/bpage=13/map/cross/full vmslib.opt/opt
```

The SAS source code needed to create the SASCBTBL attribute table and call the routine from within the DATA step is the following:

```
filename sascbtbl 'sas$worklib:temp.dat';
data _null_;
   file sascbtbl;
   input;
   put _infile_;
   datalines4;
routine useptr minarg=1 maxarg=1 module=vmslib;
arg 1 char update format=$char20.;
;;;;
data _null_;
   length ptrval $20 thedata $12;
   call module('*i','useptr',ptrval);
   thedata=peekclong(ptrval,12);

   /* Converts hexadecimal data to character data */
   put thedata=$hex24.;

   /* Converts hexadecimal positive binary values to fixed
      or floating point values */
   put ptrval=hex40.;
run;
```

Note: PEEKCLONG is used in this example because SAS 9.1 is 64-bit enabled. △

The SAS log output would be the following:

Output 9.1 Log Output for Using PEEKLONG Functions To Access Character Strings

```
thedata=010000000200000003000000
ptrval=00202F010000000020202020202020202020202020
```

In this example, the PEEKCLONG function is given two arguments:

- a pointer via a numeric variable
- a length in bytes.

PEEKCLONG returns a character string of the specified length containing the characters that are at the pointer location.

For more information, see "PEEKLONG Function" on page 345.

Accessing External Shareable Images Efficiently

The MODULE function reads the attribute table that is referenced by the SASCBTBL fileref once per step (DATA step, PROC IML step, or SCL step). It parses the table and stores the attribute information for future use during the step. When you use the MODULE function, SAS searches the stored attribute information for the matching routine and module names. The first time you access a shareable image during a step, SAS loads the shareable image and determines the address of the requested routine. Each shareable image you invoke stays loaded for the duration of the step, and is not reloaded in subsequent calls. For example, suppose the attribute table had the following basic form:

```
* routines XYZ and BBB in FIRST.EXE;
routine XYZ minarg=1 maxarg=1 module=first;
arg 1 num input;
routine BBB minarg=1 maxarg=1 module=first;
arg 1 num input;
* routines ABC and DDD in SECOND.EXE;
routine ABC minarg=1 maxarg=1 module=second;
arg 1 num input;
routine DDD minarg=1 maxarg=1 module=second;
arg 1 num input;
```

and the DATA step looked like the following:

```
filename sascbtbl 'myattr.tbl';
data _null_;
   do i=1 to 50;
      /* FIRST.EXE is loaded only once */
      value = modulen('XYZ',i);

      /* SECOND.EXE is loaded only once */
      value2 = modulen('ABC',value);
      put i= value= value2=;
   end;
run;
```

In this example, MODULEN parses the attribute table during DATA step compilation. In the first loop iteration (i=1), FIRST.EXE is loaded and the XYZ routine is accessed when MODULEN calls for it. Next, SECOND.EXE is loaded and the ABC routine is accessed. For subsequent loop iterations (starting when i=2), FIRST.EXE and SECOND.EXE remain loaded, so the MODULEN function simply accesses the XYZ and ABC routines.

Note that the attribute table can contain any number of descriptions for routines that are not accessed for a given step. This does not cause any additional overhead (apart from a few bytes of internal memory to hold the attribute descriptions). In the above example, BBB and DDD are in the attribute table but are not accessed by the DATA step.

Grouping SAS Variables as Structure Arguments

A common need when calling external routines is to pass a pointer to a structure. Some parts of the structure might be used as input to the routine, while 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 MODULE function that you want a particular set of arguments grouped into a single structure. You indicate this 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 that follow (until encountering another FDSTART option) into a single contiguous block, and passes a pointer to the block as an argument to the shareable image routine.

Example of Grouping SAS Variables as Structure Arguments

This example uses the **uname** routine that is part of Compaq's DEC C Run-Time Library on the OpenVMS Alpha environment. It is used with permission of Compaq Computer Corporation. This routine returns information about your computer system. This information includes the following:

- the nodename on which you are executing SAS
- the version of the operating system
- the vendor of the operating system
- the machine identification number
- the model type of your machine.

Since a shareable image name is required when using the MODULE functions, you first need to create your own shareable image that contains a routine that will include the **uname** routine for your use.

The C source code for VMSLIB.C is the following:

```
#include <stdarg.h>
#include <stdio.h>
#include <string.h>
#include <utsname.h>

   /* The header file <utsname.h> declares the uname prototype and
   defines the utsname struct as:
      int uname(struct utsname *name);

      struct utsname
         {
         char sysname [31+1];
         char release [31+1];
         char version [31+1];
         char machine [31+1];
         char nodename[1024+1];
```

```
            #ifndef _POSIX_C_SOURCE
            char arch    [15+1];
            char __spare [256+1];
            #else
            char __spare [15+1+256+1];
            #endif
            };
      */

   int vmsuname(struct utsname *name)
      {
      int rc;
      struct utsname vmsname;

      /* The Compaq DEC C Run-Time Library function ''uname()'' is one of the few
      functions that does not accept 64-bit pointers; so you need to declares a
      32-bit pointer &vmsname to pass into uname() in order to access
      the necessary information */

      if ((rc=uname(&vmsname))!=0)
         perror(''vmslib'');
      else
         {

         /* printf's used for debugging:
         printf(''vmsname(%d) = %d\n'',sizeof(vmsname),&vmsname);
         printf(''sysname(%d) = %s\n'',sizeof(vmsname.sysname),vmsname.sysname);
         printf(''release(%d) = %s\n'',sizeof(vmsname.release),vmsname.release);
         printf(''version(%d) = %s\n'',sizeof(vmsname.version),vmsname.version);
         printf(''machine(%d) = %s\n'',sizeof(vmsname.machine),vmsname.machine);
         printf(''nodename(%d)= %s\n'',sizeof(vmsname.nodename),vmsname.nodename);
         printf(''arch(%d)    = %s\n'',sizeof(vmsname.arch), vmsname.arch);
         printf(''spare(%d)   = %s\n'',sizeof(vmsname.__spare),''Filler'');
         printf(''\n'');
         */

         */ Since a 32-bit address &vmsname was used to get the information it is
         necessary to copy that information over to the 64-bit location (name)
         sent in as an argument to vmsuname */

         strcpy(name->sysname,vmsname.sysname);
         strcpy(name->release,vmsname.release);
         strcpy(name->version,vmsname.version);
         strcpy(name->machine,vmsname.machine);
         strcpy(name->nodename,vmsname.nodename);
         strcpy(name->arch,vmsname.arch);
         strcpy(name->__spare,vmsname.__spare);
         }

      return(rc);
      }
```

The following example shows how the C source code could be compiled and linked using a DCL Command file, such as VMSLIB.COM:

```
$!Compiles are required to use /float=IEEE because SAS treats
$!floats as IEEE S or D-Floats on OpenVMS Alpha.
$ cc/decc/float=ieee/obj=vmslib.o/pointer=64 vmslib.c
$ open/write optfile vmslib.opt
$ write optfile ''symbol_vector=(vmsuname=procedure)''
$ write optfile ''vmslib.o''
$ close optfile
$ link/exe=vmslib.exe/share/bpage=13/map/cross/full vmslib.opt/opt
```

The SAS source code used to create the SASCBTBL attribute table and call the routine from within the DATA step is the following:

```
filename sascbtbl 'sas$worklib:temp.dat';
data _null_;
   file sascbtbl;
   input;
   put _infile_;
   datalines4;
routine vmsuname minarg=7 maxarg=7 returns=short module=vmslib;
arg 1 char output byaddr fdstart format=$cstr32.;
arg 2 char output                format=$cstr32.;
arg 3 char output                format=$cstr32.;
arg 4 char output                format=$cstr32.;
arg 5 char output                format=$cstr1025;
arg 6 char output                format=$cstr16.;
arg 7 char output                format=$cstr257;
;;;;
data _null_;
   length sysname $32 release $32 version $32 machine $32 nodename $1025 arch $16
      spare $257.;
   retain sysname release version machine nodename arch spare '' '';
   rc=modulen('vmsuname',sysname,release,version,machine,nodename,arch,spare);
   put rc      =;
   put sysname =;
   put release =;
   put version =;
   put machine =;
   put nodename=;
   put arch    =;
run;
```

The SAS log output would be the following:

Output 9.2 Log Output for Grouping SAS Variables as Structure Arguments

```
rc=0
sysname=OpenVMS
release=0
version=V7.2--2
machine=AlphaServer_4100_5/533_4MB
nodename=AX4000
arch=Alpha
```

Using Constants and Expressions as Arguments to MODULE

You can pass any kind of expression as an argument to the 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 MODULE function cannot perform the update (meaning that the value of the argument you wanted to update will be 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 above example, the first call to MODULE is correct because **x** is updated by the value that the **abc** routine returns for the second argument. The second call to MODULE is not correct 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 not correct because an arithmetic expression is passed, which 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

You specify the SAS format and informat for each shareable image routine argument by specifying the FORMAT attribute in the ARG statement. The format indicates how numeric and character values should be passed to the shareable image routine and how they should be read back upon completion of the routine.

Usually, the format 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

C Type	SAS Format/Informat
double	RB8.
float	FLOAT4.
signed int	IB4.

C Type	SAS Format/Informat
signed short	IB2.
signed long	IB4.
char *	IB8.
unsigned int	PIB4.
unsigned short	PIB2.
unsigned long	PIB4.
char[*w*]	$CHAR*w*. or $CSTR*w*. (see "$CSTR*w*. Format" on page 222)

Note: For information about passing character data other than as pointers to character strings, see "$BYVAL*w*. Format" on page 223. △

FORTRAN Language Formats

FORTRAN Type	SAS Format/Informat
integer*2	IB2.
integer*4	IB4.
real*4	RB4.
real*8	RB8.
character**w*	$CHAR*w*.

The MODULE function can support FORTRAN character arguments only if they are not expected to be passed by a descriptor.

PL/I Language Formats

PL/I Type	SAS Format/Informat
FIXED BIN(15)	IB2.
FIXED BIN(31)	IB4.
FLOAT BIN(21)	RB4.
FLOAT BIN(31)	RB8.
CHARACTER(*w*)	$CHAR*w*.

The PL/I descriptions are added here for completeness. This does not guarantee that you will be able to invoke PL/I routines.

COBOL Language Formats

COBOL Format	SAS Format/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

The following COBOL specifications might not match properly with the SAS supplied formats because zoned and packed decimal are not truly defined for systems based on Intel architecture.

COBOL Format	SAS Format/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 only usable in conjunction with the corresponding S370F*xxx* informat and format, which enables IBM mainframe-style representations to be read and written in the PC environment.

COBOL Format	SAS Format/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
PIC *xxxx* BINARY	S370FIBU*w*.	integer binary unsigned
PIC *xxxx* PACKED-DECIMAL	S370FPDU*w*.	packed decimal unsigned

$CSTR*w*. Format

If you pass a character argument as a null-terminated string, use the $CSTR*w*. format. This format looks for the last nonblank character of your character argument and passes a copy of the string with a null terminator after the last nonblank character. For example, given the following attribute table entry:

```
* attribute table entry;
routine abc minarg=1 maxarg=1;
arg 1 input char format=$cstr10.;
```

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. This is equivalent to the following attribute entry:

```
* attribute table entry;
routine abc minarg=1 maxarg=1;
arg 1 input char format=$char10.;
```

with 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 shareable image routine is supposed to update a character argument, use the $CSTR informat in the argument attribute.

$BYVAL*w*. Format

When you use the 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/informat called $BYVAL*w*. The $BYVAL*w*. format/informat expects a single character and will produce a numeric value, the size of which depends on *w*, the value of width. $BYVAL2. produces a short, $BYVAL4. produces a long, and $BYVAL8. produces a double. 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 long is an **`X`**, the actual value of the long is 88 in decimal. This is because an ASCII **`X`** is stored as hex 58, and this is promoted to a long, represented as 0x00000058 (or 88 decimal). If the value of **`a`** is **`X`**, or 88, then a 1 is returned. If the second argument, a double, is **`Y`** (which is interpreted as 89), then 2 is returned.

Now suppose that you want to pass characters as the arguments to **xyz**. In C, you would invoke them as follows:

```
x = xyz('X',(double)'Z');
y = xyz('Q',(double)'Y');
```

This is because the **X** and **Q** values are automatically promoted to integers (which are the same as longs for the sake of this example), and the integer values corresponding to **Z** and **Y** are cast to doubles.

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 it is important that the BYVALUE option appears 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 it characters:

```
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.EXE). In the example, MODULEIN passes the constant 6 and the matrix x2, which is a 4x5 matrix to be converted to an integer matrix. The attribute table for **changi** is as follows:

```
routine changi module=trymod returns=long;
arg 1 input num format=ib4. byvalue;
arg 2 update num format=ib4.;
```

The following PROC IML step invokes MODULEIN:

```
proc iml;
     x1 = J(4,5,0);
     do i=1 to 4;
        do j=1 to 5;
           x1[i,j] = i*10+j+3;
           end;
        end;
     y1= x1;
             x2 = x1;
                      y2 = y1;
     rc = modulein('*i','changi',6,x2);
     ....
```

The `'*i'` control string causes the lines shown in the following output to be printed in the log.

Output 9.3 MODULEIN Log Output

```
---PARM LIST FOR MODULEIN ROUTINE---  CHR PARM 1 885E0AA8 2A69 (*i)
CHR PARM 2 885E0AD0 6368616E6769 (changi)
NUM PARM 3 885E0AE0 0000000000001840
NUM PARM 4 885E07F0
0000000000002C400000000000002E40000000000000304000000000000031400000000000003240
0000000000003840000000000000394000000000000003A4000000000000003B400000000000003C40
0000000000004140000000000080414000000000
---ROUTINE changi LOADED AT ADDRESS 886119B8 (PARMLIST AT 886033A0)--- PARM 1 06000000     <CALL-BY-VALUE>
PARM 2 88604720
0E0000000F000000100000001100000012000000180000001900000001A0000001B0000001C000000
22000000230000002400000025000000260000002C0000002D0000002E0000002F00000030000000
---VALUES UPON RETURN FROM changi ROUTINE---   PARM 1 06000000     <CALL-BY-VALUE>
PARM 2 88604720
140000001F0000002A00000035000000400000008200000008D00000098000000A3000000AE000000
F0000000FB000000060100001101000001C0100005E010000690100007401000007F0100008A010000
---VALUES UPON RETURN FROM MODULEIN ROUTINE---  NUM PARM 3 885E0AE0 0000000000001840
NUM PARM 4 885E07F0
0000000000003440000000000000003F400000000000004540000000000000804A400000000000005040
00000000004060400000000000A061400000000000006340000000000060644000000000000C06540
0000000000006E400000000000606F4000000000
```

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, 885E0AA8 is the actual address of the first character parameter to MODULEIN. The value at the address is hex 2A69, and the ASCII representation of that value ('*i') is in parentheses after the hex value. The second parameter is likewise printed similarly. Only these first two arguments have their ASCII equivalents printed; this is because other arguments might contain unreadable binary data.

  The remaining parameters appear with only hex 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 885E0AE0. The hex representation of the floating point number 6 is shown. The fourth parameter is at address 885E07F0, 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 second 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 first parameter 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 calling routine.

Examples of Accessing External Shareable Images from SAS

Example 1: Updating a Character String Argument

This example uses the **tmpnam** routine that is part of Compaq's DEC C Run-Time Library under the OpenVMS Alpha environment. The **tmpnam** routine generates a unique filename that can safely be used as a temporary filename.

The C source code for VMSLIB.C is the following:

```
#include <stdio.h>   /* Declares prototype:  char * tmpnam(char *s); */
#include <string.h>

vmstmpnam(char *s)
   {
   tmpnam(s);
   printf(''tmpnam(%d) = %s\n'',sizeof(s),s);

   return(0);
   }
```

The following code shows how the C source code could be compiled and linked using a DCL Command file, such as VMSLIB.COM.

```
$!Compiles are required to use /float=IEEE because SAS treats
$!floats as IEEE S or D-Floats on OpenVMS Alpha.
$ cc/decc/float=ieee/obj=vmslib.o/pointer=64 vmslib.c
$ open/write optfile vmslib.opt
$ write optfile ''symbol_vector=(vmstmpnam=procedure)''
$ write optfile ''vmslib.o''
$ close optfile
$ link/exe=vmslib.exe/share/bpage=13/map/cross/full vmslib.opt/opt
```

The following SAS source code can be used to create the SASCBTBL attribute table and call the routine from within the DATA step.

```
filename sascbtbl 'sas$worklib:temp.dat';
data _null_;
   input;
   put _infile_;
   datalines4;
routine vmstmpnam minarg=1 maxarg=1 module=vmslib;
arg 1 char update byaddr format=$cstr255.;
;;;;
data _null_;
   length tempname $255;
   retain tempname '' '';
   tret = modulec('vmstmpnam',tempname);
   put tempname = ;
run;
```

The SAS log output would be:

Output 9.4 Log Output for Updating a Character String Argument

```
tempname=aaa383073
```

The POSIX standard for the maximum number of characters in a pathname is defined in <limits.h> to be 255 characters. Consequently, this example uses 254 characters as the length of the generated filename, **tempname**, with one character reserved for the null-terminator. The $CSTR255. informat ensures that the null-terminator and all subsequent characters are replaced by trailing blanks when control returns to the DATA step.

Example 2: Passing Arguments by Value

This example calls the **access** routine that is part of Compaq's DEC C Run-Time Library under OpenVMS Alpha. This routine is used with the permission of Compaq Computer Corporation. The **access** routine checks for the existence and accessibility of a file according to the bit pattern contained in the mode argument. A return value of 0 indicates a successful completion and the requested access is permitted. A return value of -1 indicates a failure, and the requested access is not permitted.

Because the mode argument is passed by value, this example includes the BYVALUE option for arg 2 in the attribute table. If both arguments were pass by value, you could use the CALLSEQ=BYVALUE attribute in the ROUTINE statement, and it would not be necessary to specify the BYVALUE option in arg 2.

The C source code for the VMSLIB.C is:

```
#include <unistd.h>
#include <stdlib.h>
#include <stdio.h>

   /* The header file <unistd.h> declares the access prototype and defines the
bit patterns for mode as:

   int access(const char *file_spec,int mode);

   #define F_OK   0   ... File existence
   #define X_OK   1   ... Execute access
   #define W_OK   2   ... Write access
   #define R_OK   4   ... Read access

   A logical OR of these values will test for more than one bit pattern. */

int vmsaccess(const char *file_spec,int mode)
   {
   int rc;

   if ((rc=access(file_spec,mode)) == -1)
      perror(‘‘vmsaccess’’);

   return(rc);
   }
```

The following example shows how the C source code is compiled and linked using a DCL Command file, such as VMSLIB.COM:

```
$!Compiles are required to use /float=IEEE because SAS treats
$!floats as IEEE S or D-Floats on OpenVMS Alpha.
$ cc/decc/float=ieee/obj=vmslib.o/pointer=64 vmslib.c
$ open/write optfile vmslib.opt
$ write optfile ‘‘symbol_vector=(vmsaccess=procedure)’’
$ write optfile ‘‘vmslib.o’’
$ close optfile
$ link/exe=vmslib.exe/share/bpage=13/map/cross/full vmslib.opt/opt
```

The following SAS source code can be used to create the SASCBTBL attribute table and call the routine from within the DATA step.

```
filename sascbtbl ’sas$worklib:temp.dat’;
data _null_;
   file sascbtbl;
   input;
   put _infile_;
   datalines4;
routine vmsaccess minarg=2 maxarg=2 returns=short module=vmslib;
arg 1 char input byaddr  format=$cstr200.;
arg 2 num  input byvalue format=ib4.;
;;;;
data _null_;
   length path $200.;
   /* A test file’s permissions have been modified to the following:
   set protection vmstest.com/prot=(system:r,owner:r,group:r,world:r) */
   path=’sys$login:vmstest.com’;
   /* User is testing for Write and Execute permissions (W_OK | E_OK) */
   rc = modulen( ‘‘*ie’’, ’vmsaccess’, path, 3 );
   put rc = ;
run;
```

The SAS log output would be the following:

Output 9.5 Log Output for Failure

```
rc=-1
```

This return code means that one of the following conditions was true:

- □ the file did not have the bit pattern you were searching for
- □ the file could not be located in the specified path.

This return code means that requested access is not permitted.
The SAS source code is changed to check for read permissions,

```
rc = modulen( ‘‘*ie’’, ’vmsaccess’, path, 4);
```

then the SAS log output is the following:

Output 9.6 Log Output for Successful Completion

```
rc=0
```

Example 3: Invoking a Shareable Image Routine from PROC IML

This example shows how to pass a matrix as an argument within PROC IML. The example creates a 4x5 matrix. Each cell is set to 10*x*+*y*+3, where *x* is the row number and *y* is the column number. For example, the cell at row 1 column 2 is set to (10*1)+2+3, or 15.

The example invokes several routines from the theoretical TRYMOD shareable image. It uses the **changd** routine to add 100*x*+10*y* to each element, where *x* is the C row number (0 through 3) and *y* is the C column number (0 through 4). The first argument to **changd** specifies the extra amount to sum. The **changdx** routine works just like **changd**, except that it expects a transposed matrix. The **changi** routine works like **changd** except that it expects a matrix of integers. The **changix** routine works like **changdx** except that integers are expected.

Note: A maximum of three arguments can be sent when invoking a shareable image routine from PROC IML. △

In this example, all four matrices x1, x2, y1, and y2 should become set to the same values after their respective MODULEIN calls. Here are the attribute table entries:

```
routine changd module=trymod returns=long;
arg 1 input num format=rb8. byvalue;
arg 2 update num format=rb8.;
routine changdx module=trymod returns=long transpose=yes;
arg 1 input num format=rb8. byvalue;
arg 2 update num format=rb8.;
routine changi module=trymod returns=long;
arg 1 input num format=ib4. byvalue;
arg 2 update num format=ib4.;
routine changix module=trymod returns=long transpose=yes;
arg 1 input num format=ib4. byvalue;
arg 2 update num format=ib4.;
```

Here is the PROC IML step:

```
proc iml;
   x1 = J(4,5,0);
      do i=1 to 4;
         do j=1 to 5;
            x1[i,j] = i*10+j+3;
         end;
      end;
   y1= x1; x2 = x1; y2 = y1;
   rc = modulein('changd',6,x1);
   rc = modulein('changdx',6,x2);
   rc = modulein('changi',6,y1);
   rc = modulein('changix',6,y2);
   print x1 x2 y1 y2;
run;
```

The following are the results of the PRINT statement:

Output 9.7 Invoking a Shareable Image Routine from PROC IML

```
X1
 20        31        42        53        64
130       141       152       163       174
240       251       262       273       284
350       361       372       383       394
 X2
 20        31        42        53        64
130       141       152       163       174
240       251       262       273       284
350       361       372       383       394
 Y1
 20        31        42        53        64
130       141       152       163       174
240       251       262       273       284
350       361       372       383       394
 Y2
 20        31        42        53        64
130       141       152       163       174
240       251       262       273       284
350       361       372       383       394
```

PART 2

Application Considerations

CHAPTER 10 Data Representation

Numeric Variables in the Alpha Environment

The default length of numeric variables in SAS data sets is 8 bytes. (You can change the length of SAS numeric variables with the LENGTH statement in the DATA step.) In SAS under OpenVMS Alpha, the data type of numeric variables is IEEE double precision or T_FLOATING. The precision of an OpenVMS Alpha T_FLOATING value is expressed as 15 decimal digits, with a range for T_FLOATING numeric variables of 1.7E+308 to 2.3E–308.

In addition, with Alpha T_FLOATING numbers, you must specify a minimum length of 3 bytes using the LENGTH statement in the DATA step.

The issue of numeric precision affects the return values of almost all SAS math functions and many numeric values returned from SAS procedures. The following table shows the number of nontruncated significant digits and the largest integers that can be represented exactly with no loss of precision for each of the specified lengths.

Table 10.1 Significant Digits and Largest Integer for SAS Variables in the Alpha Environment

Length in Bytes	Significant Digits Retained	Largest Integer Represented Exactly
3	3	8,191
4	6	2,097,151
5	8	536,870,911
6	11	137,438,953,471
7	13	35,184,372,088,831
8	15	9,007,199,254,740,991

Missing Values under OpenVMS

In SAS under OpenVMS Alpha, missing values are represented by IEEE Not-a-Number values. An IEEE Not-a-Number is an IEEE floating-point bit pattern that represents something other than a valid numeric value. These numbers are not computationally derivable, meaning that the numeric representation for a Not-a-Number is artificially set. The bit pattern will never be generated by an arithmetic operation.

CHAPTER 11 Optimizing System Performance

Overview of Optimizing OpenVMS System Performance

All software users are concerned about system speed and resource consumption. This section provides suggestions that might increase performance and reduce resource consumption in the OpenVMS operating environment. Suggestions are grouped by SAS function: data set I/O, external file I/O, and system start-up.

SAS performance partially depends on the performance of the underlying OpenVMS environment. This document does not discuss how to improve the performance of your OpenVMS environment, but it does offer some suggestions, such as installing SAS images, that can aid OpenVMS system-wide performance.

Note: This section does not discuss OpenVMS hardware solutions to problems that are related to I/O. △

The suggestions described here are based on testing on an OpenVMS Alpha workstation with 64MB of memory and an attached SCSI disk drive. Both SAS performance data that is generated by the STIMER system option and information from the DCL SHOW STATUS command were used to collect data points.

Each suggestion includes the following information in a tabular summary at the beginning of each section:

Job type	is the type of SAS application affected.
User	is the person(s) who can implement the suggestion.
Usage	is a usage example.
Benefit	describes the potential benefits.
Cost	is the cost in system performance.

Use this information to help you decide which suggestions are suitable for your SAS applications.

Most of these suggestions have an associated cost, which can often involve a tradeoff between resources. For example, reduced I/O might require more memory consumption or greater CPU time. Pay careful attention to the possible costs of each suggestion. Some suggestions can cause performance degradation if they are misapplied.

Data Set I/O under OpenVMS

The information that is presented in this section applies to reading and writing SAS data sets. In general, the larger your data sets, the greater the potential performance gain for your entire SAS job. The performance gains that are described here were observed on data sets of approximately 100,000 blocks.

Allocating Data Set Space Appropriately

Job type	Jobs that write data sets.
User	SAS programmer.
Usage	Use ALQ=*x* and DEQ=*y* (or ALQMULT=*x* and DEQMULT=*y*) as LIBNAME statement options or as data set options, where *x* and *y* are values representing the number of blocks.
Benefit	There is up to a 50 percent decrease in elapsed time on write operations as reflected in fewer direct I/Os. File fragmentation is also reduced, thereby enhancing performance when you read the data set.
Cost	You will experience performance degradation when ALQ= or DEQ= values are incompatible with the data set size.

SAS initially allocates enough space for 10 pages of data for a data set. Each time the data set is extended, another 5 pages of space is allocated on the disk. OpenVMS maintains a bit map on each disk that identifies the blocks that are available for use. When a data set is written and then extended, OpenVMS alternates between scanning the bit map to locate free blocks and actually writing the data set. However, if the data sets were written with larger initial and extent allocations, then write operations to the data set would proceed uninterrupted for longer periods of time. At the hardware level, this means that disk activity is concentrated on the data set, and disk head seek operations that alternate between the bit map and the data set are minimized. The user sees fewer I/Os and faster elapsed time.

Large initial and extent values can also reduce disk fragmentation. SAS data sets are written using the RMS algorithm “contiguous best try.” With large preallocation, the space is reserved to the data set and does not become fragmented as it does when inappropriate ALQ= and DEQ= values are used.

SAS recommends setting ALQ= to the size of the data set to be written. If you are uncertain of the size, underestimate and use DEQ= for extents. Values of DEQ= larger than 5000 blocks are not recommended. For information about predicting data set size, see “Estimating the Size of a SAS Data Set under OpenVMS” on page 149.

The following is an example of using the ALQ= and DEQ= options:

```
libname x '[]';
/* Know this is a big data set. */
data x.big (alq=100000 deq=5000);
   length a b c d e f g h i j k l m
_n o p q r s t u v w x y z $200;
   do ii=1 to 13000;
   output;
end;
run;
```

Note: If you do not want to specify an exact number of blocks for the data set, use the ALQMULT= and DEQMULT= options. △

References for Allocating Data Set Space

- □ “ALQ= Data Set Option” on page 282
- □ “DEQ= Data Set Option” on page 289
- □ “ALQMULT= Data Set Option” on page 283
- □ “DEQMULT= Data Set Option” on page 290
- □ *Guide to OpenVMS File Applications*

Turning Off Disk Volume Highwater Marking

Job type	Any SAS application that writes data sets. Data set size is not important.
User	System manager.
Usage	Use the /NOHIGHWATER_MARKING qualifier when initializing disks. For active disks, issue the DCL command SET VOLUME/NOHIGHWATER_MARKING.
Benefit	There is a greater percentage gain for jobs that are write intensive. The savings in elapsed time can be as great as 40 percent. Direct I/Os are reduced.
Cost	There is no performance penalty. However, for security purposes, some OpenVMS sites might require this OpenVMS highwater marking feature to be set.

Highwater marking is an OpenVMS security feature that is enabled by default. It forces prezeroing of disk blocks for files that are opened for random access. All SAS data sets are random-access files and, therefore, pay the performance penalty of prezeroing, increased I/Os, and increased elapsed time.

Two DCL commands can be used independently to disable highwater marking on a disk. When initializing a new volume, use the NOHIGHWATER_MARKING qualifier to disable the highwater function as in the following example:

```
$ initialize/nohighwater $DKA470 mydisk
```

To disable volume highwater marking on an active disk, use a command similar to the following:

```
$ set volume/nohighwater $DKA200
```

References for Turning Off Disk Volume Highwater Marking

- □ *OpenVMS System Manager's Manual: Tuning, Monitoring, and Complex Systems*
- □ *OpenVMS DCL Dictionary A-M*

Eliminating Disk Fragmentation

Job type	Any jobs that frequently access common data sets.
User	SAS programmer and system manager.
Usage	Devote a disk to frequently accessed data sets, or keep your disks defragmented.
Benefit	The savings in elapsed time varies with the current state of the disk, but it can exceed 50 percent on write operations and 25 percent on read operations.
Cost	The cost to the user is the time and effort to better manage disk access. For the system manager, it can involve regularly defragmenting disks or obtaining additional disk drives.

Any software that reads and writes from disk benefits from a well-managed disk. This applies to SAS data sets. On an unfragmented disk, files are kept contiguous; thus, after one I/O operation, the disk head is well positioned for the next I/O operation.

A disk drive that is frequently defragmented can provide performance benefits. Use a frequently defragmented disk to store commonly accessed SAS data sets. In some situations, adding an inexpensive SCSI drive to the configuration allows the system manager to maintain a clean, unfragmented environment more easily than using a large disk farm. Data sets maintained on an unfragmented SCSI disk might perform better than heavily fragmented data sets on larger disks.

Defragmenting means a process that runs the OpenVMS Backup Facility after regular business hours. SAS does not recommend using dynamic defragmenting tools that run in the background of an active system because such programs can corrupt files.

Setting Larger Buffer Size for Sequential Write and Read Operations

Job type	SAS steps that do sequential I/O operations on large data sets.
User	SAS programmer.

Usage	The CACHESIZE= data set option controls the buffering of data set pages during I/O operations. CACHESIZE= can be used either as a data set option or in a LIBNAME statement that uses the BASE engine. The BUFSIZE= data set option sets the data set page size when the data set is created. BUFSIZE= can be used as a data set option, in a LIBNAME statement, or as a SAS system option.
Benefit	There is as much as a 30 percent decrease in elapsed time in some steps when an appropriate value is chosen for a particular data set.
Cost	If the data set observation size is large, substantial space in the data set might be wasted if you do not choose an appropriate value for BUFSIZE=. Also, memory is consumed for the data cache, and multiple caches might be used for each data set opened.

Using the BUFSIZE= Option

The BUFSIZE= data set option sets the SAS internal page size for the data set. Once set, this becomes a permanent attribute of the file that cannot be changed. This option is meaningful only when you are creating a data set. If you do not specify a BUFSIZE= option, SAS selects a value that contains as many observations as possible with the least amount of wasted space.

An observation cannot span page boundaries. Therefore, unused space at the end of a page can occur unless the observations pack evenly into the page. By default, SAS tries to choose a page size between 8192 and 32768 if an explicit BUFSIZE= option has not been specified. If you increase the BUFSIZE= value, more observations can be stored on a page, and the same amount of data can be accessed with fewer I/Os. When explicitly choosing a BUFSIZE, be sure to choose a value that does not waste space in a data set page, resulting in wasted disk space. The highest recommended value for BUFSIZE= is 65024.

The following is an example of an efficiently written large data set, using the BUFSIZE= data set option. Note that in the following example, BUFSIZE=63488 becomes a permanent attribute of the data set:

```
libname buf '[]';
data buf.big (bufsize=63488);
   length a b c d e f g h i j k l m
          n o p q r s t u v w x y z $200;
   do ii=1 to 13000;
   output;
end;
run;
```

Using the CACHENUM= Option

For each SAS file that you open, SAS maintains a set of caches to buffer the data set pages. The size of each of these caches is controlled by the CACHESIZE= option. The number of caches used for each open file is controlled by the CACHENUM= option. The ability to maintain more data pages in memory potentially reduces the number of I/Os that are required to access the data. The number of caches that are used to access a file is a temporary attribute. It might be changed each time you access the file.

By default, up to 10 caches are used for each SAS file that is opened; each of the caches is the value (in bytes) of CACHESIZE= in size. On a memory-constrained system you might wish to reduce the number of caches used in order to conserve memory.

The following example shows using the CACHENUM= option to specify that 8 caches of 65024 bytes each are used to buffer data pages in memory.

```
proc sort data=cache.big (cachesize=65024 cachenum=8);
   by serial;
run;
```

Using the CACHESIZE= Option

SAS maintains a cache that is used to buffer multiple data set pages in memory. This reduces I/O operation by enabling SAS to read or write multiple pages in a single operation. SAS maintains multiple caches for each data set that is opened. The CACHESIZE= data set option specifies the size of each cache.

The CACHESIZE= value is a temporary attribute that applies only to the data set that is currently open. You can use different CACHESIZE= values at different times when accessing the same file. To conserve memory, a maximum of 65024 bytes is allocated for the cache by default. The default allows as many pages as can be completely contained in the 65024-byte cache to be buffered and accessed with a single I/O.

Here is an example that uses the CACHESIZE= data set option to write a large data set efficiently. Note that in the following example, CACHESIZE= value is *not* a permanent attribute of the data set:

```
libname cache '[]';
data cache.big (cachesize=65024);
   length a b c d e f g h i j k l m
          n o p q r s t u v w x y z $200;
   do ii=1 to 13000;
   output;
end;
run;
```

Using Asynchronous I/O When Processing SAS Data Sets

Job type	Jobs that read or write SAS files.
User	SAS programmer.
Usage	The BASE engine now performs asynchronous reading and writing by default. This allows overlap between SAS data set I/O and computation time. *Note:* Asynchronous reading and writing is enabled only if caching is turned on. △
Benefit	Asynchronous I/O allows other processing to continue while SAS is waiting for I/O completion. If there is a large gap between the CPU time used and the elapsed time reported in the FULLSTIMER statistics, asynchronous I/O can help reduce that gap.
Cost	Because data page caching must be in effect, the memory usage of the I/O cache must be incurred. For more information about controlling the size and number of caches used for a particular SAS file, see “CACHENUM= Data Set Option” on page 286 and “CACHESIZE= Data Set Option” on page 287.

Asynchronous I/O is enabled by default. There are no additional options that need to be specified to use this feature. For all SAS files that use a data cache, SAS performs asynchronous I/O. Since multiple caches are now available for each SAS file, while an

I/O is being performed on one cache of data, SAS might continue processing using other caches. For example, when SAS writes to a file, once the first cache becomes full an asynchronous I/O is initiated on that cache, but SAS does not have to wait on the I/O to complete. While that transaction is in progress, SAS can continue processing new data pages and store them in one of the other available caches. When that cache is full, an asynchronous I/O can be initiated on that cache as well.

Similarly, when SAS reads a file, additional caches of data can be read from the file asynchronously in anticipation of those pages being requested by SAS. When those pages are required, they will have already been read from disk, and no I/O wait will occur.

Because caching (with multiple caches) needs to be enabled in order for asynchronous I/O to be effective, if the cache is disabled with the CACHESIZE=0 option or the CACHENUM=0 option, no asynchronous I/O can occur.

References for Using Asynchronous I/O

- "CACHENUM= Data Set Option" on page 286
- "CACHESIZE= Data Set Option" on page 287

External I/O under OpenVMS

The following guidelines apply to reading and writing OpenVMS native files using SAS. For several of the suggestions, the larger your files, the more performance gain for your entire SAS job. These suggestions parallel several of the SAS data set I/O suggestions.

Allocating File Space Appropriately

Job type	SAS procedures and DATA steps that write external files.
User	SAS programmer.
Usage	The ALQ= and DEQ= options are specified as part of the FILENAME or FILE statement.
Benefit	Specifying appropriate values can decrease elapsed time up to 50 percent and reduce disk fragmentation.
Cost	You will experience performance degradation when ALQ= and DEQ= values are incompatible with file size.

SAS allocates disk space for external files based on the value of ALQ=. It then extends the file if needed, based on the value of DEQ=. By default, the ALQ= value is 0 (indicating that the minimum number of blocks required for the given file format is used) and the value for DEQ= is 0 (telling OpenVMS RMS to use the process's default value). For more information about specifying the ALQ= and DEQ= options, see "FILENAME Statement" on page 397 and "FILE Statement" on page 395.

Every time a file must be extended, the system must search the disk for free space. This requires I/Os. When this is done repeatedly for large files, performance degrades. By setting larger ALQ= and DEQ= values for large files, this overhead will be reduced. Optimal I/O will occur when ALQ= is equal to the size of the file. Because this is not always feasible, it is better to underestimate the value for ALQ= and set a larger DEQ=

value. This allocates enough space for a smaller file, while extending it occasionally to meet the demands of a larger file. Allocating too much space can be costly if /HIGHWATER_MARKING is set on the disk. (For more information, see “Turning Off Disk Volume Highwater Marking” on page 242.)

References for Allocating File Space

- *Guide to OpenVMS File Applications*
- “FILE Statement” on page 395
- “FILENAME Statement” on page 397

Turning Off Disk Volume Highwater Marking

Job type	Jobs that write external files.
User	System manager.
Usage	Use the /NOHIGHWATER_MARKING qualifier when initializing disks. For active disks, issue the DCL command SET VOLUME/NOHIGHWATER_MARKING.
Benefit	Elapsed time can be improved by up to 40 percent. Direct I/Os are reduced.
Cost	There is no performance penalty. However, for security purposes, some OpenVMS sites might require this OpenVMS highwater marking feature to be set.

SAS uses the random access method when opening external files. This means that allocated disk space does not have to be processed in a sequential method. /HIGHWATER_MARKING is a safeguard that clears disk space before it is allocated to remove residue of former files. To do this, the entire space that is allocated has to be overwritten. Overwriting the space costs some elapsed time and I/Os. If the data that is stored on the disk is not of a truly confidential nature, then a performance gain can be achieved by disabling highwater marking on this disk.

Two DCL commands can be used independently to disable highwater marking on a disk. When initializing a new volume, use the following to disable the highwater function:

```
$ initialize/nohighwater $DKA470 mydisk
```

To disable volume highwater marking on an active disk, use a command similar to the following:

```
$ set volume/nohighwater $DKA200
```

References for Turning Off Disk Volume Highwater Marking

- *OpenVMS System Manager’s Manual: Tuning, Monitoring, and Complex Systems*

Eliminating Disk Fragmentation

Job type	Any jobs that access common external files frequently.
User	System manager.
Usage	You will need to devote a disk to frequently accessed files or keep your disks defragmented.
Benefit	The savings on elapsed time depend on the current state of the disk, but the time can be reduced by up to 40 percent.
Cost	The cost to the user is the time and effort to better manage disk access rather than letting the OpenVMS environment do all of the work. For the system manager, this might involve regularly defragmenting disks or obtaining additional disk drives.

On an defragmented disk, files are contiguous, so after one I/O operation the disk head is well positioned for the next I/O operation. Split I/Os are rare on an defragmented disk, which decreases elapsed time to perform I/O.

Where possible, dedicating a disk drive to frequent defragmentation can provide performance benefits. Use this disk to store commonly accessed SAS external files. In some situations, adding an inexpensive SCSI drive to the configuration might allow the system manager to maintain a clean, defragmented environment more easily than maintaining a large disk farm. Files that are maintained on this defragmented SCSI disk might perform better than heavily fragmented files on larger disks.

Specifying Default Multiblock Count

Job type	Jobs that write large external files.
User	SAS programmer.
Usage	The MBC= option (multiblock count) is specified as part of the FILENAME or FILE statement.
Benefit	Elapsed time can be improved by 25 to 35 percent on jobs that output large external files.
Cost	Increasing multiblock count can slightly increase the requirements for memory.

By default, SAS uses the default value for your process for the multiblock count, which is specified by the RAB$B MBC field in OpenVMS RMS. You can use the MBC= external I/O option to specify the size of the I/O buffers that OpenVMS RMS allocates for writing or reading an external file. The MBC= option controls how many 512-byte pages of memory are reserved to perform file access. When you increase the buffer size, you use more memory.

We recommend a value of approximately 32 blocks for the MBC= option when you are writing a very large external file (over 100,000 blocks). You might see improvement in elapsed time up to 35 percent. Only minimal gains in performance will occur when you specify the MBC= option for reading an external file.

Note: You can use the MBC= option to affect a particular file. If you want to specify a default multiblock count for your process that will affect all external files in your SAS program, use the DCL SET RMS_DEFAULT command. △

System Start-up under OpenVMS

Job type	All jobs.
User	System manager.
Usage	The OpenVMS Install facility can be used to make core SAS images resident in memory.
Benefit	Elapsed time of system start-up might decrease as much as 30 percent when you are running SAS under X windows and by 40 percent in other modes.
Cost	Installing all images listed in the sample commands consumes between 7500 and 1200 global pages and 6 to 8 global sections.

Installing SAS images can decrease the elapsed time of SAS start-up by up to 40 percent. Installing images is most effective on systems where two or more users are using SAS simultaneously. Use the following commands in the system start-up file to install the core set of SAS images:

```
$ @SASdisk:[SAS91.TOOLS]SAS91.COM
$ INSTALL :== $SYS$SYSTEM:INSTALL/COMMAND"
$ INSTALL ADD SAS$ROOT:[SASEXE]SAS91.EXE/OPEN/SHARE
$ INSTALL ADD SAS$ROOT:[SASEXE]SASMOTIF.EXE/OPEN/SHARED
```

SASdisk is the disk containing SAS; *SAS$ROOT* is the root directory of SAS.

The Install facility can be used to make core SAS images resident in the memory. Elapsed time of system start-up might decrease by as much as 30 percent when you are running SAS under X windows, and by 40 percent in other modes. Installing the images listed in the sample commands consumes the following resources:

SAS91.EXE	2 global sections and 2352 global pagelets
SASMOTIF.EXE	2 global sections and 10144 global pagelets

References for System Start-up

□ *OpenVMS System Manager's Manual: Tuning, Monitoring, and Complex Systems*

Optimizing Memory Usage under OpenVMS

You can make tradeoffs between memory and other resources. This is explained in "Data Set I/O under OpenVMS" on page 236 and "External I/O under OpenVMS" on page 241. To make the most of the I/O subsystem, you need to use more, larger buffers. These buffers are allocated out of your available virtual address space and must share your physical address space (that is, your working set) with the other memory demands of your SAS session.

Therefore, optimization of other resources is often at the expense of using more and more memory. If memory is your critical resource, there are several things you can do to reduce the dependence on increased memory. However, most of these techniques are at the expense of increased I/O processing or increased CPU usage.

Increasing the values of the MBC= and MBF= external I/O statement options, the CACHESIZE= option, and the BKS= option enables you to optimize the I/O subsystem by reducing the number of accesses necessary to reference the data. But reducing the number of accesses uses more memory. If you are operating in a memory-constrained environment, you need to reduce these values to minimize memory usage.

The size of your I/O buffers depends on your working set size. It is important not to increase I/O buffers up to the point that you exhaust your available working set. If you do this, you will notice an increase in the page fault rate for your job.

Using the LOADLIST= System Option

Job type	Any job that accesses a SAS image.
User	SAS programmer.
Usage	The LOADLIST= system option reports the SAS images that were used the most often.
Benefit	You can optimize memory usage by installing the most heavily used images as known images.
Cost	There is no performance penalty.

To optimize memory usage, ensure that images that are used most often are installed as known images to the OpenVMS operating environment. If you use the LOADLIST= system option, SAS reports which images were used most often. If you install the most heavily used images as known images, they do not require additional physical memory if used by multiple users. These images should be installed with the /SHARED option. For information about using the INSTALL utility, refer to “System Start-up under OpenVMS” on page 244. For more information, see “LOADLIST= System Option” on page 471.

P A R T 3

Features of the SAS Language for OpenVMS

CHAPTER

12

Commands under OpenVMS

SAS Commands under OpenVMS

During an interactive SAS session, you can issue commands from the SAS command line or from the SAS command window. SAS supports many commands that help you navigate through your session and accomplish certain tasks. In many cases, the command is another way to invoke an action that you can also accomplish by using the SAS menus and windows. However, advanced users might find that the supported commands are a more efficient way to work. Sometimes commands offer a more flexible way to accomplish a task when the parameters of your task are different from those that the SAS interface supports.

There are two main types of commands available under OpenVMS: SAS windowing environment commands and SAS Text-Editor commands. The SAS windowing environment commands control window management, file management, toolboxes, dialog boxes, color, and output. The SAS Text-Editor commands control how text is manipulated, such as upper- and lowercase, cutting, copying and pasting.

Most SAS commands are described in the Base SAS Software section in SAS Help and Documentation. The commands that are described here have syntax or behavior that is specific to the OpenVMS operating environment.

Dictionary

AUTOSCROLL Command

Controls the display of lines in the Log and Output windows

OpenVMS specifics: default values

Syntax

AUTOSCROLL <*n* | PAGE | MAX >

no argument
displays the current setting of the AUTOSCROLL command.

n
specifies the number of lines that the window should scroll when it receives a line of data that cannot fit. The default in the Output window is 1.

PAGE
specifies in the Output window only that no lines are displayed until a complete page of output is written to the window.

MAX
specifies in the Output window only that no lines are written until the end of each procedure.

Details

Under OpenVMS, the default value for the AUTOSCROLL command in the Output window is 1 (meaning that no output is written to that window while statements are executing, which provides the best performance).

Scrolling can increase the length of time that SAS takes to run your program. The less scrolling that the Log and Output windows do, the faster your program will run. Setting the value of *n* equal to 0 might also speed up interactive jobs.

See Also

- "AUTOSCROLL Command" in the Base SAS Software section in SAS Help and Documentation

CAPS Command

Changes the default case of text

OpenVMS specifics: All aspects are host-specific

Syntax

CAPS <ON | OFF>

ON
causes characters to be translated to uppercase.

OFF
turns off CAPS command; characters retain their case.

Details

The CAPS command is a SAS Text-Editor command.

Under OpenVMS, characters are translated when you move the cursor off the line *or* when you press RETURN.

See Also

- "CAPS Command" in the Base SAS Software section in SAS Help and Documentation

COLOR Command

Changes the color and highlighting of selected portions of a window

OpenVMS specifics: valid field types and attributes

Syntax

COLOR *field-type* <*color* | NEXT <*highlight*>>

Note: This is a simplified description of the COLOR command syntax. For the complete description, see the COLOR command in the Base SAS Software section in SAS Help and Documentation △

field-type
specifies the area of the window (such as background, banner, command, border, or message) or type of text you want to change.

color
specifies the color for the field. On terminals that support color, the following values are valid:

K	black
B	blue
n	brown
C	cyan
G	green
?	grey
M	magenta
O	orange
R	red
W	white
Y	yellow

NEXT
specifies to change the color to the next color in the list.

highlight
specifies the highlighting attribute for the field. The following values are valid:

H	highlight, which causes the text to be displayed in a bold font.
R	reverse video.
U	underline.

The B (blinking) attribute is not supported under OpenVMS.

Details

The COLOR command enables you to set the color for specific elements of the active window.

To save your changes beyond your current session, do one of the following:

- □ Issue the WSAVE command. The changes are saved to SASUSER.PROFILE.*window*.WSAVE.
- □ From the **`View`** menu, select **`Change display`**, and then select **`Save attributes`**.

Note: The WSAVE command is not available for all SAS windows. For example, with SAS/FSP or SAS/CALC software, changes are saved either through the EDPARMS window or the PARMS window. To determine whether WSAVE is available for a particular SAS window, refer to the product documentation. △

Both the COLOR command and the WSAVE command override actions in the SASCOLOR window. That is, COLOR and WSAVE override the use of CPARMS colors for that particular window without affecting the CPARMS values for other SAS windows.

See Also

- □ "COLOR Command" in the Base SAS Software section in SAS Help and Documentation
- □ "WSAVE Command" in the Base SAS Software section in SAS Help and Documentation
- □ "Customizing Colors Using the SASCOLOR Window" on page 107

DLGABOUT Command

Opens the About SAS dialog box

OpenVMS specifics: All aspects are host-specific

Syntax

DLGABOUT

Details

To open the About SAS dialog box in the active window, select the **`Help`** menu and then select **`About SAS 9`**.

DLGCDIR Command

Opens the Change Working Directory dialog box

OpenVMS specifics: All aspects are host-specific

Syntax

DLGCDIR

Details

From the Change Working Directory dialog box, you can select a new working directory.
To open the Change Working Directory dialog box in the active window, select the **`Tools`** menu, select **`Options`**, and then select **`Change Directory`**.

See Also

- □ "Changing Your Current Working Directory under OpenVMS" on page 67
- □ "Opening Files under OpenVMS" on page 65

DLGENDR Command

Opens the Exit dialog box

OpenVMS specifics: All aspects are host-specific

Syntax

DLGENDR

Details

The Exit dialog box prompts you to confirm that you want to exit SAS. If you click $\boxed{\text{OK}}$ in the dialog box, the SAS session ends. If you have set the **`SAS.confirmSASExit`** resource to **`False`**, then this command is equivalent to the BYE command.

To open the Exit dialog box in the active window, select the **`File`** menu and then select **`Exit`**.

See Also

- □ "Miscellaneous Resources under OpenVMS" on page 120 for more information about the **`SAS.confirmSASExit`** resource

DLGFIND Command

Opens the Find dialog box

OpenVMS specifics: All aspects are host-specific

Syntax

DLGFIND

Details

The Find dialog box enables you to search for text strings. To open the Find dialog box in the active window, select the **`Edit`** menu and then select **`Find`**.

See Also

- □ "Searching for Character Strings under OpenVMS" on page 68
- □ "DLGREPLACE Command" on page 257
- □ "Replacing Character Strings under OpenVMS" on page 69

DLGFONT Command

Opens the Fonts dialog box

OpenVMS specifics: All aspects are host-specific

Syntax

DLGFONT

Details

The Fonts dialog box enables you to dynamically change the font when you are in the SAS windowing environment. To open the Fonts dialog box in the active window, select the **`Tools`** menu, then select **`Options`**, and then select **`Fonts`**.

See Also

- □ "Customizing Fonts under OpenVMS" on page 101

DLGOPEN Command

Opens the Open or Import dialog box

OpenVMS specifics: All aspects are host-specific

Syntax

DLGOPEN <FILTERS='*filters*' <IMPORT> <SUBMIT | NOSUBMIT> <VERIFY>>

no arguments
opens the Open dialog box with the default settings.

FILTERS='*filters*'
specifies one or more file filters to use as search criteria when SAS is displaying files. For example, the following command displays all files in the current directory that have a .SAS extension and adds *.TXT to the **`File type`** combo box in the dialog box:

```
DLGOPEN FILTERS="*.sas *.txt"
```

You can specify multiple filters; they all appear in the **File type** box. If you do not specify any filters, the dialog box displays a default list.

IMPORT
opens the Import dialog box, which enables you to import graphics files to your SAS/GRAPH applications.

SUBMIT | NOSUBMIT
specifies whether the SUBMIT command is pushed after the file is opened.

VERIFY
checks whether the DLGOPEN command is appropriate for the active window.

Details

The Open and Import dialog boxes enable you to select a file to read into the active window. To open the Open dialog box in the active window, select the **File** menu and then select **Open**. To open the Import dialog box in the active window, select the **File** menu and then select **Import**.

See Also

- "Opening Files under OpenVMS" on page 65
- "Image Extensions" section in *SAS/GRAPH Reference, Volumes 1 and 2*

DLGPREF Command

Opens the Preferences dialog box

OpenVMS specifics: All aspects are host-specific

Syntax

DLGPREF

Details

The Preferences dialog box enables you to dynamically change certain X resource settings. To open the Preferences dialog box in the active window, select the **Tools** menu, select **Options**, and then select **Preferences**.

See Also

- "Modifying X Resource Settings by Using the Preferences Dialog Box" on page 80

DLGREPLACE Command

Opens the Replace dialog box

OpenVMS specifics: All aspects are host-specific

Syntax

DLGREPLACE

Details

The Replace dialog box enables you to search for and replace text strings. To open the Replace dialog box in the active window, select the **`Edit`** menu and then select **`Replace`**.

See Also

- “Replacing Character Strings under OpenVMS” on page 69
- Command: “DLGFIND Command” on page 254

DLGSAVE Command

Opens the Save As or Export dialog box

OpenVMS specifics: All aspects are host-specific

Syntax

DLGSAVE <FILTERS=’*filters*’ <EXPORT> <VERIFY>>

no arguments
opens the Save As dialog box with the default settings.

FILTERS=’*filters*’
specifies one or more file filters to use as search criteria when you are displaying files. For example, the following command displays all files in the current directory that have a .SAS extension and adds *.TXT to the **`File type`** combo box in the dialog box:

```
DLGSAVE FILTERS="*.sas *.txt"
```

You can specify multiple filters; they all appear in the file type box. If you omit the filters, the dialog box displays a default list.

EXPORT
opens the Export dialog box, enabling you to export graphics files in your SAS session.

VERIFY
verifies whether the DLGSAVE command is appropriate for the active window.

Details

To open the Save As dialog box in the active window, select the **`File`** menu and then select **`Save as`**.

To open the Export dialog box in the active window, select the **`File`** menu and then select **`Export as Image`**.

See Also

- □ "Image Extensions" section in *SAS/GRAPH Reference, Volumes 1 and 2*.

DLGSCRDUMP Command

Saves the active SAS/GRAPH window as an image file using the file specification and file type that you specify

OpenVMS specifics: All aspects are host-specific

Syntax

DLGSCRDUMP <'*file-specification.ext*' FORMAT='*file-type*'>

no argument
opens the Export dialog box and enables you to choose a filename and file type.

'file-specification.ext'
specifies the name of the file you want to save.

FORMAT='*file-type*'
specifies the file type of the file you want to save.

Details

The DLGSCRDUMP command saves screen captures in any image format that is supported by SAS/GRAPH software with Image extensions. If your site has not licensed SAS/GRAPH with Image extensions, then screen captures can be saved only as .XPM files.

See Also

- □ "Opening Files under OpenVMS" on page 65
- □ "Image Extensions" section in *SAS/GRAPH Reference, Volumes 1 and 2*.

FILE Command

Writes the contents of the current window to an external file

OpenVMS specifics: valid values for *file-specification* and *encoding-value*

Syntax

FILE <*file-specification*><ENCODING=*'encoding-value'*><*option-list*>

file-specification
can be any of the following:

- a single filename. SAS writes the file in the current directory. If you enclose the filename in quotation marks, SAS uses the filename exactly as you specify it. If you do not enclose the filename in quotation marks and if you do not specify a filename extension, SAS uses .SAS, .LOG, or .LIS, depending on whether you issue the command from the Program Editor, Log, or Output window. If no filename extension is specified and the *file-specification* is longer than eight characters, then the default value is .DAT.
- an entire pathname. SAS does not assume any filename extensions, even if you do not enclose the pathname in quotation marks.
- a fileref.

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.

When you write data to the output file, SAS transcodes the data from the session encoding to the specified encoding.

For valid encoding values, see "Encoding Values in SAS Language Elements" in *SAS National Language Support (NLS): User's Guide*.

option-list
specifies options for the FILE command that are valid in all operating environments. For more information about these options, see the FILE command in the Base SAS Software section in SAS Help and Documentation.

Details

The FILE command writes the entire contents of the current window to an external file without removing text from the window.

You can also use a physical filename (enclosed in quotation marks) in place of the fileref.

CAUTION:
If you do not specify a filename, then the file from the previous FILE or INCLUDE command is used. In this case, a dialog box first asks if you are sure you want to overwrite the file. △

If you have not issued any FILE or INCLUDE commands, then an error message informs you that no default file exists. For a list of default file types used for the FILE command, see "Default File Types" on page 177

Examples

Example 1: Copying Text from a Window to a File Suppose you have previously specified the following FILENAME statement:

```
filename sasfile '[mydir]program1.sas';
```

Issuing the following FILE command on the Program Editor command line copies the text from the Program Editor window into the file PROGRAM1.SAS:

```
file sasfile
```

Example 2: Appending Text to an Existing External File To append text to an existing external file, use the APPEND option in the FILE command. For example, you can issue the following command from the Program Editor window to append the contents to the file associated with the fileref MYFILE:

```
file myfile append
```

See Also

- □ "FILE Command" in the Base SAS Software section in SAS Help and Documentation
- □ "Identifying External Files to SAS" on page 173
- □ "Default File Types" on page 177

FILL Command

Specifies the fill character

OpenVMS specifics: default character

Syntax

FILL <*fill-character*> <*n*>

fill-character
specifies the fill character to be used. Under OpenVMS, the default fill character is an underscore (_).

n
specifies the exact number of fill characters.

Details

The FILL command is a SAS Text-Editor command.

The fill characters are placed beginning at the current cursor position. The space will be filled with the fill character from the current cursor position either to the end of the line or to the space before the first nonblank character, whichever occurs first.

See Also

- □ "FILL Command" in the Base SAS Software section in SAS Help and Documentation

FONTLIST Command

Lists available software fonts

OpenVMS specifics: all

Syntax

FONTLIST

Details

The FONTLIST command opens windows that list all of the software fonts that are available in your operating environment. This might be useful if you want to choose a font to use in a SAS program, typically with a FONT= or FTEXT= option. Issuing the FONTLIST command from the SAS command line opens the **`Select Font`** window, which contains two buttons, Copy and System. Clicking the System button opens the **`Fonts`** window, from which you select and preview all available system fonts. Once you select the desired font and font attributes, click OK. The Select Font window reopens with your selected font name displayed. Clicking the copy button places the font name in the copy buffer so that you can paste the selected font name into your SAS program.

HOME Command

Toggles the cursor position between current position and home position

OpenVMS specifics: keyboard equivalent

Syntax

HOME

Details

Under OpenVMS, you can define a function key to execute the HOME command, which toggles between the last cursor position and the home position (usually the command line). This behavior is the same in all windows. You can also define a function key to execute the CURSOR command, which positions the cursor on the command line but has no toggle effect.

See Also

- “HOME Command” in the Base SAS Software section in SAS Help and Documentation

HOSTEDIT Command

Invokes the host editor

OpenVMS specifics: All aspects are host-specific

Syntax

HOSTEDIT

Details

Under OpenVMS, HOSTEDIT invokes the editor specified by the EDITCMD system option. By default, HOSTEDIT issues the TPU (Text Processing Unit) command. For more information about this command, see "TPU Command" on page 266.

INCLUDE Command

Copies the entire contents of an external file into the current window

OpenVMS specifics: valid values for *file-specification* and *encoding-value*

Syntax

INCLUDE <*file-specification*><ENCODING='*encoding-value*'><*option-list*>

file-specification
can be any of the following:

- □ a single filename. SAS searches for the file in the current directory. If you enclose the filename in quotation marks, SAS uses the filename exactly as you specify it. If you do not enclose the filename in quotation marks and if you do not specify a filename extension, SAS searches for ***`file-specification`***`.sas`.
- □ an entire pathname. SAS does not assume any filename extensions, even if you do not enclose the pathname in quotation marks.
- □ a fileref.

ENCODING='*encoding-value*'
specifies the encoding to use when reading from the external file. The value for ENCODING= indicates that the external file has a different encoding from the current session encoding.

When you read data from an external file, SAS transcodes the data from the specified encoding to the session encoding.

For valid encoding values, see "Encoding Values in SAS Language Elements" in *SAS National Language Support (NLS): User's Guide*.

option-list
names options for the INCLUDE command that are valid in all operating environments. For more information about these options, see the INCLUDE command in the Base SAS Software section in SAS Help and Documentation.

Details

The INCLUDE command copies the entire contents of an external file into the current window.

If you do not specify a *file-specification*, then SAS uses the filename from the previous FILE or INCLUDE command. In this case, SAS first asks you if you want to overwrite the file. If you have not issued any FILE or INCLUDE commands, you receive an error message indicating no default file exists. For a list of default file types used for the INCLUDE command, see “Default File Types” on page 177.

Example

Suppose you have previously specified the following FILENAME statement:

```
filename myfile '[mydir]oranges.dat';
```

The following INCLUDE command includes the file ORANGES.DAT in the Program Editor window:

```
include myfile
```

See Also

- □ “INCLUDE Command” in the Base SAS Software section in SAS Help and Documentation
- □ “Identifying External Files to SAS” on page 173
- □ “Default File Types” on page 177

RESHOW Command

Redisplays the windows that are currently displayed

OpenVMS specifics: keyboard equivalent

Syntax

RESHOW

Details

If your session is interrupted, by a message from the operating environment for example, the RESHOW command redisplays the windows that were displayed before the interruption.

See Also

- □ "RESHOW Command" in the Base SAS Software section in SAS Help and Documentation

TOOLCLOSE Command

Closes the toolbox in the active window

OpenVMS specifics: All aspects are host-specific

Syntax

TOOLCLOSE

Details

Use the TOOLCLOSE command to close the toolbox in the active window.

TOOLEDIT Command

Opens the specified toolbox entry for editing

OpenVMS specifics: All aspects are host-specific

Syntax

TOOLEDIT <*library.catalog.entry*>

no argument
edits the toolbox for the active window.

library.catalog.entry
specifies the toolbox entry that you want to edit.

Details

If you do not specify an entry name, the Tool Editor opens the toolbox for the active window. You can then make changes to the toolbox.

TOOLLARGE Command

Toggles the size of the buttons in the toolbox

OpenVMS specifics: All aspects are host-specific

Syntax

TOOLLARGE <ON | OFF>

no argument
toggles the size of the toolbox.

ON
sets the size of the buttons in the toolbox to 48x48 pixels.

OFF
sets the size of the buttons in the toolbox to 24x24 pixels.

Details

If you do not specify ON or OFF, the TOOLLARGE command toggles the size of the toolbox. The size of the toolbox changes for your current session only; the new size is not saved.

To change the size of the toolbox in the active window, select the **`Tools`** menu, select **`Options`**, and then select **`Preferences`**. This opens the Preferences dialog box. Select the ToolBox tab, and select **`Use large tools`**. If you change the size of the toolbox through the Preferences dialog box, the new size is saved, and SAS will display the large toolbox in subsequent sessions.

TOOLLOAD Command

Loads the specified toolbox

OpenVMS specifics: All aspects are host-specific

Syntax

TOOLLOAD <*library.catalog.entry*>

no argument
loads the toolbox for the active window.

library.catalog.entry
specifies the catalog entry to load.

Details

If you do not specify a catalog entry, the TOOLLOAD command loads the toolbox for the active window. After this command is processed, the specified toolbox is the active toolbox.

TOOLTIPS Command

Toggles the tool-tip text for an icon on and off

OpenVMS specifics: All aspects are host-specific

Syntax

TOOLTIPS <ON | OFF>

no argument
toggles the tool-tip text on and off.

ON
specifies that the tool-tip text is displayed when you move the cursor over an icon in the toolbox.

OFF
specifies that the tool-tip text is not displayed.

Details

The TOOLTIPS command specifies whether the tool-tip text is displayed when you move the cursor over an icon in the toolbox. If you do not specify either ON or OFF, the TOOLTIPS command toggles the text on and off, depending on the current setting.

See Also

- "Changing an Existing Tool" on page 90

TPU Command

Starts a session of the TPU Editor

OpenVMS specifics: all aspects are host-specific

Syntax

TPU

TPU
opens a session of the TPU Editor.

Details

The TPU command enables you to use the OpenVMS Text Processing Utility (TPU) Editor for editing instead of the default SAS Text Editor.

The command initiates a session of the TPU Editor. When this session begins, the TPU window displays the contents of the window from which it was invoked, and the name of the window is displayed on the TPU status line. You can then edit the window's contents.

- □ If you have write access to the window (such as the Program Editor window), then you can save the changes that you make during the TPU session to the window when you exit from the editor, or you can save the changes to an external file.
- □ If you have only read access to the window, then a message on the message line of the TPU window alerts you to this fact. When you exit from the editor, you can save your changes to an external file, but you cannot save them to the window.

Special text attributes such as color or highlighting are lost during a TPU editing session. Therefore, when you issue the TPU command from a window that contains text with these attributes, a dialog box appears that enables you either to continue or abort the TPU command.

To suppress this warning, issue the HEATTR OFF command from the window's command line before you invoke TPU. Text attributes will then be deleted without warning. To redisplay the warning message, issue the HEATTR ON command from the window command line, and then issue the TPU command.

When you have finished editing in a TPU session, do one of the following:

- □ To save the changes to the window, use the CTRL+Z key sequence or type **`EXIT`** at the TPU command prompt.
- □ To discard the changes you made, type **`QUIT`** at the TPU command prompt.
- □ To save the contents of the window to an external file, use the standard TPU commands. Then use the CTRL+Z command or the QUIT command, depending on whether you also want to save the changes to the window.

You can undo any changes you made to the window text during that session by issuing the UNDO command from the window command line.

Note: The SAS Session Manager, xsassm, must be running in order for the TPU command to work. △

UNDO Command

Undoes one line of text entry

OpenVMS specifics: command behavior

Syntax

UNDO

Details

The UNDO command is a SAS Text-Editor command.

Under OpenVMS, executing the UNDO command once undoes one line of text entry. For example, suppose you have entered three lines of text. You must issue the UNDO command three times to undo all three lines.

See Also

- “UNDO Command” in the Base SAS Software section in SAS Help and Documentation

WBROWSE Command

Invokes a World Wide Web browser

OpenVMS specifics: All aspects are host-specific

Syntax

WBROWSE <“*URL*”>

no argument
invokes the Web browser specified by the X resource.

“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. The value for *URL* must be enclosed in double quotation marks.

Details

By default, the WBROWSE command invokes the Web browser that is specified by the X resource **`SAS.helpBrowser`**. If you specify a URL, the document that the URL identifies is displayed instead. Note that you must enclose the URL in double quotation marks.

See Also

- “Miscellaneous Resources under OpenVMS” on page 120 for more information about the **`SAS.helpBrowser`** resource

WCOPY Command

Copies the marked contents of the active window to the default buffer

OpenVMS specifics: All aspects are host-specific

Syntax

WCOPY

Details

The WCOPY command is a SAS Text-Editor command.
If the active window is a Base SAS window, SAS issues the STORE command.

WCUT Command

Moves the marked contents of the active window to the default buffer

OpenVMS specifics: All aspects are host-specific

Syntax

WCUT

Details

The WCUT command is a SAS Text-Editor command.
If the active window is a Base SAS window, SAS issues the CUT command.

WPASTE Command

Pastes the contents of the default buffer into the active window

OpenVMS specifics: All aspects are host-specific

Syntax

WPASTE

Details

The WPASTE command is a SAS Text-Editor command.
If the active window is a Base SAS window, SAS issues the PASTE command.

WUNDO Command

Undoes one line of text entry

OpenVMS specifics: All aspects are host-specific

Syntax

WUNDO

Details

The WUNDO command is a SAS Text-Editor command.

If the active window is a Base SAS window, SAS issues the UNDO command. If the active window is a SAS/GRAPH window, WUNDO is not a valid command.

Under OpenVMS, executing the WUNDO command once undoes one line of text entry. For example, suppose you have entered three lines of text. You must issue the WUNDO command three times to undo all three lines.

X Command

Enters host-system mode or enables you to submit a DCL command without ending your SAS session

OpenVMS specifics: valid values for *DCL-command*; syntax

Syntax

X <'>*DCL-command*<'>

DCL-command

specifies the DCL command that you want to execute. If SAS recognizes the value for *DCL-command* as a valid DCL command, then no quotation marks are needed. However, code is easier to read if quotation marks appear around the DCL commands.

Details

This form of the X command issues one DCL command. The DCL command is passed to the operating environment and executed. If errors occur, the appropriate error messages are displayed.

The VMS command element limit is 256 characters. Any DCL command that is greater than 256 characters will be broken up and sent to the operating system in chunks less than or equal to 256 characters. Breaks will occur on the following characters:

- forward slash (/)
- hyphen (-)
- space
- quotation marks (").

Note: If the DCL command is longer than 256 characters, then SAS will be unable to verify whether the DCL command should be executed in the parent process. All DCL commands greater than 256 characters will always be executed in a subprocess. △

See Also

- “X Command” in the Base SAS Software section in SAS Help and Documentation
- “Issuing DCL Commands during a SAS Session” on page 43

Function-Key Commands

SAS under OpenVMS provides many windowing environment commands in addition to those that are documented in the Base SAS Software section in SAS Help and Documentation. These host-specific commands are described in Table 12.1 on page 271.

Before you use these commands, be aware of several special considerations:

- Each of these commands is the only definition for a function key; that is, the command cannot be combined with any other command. For example, the following is a valid key definition:

  ```
  PF1            CURSORUP
  ```

  The following key definitions are not valid:

  ```
  PF1            HOME; CURSORUP
  PF2            CURSORUP; CURSORUP
  ```

- You cannot specify any of these commands in the DM statement.
- You cannot enter any of these commands on a command line except where noted in the description.

If you use one of these commands incorrectly, you receive a message that the given use is not supported.

Table 12.1 Host-Specific Windowing Commands Under OpenVMS

Command	Description
CHINSERT	Toggles insert mode.
CURSORDOWN	Moves the cursor down.
CURSORLEFT	Moves the cursor left.
CURSORRIGHT	Moves the cursor right.
CURSORUP	Moves the cursor up.
DELCHAR	Deletes the character at the cursor location.
DELLINE	Deletes all characters on the current line.
DELPCHAR	Deletes the character to the left of the cursor.
DELTOEOL	Deletes all characters to the end of the line.
DELWORD	Deletes the word under the cursor.
KP_APPLICATION	See KP_NUMERIC.
KP_NUMERIC	Puts the application keypad into numeric mode. Numeric mode is convenient to use in data entry where numbers are involved. The KP_APPLICATION command returns the keypad to application mode, so that the keypad keys resume their functionality listed in the KEYS window. You can issue this command from the command line.
MOVEBOL	Moves to the beginning of the line.

Command	Description
MOVEEOL	Moves to the end of the line.
NEWLINE	If there is a command on the command line, NEWLINE executes it; otherwise, the cursor moves to the beginning of the next line (equivalent to a carriage return).
NEXTFIELD	Moves to the next field. This command does not move the cursor from the command line; use the HOME (CTRL-F) command to move from the command line.
NEXTWORD	Moves to the next word.
PREVFIELD	Moves to the previous field. This command does not move the cursor from the command line; use the HOME (CTRL-F) command to move from the command line.
PREVWORD	Moves to the previous word.

Host-Specific Frames of the Form Window

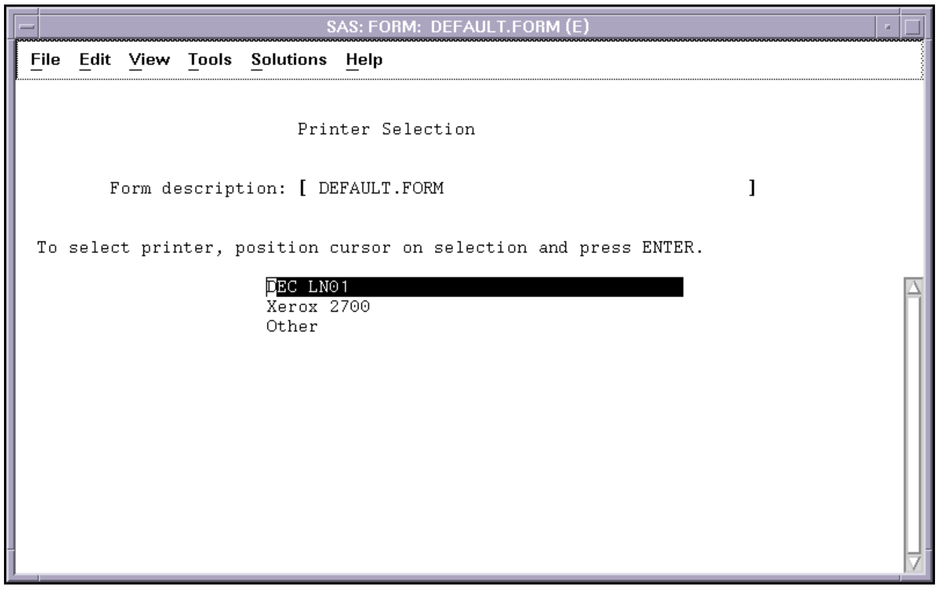
The FSFORM command activates a series of window frames collectively called the Form window, which enables you to specify the printer, text format, and destination for your output. This capability is useful when you issue the PRINT command and when you print from SAS/AF and SAS/FSP procedure output. This section describes the frames of the Form window that are specific to OpenVMS. For information about other Form window frames, see Chapter 8, “Routing the SAS Log and SAS Procedure Output,” on page 195 and the FSFORM command in the Base SAS Software section in SAS Help and Documentation.)

To invoke the Form window, issue the following command:

FSFORM *form-name*.FORM

The first frame that you see after issuing the FSFORM command is the Printer Selection window. This window enables you to specify which printer you want to use. The following display shows the default information for this window under OpenVMS.

Display 12.1 Printer Selection Window


SAS: FORM: DEFAULT.FORM (E)
File Edit View Tools Solutions Help

```
                    Printer Selection

      Form description: [ DEFAULT.FORM                          ]

To select printer, position cursor on selection and press ENTER.

                      DEC LN01
                      Xerox 2700
                      Other
```

Note: The information in the Printer Selection window is also site-dependent, so your window might look slightly different. △

The Printer Selection window appears only the first time you create a print form. After you modify a form, it is stored in your SASUSER.PROFILE catalog (entry type FORM).

The next time you modify this form, the Printer Selection window is skipped. You cannot return to the Printer Selection window from the second Form window frame.

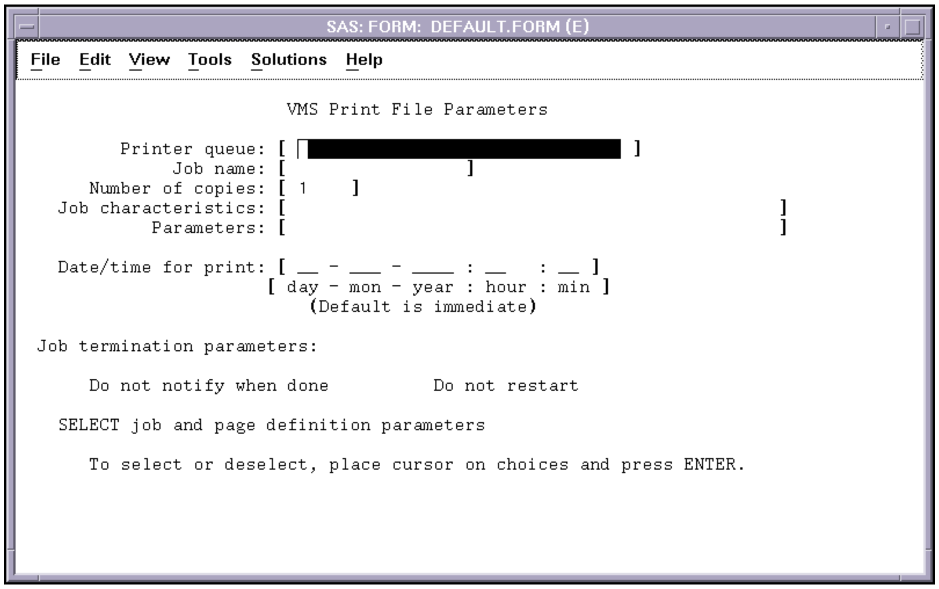
The third Form window frame is also host-specific. This frame has two parts: the OpenVMS Print File Parameters window frame and the OpenVMS Job and Page Definitions window frame.

Note: The information in these window frames is site-dependent, so your window frames might look slightly different from those shown in Display 12.2 on page 273 and Display 12.3 on page 275. △

OpenVMS Print File Parameters Window Frame

The first part of the third Form window is the OpenVMS Print File Parameters window frame (shown in the following display). The OpenVMS print file parameters displayed in this window frame are the same parameters that you would use in an OpenVMS PRINT command. This window frame provides field-specific help. To receive help on a field, place your cursor on that field and press the HELP function key. In addition to the help given in this window, you can also request help on the PRINT command by using the OpenVMS Help Facility.

Display 12.2 OpenVMS Print File Parameters Window Frame


SAS: FORM: DEFAULT.FORM (E)
File Edit View Tools Solutions Help

```
                         VMS Print File Parameters

        Printer queue: [                                        ]
             Job name: [                     ]
     Number of copies: [ 1    ]
  Job characteristics: [                                                ]
           Parameters: [                                                ]

  Date/time for print: [ __ - ___ - ____ : __   : __ ]
                      [ day - mon - year : hour : min ]
                          (Default is immediate)

Job termination parameters:

     Do not notify when done          Do not restart

  SELECT job and page definition parameters

     To select or deselect, place cursor on choices and press ENTER.
```

The following fields appear in the OpenVMS Print File Parameters window frame:

`Printer queue`

sends output to the specified queue. If no queue is specified, the default is SYS$PRINT. Filling in this field is equivalent to using the QUEUE= option in the OpenVMS PRINT command. Do not include quotation marks in the queue specification. The value can contain up to 31 characters.

Job name

specifies the output name. The name is specified using 1 to 39 alphanumeric characters. The default is the name of the file being submitted. Filling in this field is equivalent to using the NAME= option in the OpenVMS PRINT command, except that the job name cannot contain any spaces or quotation marks.

Issuing the SHOW QUEUE command from the DCL prompt displays the job name. The job name is also printed on the flag page for the output.

Number of copies

specifies the number of copies of the output that you want to receive. The number of copies defaults to 1, but it can be specified from 1 to 255. Filling in this field is equivalent to using the COPIES= option in the OpenVMS PRINT command.

Job characteristics

specifies one or more characteristics, separated by commas, for your output. The list of characteristics cannot contain any spaces. For example, you can specify the following:

```
LOWER,DOUBLE
```

Job characteristics are site- and printer-specific; see your system manager for information on what characteristics are available for your printers. Filling in this field is equivalent to using the CHARACTERISTICS= option in the OpenVMS PRINT command, except that the specification might not include parentheses or quotation marks.

Parameters

specifies one or more parameters, separated by commas, for your output. The list of parameters cannot contain any spaces. These parameters are site-specific; see your system manager for information about what parameters are available. Filling in this field is equivalent to using the PARAMETERS= option in the OpenVMS PRINT command, except that the specification cannot include parentheses or quotation marks. You can specify up to eight parameters.

Date/time for print

can be used to hold the output until the date and time specified. Use absolute date and time to specify the day and time the output is printed. (That is, specify 12:00, not “3 hours from now.”) Enter values from left to right. You do not need to fill in each field, but each field to the left of one that is entered must be filled in. Filling in this field is equivalent to using the AFTER= option in the OpenVMS PRINT command, except that the date and time specification cannot include quotation marks.

Job termination parameters:

Do not notify when done

specifies whether you are notified when the output has been printed. By default, you are notified when your job is finished. Filling in this field is equivalent to using the NOTIFY= option in the OpenVMS PRINT command.

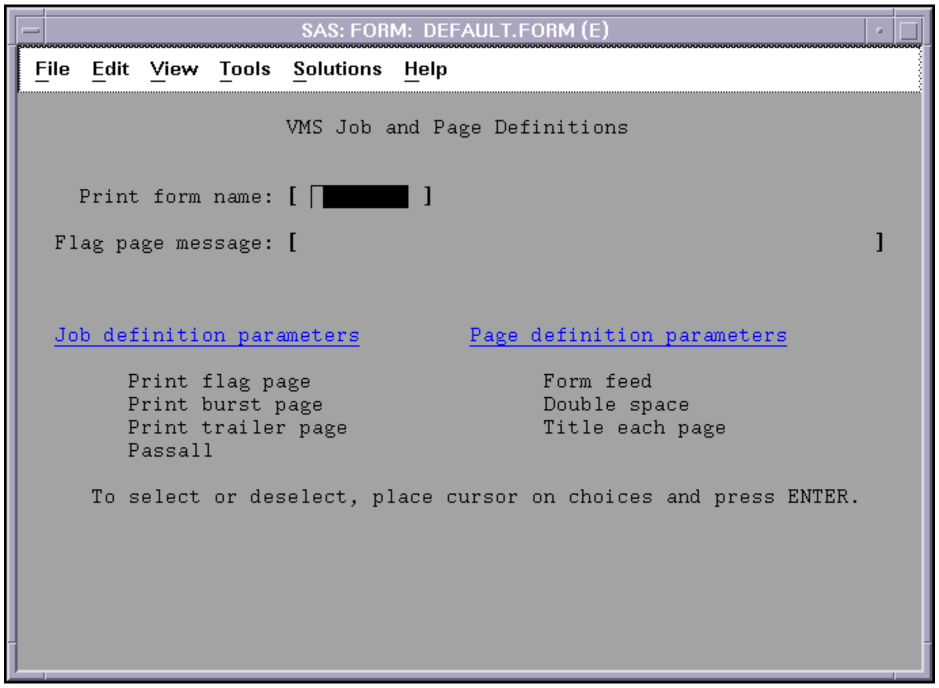
Do not restart

specifies whether to restart the printing of the output when a crash occurs or if a stop/requeue command is issued. By default, jobs are restarted. This field is equivalent to using the RESTART= option in the OpenVMS PRINT command.

OpenVMS Job and Page Definitions Window Frame

The second part of the third Form window frame is the OpenVMS Job and Page Definitions window frame. This window frame is shown in the following display. You display this window frame by placing the cursor on the **`SELECT`** field at the bottom of the OpenVMS Print File Parameters window frame (described in "OpenVMS Print File Parameters Window Frame" on page 273) and pressing RETURN.

Display 12.3 OpenVMS Job and Page Definitions Window


SAS: FORM: DEFAULT.FORM (E)
File Edit View Tools Solutions Help

```
                    VMS Job and Page Definitions

  Print form name: [          ]

Flag page message: [                                              ]


Job definition parameters         Page definition parameters

      Print flag page                   Form feed
      Print burst page                  Double space
      Print trailer page                Title each page
      Passall

   To select or deselect, place cursor on choices and press ENTER.
```

The following fields appear in the OpenVMS Job and Page Definitions window frame:

`Print form name:`
specifies the name of the form that is used for the print queue. Filling in this field is equivalent to using the FORM= option in the OpenVMS PRINT command. These forms are site-dependent. See your system manager for information about which forms are available.

`Flag page message:`
specifies the message to be printed on the flag page. Filling in this field is equivalent to using the NOTE= option in the OpenVMS PRINT command, except that the message cannot contain any spaces or quotation marks.

`Job definition parameters`

`Print flag page`
controls whether a flag page is printed before the output. The flag page displays the name of the user submitting the output and other information about the output being printed. By default, no flag page is printed. Filling in this field is equivalent to using the FLAG= option in the OpenVMS PRINT command.

`Print burst page`
specifies whether a flag page is printed over the perforation in the paper so that the output is easily identified. By default, no burst page is printed. Filling in this field is equivalent to using the BURST= option in the OpenVMS PRINT command.

`Print trailer page`
specifies whether to print a trailer page at the end of the output. The trailer page has the name of the user submitting the output and other information about the output being printed. By default, no trailer page is printed. Filling in this field is equivalent to using the TRAILER= option in the OpenVMS PRINT command.

`Passall`
specifies whether all formatting is bypassed and sent to the printer with formatting suppressed. By default, formatting is used. Filling in this field is equivalent to using the PASSALL= option in the OpenVMS PRINT command.

`Page definition parameters`

`Form feed`
specifies whether form feeds occur within the last four lines of the page when printing is taking place. By default, no form feeds are performed. Filling in this field is equivalent to using the FEED= option in the OpenVMS PRINT command.

`Double space`
specifies whether to double-space the output. By default, the output is single-spaced. Filling in this field is equivalent to using the SPACE= option in the OpenVMS PRINT command.

`Title each page`
specifies whether to print a title on each page of output. By default, no titles are printed. Filling in this field is equivalent to using the HEADER= option in the OpenVMS PRINT command.

CHAPTER 13 Data Set Options under OpenVMS

SAS Data Set Options under OpenVMS

SAS data set options control certain aspects of your SAS session, including the attributes of SAS files and data libraries.

Most SAS data set options are completely described in *SAS Language Reference: Dictionary*. Only the data set options that are specific to the OpenVMS operating environment are documented here. However, all the SAS data set options that are available under OpenVMS are listed in "Summary Table of SAS Data Set Options under OpenVMS" on page 278.

Specifying Data Set Options

Data set options can be specified in parentheses following a data set name. Each option applies only to the SAS data set whose name it follows. RENAME= and KEEP= are examples of SAS data set options.

Some data set options can also be specified as engine or host options in the LIBNAME statement or function.

When one such option appears in a LIBNAME statement or function, it affects all data sets in that SAS data library. If the same option is specified both in the LIBNAME statement or function and after a data set name, SAS uses the value given after the data set name. For more information about the LIBNAME statement and about engine or host options, see "LIBNAME Statement" on page 420.

Some SAS data set options have the same effect (and usually the same name) as system or statement options. For example, the BUFSIZE= data set option is analogous to the BUFSIZE= system option. In the case of overlapping options, SAS uses the following rules of precedence:

- data set option values (highest precedence)
- statement option values (precedence over system options)
- system option values (precedence over default values)
- default values (lowest precedence).

For more information about SAS system options under OpenVMS, see Chapter 19, "System Options under OpenVMS," on page 429.

Option Syntax

When you specify a data set option, use the following syntax:

data-set-name (*option-1* = *value-1 option-2* = *value-2*)

For those options that are valid as engine or host options in the LIBNAME statement or function, use the following syntax:

LIBNAME *libref <engine> 'SAS-data-library' option-1=value-1 option-2=value-2* ...;

Remember that not all data set options are valid as engine or host options. Also keep in mind that it is usually better to specify an engine in the LIBNAME statement than to let SAS determine which engine to use. This is important when you specify an engine or host option that is supported by two engines (for example, the ALQ= data set option) but which behaves differently in each context.

Summary Table of SAS Data Set Options under OpenVMS

The following table lists both the data set options that are valid in all operating environments and the data set options that are specific to OpenVMS. It describes each option and tells whether the option can be used for a data set that has been opened for input, output, or update. The See column tells you where to look for more detailed information about an option. Use the following legend to see where to find more information about an option.

COMP	See the description of the data set option in this section.
LR	See *SAS Language Reference: Dictionary*.
NLS	See *SAS National Language Support (NLS): User's Guide*.

The table also lists the engines with which the option is valid.

Table 13.1 Summary of SAS Data Set Options

Data Set Option	Description	Where Used	Engines	See
ALQ=	specifies the allocation quantity for a data set	output	V9, V8, V7, CONCUR	COMP
ALQMULT=	specifies the multiple of pages allocated for a data set	output	V9, V8, V7, CONCUR	COMP
ALTER=	assigns an alter password to a SAS file and enables access to a password-protected SAS file	input, output, update	V9, V8, V7, V6, V9TAPE, V8TAPE, V7TAPE, CONCUR	LR
BKS=	specifies the bucket size for a data set	output	CONCUR	COMP
BUFNO=	specifies the number of buffers for processing a SAS data set	input, output, update	V9, V8, V7, V6, V9TAPE, V8TAPE, V7TAPE	LR
BUFSIZE=	specifies permanent buffer page size for output SAS data sets	output	V9, V8, V7, V9TAPE, V8TAPE, V7TAPE	LR, COMP
CACHENUM=	specifies the number of I/O data caches	input, output, update	V9, V8, V7, V6	COMP
CACHESIZE=	specifies the size of each I/O data cache allocated for a file	input, output, update	V9, V8, V7, V6	COMP
CNTLLEV=	specifies the level of shared access to SAS data sets	input, update	V9, V8, V7, CONCUR	LR, COMP
COMPRESS=	compresses observations in an output SAS data set	output	V9, V8, V7, V6, V9TAPE, V8TAPE, V7TAPE	LR
DEQ=	specifies the default file-extension quantity for a data set	output, update	V9, V8, V7, CONCUR	COMP
DEQMULT=	specifies the number of pages to extend	output, update	V9, V8, V7, CONCUR	COMP
DLDMGACTION=	specifies what type of action to take when a SAS catalog in a SAS data library is detected as damaged	input, output, update	V9, V8, V7,	LR

Data Set Option	Description	Where Used	Engines	See
DROP=	excludes variables from processing or from output SAS data sets	input, output, update	all	LR
ENCODING=	specifies the character-set encoding to use for processing a particular input or output SAS data set	input, output	V9, V8, V7, V9TAPE, V8TAPE, V7TAPE	NLS
ENCRYPT=	encrypts SAS data files	output	V9, V8, V7	LR
FILECLOSE=	specifies how a tape is positioned when a SAS file on the tape is closed	input, output	V9TAPE, V8TAPE, V7TAPE	LR, COMP
FIRSTOBS=	begins processing at a specified observation	input, update	all	LR
IDXNAME=	directs SAS to use a specific index to satisfy the conditions of a WHERE expression	input, update	V9, V8, V7, V6	LR
IDXWHERE=	overrides the SAS decision about whether to use an index to satisfy the conditions of a WHERE expression	input, update	V9, V8, V7, V6	LR
IN=	creates a variable that indicates whether a data set contributed data to the current observation	input	all	LR
INDEX=	defines indexes when creating a SAS data set	input, output, update	V9, V8, V7, V6, V9TAPE, V8TAPE, V7TAPE	LR
KEEP=	specifies variables for processing or writing to output SAS data sets	input, output, update	all	LR
LABEL=	specifies a label for a data set	input, output, update	all	LR
LOCKREAD=	specifies whether to read a record if a lock cannot be obtained for the record	input	CONCUR	COMP
LOCKWAIT=	indicates whether SAS should wait for a locked record	input	CONCUR	COMP
MBF=	specifies the multibuffer count for a data set	input, output, update	CONCUR	COMP
OBS=	specifies the last observation of a data set to process	input, update	all	LR
OBSBUF=	determines the size of the view buffer for processing a DATA step view	input	V9, V8, V7	LR
OUTREP=	specifies the data representation for the output SAS data set	output	V9, V8, V7, V9TAPE, V8TAPE, V7TAPE	COMP

Data Set Option	Description	Where Used	Engines	See
POINTOBS=	controls whether or not a compressed data set is processed by random access rather than by sequential access only	input	V9, V8, V7	LR
PW=	assigns a read, write, or alter password to a SAS file and enables access to a password-protected SAS file	input, output, update	V9, V8, V7, V6, V9TAPE, V8TAPE, V7TAPE, CONCUR	LR
PWREQ=	controls the pop-up menu of a requestor window for a data set password	input, output, update	V9, V8, V7, V6, V9TAPE, V8TAPE, V7TAPE	LR
READ=	assigns a read password to a SAS file and enables access to a read-protected SAS file	input, output, update	V9, V8, V7, V6, V9TAPE, V8TAPE, V7TAPE, CONCUR	LR
RENAME=	changes the name of a variable	input, output, update	all	LR
REPEMPTY=	replaces an existing data set with a new data set of the same name	output	V9, V8, V7	LR
REPLACE=	controls replacement of like-named temporary or permanent SAS data sets	output	all	LR
REUSE=	specifies reuse of space when observations are added to a compressed data set	output	V9, V8, V7	LR
SORTEDBY=	specifies how the data set is currently sorted	input, output, update	V9, V8, V7, V6, V9TAPE, V8TAPE, V7TAPE	LR
SORTSEQ=	specifies the collating sequence to be used by the SORT procedure	input, output, update	V9, V8, V7	NLS
SPILL=	specifies whether to create a spill for non-sequential processing of a DATA step view	output	V9, V8, V7	LR
TOBSNO=	specifies the number of observations to be transmitted in each multi-observation exchange with a SAS server	input, output, update	V9, V8, V7	LR
TYPE=	specifies the data set type for input, update, and output data	input, output, update	all	LR
WHERE=	selects observations that meet the specified condition	input, output, update	all	LR
WHEREUP=	specifies whether to evaluate added observations and modified observations against a WHERE clause	output, update	V9, V8, V7, V6	LR

Data Set Option	Description	Where Used	Engines	See
WORKCACHE=	specifies the size of the I/O data cache allocated for a file in the WORK data library	input, output, update	V9, V8, V7	COMP
WRITE=	assigns a write password to a SAS file and enables access to a write-protected SAS file	input, output, update	V9, V8, V7, V6, V9TAPE, V8TAPE, V7TAPE, CONCUR	LR

Data Set Options That Are Not Applicable Under OpenVMS

The following SAS data set options are not applicable under OpenVMS:

- RDBLOCK=
- RDBCONST=

Dictionary

ALQ= Data Set Option

Specifies how many disk blocks to initially allocate to a new SAS data set

Default: enough blocks for 10 data set pages

Valid in: DATA step and PROC steps

Category: Data Set Control

Engines: V9, V8, V7, CONCUR

OpenVMS specifics: All aspects are host-specific

Syntax

ALQ=*allocation-quantity*

allocation-quantity

can range from 0 to 2,147,483,647 blocks. (A block is 512 bytes.) The default value is enough space for 10 pages. If you specify ALQ=0 with the V6 or V8 engine, OpenVMS uses the minimum number of blocks that are required for a sequential file. If you specify ALQ=0 with the CONCUR engine, OpenVMS uses the minimum number of blocks that are required for a relative file. OpenVMS RMS always rounds the ALQ= value up to the next disk cluster boundary.

Details

The ALQ= data set option is often used with the BUFSIZE= and DEQ= data set options to control buffer size and disk allocation for more efficient I/O. For example, if an application processes a large SAS data set sequentially, it might be more efficient to use option values like the following:

```
data mylib.a(bufsize=16384 alq=300 deq=96);
   . . . more data lines . . .
run;
```

These statements tell SAS to use a buffer size of 16,384 bytes for data set I/O and to allocate 300 disk blocks to the file initially; when more space is needed, it is allocated in 96-block chunks. This potentially reduces the number of file extensions required for the file. Unused disk blocks are deallocated and freed to the file system at close time. This reduces the number of times a file must be extended, potentially creates a more contiguous file, and reduces subsequent access time.

The order of precedence (from highest to lowest) for specifying initial-allocation values and file-extension values is

1 an ALQ= or DEQ= data set option specified for a specific data set
2 an ALQ= or DEQ= data set option specified in a LIBNAME statement or function
3 system default values.

The ALQ= data set option also corresponds to the **FAB$L_ALQ** field in the OpenVMS RMS structure. For information about the **FAB$L_ALQ** field, see *Guide to OpenVMS File Applications*.

See Also

- "ALQMULT= Data Set Option" on page 283
- "BUFSIZE= Data Set Option" on page 285
- "DEQ= Data Set Option" on page 289
- "DEQMULT= Data Set Option" on page 290
- "Allocating Data Set Space Appropriately" on page 236
- "Allocating File Space Appropriately" on page 241

ALQMULT= Data Set Option

Specifies the number of pages that are preallocated to a file

Default: 10

Valid in: DATA step and PROC steps

Category: Data Set Control

Engines: V9, V8, V7, CONCUR

OpenVMS specifics: All aspects are host-specific

Syntax

ALQMULT=*n*

n

specifies the number of pages that are allocated for a file. The default value is 10.

Details

The ALQMULT= data set option is related to the ALQ= data set option. With the ALQ= data set option, you specify a block value that is preallocated. With the ALQMULT= data set option, enough blocks are preallocated to accommodate the number of pages that you specify. With the ALQMULT= data set option you don't need to know how big the page size (buffer size) is for a file or to determine how many blocks are needed for the desired number of pages.

See Also

- "ALQ= Data Set Option" on page 282
- "BUFSIZE= Data Set Option" on page 285
- "DEQMULT= Data Set Option" on page 290
- "ALQMULT= System Option" on page 443

BKS= Data Set Option

Specifies the bucket size for a new data set

Default: 32

Valid in: DATA step and PROC steps

Category: Data Set Control

Engines: CONCUR

OpenVMS specifics: All aspects are host-specific

Syntax

BKS=*bucket-size*

bucket-size
can range from 0 to 63. If you specify a value of 0, SAS uses the minimum number of blocks that are needed to contain a single observation.

Details

The BKS= data set option specifies the number of OpenVMS disk blocks in each bucket of a new data set. A *disk block* is 512 bytes. A *bucket* is a storage structure of a set number of blocks used for building and processing files of relative and indexed organization. A bucket contains one or more records or record cells. Buckets are the unit of contiguous transfer between RMS buffers and the disk.

The BKS= data set option is applied only when the data set is created. When deciding on the bucket size to use, consider whether the file will be accessed randomly (small bucket size), sequentially (large bucket size), or both ways (medium bucket size). For example, if you know that all the files in a SAS data library will be accessed randomly, by using the FSEDIT procedure for example, then use a small bucket size at the creation of each file to optimize the access. The following example uses the BKS= option in the LIBNAME statement so that the bucket size applies to all CONCUR data sets in that library:

```
libname test concur '[randomdir]' bks=30;
```

The BKS= data set option corresponds to the **`FAB$B_BKS`** field in OpenVMS RMS or to the FILE BUCKET_SIZE attribute when you use File Definition Language (FDL). For additional details, see *Guide to OpenVMS File Applications*.

See Also

□ "The CONCUR Engine under OpenVMS" on page 160

BUFSIZE= Data Set Option

Specifies the permanent buffer page size for an output SAS data set

Default: none

Valid in: DATA step and PROC steps

Category: Data Set Control

Engines: V9, V8, V7, V9TAPE, V8TAPE, V7TAPE

OpenVMS specifics: the value of *n*

See: BUFSIZE= Data Set Option in *SAS Language Reference: Dictionary*

Syntax

BUFSIZE=*n* | *n*K | *n*M | *n*G | *hex*X | MAX

***n* | *n*K | *n*M | *n*G**
specifies the page size in multiples of 1 (bytes); 1,024 (kilobytes); 1,048,576 (megabytes); or 1,073,741,824 (gigabytes). For example a value of **`4k`** specifies a page size of 4096 bytes.

Note: When you specify *n*, the value should be in increments of 512. However, the *n* in *n*K, *n*M, and *n*G does not need to be in increments of 512. △

***hex*X**
specifies the page size as a hexadecimal value. You must specify the value beginning with a number (0–9), followed by hex digits (0–9, A-F), and then followed by an X. For example, **`2dx`** sets the page size to 45 bytes.

MAX
sets the buffer page size to the maximum possible number in your operating environment, up to the largest four-byte, signed integer, which is 2^{31}-1, or approximately 2 billion bytes.

Details

The BUFSIZE= data set option specifies the page size (in bytes) for SAS files. A page of a data set is a logical unit that is used by the engine. The page size is a permanent attribute of the data set. The page size is set when the file is created and cannot be changed thereafter. There is no default value; the value that the engine uses depends on the size of the observation.

For efficiency, use a larger BUFSIZE= value because it reduces the number of I/Os required to read or write the file. However, if the value is too large, disk space could be wasted. Pages must be written in full, even if they are only partially full of data. This means that if you set BUFSIZE= to a large value, 65,536 for example, and the last page contains only 4,000 bytes of data, more than 61,000 bytes of unused storage are written to disk, consuming approximately 120 disk blocks unnecessarily.

The system-dependent CACHESIZE= data set option is related to the BUFSIZE= data set option and can improve I/O performance without wasting disk space. For information about using the CACHESIZE= and BUFSIZE= options together, see "CACHESIZE= Data Set Option" on page 287.

See Also

- "CACHESIZE= Data Set Option" on page 287
- "Setting Larger Buffer Size for Sequential Write and Read Operations" on page 238
- "BUFSIZE= System Option" on page 448

CACHENUM= Data Set Option

Specifies the number of I/O data caches used per SAS file

Default: 10

Valid in: DATA step and PROC steps

Category: Data Set Control

Engines: V9, V8, V7, V6

OpenVMS specifics: All aspects are host-specific

Syntax

CACHENUM=*n*

n

specifies the number of I/O data-cache pages to be used per SAS file. The default value is 10.

Details

The CACHENUM= data set option operates in conjunction with the CACHESIZE= data set option. Pages are cached in memory in a buffer that is the size of the CACHESIZE= value. SAS maintains up to the CACHENUM= value of these caches for each open file.

See Also

- "CACHESIZE= Data Set Option" on page 287
- "CACHENUM= System Option" on page 449

CACHESIZE= Data Set Option

Controls the size of the I/O data cache that is allocated for a SAS file

Default: 65024

Valid in: DATA step and PROC steps

Category: Data Set Control

Engines: V9, V8, V7, V6

OpenVMS specifics: All aspects are host-specific

Syntax

CACHESIZE=*n* | *n*K | *hex*X | MIN | MAX

***n* | *n*K**
specifies the cache size in multiples of 1 (bytes) or 1,024 (kilobytes). For example, a value of **`8`** specifies 8 bytes, and a value of **`3k`** specifies 3,072 bytes.
This value can range from 0 to 65,024 bytes on OpenVMS Alpha before Release 7.2. The cache size can range from 0 to 130,048 bytes on OpenVMS Alpha Release 7.2 or later.

***hex*X**
specifies the cache size as a hexadecimal value. You must specify the value beginning with a number (0–9), followed by hex digits (0–9, A-F), and then followed by an X. For example, the value **`2dx`** sets the cache size to 45 bytes.

MIN
sets the cache size to 0.

MAX
sets the cache size for your operating environment. MAX is 65,024 bytes on OpenVMS Alpha before Release 7.2 and 130,048 bytes on OpenVMS Alpha Release 7.2 or later.

Details

Pages of SAS files are cached in memory with each cache containing multiple pages. The CACHESIZE= data set option controls the size (in bytes) of the data cache used to buffer the I/O pages. Note that memory is consumed for each data cache, and multiple caches are used for each data set opened. Thus, the disadvantage of specifying extremely large CACHESIZE= values is large consumption of memory. The advantage of a larger CACHESIZE= value is that it reduces the actual number of disk I/Os required to read from or write to a file. For example, if you are reading a large data set, you can use the following statements:

```
libname test v8 '[mydir]';
data new;
   set test.big(cachesize=65024);
   . . . more data lines . . .
run;
```

This DATA step reads the TEST.BIG data set in the most efficient manner.

If a data cache is used, then one disk I/O is the size of the CACHESIZE= value. If no data cache is allocated, then one disk I/O is the size of the BUFSIZE= value. The size of the page is controlled with the BUFSIZE= data set option.

Comparisons

The CACHESIZE= and BUFSIZE= data set options are similar, but they have important differences. BUFSIZE= specifies the file's page size, which is a permanent attribute of the file. It can be set only when the file is created. CACHESIZE= is the size of the internal memory cache that is used for the life of the current file open. It can change any time the file is opened. Specifying a large BUFSIZE= value and CACHESIZE=0 improves I/O the same way that specifying a large CACHESIZE= value does. However, because only complete pages can be written to the file, if the actual data requires less space than the specified BUFSIZE= value, the file uses more disk space than necessary.

For example, if you specify BUFSIZE=65024 and CACHESIZE=0, I/O is performed in increments of the page size. If the data actually require only 32,000 bytes of storage, then more than half the space allocated for the file is unused. If you specify BUFSIZE=32768 and CACHESIZE=65024, I/O is still performed in increments of 65,024 bytes. However, if the data requires only 32,000 bytes, little space is wasted.

See Also

- □ "BUFSIZE= Data Set Option" on page 285
- □ "CACHENUM= Data Set Option" on page 286
- □ "Setting Larger Buffer Size for Sequential Write and Read Operations" on page 238
- □ "CACHESIZE= System Option" on page 450

CNTLLEV= Data Set Option

Specifies the level of shared access to SAS data sets

Default: varies

Valid in: DATA step and PROC steps

Category: Data Set Control

Engines: V9, V8, V7, CONCUR

OpenVMS specifics: syntax

See: CNTLLEV= Data Set Option in *SAS Language Reference: Dictionary*

Syntax

CNTLLEV=MEM | REC

MEM
specifies that concurrent access is controlled at the SAS data set (or member) level. Member-level control restricts concurrent access to only one update or output process but allows read access to many sessions, procedures, or statements.

REC
specifies that concurrent access is controlled at the observation (or record) level. Record-level control allows more than one update access to the same SAS data set, but it denies concurrent update of the same observation.

Details

The CNTLLEV= option specifies the level at which shared update access to a SAS data set is denied.

With the CONCUR engine, you can request exclusive access to the file, or you can share access with record-level locking.

By default with the concurrency engine, data sets that are opened for input allow shared read access; data sets that are opened for output demand exclusive access; and data sets that are opened for update either allow shared read and shared write access or they retain exclusive access to the file, depending on the method that is used.

For example, you can allow other users both read and write access to a data set that you are opening for input only. By default, only shared read access is allowed. To enable record-level locking for the data set TEST.TWO, use the following statements:

```
libname test concur '[mydir]';
data test.one;
   set test.two(cntllev=rec);
run;
```

As another example, suppose you want to both plot and update your file simultaneously by using the FSEDIT procedure. By default, the PLOT procedure opens a data set for exclusive access, even though it only reads the file. To allow concurrent access, use the following statements:

```
libname test concur '[mydir]';
proc plot data=test.a(cntllev=rec);
run;
```

Note: The CNTLLEV= data set option is ignored for output files; output files always retain exclusive access. △

DEQ= Data Set Option

Tells OpenVMS how many disk blocks to add when it automatically extends a SAS data set during a write operation

Default: enough blocks for 5 data set pages

Valid in: DATA step and PROC steps

Category: Data Set Control

Engines: V9, V8, V7, CONCUR

OpenVMS specifics: All aspects are host-specific

Syntax

DEQ=*default-file-extension-quantity*

default-file-extension-quantity
can range from 0 to 65,535 blocks. (A block is 512 bytes.) If you specify a value of 0, OpenVMS uses the process's default value. The default value is enough space for 5 pages.

Details

You should set the value to at least 10 percent of the normal data set size. A large value results in fewer file extensions during the life of the file; a small value results in many file extensions over the life of the file. Note that record access is slowed when a file has many noncontiguous file extensions.

Example

Suppose you specify the DEQ= data set option as follows:

```
libname test '[mydir]';
data test.a(alq=1000 deq=1000);
   . . . more data lines . . .
run;
```

Specifying DEQ=1000 indicates that if more space is needed for the file, that space is allocated in 1,000-block chunks. Note that OpenVMS always rounds the DEQ= value up to the next disk-cluster boundary.

See Also

- □ “ALQ= Data Set Option” on page 282
- □ “DEQMULT= Data Set Option” on page 290
- □ “Allocating Data Set Space Appropriately” on page 236
- □ “Allocating File Space Appropriately” on page 241

DEQMULT= Data Set Option

Specifies the number of pages to extend a SAS file

Default: 5

Valid in: DATA step and PROC steps

Category: Data Set Control

Engines: V9, V8, V7, CONCUR

OpenVMS specifics: All aspects are host-specific

Syntax

DEQMULT=*n*

n

specifies the number of pages to extend a SAS file. The default value is 5.

Details

The DEQMULT= data set option controls how many pages worth of disk blocks are added to a file each time it has to be extended. By default, enough space for 5 pages is added.

See Also

- “ALQ= Data Set Option” on page 282
- “ALQMULT= Data Set Option” on page 283
- “DEQ= Data Set Option” on page 289
- “DEQMULT= System Option” on page 455

FILECLOSE= Data Set Option

Specifies how a tape is positioned when a SAS file on the tape is closed

Default: LEAVE

Valid in: DATA step and PROC steps

Category: Miscellaneous

Engines: V9TAPE, V8TAPE, V7TAPE

OpenVMS specifics: list of valid values

See: FILECLOSE= Data Set Option in *SAS Language Reference: Dictionary*

Syntax

FILECLOSE= FREE | LEAVE | REREAD | REWIND

FREE
rewinds and dismounts the tape when the current file is closed. Note that under OpenVMS, the device is dismounted, not deallocated or “freed.”

LEAVE
positions the tape at the end of the file that was just processed. Use FILECLOSE=LEAVE if you are not repeatedly accessing the same files in a SAS program, but you are accessing one or more subsequent SAS files on the same tape.

REREAD
positions the tape volume at the beginning of the file that was just processed. Use FILECLOSE=REREAD if you are accessing the same SAS data set on tape several times in a SAS program.

REWIND
rewinds the tape volume to the beginning. Use the FILECLOSE=REWIND if you are accessing one or more previous SAS files on the same tape, but you are not repeatedly accessing the same files in a SAS program.

Details

The FILECLOSE= data set option overrides the TAPECLOSE= system option.

See Also

- “TAPECLOSE= System Option” on page 503

LOCKREAD= Data Set Option

Specifies whether to read a record if a lock cannot be obtained for the record

Default: NO

Valid in: DATA step and PROC steps

Category: Observation Control

Engines: CONCUR

OpenVMS specifics: All aspects are host-specific

Syntax

LOCKREAD=YES | NO

YES
indicates that the record must be locked when read. If another process already has the record locked, the read operation fails, and you receive a message that the record is locked by another process.

NO
indicates that records do not have to be locked when they are read. If another process already has the record locked, the data is read but is not locked by the reading process.

Details

The LOCKREAD= data set option controls whether SAS reads a record when the record is locked by another process. This option applies only to data sets that are accessed for input. Examples of accessing a data set for input include using the SET statement and the PRINT and FSBROWSE procedures. This data set option does not apply when you are using, for example, the FSEDIT procedure, which accesses a data set for update.

If you specify LOCKREAD=YES and your job tries to access a locked record, the read operation fails. The severity of the failure depends on your job. If you are using FSBROWSE, and you try to move to a locked observation, a message displays saying the observation is unavailable. However, you can still move to other observations that are not locked. A more severe failure occurs if you are using a SET statement in the DATA step. If the DATA step encounters a locked record, the DATA step fails, and your data set will probably be incomplete.

CAUTION:
Use LOCKREAD=NO with care. When you specify LOCKREAD=NO, SAS reads locked records. This can result in obsolete data being read. If you know that the data that you are reading is changing often, do not use LOCKREAD=NO. △

LOCKREAD= is closely related to the LOCKWAIT= data set option, which controls whether SAS waits for a locked record to become available.

See Also

- "LOCKWAIT= Data Set Option" on page 293

LOCKWAIT= Data Set Option

Indicates whether SAS should wait for a locked record

Default: NO

Valid in: DATA step and PROC steps

Category: Observation Control

Engines: CONCUR

OpenVMS specifics: All aspects are host-specific

Syntax

LOCKWAIT=YES | NO | *n*

YES
tells OpenVMS RMS to wait when it is requesting access to locked records. If you specify LOCKWAIT=YES, OpenVMS RMS waits forever. Even if LOCKREAD=NO is in effect, the record is not read.

NO
tells OpenVMS RMS not to wait for a locked record to become available. If a record is locked and LOCKREAD=NO is in effect, SAS reads the record anyway. This can result in obsolete data being read. If LOCKREAD=YES is in effect, the I/O request fails.

n
tells OpenVMS RMS to wait for *n* seconds for a locked record. If the record becomes available within *n* seconds, the record is read. If the record does not become available and LOCKREAD=YES is in effect, the I/O request fails. If the record does not become available and LOCKREAD=NO is in effect, the record is read even though it is locked. Note, however, that you may read obsolete data in this case. The value of *n* can range from 1 to 255.

Details

The LOCKWAIT= data set option indicates whether OpenVMS RMS should wait when requesting access to locked records for read, write, or update access. It is used in conjunction with the LOCKREAD= data set option.

See Also

- "LOCKREAD= Data Set Option" on page 292

MBF= Data Set Option

Specifies the multibuffer count for a data set

Default: 2 for files opened for update; 1 for files opened for input or output

Valid in: DATA step and PROC steps

Category: Data Set Control

Engines: CONCUR

OpenVMS specifics: All aspects are host-specific

Syntax

MBF=*multibuffer-count*

multibuffer-count
is the number of I/O buffers that you want OpenVMS RMS to allocate for a particular file. The value can range from 0 to 127, and it must be an integer. If you specify MBF=0, the process's default value is used.

Details

A multibuffer count of 1 is adequate to process your data set sequentially. However, for random access, it is more efficient to use more than one buffer to store various parts of your file in memory. For example, to tell OpenVMS RMS to allocate five buffers for every file in a data library, use the following statement:

```
libname test concur '[mydir]' mbf=5;
```

The MBF= data set option corresponds to the **FAB$B_MBF** field in OpenVMS RMS or to the CONNECT MULTIBUFFER_COUNT attribute when you are using FDL. For additional details about the **FAB$B_MBF** field, see *Guide to OpenVMS File Applications*.

See Also

- "The CONCUR Engine under OpenVMS" on page 160

OUTREP= Data Set Option

Specifies the data representation for the output SAS data set

Valid in: DATA step, PROC steps, LIBNAME statement

Engines: V9, V8, V7, V9TAPE, V8TAPE, V7TAPE

Category: Data Set Control

OpenVMS specifics: enables you to access files between OpenVMS VAX and ALPHA operating environments

See: OUTREP= Data Set Option in *SAS Language Reference: Dictionary*

Syntax

OUTREP=*format*

format
specifies the data representation for the output SAS data set. For a complete list of valid values, see "OUTREP= Data Set Option" in *SAS Language Reference: Dictionary*.

Details

CEDA enables you to access files between ALPHA_VMS and VAX_VMS hosts in SAS Version 8. They are considered one platform even though they have different representations.

For more information about CEDA, see *SAS Language Reference: Concepts*.

See Also

- "WORKCACHE= System Option" on page 507
- "CACHESIZE= Data Set Option" on page 287

WORKCACHE= Data Set Option

Specifies the size of the I/O data cache allocated for a file in the WORK data library

Default: 65024

Valid in: DATA step and PROC steps

Category: Data Set Control

Engines: V9, V8, V7

OpenVMS specifics: valid values for *n*

Syntax

WORKCACHE=*n* | *n*K | *hex*X | MIN | MAX

***n* | *n*K**
specifies the size of the I/O data cache in multiples of 1 (bytes) or 1,024 (kilobytes). For example, a value of **8** specifies 8 bytes, and a value of **3k** specifies 3,072 bytes.

This value can range from 0 to 65,024 bytes on OpenVMS Alpha before Release 7.2. The size of the data cache can range from 0 to 130,048 bytes on OpenVMS Alpha Release 7.2 or later.

***hex*X**
specifies the size of the I/O data cache as a hexadecimal value. You must specify the value beginning with a number (0–9), followed by hex digits (0–9, A-F), and then followed by an X. For example, the value **2dx** sets the size of the I/O data cache to 45 bytes.

MIN
sets the size of the I/O data cache to 0.

MAX
sets the size of the I/O data cache for your operating environment. MAX is 65,024 bytes on OpenVMS Alpha before Release 7.2 and 130,048 bytes on OpenVMS Alpha Release 7.2 or later.

Details

The WORKCACHE= data set option controls the size (in bytes) of each I/O data cache used for all files in the WORK data library. The value of *n* must be a positive integer.

See Also

- “WORKCACHE= System Option” on page 507
- “CACHESIZE= Data Set Option” on page 287

CHAPTER 14

Formats under OpenVMS

SAS Formats under OpenVMS

A SAS format is an instruction or template that SAS uses to write data values. Most SAS formats are described completely in *SAS Language Reference: Dictionary*. The formats that are described here have behavior that is specific to SAS under OpenVMS.

Many of the SAS formats that have details that are specific to the OpenVMS operating environment are used to write binary data. For more information, see "Writing Binary Data under OpenVMS" on page 297.

Writing Binary Data under OpenVMS

Different computers store numeric binary data in different forms. IBM 370 and Hewlett-Packard 9000 computers store bytes in one order. Microcomputers that are IBM compatible and some computers manufactured by Compaq store bytes in a different order called *byte-reversed*.

Binary data that is stored in one order cannot be read by a computer that stores binary data in the other order. When you are designing SAS applications, try to anticipate how your data will be read and choose your formats and informats accordingly.

SAS provides two sets of informats for reading binary data and corresponding formats for writing binary data.

- The IB*w.d*, PD*w.d*, PIB*w.d*, and RB*w.d* informats and formats read and write in native mode, that is, using the byte-ordering system that is standard for the machine.

- The S370FIB*w.d*, S370FPD*w.d*, S370FRB*w.d*, and S370FPIB*w.d* informats and formats read and write according to the IBM 370 standard, regardless of the native mode of the machine. These informats and formats enable you to write SAS programs that can be run in any SAS environment, regardless of how numeric data is stored.

If a SAS program that reads and writes binary data runs on only one type of machine, you can use the native mode informats and formats. However, if you want to write SAS programs that can be run on multiple machines using different byte-storage systems, use the IBM 370 formats and informats. The purpose of the IBM 370 informats and formats is to enable you to write SAS programs that can be run in any SAS environment, no matter what standard you use for storing numeric data.

For example, suppose you have a program that writes data with the PIB*w.d* format. You execute the program on a microcomputer so that the data is stored in byte-reversed mode. Then you run another SAS program on the microcomputer that uses the PIB*w.d* informat to read the data. The data is read correctly because both of the programs are run on the microcomputer using byte-reversed mode. However, you cannot upload the data to a Hewlett-Packard 9000-series machine and read the data correctly because it is stored in a format that is native to the microcomputer but foreign to the Hewlett-Packard 9000. To avoid this problem, use the S370FPIB*w.d* format to write the data; even on the microcomputer, this causes the data to be stored in IBM 370 mode. Then read the data using the S370FPIB*w.d* informat. Regardless of what type of machine you use when reading the data, it is read correctly.

Dictionary

HEX*w*. Format

Converts real-binary (floating-point) values to hexadecimal values

Category: numeric

Width range: 1 to 16

Default width: 8

Alignment: left

OpenVMS specifics: ASCII character-encoding system

See: HEXw. Format in *SAS Language Reference: Dictionary*

Syntax

HEX*w*.

w

specifies the width of the output field. When you specify a *w* value of 1 through 15, the real binary number is truncated to a fixed-point integer before being converted to hexadecimal notation. When you specify 16 for the *w* value, the floating-point value of the number is used; in other words, the number is not truncated.

Details

Each byte requires two columns to represent the corresponding hexadecimal digits. Under OpenVMS, the hexadecimal format of the number is stored in ASCII representation. For example, the decimal integer 17 has a hexadecimal value of 11, so the HEX2. format of 17 is 11.

If HEX16. is specified, the floating-point number is not converted to an integer, and you receive the hexadecimal representation of the native floating-point representation. The bytes of the number are printed so that the left-most byte is of the lowest significance. For more information about OpenVMS floating-point representation, see *OpenVMS Programming Interfaces: Calling a System Routine, Appendix B*.

See Also

- □ "$HEX*w*. Format" on page 299
- □ "HEX*w*. Informat" on page 362

$HEX*w*. Format

Converts character values to hexadecimal values

Category: character

Width range: 1 to 32767

Default width: 4

Alignment: left

OpenVMS specifics: ASCII character-encoding system

See: $HEXw. Format in *SAS Language Reference: Dictionary*

Syntax

$HEX*w*.

w
specifies the width of the output field.

Details

The $HEX*w*. format is like the HEX*w*. format in that it converts a character value to hexadecimal notation, with each byte requiring two columns. Under OpenVMS, the $HEX*w*. format produces hexadecimal representations of ASCII codes for characters.

See Also

- □ "HEX*w*. Format" on page 298
- □ "$HEX*w*. Informat" on page 363

IB*w.d* Format

Writes numbers in integer binary (fixed-point) format

Category: numeric

Width range: 1 to 8

Default width: 4

Decimal range: 0 to 10

Alignment: left

OpenVMS specifics: twos-complement notation; overflow behavior

See: IBw.d Format in *SAS Language Reference: Dictionary*

Syntax

IB*w.d*

w
specifies the width of the output field in bytes (not digits).

d
optionally specifies a scaling factor. When you specify a *d* value, the IB*w.d* format multiplies the number by the 10^d value, then applies the integer binary format to that value.

Details

Negative values are stored in twos-complement notation. If a noninteger value is formatted, rounding occurs. If the value to be formatted is too large to fit in a field of the specified width, then the IB*w.d* format does the following:

- for positive values, it sets the output to the largest positive number that fits in the given width.
- for negative values, it sets the output to the negative number of greatest magnitude that fits in the given width.

For more information about OpenVMS native fixed-point values, see *OpenVMS Programming Interfaces: Calling a System Routine, Appendix B.*

Example

If you format the value 300 using the IB1. format, you receive the following value:

```
127
```

which is the largest positive value that fits in a byte.

If you format the value -300 using the IB1. format, you receive the following value:

```
-128
```

See Also

- □ "IB*w.d* Informat" on page 364
- □ "Writing Binary Data under OpenVMS" on page 297

PD*w.d* Format

Writes values in packed decimal format

Category: numeric

Width range: 1 to 16

Default width: 1

Decimal range: 0 to 10

Alignment: left

OpenVMS specifics: overflow behavior

See: PDw.d Format in *SAS Language Reference: Dictionary*

Syntax

PD*w.d*

w
specifies the width of the output field in bytes (not digits).

d
optionally specifies a scaling factor. When you specify a *d* value, the PD*w.d* format multiplies the number by the 10^d value, then applies the packed decimal format to that value.

Details

Under OpenVMS, if the value to be formatted is too large to fit in a field of the specified width, then the PD*w.d* format does the following:

- □ for positive values, it sets the output to the largest positive number that fits in the given width.
- □ for negative values, it sets the output to the negative number of greatest magnitude that fits in the given width.

Example

If you format the value 300 using the PD1. format, you receive the following hexadecimal string:

```
'9C'x
```

which is the packed decimal representation for 9.

If you format the value -300 using the PD1. format, you receive the following hexadecimal string:

```
'9D'x
```

which is the packed decimal representation for -9.

See Also

- □ "PD*w.d* Informat" on page 364
- □ "Writing Binary Data under OpenVMS" on page 297

PIB*w.d* Format

Writes positive integer-binary fixed-point values

Category: numeric

Width range: 1 to 8

Default width: 1

Decimal range: 0 to 10

Alignment: left

OpenVMS specifics: overflow behavior

See: PIBw.d Format in *SAS Language Reference: Dictionary*

Syntax

PIB*w.d*

w

specifies the width of the output field in bytes (not digits).

d

optionally specifies a scaling factor. When you specify a *d* value, the PIB*w.d* format multiplies the number by the 10^d value, then applies the positive integer binary format to that value.

Details

If the value to be formatted is too large to fit in a field of the specified width, then this format does the following:

- □ for positive values, it sets the output to the largest positive number that fits in the given width.
- □ for negative values, it sets the output to the negative number of greatest magnitude that fits in the given width.

If a noninteger value is formatted, rounding occurs.

For more information about OpenVMS native fixed-point values, see *OpenVMS Programming Interfaces: Calling a System Routine, Appendix B*.

Example

If you format the value 300 with the PIB1. format, you receive the following value:

```
255
```

which is the largest unsigned value that fits in a 1-byte field.

See Also

- □ "PIB*w.d* Informat" on page 365
- □ "Writing Binary Data under OpenVMS" on page 297

RB*w.d* Format

Writes numeric data in real-binary (floating-point) notation

Category: numeric

Width range: 2 to 8

Default width: 4

Decimal range: 0 to 10

Alignment: left

OpenVMS specifics: native floating-point representation

See: RBw.d Format in *SAS Language Reference: Dictionary*

Syntax

RB*w.d*

w
specifies the width of the output field.

d
optionally specifies a scaling factor. When you specify a *d* value, the RB*w.d* format multiplies the number by the 10^d value, then applies the real binary format to that value.

Details

Under OpenVMS, the RB*w.d* format causes floating-point numbers to be formatted in the native floating-point representation. Numeric data for scientific calculations are commonly represented in floating-point notation. (SAS stores all numeric values in floating-point notation.) A floating-point value consists of two parts: a mantissa that gives the value and an exponent that gives the value's magnitude.

Real binary is the most efficient format for representing numeric values because SAS already represents numbers this way and no conversion is needed.

For more information about OpenVMS floating-point representation, see *OpenVMS Programming Interfaces: Calling a System Routine, Appendix B*.

See Also

- □ "RB*w.d* Informat" on page 366
- □ "Writing Binary Data under OpenVMS" on page 297

UIC*w*. Format

Converts a SAS numeric value to an OpenVMS UIC string

Category: numeric

Width range: 16 to 31

Default width: 31

Alignment: left

OpenVMS specifics: All aspects are host-specific

Syntax

UIC*w*.

w

is the width of the output field and must be 16 through 31 (numbers less than 16 or greater than 31 are invalid). If no *w* value is specified, then UIC defaults to the width of the resulting output string.

Details

The UIC value is a 32-bit value, where the upper 16 bits is the group value and the lower 16 bits is the member value. The UIC values that are displayed as two numbers are octal numbers. If alphanumeric values exist for the numbers, the alphanumerics will be displayed. For example:

```
data _null_;
   x=4194377;
   put x uic.;
run;
```

produces

```
[HOSTVMS,MYIDENT]
```

A system manager assigns a user identification code (UIC) to each OpenVMS user and stores the UIC in the user authorization file (UAF). Each UIC consists of a member identifier and (optionally) a group identifier, enclosed in square brackets, as follows:

```
[<group-identifier>,member-identifier]
```

where *member-identifier* and *group-identifier* can be either names, numbers, or hexadecimal representations.

See Also

- □ "GETQUOTA Function" on page 336

VMSMSG*w*. Format

Writes numeric values as character strings that contain the equivalent OpenVMS message

Category: numeric

Width range: 16 to 32767

Alignment: left

OpenVMS specifics: All aspects are host-specific

Syntax

VMSMSG*w*.

w

specifies the width of the output field.

Details

Data formatted using the VMSMSG*w*. format are ASCII strings.

Symbolic FAO (Formatted ASCII Output) substitution is not performed.

Example

If you format the value 1 using the VMSMSG. format in the following SAS statement:

```
put rc vmsmsg.;
```

the result is %SYSTEM-S-NORMAL, which is an ASCII string indicating normal successful completion.

VMSTIMEF. Format

Converts a SAS date-time value to an 8-byte binary value in OpenVMS date and time format

Category: date and time

Width range: 8

Default width: 8

Alignment: left

OpenVMS specifics: All aspects are host-specific

Syntax

VMSTIMEF.

Details

The VMSTIMEF. format is specific to OpenVMS. You cannot specify a width with this format; the width is always 8 bytes.

OpenVMS date and time values that are read in with the VMSTIME. informat retain precision up to 1/100 of a second, even though SAS cannot display anything less than whole seconds. If you later use the VMSTIMEF. format to write out the date-time value, the precision is retained.

See Also

- “VMSTIME. Informat” on page 368

VMSZN*w.d* Format

Generates VMS zoned numeric data

Category: numeric

Width range: 1 to 32

Default width: 1

Alignment: left

OpenVMS specifics: All aspects are host-specific

Syntax

VMSZN*w.d*

w
specifies the width of the output field

d
optionally specifies the number of digits to the right of the decimal point in the numeric value.

Details

The VMSZN*w.d* format is similar to the ZD*w.d* format. Both generate a string of ASCII digits, and the last digit is a special character that denotes the magnitude of the last digit and the sign of the entire number. The difference between these formats is in the special character that is used for the last digit. The following table shows the special characters that are used by the VMSZN*w.d* format.

Desired Digit	Special Character	Desired Digit	Special Character
0	0	-0	p
1	1	-1	q
2	2	-2	r

Desired Digit	Special Character	Desired Digit	Special Character
3	3	-3	s
4	4	-4	t
5	5	-5	u
6	6	-6	v
7	7	-7	w
8	8	-8	x
9	9	-9	y

Data formatted using the VMSZN*w.d* format are ASCII strings.

If the value to be formatted is too large to fit in a field of the specified width, then the VMSZN*w.d* format does the following:

□ for positive values, it sets the output to the largest positive number that fits in the given width.

□ for negative values, it sets the output to the negative number of greatest magnitude that fits in the given width.

Example

Example 1: Using the VMSZN*w.d* Format in a SAS Statement If you format the value 1234 using the VMSZN*w.d* format in the following SAS statement:

```
put i vmszn4.;
```

the result is 1234, which is an ASCII string.

If you format the value 1234 using the VMSZN*w.d* format in the following SAS statement:

```
put i vmszn5.1;
```

the result is 12340, which is an ASCII string.

If you format the value 1234 using the VMSZN*w.d* format in the following SAS statement:

```
put i vmszn6.2;
```

the result is 123400, which is an ASCII string.

If you format the value -1234 using the VMSZN*w.d* format in the following SAS statement:

```
put i vmszn5.;
```

the result is 123t, which is an ASCII string.

See Also

□ "ZD*w.d* Format" in *SAS Language Reference: Dictionary*

□ "VMSZN*w.d* Informat" on page 368

□ "ZD*w.d* Informat" on page 370

CHAPTER

15

Functions and CALL Routines under OpenVMS

SAS Functions under OpenVMS

A SAS function returns a value from a computation or system operation. Most functions use arguments that are supplied by the user as input.

Most SAS functions are completely described in *SAS Language Reference: Dictionary*. The functions that are described here have syntax or behavior that is specific to the OpenVMS operating environment.

Using Terminal-Access Functions

In the following sections, a category is listed immediately following the name and short description of each function. Most of these categories are self-explanatory. For terminal-access functions, which enable you to get information from and write information to the terminal, please observe the following caution:

CAUTION:
Do not use the terminal-access functions in the windowing environment. Terminal-access functions work in the windowing environment, but they can either overwrite the display or be overwritten by the display. (The REFRESH (CTRL-R) command can be used to restore your display.) For details about the REFRESH command, see the Base SAS Software section in SAS Help and Documentation. △

Under OpenVMS, the following SAS functions are terminal-access functions:

SETTERM

TERMIN

TERMOUT

TTCLOSE

TTCONTRL

TTOPEN

TTREAD

TTWRITE

SAS CALL Routines under OpenVMS

SAS CALL routines are used to alter variable values or perform other system functions. Most CALL routines are completely described in *SAS Language Reference: Dictionary*. The CALL routines that are described here have syntax or behavior that is specific to the OpenVMS operating environment.

Dictionary

ASCEBC Function

Converts an input character string from ASCII to EBCDIC

Category: Character-String Translation

OpenVMS specifics: All aspects are host-specific

Syntax

ASCEBC (*in-string*)

in-string
is any ASCII string, and can be a character variable, a character literal enclosed in double quotation marks, or another character expression. The value of *in-string* is limited to 200 characters.

Details

The return value is the EBCDIC translation of *in-string*.

BYTE Function

Returns one character in the ASCII collating sequence

Category: Character

OpenVMS specifics: ASCII collating sequence

See: BYTE Function in *SAS Language Reference: Dictionary*

Syntax

BYTE(*n*)

n
specifies an integer that represents a specific ASCII character. The value of *n* can range from 0 to 255.

Details

If the BYTE function returns a value to a variable that has not yet been assigned a length, by default the variable is assigned a length of 1.

CALL FINDEND Routine

Releases resources that are associated with a directory search

Category: General-Purpose OpenVMS

OpenVMS specifics: All aspects are host-specific

Syntax

CALL FINDEND(*context*);

context
is the same as the context variable that is used by the FINDFILE function to maintain the search context between executions of FINDFILE. The context argument must be initialized before FINDFILE is called. Also, the value of context must not be manipulated before it is used in the CALL FINDEND routine; if it is, channels and resources cannot be freed to the process until the process terminates.

Details

Like the LIB$FIND_FILE_END Run Time Library Call, the CALL FINDEND routine releases resources that were associated with a directory search. Use the CALL FINDEND routine with the FINDFILE function.

Example

In the following example, FINDFILE is used to search the user's directories for a filename that matches MYPROG*.SAS. If it finds a file named MYPROG12.SAS, for example, then FN is set to **`myprog12.sas`**. The CALL FINDEND routine is then called to terminate the directory search and to release the associated resources.

```
context=0;
fn=findfile("myprog*.sas",context);
do while (fn ^= ' ');
   put fn;
   fn=findfile("myprog*.sas",context);
end;
call findend(context);
```

See Also

- "FINDFILE Function" on page 327

CALL SYSTEM Routine

Submits an operating system command for execution

Category: Special

OpenVMS specifics: Issues DCL commands; some commands execute in a subprocess, others in the parent process

See: CALL SYSTEM Routine in *SAS Language Reference: Dictionary*

Syntax

CALL SYSTEM(*DCL-command*);

DCL-command
can be any of the following under OpenVMS:

- a DCL command enclosed in single or double quotation marks
- an expression whose value is a DCL command
- the name of a character variable whose value is a DCL command.

Details

In the windowing environment, a new window is displayed when the command executes. Any output from the command is displayed (for example, a directory listing). Select the **`File`** menu and click on **`Exit`** to remove this window.

Note that some DCL commands execute in the parent OpenVMS process and some execute in a subprocess. For more information, see "Issuing DCL Commands during a SAS Session" on page 43.

Comparisons

The CALL SYSTEM routine is similar to the X statement, the X command, the %SYSEXEC macro, and the VMS function; however it can be called conditionally. In most cases, the X statement, the X command, or the %SYSEXEC macro are preferable because they require less overhead. However, the CALL SYSTEM routine can be useful in certain situations because it is executable, and because it accepts expressions as arguments. The benefit of the CALL SYSTEM routine being callable is that it is not executed unconditionally at DATA step compile time, whereas other methods are.

Example

The following is an example of the CALL SYSTEM routine:

```
data _null_;
   call system('define mylib [mydir.datasets]');
run;
```

See Also

- "Issuing DCL Commands during a SAS Session" on page 43
- "X Command" on page 270
- "VMS Function" on page 359
- "X Statement" on page 427
- %SYSEXEC Macro in "Macro Functions under OpenVMS" on page 519

COLLATE Function

Returns an ASCII collating sequence character string

Category: Character

OpenVMS specifics: ASCII collating sequence

See: COLLATE Function in *SAS Language Reference: Dictionary*

Syntax

COLLATE(*start-position<,end-position>*) | (*start-position<,,length>*)

start-position
specifies the numeric position in the collating sequence of the first character to be returned.

end-position
specifies the numeric position in the collating sequence of the last character to be returned.

length
specifies the number of characters in the collating sequence.

Details

The COLLATE function returns a string of ASCII characters, which can range in value from 0 to 255. Characters 128 to 255 are usually special control characters such as special fonts, but the COLLATE function returns them.

Unless you assign the return value of the COLLATE function to a variable with a defined length less than 200, the ASCII collating sequence string is padded with blanks to a length of 200. If the ASCII collating sequence is greater than 200 characters, you must specify the length for the return string in a LENGTH statement; otherwise, the returned string will be truncated to a length of 200 characters. For more information, see the following examples.

Examples: How SAS Determines the Length of the Return String

Example 1: Truncating the Variable Length to 200 Characters Since the following code does not include a LENGTH statement, the length attribute for the Address variable is truncated to 200 characters.

```
data sales;
   Address=collate(1,241);
run;

proc contents;
run;
```

Output 15.1 Portion of PROC CONTENTS Output

```
Alphabetic List of Variables and Attributes
#      Variable      Type      Len

1      Address       Char      200
```

Since length for Address is limited to 200 characters, the returned string from the COLLATE function will be limited to 200 characters.

Example 2: Specifying a Length Greater than 200 Characters To specify a length greater than 200 characters for a specific variable, you can use the LENGTH statement. In the following code, the length of Address is specified as 240 characters.

```
data sales;
   length Address $240;
   Address=collate(1,241);
run;

proc contents;
run;
```

Output 15.2 Portion of PROC CONTENTS Output

```
Alphabetic List of Variables and Attributes
#      Variable      Type      Len

1      Address       Char      240
```

Since the length of Address is set to 240 characters, the returned string from the COLLATE function will contain 240 characters.

See Also

- "LENGTH Statement" on page 419

DELETE Function

Deletes a file

Category: General-Purpose OpenVMS

OpenVMS specifics: All aspects are host-specific

Syntax

DELETE('*file-specification*')

'file-specification'
is the name of the file to be deleted. It can be a character variable, a character literal enclosed in double quotation marks, or another character expression. The value for *file-specification* must be enclosed in single or double quotation marks.

Details

If the DELETE function executes successfully, the return value is 0. Otherwise, the return value is any of the OpenVMS error codes that indicate why it failed.
The following are two common error codes:

`98962`	File not found.
`98970`	Insufficient privilege or file protection violation.

The text of the error codes is retrieved using the GETMSG function.

See Also

- "GETMSG Function" on page 335

DINFO Function

Returns information about a directory

Category: External Files

OpenVMS specifics: Valid values for *info-item*; returned values

See: DINFO Function in *SAS Language Reference: Dictionary*

Syntax

DINFO(*directory-id*,*info-item*)

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.

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.

See Also

- "DOPEN Function" on page 317
- "DOPTNAME Function" on page 318
- "DOPTNUM Function" on page 318

DOPEN Function

Opens a directory and returns a directory identifier value

Category: External Files

OpenVMS specifics: Valid values for *fileref*

See: DOPEN Function in *SAS Language Reference: Dictionary*

Syntax

DOPEN('*fileref*')

'fileref'
specifies the fileref assigned to the directory. The value for *fileref* must be enclosed in single or double quotation marks.

Details

The DOPEN function 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. If the directory cannot be opened, DOPEN returns a value of 0. The directory to be opened must be identified by a fileref.

See Also

- "DINFO Function" on page 316
- "DOPTNAME Function" on page 318
- "DOPTNUM Function" on page 318

DOPTNAME Function

Returns the name of a directory information item

Category: External Files

OpenVMS specifics: Valid values for *nval*; number of options available

See: DOPTNAME Function in *SAS Language Reference: Dictionary*

Syntax

DOPTNAME(*directory-id*,*nval*)

directory-id
specifies the identifier that was assigned when the directory was opened, generally by the DOPEN function.

To use DOPTNAME on a directory, the directory must have been previously opened by using the DOPEN function.

nval
specifies the sequence number of the information item.

Details

The number, names, and nature of the directory information varies between operating environments. The number of options available for a directory varies depending on the operating environment. Under OpenVMS, the filename is returned.

See Also

- "DINFO Function" on page 316
- "DOPEN Function" on page 317
- "DOPTNUM Function" on page 318

DOPTNUM Function

Returns the number of information items that are available for a directory

Category: External Files

OpenVMS specifics: Valid values for *directory-id*; number of options available

See: DOPTNUM Function in *SAS Language Reference: Dictionary*

Syntax

DOPTNUM(*directory-id*)

directory-id
specifies the identifier that was assigned when the directory was opened, generally by the DOPEN function.

Details

The directory specified by *directory-id* must have been previously opened by using the DOPEN function.

See Also

- □ "DINFO Function" on page 316
- □ "DOPEN Function" on page 317
- □ "DOPTNAME Function" on page 318

EBCASC Function

Converts an input character string from EBCDIC to ASCII

Category: Character-String Translation

OpenVMS specifics: All aspects are host-specific

Syntax

EBCASC(*in-string*)

in-string
is any EBCDIC string, and can be a character variable, a character literal enclosed in double quotation marks, or another character expression. The value of *in-string* is limited to 200 characters.

Details

The return value is the ASCII translation of *in-string*.

FDELETE Function

Deletes an external file or an empty directory

Category: External Files

OpenVMS specifics: Valid values for *directory*

See: FDELETE Function in *SAS Language Reference: Dictionary*

Syntax

FDELETE('*fileref*')

fileref
specifies the fileref that you assign to the external file or directory you want to delete. The fileref cannot be associated with a list of concatenated filenames or directories. If the fileref is associated with a directory, the directory must be empty. You must have permission to delete the file.

Under OpenVMS, filerefs can be assigned by environment variables and by system commands. The *fileref* must be enclosed in single or double quotation marks.

Details

FDELETE returns 0 if the operation was successful, or a non-zero number if it was not successful.

FEXIST Function

Verifies the existence of an external file associated with a fileref

Category: External Files

OpenVMS specifics: Valid values for *fileref*

See: FEXIST Function in *SAS Language Reference: Dictionary*

Syntax

FEXIST("*fileref*")

"fileref"
specifies the fileref assigned to an external file. The *fileref* must have been previously assigned. The *fileref* must be enclosed in single or double quotation marks.

Details

The FEXIST function returns a value of 1 if the external file that is associated with *fileref* exists, and a value of 0 if the file does not exist.

See Also

- "FILENAME Statement" on page 397
- "FILENAME Function" on page 322

FILEATTR Function

Returns the attribute information for a specified file

Category: General-Purpose OpenVMS

OpenVMS specifics: All aspects are host-specific

Syntax

FILEATTR(*file-specification*,*item*)

file-specification
is the file for which you are requesting information. It can be a character variable, a character literal enclosed in double quotation marks, or another character expression. You must have access to the file that you are referencing.

item
specifies which attribute of the file you are requesting. It can be a character variable, a character literal enclosed in double quotation marks, or another character expression. If the item is more than 16 characters long, it is truncated. The items that can be requested are the same as the items that can be requested using the DCL lexical function F$FILE_ATTRIBUTE.

Details

The FILEATTR function returns information about a file based on the type of information that is requested with the *item* parameter. Numeric values are returned as character values.

The FILEATTR function closely resembles the F$FILE_ATTRIBUTE lexical function of DCL. For more information about DCL lexical functions, refer to *OpenVMS DCL Dictionary*.

You cannot request the following attribute information:

- after-image journaling (AI)
- before-image journaling (BI)
- recovery-unit journaling (RU).

Example

The following example uses the FILEATTR function:

```
data a;
   fattr=fileattr(''test.sas'', ''rdt'');
   put fattr=;
run;
```

This example displays the revision date of the file. The revision date (**`rdt`**) should be the same as the date displayed outside of SAS when you use the DIR/FULL or DIR/DATE=MODIFIED command on the TEST.SAS file.

FILEEXIST Function

Verifies the existence of an external file by its physical name

Category: External Files

OpenVMS specifics: Valid values for *filename*

See: FILEEXIST Function in *SAS Language Reference: Dictionary*

Syntax

FILEEXIST(“*filename*”)

“filename”
specifies a fully qualified physical filename of the 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.

Under OpenVMS, the *filename* that you specify must be enclosed in single or double quotation marks.

Details

The FILEEXIST function returns a value of 1 if the external file exists and a value of 0 if the external file does not exist.

You must always use fully qualified physical filenames with the FILEEXIST function. An example of a fully qualified physical filename is the TEST.SAS file in your default directory. For more information, see “Basics of the OpenVMS File System” on page 6.

See Also

□ “FILENAME Function” on page 322

FILENAME Function

Assigns or deassigns a SAS fileref for an external file, directory, or an output device

Category: External Files

OpenVMS specifics: Valid values for *filename*, *device-type*, *host-options* and *dir-ref*

See: FILENAME Function in *SAS Language Reference: Dictionary*

Syntax

FILENAME(*fileref, filename*<, *device-type*<,*host-options*<,*dir-ref*>>>)

fileref
in a DATA step, specifies the *fileref* to assign to an external file. 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. (For details, see the FILENAME function in *SAS Language Reference: Dictionary*.)

filename

specifies the external file. Specifying a blank *filename* (' ')deassigns the fileref that was previously assigned.

Under OpenVMS, the *filename* must be a valid OpenVMS pathname to the external file that you want to use. You can specify the version number of the file, for example, **`myfile.dat;1`**.

device-type

specifies the type of device or the access method that is used if the SAS fileref points to an input or output device or location that is not a physical file:

DISK
: specifies that the device is a disk drive.

DUMMY
: specifies that the output to the file is discarded.

PIPE
: specifies an OpenVMS command. For more information, see "Reading from and Writing to OpenVMS Commands (Pipes)" on page 186.

PLOTTER
: specifies an unbuffered graphics output device.

PRINTER
: specifies a printer or printer spool file.

TAPE
: specifies a tape drive.

TEMP
: specifies a temporary file that can only be accessed through the logical name and is only available 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.

TERMINAL
: specifies the user's terminal.

host-options

can be any of the following:

ALQ=
: specifies how many disk blocks to allocate to a new external file. The value can range from 0 to 2,147,483,647. If the value is 0 (the default), the minimum number of blocks required for the given file format is used.

CC=
: tells SAS what type of carriage control to use when it writes to external files. Values for the CC= option are

FORTRAN	indicates FORTRAN carriage-control format. This is the default for print files.
PRINT	indicates OpenVMS print format.
CR	indicates OpenVMS carriage-return carriage-control format. This is the default for nonprinting files.

DEQ=
: tells OpenVMS how many disk blocks to add when it automatically extends an external file during a write operation. The value can range from 0 to 65,535. The default value is 0, telling OpenVMS RMS to use the process's default value.

FAC=
: overrides the default file access attributes used for external files. Values for the FAC= option are

DEL	specifies delete access.
GET	specifies read access.
PUT	specifies write access.
UPD	specifies update access.

GSFCC=
: specifies the file format of graphic stream files (GSF files). The accepted values are

PRINT	creates a GSF file. It is a VFC format file with carriage control set to null. These files can be used with most utilities with the exception of some file transfer protocols, such as Kermit. This is the default value for this option.
CR	creates a carriage return carriage control file.
NONE	creates a file with no carriage control. This format is useful if you plan to download the file to a personal computer.

KEY=
: specifies which key SAS uses to read the records in an RMS file with indexed organization. The KEY= option is always used with the KEYVALUE= option.

KEYVALUE=
: specifies the key value with which to begin reading an indexed file.

LRECL=
: specifies the record length of the output file. If you do not specify a record length, the default is varying length records. For input, the existing record length is used by default. If the LRECL= option is used, the input records are padded or truncated to the specified length.

  The maximum record size for OpenVMS is 32,767. LRECL values greater than 32,767 are valid only when reading and writing to tape. If an LRECL value greater than 32,767 is specified when writing to a non-tape device, the LRECL value is set 32,767. You should use the maximum LRECL values for the various file types provided in Table 18.1 on page 404.

MBC=
: specifies the size of the I/O buffers that OpenVMS RMS allocates for a particular file. The value can range from 0 to 127 and represents the number of blocks used for each buffer. By default, this option is set to 0 and the default values for the process are used.

MBF=
: specifies the number of I/O buffers you want OpenVMS RMS to allocate for a particular file. The value can range from 0 to 255 and represents the number of buffers used. By default, this option is set to 2 buffers. If a value of 0 is specified, the default value for the process is used.

MOD
opens the file referenced for append. This option does not take a value.

NEW
opens a new file for output. This option does not take a value.

OLD
opens a new file for output. This option does not take a value.

RECFM=
specifies the record format of the output file. Values for the RECFM= option are

F	specifies fixed length.
N	specifies binary format. The file consists of a stream of bytes with no record boundaries.
V	specifies variable length.
D	specifies you are accessing unlabeled tapes with the PUT and INPUT DATA step statements. For more information, see "Reading from an Unlabeled Tape" on page 184.

SHR=
overrides the default file-sharing attributes used for external files. Values for the SHR= option are

DEL	specifies delete access.
GET	specifies shared read access.
NONE	specifies no shared access.
PUT	specifies shared write access.
UPD	specifies update access.

You can combine these values in any order. For additional details about these options, see the discussion of host-specific external I/O statement options for the FILENAME statement in "FILENAME Statement" on page 397.

dir-ref
specifies the fileref that is assigned to the directory in which the external file resides.

Details

FILENAME returns 0 if the operation was successful, and a non-zero number if it was not successful.

Under OpenVMS, you can assign SAS filerefs using two methods. You can use the DCL DEFINE command to assign a fileref before you invoke SAS. For example:

```
$ define myfile a.txt
$ sas;
  data;
  file myfile;
  put "HELLO";
  run;
```

This creates the file A.TXT.

You can use the X command to assign a fileref during your SAS session.

See Also

- "FILEREF Function" on page 326
- "FILENAME Statement" on page 397
- "ALQ= Data Set Option" on page 282
- "DEQ= Data Set Option" on page 289
- "CC= System Option" on page 452
- "X Command" on page 270

FILEREF Function

Verifies that a fileref has been assigned for the current SAS session

Category: External Files

OpenVMS specifics: Valid values for *fileref*

See: FILEREF Function in *SAS Language Reference: Dictionary*

Syntax

FILEREF(*fileref*)

fileref
specifies the fileref to be validated. Under OpenVMS, *fileref* can also be an OpenVMS logical name that was assigned using the DCL DEFINE command.

Details

A negative return code indicates that the fileref exists but the physical file associated with the filref does not exist. A positive value indicates that the fileref is not assigned. A value of zero indicates that the fileref and external file both exist.

Under OpenVMS, you can assign SAS filerefs using either of the following commands:

1. the DCL DEFINE command
2. X command

You can use the DCL DEFINE command to assign a fileref before you invoke SAS. For example:

```
$ define myfile a.txt
$ sas;
  data;
     file myfile;
     put "HELLO";
  run;
```

This creates the file A.TXT.

You can use the X command to assign an OpenVMS logical name during your SAS session.

Then you can use the FILEREF function to verify that the fileref was correctly assigned. For examples of using this function, see *SAS Language Reference: Dictionary*.

See Also

- □ "FILENAME Function" on page 322
- □ "X Command" on page 270

FINDFILE Function

Searches a directory for a file

Category: General-Purpose OpenVMS

OpenVMS specifics: All aspects are host-specific

Syntax

FINDFILE(*file-specification*,*context*)

file-specification
specifies the file specification of the file that you are searching for. It can contain any valid OpenVMS file specification, including wildcards. The value for *file-specification* can be a character variable, a character literal enclosed in double quotation marks, or another character expression. You must have access to the file that you are searching for.

context
is a variable used internally by SAS to maintain the search context between executions of FINDFILE. It must be initialized to 0 before the first execution of FINDFILE for a given *file-specification* and must not be modified between executions. The *context* value must be a numeric variable initialized to 0; it cannot be a literal 0. You can use FINDFILE for multiple search streams by specifying a different context variable for each stream. For example, you can have variables named CONTEXT1 and CONTEXT2.

Details

The FINDFILE function searches all directories and subdirectories for *file-specification* and returns the first filename that matches the file specification given. Subsequent calls return other filenames that match the specification. For more information, see the description of the CALL FINDEND routine in "CALL FINDEND Routine" on page 312.

The return value is the name of the file that matches *file-specification*. If no file matches or if the last one in the list has already been returned, a blank is returned. The target variable must be long enough to contain an OpenVMS file specification, which can be up to 4095 characters long (for ODS-5 enabled volumes). SAS character variables have a maximum length of 32,767.

Example

The following example uses the FINDFILE function:

```
context=0;
fn=findfile('myprog*.sas',context);
do while (fn ^= ' ');
```

```
      put fn;
      fn=findfile('myprog*.sas',context);
   end;
```

This example searches the user's directories for a filename that matches MYPROG*.SAS; for example, if it finds a file named MYPROG12.SAS, then FN is set to **myprog12.sas**.

Note: If you use a file specification that is greater than 200 characters (such as a filename allowed by ODS-5), then you must specify a LENGTH statement for the variable to receive the filename. The following code shows the LENGTH statement for the previous example:

```
length fn $ 4096;
```

△

See Also

- "CALL FINDEND Routine" on page 312

FINFO Function

Returns the value of an information item for an external file

Category: External Files

OpenVMS specifics: Types of information items

See: FINFO Function in *SAS Language Reference: Dictionary*

Syntax

FINFO(*file-id*,*info-item*)

file-id
specifies the identifier that was assigned when the file was opened, generally by the FOPEN function.

info-item
specifies the name of the file information item to be retrieved. This is a character value.

Under OpenVMS, *info-item* can have the following values:

- File Name
- Owner Name
- Group Name
- Access Permission
- File Size (bytes).

If you concatenate filenames, then an additional *info-item* is available: File List.

Details

The FINFO function 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.

Example 1: Returning Information on a Single File

The following example returns information on a single file named **`myfile.dat`**:

```
filename myfile "myfile.dat";

data;
   fid=fopen('myfile');
   fnum=foptnum(fid);

   do i = 1 to fnum;
      name=foptname(fid,i);
      info=finfo(fid,name);
      put name= info= ;
   end;
run;
```

Example 2: Returning Information on a Concatenation of Files

The following example returns information on a concatenation of files named **`myfile1.dat`** and **`myfile2.dat`**:

```
filename myfile ("myfile1.dat" "myfile2.dat");

data;
   fid=fopen('myfile');
   fnum=foptnum(fid);

   do i = 1 to fnum;
      name=foptname(fid,i);
      info=finfo(fid,name);
      put name = info= ;
   end;
run;
```

See Also

- "FOPEN Function" on page 329
- "FOPTNAME Function" on page 330
- "FOPTNUM Function" on page 331

FOPEN Function

Opens an external file and returns a file identifier value

Category: External Files

OpenVMS specifics: Files are not closed automatically after processing

See: FOPEN Function in *SAS Language Reference: Dictionary*

Syntax

FOPEN(*'fileref'*<,*open-mode*<,*record-length* <,*record-format*>>>)

Note: This is a simplified version of the FOPEN function syntax. For the complete syntax and its explanation, see the FOPEN function in *SAS Language Reference: Dictionary*. △

'fileref'
specifies the fileref assigned to an external file. The value for *fileref* must be enclosed in single or double quotation marks.

Details

FOPEN returns a 0 if the file could not be opened.

Under OpenVMS, you must close files with the FCLOSE function at the end of a DATA step; files are not closed automatically after processing.

See Also

- □ "FILENAME Function" on page 322
- □ "FILEREF Function" on page 326
- □ "FCLOSE Function" in *SAS Language Reference: Dictionary*

FOPTNAME Function

Returns the name of an information item for an external file

Category: External Files

OpenVMS specifics: Available information items

See: FOPTNAME Function in *SAS Language Reference: Dictionary*

Syntax

FOPTNAME(*file-id*,*nval*)

file-id
specifies the identifier that was assigned when the file was opened, generally by the FOPEN function.

nval
specifies the number of the information item. The following table shows the values that *nval* can have in OpenVMS operating environments for single and concatenated files.

	Information Items Available For...	
nval	Single File	Concatenated Files
1	File Name	File Name
2	Owner Name	File List
3	Group Name	Owner Name
4	Access Permission	Group Name
5	File Size (bytes)	Access Permission
6		File Size (bytes)

Details

FOPTNAME returns a blank if an error occurred.

See Also

- □ "FILENAME Function" on page 322
- □ "FOPEN Function" on page 329
- □ "FOPTNUM Function" on page 331

FOPTNUM Function

Returns the number of information items available for an external file

Category: External Files

OpenVMS specifics: Available information items

See: FOPTNUM Function in *SAS Language Reference: Dictionary*

Syntax

FOPTNUM(*file-id*)

file-id
specifies the identifier that was assigned when the file was opened, generally by the FOPEN function.

Details

Under OpenVMS, five information items are available for all types of files:

- □ File Name
- □ Owner Name
- □ Group Name

- Access Permission
- File Size (bytes).

If you concatenate filenames, then an additional information item is available: File List.

The *open-mode* specified in the FOPEN function will determine the value that FOPTNUM returns.

Open Mode	FOPTNUM Value	Information Items Available
Append	6 for concatenated files	All information items available.
Input	5 for single files	
Sequential		
Update		
Output	5 for concatenated files	Since the file is open for output, the File Size information type is unavailable.
	4 for single files	

For an example of how to use the FOPTNUM function, see "FINFO Function" on page 328.

See Also

- "FINFO Function" on page 328
- "FOPEN Function" on page 329
- "FOPTNAME Function" on page 330

GETDVI Function

Returns a specified item of information from a device

Category: General-Purpose OpenVMS

OpenVMS specifics: All aspects are host-specific

Syntax

GETDVI(*device-name*,*item*)

device-name

specifies a physical device name or a logical name equated to a physical device name. Specify the device name as a character-string expression.

After the *device-name* argument is evaluated, the F$GETDVI lexical function examines the first character of the name. If the first character is an underscore (_), the name is considered a physical device name. Otherwise, a maximum of 10 levels of logical name translations are performed, and the equivalence names, if any, are used.

item
: is a character variable that contains any item accepted by the F$GETDVI lexical function (for example, the physical device name). For more information about the F$GETDVI lexical function, see *OpenVMS DCL Dictionary*.

Details

The GETDVI function returns the device information as a character string. If the device information string is longer than the length of the target variable, it is truncated.

GETJPI Function

Retrieves job-process information

Category: General-Purpose OpenVMS

OpenVMS specifics: All aspects are host-specific

Syntax

GETJPI(*jpi-item<,pid>*)

jpi-item
: is a character variable that contains any item accepted by the F$GETJPI lexical function, for example, a user process name. For more information about the F$GETJPI lexical function, see *OpenVMS DCL Dictionary*.

pid
: can be either character (process-name variable) or numeric (process-ID variable). If the PID parameter is a character variable, GETJPI looks up information for a process whose name matches the value of the character variable. However, because of the way in which character variables are passed to functions, the GETJPI function must trim trailing blanks from the character variable. For this reason, you cannot use character variables to specify a process name if the process name itself contains trailing blanks. Instead, you should either use a numeric value to specify the process ID, or you should omit the trailing blanks from the name of the desired process. If you do not specify this argument, the current process is used.

Details

The GETJPI function returns the job-process information as a character string. If the job-process information string is longer than the length of the target variable, it is truncated.

GETLOG Function

Returns information about a DCL logical name

Category: General-Purpose OpenVMS

OpenVMS specifics: All aspects are host-specific

Syntax

GETLOG(*logical-name<,table>*,<*index*>,
<*mode*>,<*case*>,<*item*>)

logical-name
can be a character variable, character literal enclosed in double quotation marks, or another character expression. This required argument is the DCL logical name that you want information about.

table
is an optional character parameter that is the name of a DCL logical name table. It can be a character variable, a character literal enclosed in double quotation marks, or another character expression. The default is "LNM$DCL_LOGICAL". If the table name is more than 31 characters long, it is truncated. If *table* is specified, the GETLOG function searches only the specified table for the logical name.

If you specify "CASE_SENSITIVE" in the *case* argument, then you must use the proper case in the *table* argument as well.

index
is an optional numeric parameter that indicates the number of the translation to return if a logical name has multiple translations. This argument can be either a numeric literal or numeric variable. The default value is 0.

mode
is an optional character parameter that contains the access mode to be used for translation. It can be a character variable, a character literal enclosed in double quotation marks, or another character expression. The default is "USER". If the mode name is more than 10 characters long, it is truncated. If *mode* is specified, the GETLOG function searches only for a logical name created with the specified access mode.

case
is an optional character parameter that determines the case to be used for translation. It can be a character variable, a character literal enclosed in double quotation marks, or another character expression. If the case name is more than 14 characters long, it is truncated.

"CASE_BLIND"
specifies to ignore the case of the characters for translation. This is the default.

"CASE_SENSITIVE"
specifies to accept the case of the characters for translation.

If you specify "CASE_SENSITIVE" as the value for the *case* argument, then you must also use the correct case in the *table* argument value.

item
is an optional character parameter that specifies what type of information is to be returned about a logical name. It can be a character variable, a character literal enclosed in double quotation marks, or another character expression. The default value is “VALUE”. If *item* is more than 11 characters long, it is truncated.

Details

The GETLOG function returns information about a DCL logical name. The return string is always a character value. Numeric values are returned as character values. The default return value is the equivalence name of a logical name.

The GETLOG function closely resembles the F$TRNLNM lexical function of DCL. For more information about the syntax and arguments of the GETLOG function, such as all valid values for a particular argument, refer to the F$TRNLNM lexical function in *OpenVMS DCL Dictionary* or in the Base SAS Software section in SAS Help and Documentation.

Note: You cannot skip any arguments when using the GETLOG function. For example, in order to specify a value for *item*, you must also specify values for *table*, *index*, *mode*, and *case*. If you do not want to change the values for these arguments, then simply specify the default value. △

GETMSG Function

Translates an OpenVMS error code into text

Category: General-Purpose OpenVMS

OpenVMS specifics: All aspects are host-specific

Syntax

GETMSG(*status*)

status
is an OpenVMS status code. It is usually returned from one of the other functions that return an OpenVMS status code on failure.

Details

The return value is a character variable that receives the message text corresponding to the status code. If the message string is longer than the length of the target variable, it is truncated.

See Also

- “DELETE Function” on page 316

GETQUOTA Function

Retrieves disk quota information

Category: General-Purpose OpenVMS

OpenVMS specifics: All aspects are host-specific

Syntax

GETQUOTA(*dev*,*user*,*usage*,*perm*,*over*,*context*,*chan*)

dev
is the device that you want to gather disk quota information for.

user
receives your numeric user identification code (UIC) on the disk. The UIC*w*. format can be used to format the numeric value. This variable must be initialized to 0 before the first execution.

usage
receives your current disk usage in blocks. This variable must be initialized to 0 before the first execution.

perm
receives your permanent quota. This variable must be initialized to 0 before the first execution.

over
receives your allowed overdraft. This variable must be initialized to 0 before the first execution.

context
is a numeric variable that must be initialized to 0 before the first execution and must not be modified between calls.

chan
is a numeric variable that must be initialized to 0 before the first execution and must not be modified between calls.

Details

Besides storing the quota information in the USER, USAGE, PERM, and OVER variables, the GETQUOTA function also returns the OpenVMS status code that is returned by SYS$QIO. The OpenVMS status code can have the following return codes:

1	indicates the GETQUOTA function was successful and more disk quota remains.
996	indicates that no more quota information is available.
980	indicates that quotas are not enabled on the volume.

Any other value indicates an OpenVMS error.

Note: In order to use the GETQUOTA function, you must have either SYSPRV privileges or read access to Quota.sys on the volume. △

Example

The following example uses the GETQUOTA function:

```
data gquota;
  dev="$1$DUA0:";
  user=0;
  usage=0;
  perm=0;
  over=0;
  context=0;
  chan=0
  do until (rc ^= 1);
   rc=getquota(dev,user,usage,perm,over,context,chan);
   output;
  end;
run;

proc print data=gquota;
run;
```

See Also

- "UIC*w*. Format" on page 304

GETSYM Function

Returns the value of a DCL symbol

Category: General-Purpose OpenVMS

OpenVMS specifics: All aspects are host-specific

Syntax

GETSYM(*symbol-name*)

symbol-name
is the name of a DCL symbol defined in your process. It can be a character variable, character literal enclosed in double quotation marks, or another character expression. If *symbol-name* is more than 200 characters long, it is truncated.

Details

The return value is the character string equivalent of the DCL symbol. If the symbol is defined as both a local and global symbol, then the local value is returned. If the symbol value string is longer than the length of the target variable, it is truncated.

See Also

□ "SYSGET Function" on page 351

GETTERM Function

Returns the characteristics of your terminal device

Category: General-Purpose OpenVMS

OpenVMS specifics: All aspects are host-specific

Syntax

GETTERM(*characteristic-name*)

characteristic-name

is the name of the terminal characteristic to be returned. The argument can be a character variable, character literal enclosed in double quotation marks, or another character expression. If *characteristic-name* is longer than 200 characters, it is truncated.

Details

The GETTERM function returns the characteristics of your terminal device from within SAS. It can be called from either the DATA step or an SCL program. This function eliminates the need to use the X command or statement to return your terminal characteristics. The return value is a numeric code, which is the current setting of a characteristic.

Characteristic values that are Boolean (off or on) are returned as 0 or 1, respectively. Characteristic values that have integer values, such as page size, are returned as the function value.

If an error occurs during the execution of the function, GETTERM returns a negative result. Some common error return codes include the following:

`–20`	represents the OpenVMS symbolic name SS$_BADPARAM, which means the characteristic name is not valid or was specified ambiguously.
`–2313`	represents the OpenVMS symbolic name, SS$_NOSUCHDEV, which means the current SYS$OUTPUT device is not a terminal device, or does not exist.

The following table lists in alphabetic order the characteristics that can be returned by the GETTERM function.

Table 15.1 Terminal Characteristics

Characteristic	Explanation
ALTTYPEAHEAD	Alternate type ahead buffer enabled
ANSICRT	Device is an ANSI CRT
APPLICATION	Keypad is in application mode

Characteristic	**Explanation**
AUTOBAUD	Automatic baud rate detection is enabled
AVO	Terminal has advanced video option
BLOCK	Terminal is in block transfer mode
BROADCAST	Terminal accepts broadcast messages
BROADCASTMBX	Broadcast messages sent via mailbox
DECCRT	Terminal is a DEC CRT (VT100 or later)
DECCRT2	Terminal is a DEC CRT (VT200 or later)
DIALUP	Terminal is on a dialup line
DISCONNECT	Terminal disconnects when hangup occurs
DMA	Terminal uses asynchronous DMA
DRCS	Terminal has soft character font set
ECHO	Terminal input is echoed
EDIT	Terminal has editing capabilities
EDITING	Terminal line editing is enabled
EIGHTBIT	Terminal accepts 8-bit escape codes
ESCAPE	Terminal validates escape sequences
FALLBACK	Output is transformed by TFF
FORMFEED	Terminal has mechanical form feed
HALFDUPLEX	Terminal is in half-duplex mode
HANGUP	Modem is hung up when terminal logs out
HOSTSYNC	Host system is synchronized to terminal
INSERT	Default mode is insert instead of overstrike
LINESIZE	Sets terminal line size
LOCALECHO	Command line read operations are echoed
LOWER	Terminal accepts lowercase characters
MAILBOX	Terminal does not use associated mailbox
MODEM	Terminal is connected via a modem
MODHANGUP	Modify hangup behavior
PAGESIZE	Sets terminal page size
PASSTHROUGH	Pass all characters unmodified/examined
PRINTER	Device has a printer port
READSYNC	Read synchronization is enabled
REGIS	Device supports graphics
REMOTE	Terminal is on a dialup line
SCOPE	Terminal is a video display device
SECURE	Device is on secure communication line
SIXEL	Device supports graphics

Characteristic	Explanation
SYSPASSWORD	System password required at login
TAB	Terminal has mechanical tab
TTSYNC	Terminal is synchronized to host system
TYPEAHEAD	Terminal accepts unsolicited input
WRAPCR/LF	Inserted for line wrap
XON	XON/XOFF handshaking used

See Also

- “SETTERM Function” on page 349

LIBNAME Function

Assigns or deassigns a libref for a SAS data library

Category: SAS File I/O

OpenVMS specifics: Valid values for *SAS-data-library*

See: LIBNAME Function in *SAS Language Reference: Dictionary*

Syntax

LIBNAME(*'libref'*<,*'SAS-data-library'*<,*engine*<,*options*>>>)

libref
specifies the libref that is assigned to a SAS data library. The value for *libref* must be enclosed in single or double quotation marks.

SAS-data-library
specifies the physical name of the SAS data library that is associated with the libref. The value of *SAS-data-library* must be enclosed in single or double quotation marks. You can omit this argument if you are merely specifying the engine for a libref or an OpenVMS logical name that you previously assigned.

If the directory that you specify does not already exist, then you must create it before you attempt to use the libref that you have assigned to it.

Details

If the LIBNAME function returns a 0, then the function was successful. However, you could receive a non-zero value, even if the function was successful. A non-zero value is returned if an error, warning, or note is produced. To determine if the function was successful, look through the SAS log and use the following guidelines:

- If a warning or note was generated, then the function was successful.
- If an error was generated, then the function was not successful.

Under OpenVMS, if you specify a *SAS-data-library* of `'[]'` (with or without a space between the brackets), SAS assigns a libref to the current directory. If you do not specify a *SAS-data-library* or if you specify a *SAS-data-library* of `''` (with no space between the quotation marks), then the LIBNAME function dissociates the libref from the data library.

OpenVMS logical names (created by using the DCL DEFINE command) can also be used to refer to SAS data libraries. For more information, see “Assigning OpenVMS Logical Names” on page 140.

See Also

- “Assigning Librefs under OpenVMS” on page 136
- “LIBNAME Statement” on page 420

LIBREF Function

Verifies that a libref has been assigned

Category: SAS File I/O

OpenVMS specifics: Syntax

See: LIBREF Function in *SAS Language Reference: Dictionary*

Syntax

LIBREF(*'libref'*)

libref
specifies the libref to be verified. The value for *libref* must be enclosed in single or double quotation marks.

Details

LIBREF returns a value of 0 if the operation was successful, and a non-zero value if it was not successful.

See Also

- “LIBNAME Function” on page 340

MODULE Function

Calls a specific routine or module that resides in a shareable image

Category: External Files

OpenVMS specifics: All

Syntax

CALL MODULE(*<cntl>*,*module*,*arg-1*,*arg-2...*,*arg-n*);

num=**MODULEN**(<*cntl*>,*module*,*arg-1*,*arg-2*...,*arg-n*);

char=**MODULEC**(<*cntl*>,*module*,*arg-1*,*arg-2*...,*arg-n*);

Note: The following functions permit vector and matrix arguments; you can use them only within the IML procedure. △

CALL MODULEI <*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*);

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 shareable image routine before and after the shareable image 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," which 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.

module

is the name of the external module to use, specified as a shareable image, and the routine name or ordinal value, separated by a comma. The routine name has to be externally callable. For example, the following C language link options file contains externally callable routines:

```
SYMBOL_VECTOR=(RTN_a=PROCEDURE, RTN_b=PROCEDURE)
RTN_a.0
RTN_b.0
```

If the shareable image supports ordinal-value naming, you can provide the shareable image name followed by a decimal number, such as 'XYZ,30'.

You do not need to specify the shareable image name if you specified the MODULE attribute for the routine in the SASCBTBL attribute table, as long as the routine name is unique (that is, no other routines have the same name in the attribute file).

You can specify *module* as a SAS character expression instead of as a constant; most often, though, you will pass it as a constant.

arg-1, arg-2, ...arg-n

are 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, you can cause SAS and possibly your operating system to crash. △

Details

The MODULE functions execute a routine *module* that resides in an external (outside SAS) shareable image with the specified arguments *arg-1* through *arg-n*. A shareable image is an executable file that is created when using the /SHAREABLE qualifier with the `LINK` command. For more information about Shareable Images, refer to *OpenVMS Linker Utility Manual*.

The MODULE call routine does not return a value, while the MODULEN and MODULEC functions return a number (*num*) or a character (*char*), respectively. Which routine you use depends on the expected return value of the shareable image 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.

This way, you can use SAS variables and formats as arguments to the MODULE function and ensure that these arguments are properly converted before being passed to the shareable image routine.

See Also

- "The SASCBTBL Attribute Table" on page 208
- "PEEKLONG Function" on page 345

MOPEN Function

Opens a file by directory ID and member name, and returns either the file identifier or a 0

Category: External Files

OpenVMS specifics: Valid values for *directory-id*

See: MOPEN Function in *SAS Language Reference: Dictionary*

Syntax

MOPEN(*directory-id*,*member-name*<,*open-mode* <,*record-length*<,*record-format*>>>)

Note: This is a simplified version of the MOPEN function syntax. For the complete syntax and its explanation, see the MOPEN function in *SAS Language Reference: Dictionary*. △

directory-id
specifies the identifier that was assigned when the directory was opened, generally by the DOPEN function.

Details

The MOPEN function returns the identifier for the file, or 0 if the file could not be opened.

See Also

- "DOPEN Function" on page 317

NODENAME Function

Returns the name of the current node

Category: General-Purpose OpenVMS

OpenVMS specifics: All aspects are host-specific

Syntax

NODENAME()

Details

This function takes no arguments. The returned value can be up to 16 bytes long. In the following example, executing the statement on a node with the node name of MYALPHA assigns the value MYALPHA to the variable THISNODE:

```
data _null_;
   thisnode=nodename();
run;
```

PATHNAME Function

Returns the physical name of a SAS data library or of an external file, or returns a blank

Category: SAS File I/O

OpenVMS specifics: *fileref* or *libref* can be an OpenVMS logical name

See: PATHNAME Function in *SAS Language Reference: Dictionary*

Syntax

PATHNAME('*fileref*' | '*libref*'<*search-ref*>)

'fileref'
specifies the fileref assigned to an external file. Under OpenVMS, *fileref* can also be an OpenVMS logical name that was assigned with a DCL DEFINE command. The value of *fileref* must be enclosed in single or double quotation marks.

'libref'
specifies the libref assigned to a SAS library. Under OpenVMS, OpenVMS logical names that are created with the DCL DEFINE command can also be used to refer to SAS libraries.

search-ref
specifies whether to search for a fileref or libref.

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 SAS library, or blank if *fileref* or *libref* is invalid.

PEEKLONG Function

Stores the contents of a memory address in a numeric variable on 32-bit and 64-bit platforms

Category: Special
OpenVMS specifics: All
See: PEEKLONG Function in *SAS Language Reference: Dictionary*

Syntax

PEEKCLONG(*address*,*length*);

PEEKLONG(*address*,*length*);

address
specifies the string that is the memory address.

length
specifies the length of the data.

Details

CAUTION:
Use the PEEKLONG functions only to access information returned by one of the MODULE functions. △

The PEEKLONG function returns a value of length *length* that contains the data that starts at memory address *address*.

The variations of the PEEKLONG functions are:

PEEKCLONG	accesses character strings.
PEEKLONG	accesses numeric values.

Usually, when you need to use one of the PEEKLONG functions, you will use PEEKCLONG to access a character string. The PEEKLONG function is mentioned here for completeness.

PUTLOG Function

Creates an OpenVMS logical-name in your process-level logical name table

Category: General-Purpose OpenVMS

OpenVMS specifics: All aspects are host-specific

Syntax

PUTLOG(*logical-name*,*value*)

logical-name
the name of the OpenVMS logical name that you want to create. It can be a character variable, a character literal enclosed in double quotation marks, or another character expression.

value
is the string to be assigned to the symbol. It can be a character variable, a character literal enclosed in double quotation marks, or another character expression.

Details

The PUTLOG function creates an OpenVMS logical name in your process-level logical name table. If the PUTLOG function executes successfully, the return value is 0. Otherwise, the return value is the OpenVMS error code indicating why it failed.

PUTSYM Function

Creates a DCL symbol in the parent SAS process

Category: General-Purpose OpenVMS

OpenVMS specifics: All aspects are host-specific

Syntax

PUTSYM(*symbol-name*,*value*,*scope*)

symbol-name

is the name of the DCL symbol that you want to create. It can be a character variable value, a character literal enclosed in double quotation marks, or another character expression.

value

is the string to be assigned to the symbol. It can be a character variable, a character literal enclosed in double quotation marks, or another character expression.

scope

defines whether the symbol is a local or global symbol. If the value of *scope* is 1, the symbol is defined as a local symbol. If the value of *scope* is 2, the symbol is defined as a global symbol. The *scope* argument can be either a numeric literal or a numeric variable.

Details

The PUTSYM function creates a DCL symbol in the parent SAS process. If the PUTSYM function executes successfully, then the return value is 0. Otherwise, the return value is the OpenVMS error code that indicates why it failed.

Symbols created by the PUTSYM function do not affect an existing subprocess. Any symbol that is created with the PUTSYM function is unavailable to future X commands, SYSTEM calls, or VMS functions for the existing subprocesses. If the current subprocess is destroyed and a new subprocess created, then the new subprocess will inherit all existing symbols and logical names from the parent SAS process.

For further information, see “XTIMEOUT= System Option” on page 514. If you need the symbol for use in future X commands, then use an X command to create the symbol using normal DCL syntax instead of using the PUTSYM function.

See Also

- □ “Issuing DCL Commands during a SAS Session” on page 43
- □ “XSYMBOL System Option” on page 513
- □ “XTIMEOUT= System Option” on page 514

RANK Function

Returns the position of a character in the ASCII collating sequence

Category: Character

OpenVMS specifics: ASCII collating sequence

See: RANK Function in *SAS Language Reference: Dictionary*

Syntax

RANK(*x*)

x
is a character expression (or character string) that contains a character in the ASCII collating sequence. If the length of *x* is greater than 1, you receive the rank of the first character in the string.

Details

Because OpenVMS uses the ASCII character set, the RANK function returns an integer that represents the position of a character in the ASCII collating sequence.

RENAME Function

Renames a file

Category: General-Purpose OpenVMS

OpenVMS specifics: All aspects are host-specific

Syntax

RENAME(*old-name*,*new-name*)

old-name
is the current name of the file. It can be a character variable, a character literal enclosed in double quotation marks, or another character expression.

new-name
is the new name of the file. It can be a character variable, character literal enclosed in double quotation marks, or another character expression.

Details

You must have proper access to both the directory that contains the file and the file that you want to rename. If the RENAME function executes successfully, the return value is 0. Otherwise, the return value is the OpenVMS error code that indicates why it failed.

The following are two common error codes:

`98962`	File not found.
`98970`	Insufficient privilege or file protection violation.

The text of the error codes is retrieved using the GETMSG function.

See Also

- "GETMSG Function" on page 335

SETTERM Function

Modifies a characteristic of your terminal device

Category: Terminal-Access

OpenVMS specifics: All aspects are host-specific

Syntax

SETTERM(*characteristic-name*,*new-value*)

characteristic-name
is the name of the terminal characteristic to be modified. The argument can be a character variable, a character literal enclosed in double quotation marks, or another character expression.

new-value
is the new setting for the characteristic.

Details

The SETTERM function modifies a terminal characteristic from within SAS. The SETTERM function can be called from either the DATA step or an SCL program. This function eliminates the need to use an X command or statement to modify your terminal characteristics.

The return value is a numeric status code, which is the previous setting of the characteristic, before the characteristic is changed by the function call.

Characteristic values that are Boolean (on or off) are returned as 1 or 0. Characteristic values that have integer values, such as page size, are returned as the function value.

If an error occurs during the execution of the SETTERM function, the result returned is negative. Some common error return codes include the following:

−20	represents the OpenVMS symbolic name SS$_BADPARAM, which means that the characteristic name is not valid or was specified ambiguously.
−2313	represents the OpenVMS symbolic name, SS$_NOSUCHDEV, which means the current SYS$OUTPUT device is not a terminal device, or does not exist.

The characteristics that can be set with the SETTERM function are the same as those that can be returned by the GETTERM function, and they are listed in Table 15.2 on page 349.

Table 15.2 Terminal Characteristics

Characteristic	Explanation
ALTTYPEAHEAD	Alternate type ahead buffer enabled
ANSICRT	Device is an ANSI CRT
APPLICATION	Keypad is in application mode

Characteristic	Explanation
AUTOBAUD	Automatic baud rate detection is enabled
AVO	Terminal has advanced video option
BLOCK	Terminal is in block transfer mode
BROADCAST	Terminal accepts broadcast messages
BROADCASTMBX	Broadcast messages sent via mailbox
DECCRT	Terminal is a DEC CRT (VT100 or later)
DECCRT2	Terminal is a DEC CRT (VT200 or later)
DIALUP	Terminal is on a dialup line
DISCONNECT	Terminal disconnects when hangup occurs
DMA	Terminal uses asynchronous DMA
DRCS	Terminal has soft character font set
ECHO	Terminal input is echoed
EDIT	Terminal has editing capabilities
EDITING	Terminal line editing is enabled
EIGHTBIT	Terminal accepts 8-bit escape codes
ESCAPE	Terminal validates escape sequences
FALLBACK	Output is transformed by TFF
FORMFEED	Terminal has mechanical form feed
HALFDUPLEX	Terminal is in half-duplex mode
HANGUP	Modem is hung up when terminal logs out
HOSTSYNC	Host system is synchronized to terminal
INSERT	Default mode is insert instead of overstrike
LINESIZE	Sets terminal line size
LOCALECHO	Command line read operations are echoed
LOWER	Terminal accepts lowercase characters
MAILBOX	Terminal does not use associated mailbox
MODEM	Terminal is connected via a modem
MODHANGUP	Modify hangup behavior
PAGESIZE	Sets terminal page size
PASSTHROUGH	Pass all characters unmodified/examined
PRINTER	Device has a printer port
READSYNC	Read synchronization is enabled
REGIS	Device supports graphics
REMOTE	Terminal is on a dialup line
SCOPE	Terminal is a video display device
SECURE	Device is on secure communication line
SIXEL	Device supports graphics

Characteristic	Explanation
SYSPASSWORD	System password required at login
TAB	Terminal has mechanical tab
TTSYNC	Terminal is synchronized to host system
TYPEAHEAD	Terminal accepts unsolicited input
WRAPCR/LF	Inserted for line wrap
XON	XON/XOFF handshaking used

Example

In the following example, the purpose of the DATA step is to turn off broadcast messages, and to force the terminal line width to be 80 characters. The old settings for these values are stored in macro variables so that they can be reset easily at a later time:

```
data _null_;
   old_bc=setterm("broadcast",0);
   old_ls=setterm("linesize",80);
   call symput("saved_bc",put(old_bc,best.));
   call symput("saved_ls",put(old_ls,best.));
run;
```

See Also

- "GETTERM Function" on page 338

SYSGET Function

Returns the value of a specified operating-environment variable

Category: Special

OpenVMS specifics: *operating-environment-variable* is the name of a DCL symbol

See: SYSGET Function in *SAS Language Reference: Dictionary*

Syntax

SYSGET("*operating-environment-variable*")

"operating-environment-variable"
is the name of a DCL symbol. The value for *operating-environment-variable* must be enclosed in double quotation marks.

Details

The specified DCL symbol must be defined in OpenVMS before it is referenced in the SYSGET function. You can specify the symbol in a number of ways, such as in a DCL

.COM file or at the DCL prompt before you invoke a SAS session. You cannot define a symbol either by using the SAS X command while you are in a SAS session or by using a logical name in OpenVMS.

If the value of the symbol is truncated, or if the symbol is not defined under OpenVMS, then SYSGET displays a warning message in the SAS log.

Example

This example defines two symbols in the OpenVMS environment:

```
$ PATH="QC:[GOMEZ.TESTING]"
$ USER="[GOMEZ.MYTESTS]"

data _null_;
   length result2 result3 $ 40;
     SYMBOL2="PATH";
     SYMBOL3="USER";
     result2=sysget(trim(symbol2));
     result3=sysget(trim(symbol3));
     put result2= result3=;
run;
```

and then returns their values:

```
RESULT2=QC:[GOMEZ.TESTING]
RESULT3=[GOMEZ.MYTESTS]
```

See Also

- □ "GETSYM Function" on page 337
- □ "X Command" on page 270

TERMIN Function

Allows simple input from SYS$INPUT

Category: Terminal-Access

OpenVMS specifics: All aspects are host-specific

Syntax

TERMIN(*prompt*)

prompt

is the prompt printed on the display. It can be a character variable, a character literal enclosed in double quotation marks, or another character expression.

Details

The TERMIN function is easier to use than the TTOPEN, TTREAD, and TTCLOSE functions, but it does not offer the same flexibility. The return value is the characters that the user entered at the terminal. The TERMIN function accepts a maximum of 132 characters.

See Also

- □ "TERMOUT Function" on page 353
- □ "TTCLOSE Function" on page 354
- □ "TTOPEN Function" on page 356
- □ "TTREAD Function" on page 358

TERMOUT Function

Allows simple output to SYS$OUTPUT

Category: Terminal-Access

OpenVMS specifics: All aspects are host-specific

Syntax

TERMOUT(*output*)

output
is a character string to write to SYS$OUTPUT. It can be a character variable, character literal enclosed in double quotation marks, or another character expression.

Details

The TERMOUT function is easier to use than the TTOPEN, TTWRITE, and TTCLOSE functions, but it does not offer the same flexibility. If the TERMOUT function executes successfully, the return value is 0. Otherwise, the return value is the OpenVMS error code that indicates why it failed.

See Also

- □ "TERMIN Function" on page 352
- □ "TTCLOSE Function" on page 354
- □ "TTOPEN Function" on page 356
- □ "TTWRITE Function" on page 359

TRANSLATE Function

Replaces specific characters in a character expression

Category: Character

OpenVMS specifics: Pairs of *to* and *from* arguments are optional

See: TRANSLATE Function in *SAS Language Reference: Dictionary*

Syntax

TRANSLATE(*source,to-1,from-1<,...to-n,from-n>*)

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 OpenVMS, you do not have to provide pairs of *to* and *from* arguments. However, if you do not use pairs, you must supply a comma as a place holder.

TTCLOSE Function

Closes a channel that was previously assigned by TTOPEN

Category: Terminal-Access

OpenVMS specifics: All aspects are host-specific

Syntax

TTCLOSE(*channel*)

channel
is the channel variable returned from the TTOPEN function.

Details

If the TTCLOSE function executes successfully, the return value is 0. Otherwise, the return value is the OpenVMS error code that indicates why it failed.

See Also

□ "TTOPEN Function" on page 356

TTCONTRL Function

Modifies the characteristics of a channel that was previously assigned by TTOPEN

Category: Terminal-Access

OpenVMS specifics: All aspects are host-specific

Syntax

TTCONTRL(*control-specification*,*channel*)

control-specification
is the control string as described for the TTOPEN function. The syntax for *control-specification* is the same as for TTOPEN, except that the DEVICE= attribute cannot be changed. The new characteristics take effect on the next I/O operation.

channel
is the channel variable that was returned from the TTOPEN function.

Details

If the TTCONTRL function executes successfully, the return value is 0. Otherwise, the return value is the OpenVMS error code that indicates why it failed.

Example

The following example prompts the user for the password, reads the password (without echoing it to the terminal), and then writes out the password. The last step closes the channel:

```
length string $ 80;
input='   ';
chan=0;
rc=ttopen("device=tt echo",chan);
rc=ttwrite(chan,"0D0A"X||"Enter password: ");
rc=ttcontrl("noecho",chan);
rc=ttread(chan,input);
rc=ttcontrl("echo",chan);
rc=ttwrite(chan,"0D0A"X||"Password was: "||input);
rc=ttclose(chan);
```

See Also

- “TTOPEN Function” on page 356

TTOPEN Function

Assigns an I/O channel to a terminal

Category: Terminal-Access

OpenVMS specifics: All aspects are host-specific

Syntax

TTOPEN(*control-specification*,*channel*)

control-specification
is the control string that specifies the terminal and processing options, separated from each other by blanks. It can be a character variable, a character literal enclosed in double quotation marks, or another character expression. The value for *control-specification* gives the device name and processing options and has the following form:

DEVICE=*name* <*processing-option-list*>

Each argument can be abbreviated to the shortest unique spelling. There is no default.

name
specifies the terminal name for subsequent I/O operations. DEVICE=*name* is required.

processing-option-list
can be one or more of the following, separated by blanks:

BUFFERFULL | NOBUFFERFULL
If you specify BUFFERFULL as one of the processing options when you enumerate the control string for the TTOPEN function, input terminates when the buffer is full or when a terminating character (either the default character or the character set with the TERMINATOR processing option) is read.
The following list enumerates the effects on input termination when you turn on combinations of processing options:

BUFFERFULL and TERMINATOR=
causes input to be terminated when any of the following is true:

- the buffer is full. The size of the buffer is specified by the SIZE= option. If SIZE= is not specified, then the buffer size defaults to 200 characters.
- a character that is contained in the terminator string is encountered.
- you press RETURN.

NOBUFFERFULL and TERMINATOR=
causes input to be terminated when any of the following is true:

- the buffer is full. In this case, the buffer size defaults to 1024 characters. The SIZE= option is ignored.
- a character that is contained in the terminator string is encountered.
- you press RETURN.

BUFFERFULL (only)
causes input to be terminated when either of the following is true:

- □ the buffer is full
- □ you press RETURN.

NOBUFFERFULL (only)
causes input to be terminated when either of the following is true:

- □ the buffer is full. In this case, the buffer size defaults to 1024 characters.
- □ you press RETURN.

TERMINATOR= (only)
causes input to be terminated when any of the following is true:

- □ the buffer is full. In this case, the buffer size defaults to 1024 characters.
- □ a character that is contained in the terminator string is encountered.
- □ you press RETURN.

The default is NOBUFFERFULL.

ECHO | NOECHO
indicates whether data typed at the terminal is echoed on the display. If this attribute is not set, the behavior is based on the LOCALECHO characteristic for the terminal specified with DEVICE=. The following DCL command shows the characteristics for the terminal:

```
$ SHOW TERMINAL name
```

SIZE=*n*
sets the size of the input buffer (that is, the number of characters that can be read at one time). The value can be no more than 200, the maximum size of a character variable in SAS. The default is 200 characters.

TERMINATOR=*hex-string*
specifies the list of characters that are considered to be terminating characters for input. The *hex-string* consists of hexadecimal digit pairs that correspond to the ASCII value of the characters used as terminators. Do not separate the digit pairs with delimiters such as commas or spaces.

If NOBUFFERFULL is in effect, the default terminator is a carriage return (hexadecimal value is 0D).

TIMEOUT=*n*
specifies how many seconds to wait for input from the terminal. If no input is received in the time specified, the operation fails with a time-out error. By default, there is no time limit and the input operation waits forever.

channel
is a numeric variable into which the TTOPEN function places the channel number.

Details

The channel that the TTOPEN function assigns is used by the other terminal-access functions to perform I/O to and from the terminal. If the TTOPEN function executes successfully, the return value is 0. Otherwise, the return value is the OpenVMS error code that indicates why it failed.

Example

The following example reads up to 20 characters, discarding extra characters when the buffer is full and accepting either the carriage return or the horizontal tab character (hexadecimal value is 09) as terminators. If the read is successful, the program prints the string:

```
length string $ 20;
rc=ttopen("dev=TT: size=20 term=0D09",chan);
rc=ttread(chan,string,size);
if size>0 & rc=0 then put string;
rc=ttclose(chan);
```

See Also

- “TTCLOSE Function” on page 354

TTREAD Function

Reads characters from the channel assigned by TTOPEN

Category: Terminal-Access

OpenVMS specifics: All aspects are host-specific

Syntax

TTREAD(*channel*,*buffer*,<*size*>)

channel
is the channel variable returned from the TTOPEN function.

buffer
is the character variable where the returned characters are stored.

size
is an optional numeric parameter which indicates the maximum number of characters to read and receives the number of characters read. If you do not specify *size*, the TTREAD function reads characters up to the size of *buffer*. The handling of extra characters is determined by the BUFFERFULL option specified with the TTOPEN function.

Details

If the TTREAD function executes successfully, the return value is 0. Otherwise, the return value is the OpenVMS error code that indicates why it failed.

See Also

- “TTOPEN Function” on page 356

TTWRITE Function

Writes characters to the channel assigned by TTOPEN

Category: Terminal-Access

OpenVMS specifics: All aspects are host-specific

Syntax

TTWRITE(*channel*,*buffer*,<*size*>)

channel
is the channel variable returned from the TTOPEN function.

buffer
is the character string variable that contains the data to be written.

size
is an optional numeric parameter that specifies how many characters to write from *buffer*. If you do not specify *size*, the entire buffer is sent, including any trailing blanks.

Details

If the TTWRITE function executes successfully, the return value is 0. Otherwise, the return value is the OpenVMS error code that indicates why it failed.

The TTWRITE function does not supply any carriage control. You must insert into the buffer any carriage-control characters that you want.

See Also

- "TTOPEN Function" on page 356

VMS Function

Spawns a subprocess and executes a DCL command

Category: General-Purpose OpenVMS

OpenVMS specifics: All aspects are host-specific

Syntax

VMS(*DCL-command*)

DCL-command
is the DCL command that is passed to the subprocess. It can be a character variable, a character literal enclosed in double quotation marks, or another character expression.

Details

The VMS function spawns a subprocess and executes the command that is passed to it. Any output that is produced is sent to SYS$OUTPUT. If you are using the SAS windowing environment, the results appear in a new window. To close the new window, select the **`File`** menu and then select **`Exit`**. This is consistent with the behavior of the X statement and the X command.

If the VMS function executes successfully, the return value is 0. Otherwise, the return value is an OpenVMS error code that indicates why the function failed. If you supply an invalid command, you will receive a return error code such as the following:

`229520`	%CLI-W-IVVERB, unrecognized command verb – check validity and spelling.

Comparisons

The VMS function is similar to the X statement, the X command, the %SYSEXEC macro, and the CALL SYSTEM routine. In most cases, the X statement, the X command, or the %SYSEXEC macro are preferable because they require less overhead. However, the VMS function is useful for conditional processing because it returns a return code. The CALL SYSTEM routine can be useful in certain situations because it is executable, and because it accepts expressions as arguments.

See Also

- □ “Issuing DCL Commands during a SAS Session” on page 43
- □ “X Statement” on page 427
- □ “X Command” on page 270
- □ “CALL SYSTEM Routine” on page 313
- □ %SYSEXEC Macro in “Macro Statements under OpenVMS” on page 519

CHAPTER

16

Informats under OpenVMS

SAS Informats under OpenVMS

A SAS informat is an instruction or template that SAS uses to read data values into a variable. Most SAS informats are described completely in *SAS Language Reference: Dictionary*. The informats that are described here have behavior that is specific to SAS under OpenVMS.

Many of the SAS informats that have details that are specific to the OpenVMS operating environment are used to read binary data. For more information, see "Reading Binary Data under OpenVMS" on page 361.

Reading Binary Data under OpenVMS

Different computers store numeric binary data in different forms. IBM 370 and Hewlett-Packard 9000 computers store bytes in one order. Microcomputers that are IBM compatible and some computers manufactured by Compaq store bytes in a different order called "byte-reversed."

Binary data that is stored in one order cannot be read by a computer that stores binary data in the other order. When you are designing SAS applications, try to anticipate how your data will be read and choose your formats and informats accordingly.

SAS provides two sets of informats for reading binary data and corresponding formats for writing binary data.

- The IB*w.d*, PD*w.d*, PIB*w.d*, and RB*w.d* informats and formats read and write in native mode, that is, using the byte-ordering system that is standard for the machine.

□ The S370FIB*w.d*, S370FPD*w.d*, S370FRB*w.d*, and S370FPIB*w.d* informats and formats read and write according to the IBM 370 standard, regardless of the native mode of the machine. These informats and formats enable you to write SAS programs that can be run in any SAS environment, regardless of how numeric data is stored.

If a SAS program that reads and writes binary data runs on only one type of machine, you can use the native mode informats and formats. However, if you want to write SAS programs that can be run on multiple machines using different byte-storage systems, use the IBM 370 formats and informats. The purpose of the IBM 370 informats and formats is to enable you to write SAS programs that can be run in any SAS environment, no matter what standard you use for storing numeric data.

For example, suppose you have a program that writes data with the PIB*w.d* format. You execute the program on a microcomputer so that the data is stored in byte-reversed mode. Then you run another SAS program on the microcomputer that uses the PIB*w.d* informat to read the data. The data is read correctly because both of the programs are run on the microcomputer using byte-reversed mode. However, you cannot upload the data to a Hewlett-Packard 9000-series machine and read the data correctly because it is stored in a format that is native to the microcomputer but foreign to the Hewlett-Packard 9000. To avoid this problem, use the S370FPIB*w.d* format to write the data; even on the microcomputer, this causes the data to be stored in IBM 370 mode. Then read the data using the S370FPIB*w.d* informat. Regardless of what type of machine you use when reading the data, it is read correctly.

Dictionary

HEX*w*. Informat

Converts hexadecimal positive binary values to either integer-binary (fixed-point) or real-binary (floating-point) values

Category: numeric

Width range: 1 to 16

Default width: 8

OpenVMS specifics: ASCII character-encoding system

See: HEXw. Informat in *SAS Language Reference: Dictionary*

Syntax

HEX*w*.

w

specifies the field width of the input value. If you specify a *w* value of 1 through 15, the input hexadecimal value is converted to an fixed-point number. If you specify 16 for the *w* value, the input hexadecimal value is converted to a floating-point number.

Details

Under OpenVMS, the hexadecimal format of the number is stored in ASCII representation.

For more information about OpenVMS floating-point representation, see *OpenVMS Programming Interfaces: Calling a System Routine, Appendix B*.

See Also

- "$HEX*w*. Informat" on page 363
- "HEX*w*. Format" on page 298

$HEX*w*. Informat

Converts hexadecimal data to character data

Category: character

Width range: 1 to 32767

Default width: 2

OpenVMS specifics: ASCII character-encoding system

See: $HEXw. Informat in *SAS Language Reference: Dictionary*

Syntax

$HEX*w*.

w
specifies width of the input value.

Details

The $HEX*w*. informat is similar to the HEX*w*. informat. The $HEX*w*. informat converts character values that are stored as the hexadecimal equivalent of ASCII character codes to the corresponding character values. The conversion is based on the ASCII character-encoding system.

In the ASCII system, the conversion for 8-bit hexadecimal input (x'80' and above) is for the Multinational Character Set, which includes national characters such as Ä and ß. For more information about the Multinational Character Set, see *Guide to Using OpenVMS*.

See Also

- "HEX*w*. Informat" on page 362
- "$HEX*w*. Format" on page 299

IB*w.d* Informat

Reads integer-binary (fixed-point) values

Category: numeric

Width range: 1 to 8

Default width: 4

Decimal range: 0 to 10

OpenVMS specifics: native twos-complement notation

See: IBw.d Informat in *SAS Language Reference: Dictionary*

Syntax

IB*w.d*

w
specifies the width of the input field.

d
optionally specifies the power of 10 by which to divide the input value. If you specify *d*, the IB*w.d* informat divides the input value by the 10^d value. SAS uses the *d* value, even if the input data contains decimal points.

Details

The IB*w.d* informat reads integer-binary (fixed-point) values that are represented in the OpenVMS twos-complement notation. For information about OpenVMS native fixed-point values, see *OpenVMS Programming Interfaces: Calling a System Routine, Appendix B*.

See Also

- □ "IB*w.d* Format" on page 300
- □ "Reading Binary Data under OpenVMS" on page 361

PD*w.d* Informat

Reads packed decimal data

Category: numeric

Width range: 1 to 16

Default width: 1

Decimal range: 0 to 10

OpenVMS specifics: How values are interpreted as negative or positive

See: PDw.d Informat in *SAS Language Reference: Dictionary*

Syntax

PD*w.d*

w
: specifies the width of the input field.

d
: optionally specifies the power of 10 by which to divide the input value. If you specify *d*, the PD*w.d* informat divides the input value by the 10^d value. If the data contains decimal points, then SAS ignores the *d* value.

Details

Under OpenVMS, the least significant 4 bits of the least significant byte in the PD value are interpreted as follows:

- If the hexadecimal number in the 4 bits is D or F, then the value is interpreted as negative.
- If the hexadecimal number in the 4 bits is C, then the value is interpreted as positive.

See Also

- "PD*w.d* Format" on page 301
- "Reading Binary Data under OpenVMS" on page 361

PIB*w.d* Informat

Reads positive integer-binary (fixed-point) values

Category: numeric

Width range: 1 to 8

Default width: 1

Decimal range: 0 to 10

OpenVMS specifics: native integer-binary values; byte reversal

See: PIBw.d Informat in *SAS Language Reference: Dictionary*

Syntax

PIB*w.d*

w
: specifies the width of the input field.

d
optionally specifies the power of 10 by which to divide the input value. If you specify *d*, the PIB*w.d* informat divides the input value by the 10^d value. SAS uses the *d* value even if the input data contains decimal points.

Details

Under OpenVMS, the PIB informat reads native integer-binary values. However, this informat ignores the negativity of data in twos-complement notation and reads it as positive. For more information about OpenVMS native fixed-point values, see *OpenVMS Programming Interfaces: Calling a System Routine, Appendix B*.

See Also

- "PIB*w.d* Format" on page 302
- "Reading Binary Data under OpenVMS" on page 361

RB*w.d* Informat

Reads real-binary (floating-point) data

Category: numeric

Width range: 2 to 8

Default width: 4

Decimal range: 0 to 10

OpenVMS specifics: native floating-point representation

See: RBw.d Informat in *SAS Language Reference: Dictionary*

Syntax

RB*w.d*

w
specifies the width of the input field.

d
optionally specifies the power of 10 by which to divide the input value. If you specify *d*, the RB*w.d* informat divides the input value by the 10^d value. SAS uses the *d* value even if the input data contains decimal points.

Details

The RB*w.d* informat reads numeric data that is stored in native real-binary (floating-point) notation. Numeric data for scientific calculations is often stored in floating-point notation. (SAS stores all numeric values in floating-point notation.) A floating-point value consists of two parts: a mantissa that gives the value and an exponent that gives the value's magnitude.

It is usually impossible to key in floating-point binary data directly from a terminal, but many programs write floating-point binary data. Use caution if you are using the RB*w.d* informat to read floating-point data created by programs other than SAS because the RB*w.d* informat is designed to read only double-precision data.

Since the RB*w.d* informat is designed to read only double-precision data, it supports widths of less than 8 bytes only for those applications that truncate numeric data for space-saving purposes. RB4., for example, does *not* expect a single-precision number that is truncated to 4 bytes.

External programs such as those written in C and FORTRAN can produce only single- or double-precision floating-point numbers. No length other than 4 or 8 bytes is allowed. The RB*w.d* informat allows a length of 3 through 8 bytes, depending on the storage you need to save.

The FLOAT4. informat has been created to read a single-precision, floating-point number. If you read the hexadecimal notation **3F800000**with FLOAT4., the result is a value of 1.

To read data created by a C or FORTRAN program, you need to decide on the proper informat to use. If the floating-point numbers require an 8-byte width, you should use the RB8. informat. If the floating-point numbers require a 4-byte width, you should use FLOAT4.

For more information about OpenVMS floating-point representation, see *OpenVMS Programming Interfaces: Calling a System Routine, Appendix B*.

Examples

Example 1: Single- vs. Double-Precision Representation Consider how the value of 1 is represented in single-precision and double-precision notation. For single-precision, the hexadecimal representation of the 4 bytes of data is **3F800000**. For double-precision, the hexadecimal representation is **3FF0000000000000**. The digits at the beginning of the data are different, indicating a different method of storing the data.

Example 2: Writing External Data Consider this C example:

```
#include <stdio.h>

main() {

FILE *fp;
float x[3];

fp = fopen(‘‘test.dat’’,’’wb’’);
x[0] = 1; x[1] = 2; x[2] = 3;

fwrite((char *)x,sizeof(float),3,fp);
fclose(fp);
}
```

The file TEST.DAT will contain, in hexadecimal notation, **3f8000004000000040400000**.

See Also

- “RB*w.d* Format” on page 303
- “Reading Binary Data under OpenVMS” on page 361

VMSTIME. Informat

Converts an 8-byte binary value that is in OpenVMS date and time format to a SAS date-time value

Category: date and time

Width range: 8

Default width: 8

OpenVMS specifics: All aspects are host-specific

Syntax

VMSTIME.

Details

The VMSTIME. informat is specific to the OpenVMS operating environment. You cannot specify a width with this informat; the width is always 8 bytes.

OpenVMS date and time values that are read in with the VMSTIME. informat retain precision up to 1/100 of a second, even though SAS cannot display anything less than whole seconds. If you later use the VMSTIMEF. format to write out the date-time value, the precision is retained.

See Also

- "VMSTIMEF. Format" on page 305

VMSZN*w.d* Informat

Reads VMS zoned numeric data

Category: numeric

Width range: 1 to 32

Default width: 1

OpenVMS specifics: All aspects are host-specific

Syntax

VMSZN*w.d*

w
specifies the width of the output field.

d
optionally specifies the number of digits to the right of the decimal point in the numeric value.

Details

The VMSZN*w.d* informat is similar to the ZD*w.d* informat. Both read a string of ASCII digits, and the last digit is a special character denoting the magnitude of the last digit and the sign of the entire number. The difference between the VMSZN*w.d* informat and the ZD*w.d* informat is in the special character used for the last digit. The following table shows the special characters used by the VMSZN*w.d* informat.

Desired Digit	**Special Character**	**Desired Digit**	**Special Character**
0	0	-0	p
1	1	-1	q
2	2	-2	r
3	3	-3	s
4	4	-4	t
5	5	-5	u
6	6	-6	v
7	7	-7	w
8	8	-8	x
9	9	-9	y

Data formatted using the VMSZN*w.d* informat are ASCII strings.

Examples

If you input the ASCII string 1234 using the VMSZN*w.d* informat in the following SAS statement:

```
input @1 vmszn4.;
```

the result is 1234.

If you input the ASCII string 123t using the VMSZN*w.d* informat in the following SAS statement:

```
input @1 vmszn4.;
```

the result is -1234.

See Also

- "ZD*w.d* Informat" in *SAS Language Reference: Dictionary*
- "ZD*w.d* Informat" on page 370
- "VMSZN*w.d* Format" on page 306

ZD*w.d* Informat

Reads zoned decimal data

Category: numeric

Width range: 1 to 32

Default width: 1

OpenVMS specifics: the last byte includes the sign

See: ZDw.d Informat in *SAS Language Reference: Dictionary*

Syntax

ZD*w.d*

w
specifies the width of the input field.

d
optionally specifies the power of 10 by which to divide the input value. If you specify *d*, the ZD*w.d* informat divides the input value by the 10^d value. If the data contains decimal points, then SAS ignores the *d* value.

Details

The ZD*w.d* informat accepts true zoned decimal, trailing numeric strings with the overpunch format; numeric strings of the form that is read by the standard numeric informat; and hybrid strings. A hybrid string is a zoned decimal string that has an explicit sign.

To achieve the same results as the SAS Release 6.06 implementation of the ZD*w.d* informat, use the ZDV*w.d* informat.

A *zoned decimal*, or trailing numeric string with overpunch format, is a character string consisting of digits. The last character of the string is a special character that specifies both the value of the last digit and the sign of the entire number. The special characters are listed in the following table.

Digit	ASCII Character	Digit	ASCII Character
0	{	-0	}
1	A	-1	J
2	B	-2	K
3	C	-3	L
4	D	-4	M
5	E	-5	N
6	F	-6	O
7	G	-7	P

Digit	ASCII Character	Digit	ASCII Character
8	H	-8	Q
9	I	-9	R

The data formatted using the ZD*w.d* informat are ASCII strings.

Examples

If you input the ASCII string 123{ using ZD*w.d* informat in the following SAS statement:

```
input i zd4.;
```

the result is 1230.

If you input the ASCII string 123} using the ZD*w.d* informat in the following SAS statement:

```
input i zd4.;
```

the result is -1230.

If you input the ASCII string 1230 using the ZD*w.d* informat in the following SAS statement:

```
input i zd4.;
```

the result is 1230.

If you input the ASCII string -1230 using the ZD*w.d* informat in the following SAS statement:

```
input i zd5.;
```

the result is -1230.

If you input the ASCII string +123{ using the ZD*w.d* informat in the following SAS statement:

```
input i zd5.;
```

the result is 1230.

See Also

- "ZDVw.d Informat" in *SAS Language Reference: Dictionary*

CHAPTER
17

Procedures under OpenVMS

SAS Procedures under OpenVMS

Base SAS procedures enable you to perform statistical computations, create reports, and manage your data. Most of the Base SAS procedures are completely described in *Base SAS Procedures Guide*. The procedures described here have syntax or behavior that is specific to the OpenVMS operating environment.

Dictionary

CATALOG Procedure

Manages entries in SAS catalogs

OpenVMS specifics: FILE= option in the CONTENTS statement

See: CATALOG Procedure in *Base SAS Procedures Guide*

Syntax

PROC CATALOG CATALOG=<*libref.*>*catalog* <ENTRYTYPE=*etype*> <KILL>;

CONTENTS <OUT=*SAS-data-set*> <FILE=*fileref*>;

Note: This is a simplified version of the CATALOG procedure syntax. For the complete syntax and its explanation, see the CATALOG procedure in *Base SAS Procedures Guide*. △

fileref
names a file specification that is specific to the OpenVMS operating environment.

Details

The CATALOG procedure manages entries in SAS catalogs.

The FILE= option in the CONTENTS statement of the CATALOG procedure accepts a file specification that is specific to OpenVMS. If an unquoted file specification is given in the FILE= option, but no FILENAME statement or DCL DEFINE command has been issued to define the file specification, then the file is named according to the rules for naming OpenVMS files. Consider the following example. If MYFILE is neither a SAS fileref nor an OpenVMS logical name, then the file MYFILE.LIS, containing the list of contents for SASUSER.PROFILE, is created in your default directory:

```
proc catalog catalog=sasuser.profile;
   contents file=myfile;
run;
```

CIMPORT Procedure

Restores a transport file created by the CPORT procedure

OpenVMS specifics: name and location of transport file; using a transport file on tape

See: CIMPORT Procedure in *Base SAS Procedures Guide*

Syntax

PROC CIMPORT *destination=libref.member-name<option(s)>*;

destination
identifies the file(s) in the transport file as a single SAS data set, single SAS catalog, or multiple members of a SAS data library.

Details

Note: Starting in SAS 9.1, you can use the MIGRATE procedure to convert your SAS files. For more information, see “Compatibility of Existing SAS Files with SAS 9.1” on page 135. △

The CIMPORT procedure *imports* a transfer file that was created (*exported*) by the CPORT procedure.

If you have used the CPORT procedure, the CIMPORT procedure enables you to move catalogs, data sets, and SAS data libraries from one operating environment to another.

Note: The CIMPORT procedure processes a transport file that was generated by PROC CPORT, not a transport file that was generated by the XPORT engine. The default record attribute for SAS transport files has been changed to NONE. This is equivalent to specifying CC=NONE in the LIBNAME or the FILENAME statement when you create the transport file. △

Examples

Example 1: Importing an Entire Data Library from a Disk

```
libname newlib 'SAS-data-library';
filename tranfile 'transport-file';
proc cimport library=newlib infile=tranfile;
run;
```

PROC CIMPORT reads from disk the transport file TRANFILE that a previous PROC CPORT created from a SAS data library and restores the transport file to the SAS data library NEWLIB.

Example 2: Importing an Entire Data Library from a Tape

CAUTION:

You must use an unlabeled tape when reading from tape with the CIMPORT procedure. △

Mount the tape onto the tape drive.

```
x 'alloc tape-drive sastape';
x 'mount/for sastape';
libname newlib 'SAS-data-library';
filename tranfile 'sastape';
proc cimport library=newlib infile=tranfile tape;
run;
```

PROC CIMPORT reads from tape the transport file TRANFILE that PROC CPORT (using the TAPE option) created from a SAS data library and restores the transport file to the SAS data library NEWLIB.

See Also

- □ "CPORT Procedure" on page 379
- □ The MIGRATE Procedure at **support.sas.com/rnd/migration**
- □ "Compatibility of Existing SAS Files with SAS 9.1" on page 135
- □ *Moving and Accessing SAS Files*

CONTENTS Procedure

Prints descriptions of the contents of one or more files from a SAS data library

OpenVMS specifics: Engine/Host Dependent Information output

See: CONTENTS Procedure in *Base SAS Procedures Guide*

Syntax

PROC CONTENTS <*option(s)*>;

Note: For a complete listing and explanation of the available options, see the CONTENTS procedure in *Base SAS Procedures Guide*. △

option(s)
can be the following under OpenVMS:

DIRECTORY
prints a list of information specific to the OpenVMS operating environment. This information is the same as the PROC DATASETS directory information that is written to the log.

Details

The CONTENTS procedure shows the contents of a SAS data set and prints the directory of the SAS data library.

Although most of the printed output that the CONTENTS procedure generates is the same on all operating environments, the **`Engine/Host Dependent Information`** output is specific to your operating environment. The following output shows the **`Engine/Host Dependent Information`** generated for the V9 engine from the following statements:

```
proc contents data=oranges;
run;
```

Output 17.1 Engine/Host Dependent Information from PROC CONTENTS Using the V9 Engine

```
                           The CONTENTS Procedure

Data Set Name        WORK.ORANGES                       Observations          1
Member Type          DATA                               Variables             5
Engine               V9                                 Indexes               0
Created              Monday, May 12, 2003 01:46:21      Observation Length    40
Last Modified        Monday, May 12, 2003 01:46:21      Deleted Observations  0
Protection                                              Compressed            NO
Data Set Type                                           Sorted                NO
Label
Data Representation ALPHA_VMS_64
Encoding            latin1  Western (ISO)

                     Engine/Host Dependent Information

  Data Set Page Size          8192
  Number of Data Set Pages    1
  First Data Page             1
  Max Obs per Page            203
  Obs in First Data Page      1
  Number of Data Set Repairs  0
  Filename                    SASDISK:[SASDEMO.SAS$WORK2040F93A]ORANGES.SAS7BDAT
  Release Created             9.0101B0
  Host Created                OpenVMS
  File Size (blocks)          17

                 Alphabetic List of Variables and Attributes

                     #    Variable    Type    Len

                     2    flavor      Num       8
                     4    looks       Num       8
                     3    texture     Num       8
                     5    total       Num       8
                     1    variety     Char      8
```

The engine name is listed in the header information. The **`Engine/Host Dependent Information`** describes the size of the data set, as well as the physical name of the data set.

Note: In SAS 9.1, the PROC CONTENTS output shows a value of **`Default`** in the **`Data Representation`** and **`Encoding`** fields for a data set that was created using the V6 engine in an OpenVMS VAX environment. △

See Also

- "Starting with SAS Data Sets" in *Step-by-Step Programming with Base SAS Software*

CONVERT Procedure

Converts OSIRIS system files and SPSS export files to SAS data sets

OpenVMS specifics: All aspects are host-specific

Syntax

PROC CONVERT *product-specification <option(s)>*;

product-specification
is required and can be one of the following:

OSIRIS=*fileref-1* DICT=*fileref-2*
specifies a fileref or libref for the OSIRIS file to be converted into a SAS data set. If you use this product specification, you must also use the DICT= option, which specifies the OSIRIS dictionary to use.

SPSS=*fileref*
specifies a fileref or libref for the SPSS file to be converted into a SAS data set. The SPSS file can have the following formats:

- SPSS-X format (whose originating operating environment is OpenVMS)
- portable file format created by using the SPSS EXPORT command (from any operating environment).

option(s)
can be one or more of the following:

FIRSTOBS=*n*
specifies the number of the observation where the conversion is to begin. This option enables you to skip over observations at the beginning of the OSIRIS or SPSS file.

OBS=*n*
specifies the number of the last observation to convert. This option enables you to exclude observations at the end of the file.

OUT=*SAS-data-set*
names the SAS data set that is created to hold the converted data. If the OUT= option is omitted, SAS still creates a data set and automatically names it DATA*n*, as if you omitted a data set name in a DATA statement. If it is the first such data set created in a job or session, SAS names it DATA1; the second is named DATA2, and so on. If the OUT= option is omitted, or if you do not specify a two-level name in the OUT= option, then the converted data set is stored in your WORK data library and by default is not permanent.

Details

The CONVERT procedure converts an OSIRIS system file or SPSS export file to a SAS data set. It produces one output data set but no printed output. The new data set contains the same information as the input file; exceptions are noted in "Output Data Sets" on page 378. The OSIRIS and SPSS engines provide more extensive capabilities.

Because the OSIRIS and SPSS products are maintained by other companies or organizations, changes might be made that make the files incompatible with the current version of PROC CONVERT. SAS upgrades PROC CONVERT to support changes made to these products only when a new version of SAS is available.

Missing Values If a numeric variable in the input data set has no value, or if it has a system missing value, PROC CONVERT assigns a missing value to it.

Output Data Sets This section describes the attributes of the output SAS data set for each *product-specification* value.

CAUTION:
Be sure that the translated names are unique. Variable names can sometimes be translated by SAS. To ensure the procedure works correctly, be sure that your variables are named in such a way that translation results in unique names. △

OSIRIS Output For single-response variables, the V1–V9999 name becomes the SAS variable name. For multiple-response variables, the suffix R*n* is added to the variable name, where *n* is the response number. For example, V25R1 is the first response of the multiple-response variable V25. If the variable after V1000 has 100 or more responses, responses above 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 that is longer than 200 is truncated to 200. The OSIRIS variable description becomes a SAS variable label, and OSIRIS print formats become SAS formats.

SPSS Output SPSS variable names and variable labels become unchanged variable names and labels. SPSS alphabetic variables become SAS character variables of length 4. SPSS blank values are converted into SAS missing values. SPSS print formats become SAS formats, and the SPSS default precision of no decimal places becomes part of the variables' formats. SPSS value labels are not copied. DOCUMENT data is copied so that PROC CONTENTS can display it.

Comparisons

Using the CONVERT procedure is similar to using the OSIRIS and SPSS engines. For example, the following two programs provide identical results:

```
   /*  using the CONVERT procedure  */
filename xxx 'mybmdp.dat';
```

```
proc convert osiris=xxx out=temp;
run;


   /*  using the OSIRIS engine  */
libname xxx osiris 'myosiris.dat';
data temp;
    set xxx._first_;
run;
```

However, the OSIRIS and SPSS engines provide more extensive capability than PROC CONVERT.

Example

The following is an example of converting an OSIRIS file to a SAS data set, using a fileref named **save**:

```
filename save '[mydir]osiris.dat';

proc convert osiris=save;
run;
```

If you have more than one save file in the OSIRIS file referenced by *fileref*, then you can use two additional options in parentheses after the fileref. The CODE= option lets you specify the code of the save file that you want, and the CONTENT= option lets you specify the save file's content. For example, if a save file had CODE=JUDGES and CONTENT=DATA, you could use the following statements to convert the save file to a SAS data set:

```
filename save '[mydir]osiris1.dat';

proc convert osiris=save(code=judges content=data);
run;
```

See Also

- "The OSIRIS and SPSS Engines under OpenVMS" on page 167

CPORT Procedure

Writes SAS data sets and catalogs into a special format in a transport file

OpenVMS specifics: name and location of transport file; creating a transport file on tape

See: CPORT Procedure in *Base SAS Procedures Guide*

Syntax

PROC CPORT *source-type=libref<.member-name> <option-list>*;

Note: This is a simplified version of the CPORT procedure syntax. For the complete syntax and its explanation, see the CPORT procedure in *Base SAS Procedures Guide*. △

libref
specifies the name and location of the file to be transported.

Details

Note: Starting in SAS 9.1, you can use the MIGRATE procedure to convert your SAS files. For more information, see "Compatibility of Existing SAS Files with SAS 9.1" on page 135. △

The CPORT procedure creates a transport file to be later restored (*imported*) by the CIMPORT procedure. The transport file can contain a SAS data set, SAS catalog, or an entire SAS library.

If you do not use the FILE= option and have not defined the reserved fileref SASCAT, a file named SASCAT.DAT is created in your default directory.

The CPORT procedure defaults to writing to a file on disk. If you want to write to a file on tape, you must use the TAPE option in the PROC CPORT statement.

Note: You do not need to define the fileref SASCAT to your tape drive. You can choose any fileref, or you can let the file default to SASCAT.DAT, as it does for disk access. △

You do not need to use the /BLOCKSIZE=8000 option in the DCL MOUNT command, although it is recommended.

Note: The default record attribute for SAS transport files has been changed to NONE. This is equivalent to specifying CC=NONE in the LIBNAME or the FILENAME statement when creating the transport file. △

Examples

Example 1: Exporting Data Sets and Catalogs to Disk The following is an example of using PROC CPORT to export all the data sets and catalogs from a data library on disk:

```
libname newlib 'SAS-data-library';
filename tranfile 'transport-file';
proc cport library=newlib file=tranfile;
run;
```

PROC CPORT writes the file TRANFILE to disk. This file contains the data sets and catalogs in the SAS data library NEWLIB in transport format.

Example 2: Exporting Data Sets and Catalogs to Tape

CAUTION:
You must use an unlabeled tape when writing to tape with the CPORT procedure. △

The following is an example of using PROC CPORT to mount a tape onto a tape drive and export all the data sets and catalogs in a data library:

```
x 'alloc tape-drive sastape';
x 'mount/for sastape';
libname newlib 'SAS-data-library';
filename tranfile 'sastape';

proc cport library=newlib file=tranfile tape;
run;
```

PROC CPORT writes the file TRANFILE to tape. This file contains the data sets and catalogs in the SAS data library NEWLIB in transport format.

See Also

- □ "CIMPORT Procedure" on page 374
- □ The MIGRATE Procedure at **`support.sas.com/rnd/migration`**
- □ "Compatibility of Existing SAS Files with SAS 9.1" on page 135
- □ *Moving and Accessing SAS Files*

DATASETS Procedure

Lists, copies, renames, repairs, and deletes SAS files; manages indexes for and appends SAS data sets in a SAS data library; changes variable names and related variable information and prints the contents

OpenVMS specifics: directory information; CONTENTS statement output

See: DATASETS Procedure in *Base SAS Procedures Guide*

Syntax

PROC DATASETS <*option(s)*>;

CONTENTS <*option(s)*>

Note: This is a simplified version of the DATASETS procedure syntax. For the complete syntax and its explanation, see the DATASETS procedure in *Base SAS Procedures Guide*. △

CONTENTS *option(s)*
the value for *option(s)* can be the following under OpenVMS:

DIRECTORY
prints a list of information specific to the OpenVMS operating environment.

Details

The SAS data library information that the DATASETS procedure displays in the SAS log is specific to your operating environment. The following output shows the information that the DATASETS procedure writes to the SAS log when the following SAS statements are executed in the OpenVMS environment:

```
proc datasets library=work;
run;
```

Output 17.2 SAS Data Library Information from PROC DATASETS with the V9 Engine

```
1     proc datasets library=work;
                                    Directory

                         Libref         WORK
                         Engine         V9
                         Physical Name  SASDISK:[SASDEMO.SAS$WORK2542293E]

                                           Member  File Size
                               #  Name     Type    (blocks)   Last Modified

                               1  ORANGES  DATA     17        12MAY2003:13:46:22

2     quit;
$
```

The output shows you the libref, engine, and physical name associated with the library, as well as the names of the data sets that the library contains. It also shows the names of any catalogs and valid memtype stored in the library.

The CONTENTS statement of the DATASETS procedure generates the same **`Engine/Host Dependent Information`** as the CONTENTS procedure.

See Also

- □ "CONTENTS Procedure" on page 375
- □ "Modifying Data Set Names and Attributes" in *Step-by-Step Programming with Base SAS Software*

FORMAT Procedure

Creates user-defined formats and informats

OpenVMS specifics: location of temporary formats and informats

See: FORMAT Procedure in *Base SAS Procedures Guide*

Syntax

PROC FORMAT <*options(s)*>;

Note: This is a simplified version of the FORMAT procedure syntax. For the complete syntax and its explanation, see the FORMAT procedure in *Base SAS Procedures Guide*. △

option(s)
specifies the options that control the behavior of and information about formats and informats.

Details

The FORMAT procedure enables you to define your own informats and formats for variables.

Under OpenVMS, temporary formats and informats are stored in the temporary catalog FORMATS.SASEB$CATALOG in your WORK data library.

OPTIONS Procedure

Lists the current values of all SAS system options

OpenVMS specifics: host options listed

See: OPTIONS Procedure in *Base SAS Procedures Guide*

Syntax

PROC OPTIONS <*options(s)*>;

option(s)
controls the format of the list of system options and the number of items displayed. The value for *option(s)* can be any of the following under OpenVMS:

HOST | NOHOST
displays only host options (HOST) or only portable options (NOHOST). PORTABLE is an alias for NOHOST.

LONG | SHORT
specifies the format for displaying the settings of the SAS system options. LONG lists each system option and its value on a separate line with an explanation. SHORT produces a compressed listing without explanations.

OPTION=*option-name* <DEFINE> <VALUE>
displays a short description and the value (if any) of the option specified by *option-name*. DEFINE and VALUE provide additional information about the option.

option-name
specifies the option to use as input to the procedure.

DEFINE
displays the short description of the option, as well as its type and how to get, set, and display its value.

VALUE
displays the option value and scope, as well as how the value was set.

If a SAS system option uses an equals sign, such as PAGESIZE=, do not include the equals sign when specifying the option to the OPTION= procedure.

RESTRICT
displays the system options that have been restricted by your site administrator. These options cannot be changed by the user. For each option that is restricted, the RESTRICT option displays the value, scope, and how it was set.

If your site administrator has not restricted any options, then the following message will appear in the SAS log:

```
Your Site Administrator has not restricted any options.
```

Details

The OPTIONS procedure lists the current settings of the SAS system options.

The portable options (session and configuration) displayed by the OPTIONS procedure are the same for every operating environment, although the default values might differ slightly. However, the host options that PROC OPTIONS displays are different for each operating environment.

Also, some option values depend on which mode of operation you use to run SAS. For example, the default for the LOG= option is blank under a windowing environment, but in interactive line mode the default is SYS$OUTPUT. Finally, the way you set up your process affects the default values of system options. For example, the default value of the CONFIG= option depends on whether you have defined the OpenVMS logical name SAS$CONFIG in your process.

By using PROC OPTIONS, you can check the values of all system options. For more information about a particular host option, see the entry for the option in Chapter 19, "System Options under OpenVMS," on page 429.

See Also

- For more information about restricted options, see "Six Types of Configuration Files" on page 36.

PMENU Procedure

Defines pull-down menu facilities for windows that were created with SAS software

OpenVMS specifics: Some options and statements are ignored in the OpenVMS environment

See: PMENU Procedure in *Base SAS Procedures Guide*

Syntax

PROC PMENU <CATALOG=<*libref.*>*catalog*>
    <DESC '*entry-description*'>;

Note: This is a simplified version of the PMENU procedure syntax. For the complete syntax and its explanation, see the PMENU procedure in *Base SAS Procedures Guide*. △

CATALOG=<*libref.*>*catalog*
specifies the catalog in which you want to store PMENU entries. If you omit *libref*, the PMENU entries are stored in a catalog in the SASUSER data library. If you omit CATALOG=, the entries are stored in the SASUSER.PROFILE catalog.

DESC '*entry-description*'
provides a description of the PMENU catalog entries created in the step.

Details

The PMENU procedure defines pull-down menus that can be used in DATA step windows, macro windows, SAS/AF and SAS/FSP windows, or in any SAS application that enables you to specify menus.

Under OpenVMS, the following statements or statement options are ignored:

- □ SEPARATOR statement
- □ HELP= option in the DIALOG statement
- □ ACCELERATE= and MNEMONIC= options in the ITEM statement
- □ ATTR= and COLOR= options in the TEXT statement. The colors and attributes for text and input fields are controlled by the CPARMS colors. For details, see "Customizing Colors under OpenVMS" on page 106.

The GRAY option makes any unavailable menu items look different (usually bold) from those that are available. On some displays, this visual distinction is not supported; on these displays, all menu items appear the same.

PRINTTO Procedure

Defines destinations for SAS procedure output and for the SAS log

OpenVMS specifics: valid values for *file-specification*; UNIT= option

See: PRINTTO Procedure in *Base SAS Procedures Guide*

Syntax

PROC PRINTTO <*option(s)*>

Note: This is a simplified version of the PRINTTO procedure syntax. For the complete syntax and its explanation, see the PRINTTO procedure in *Base SAS Procedures Guide*. △

option(s)

LOG=*file-specification*
specifies a fileref, a fully qualified OpenVMS pathname (in quotation marks), or an OpenVMS logical name as the destination for the log output.

PRINT=*file-specification*
specifies a fileref, a fully qualified OpenVMS pathname (in quotation marks), or an OpenVMS logical name as the destination for procedure output. FILE= and NAME= are valid aliases for this option.

UNIT=*nn*
sends output to the file FT*nn*F001.LIS, where *nn* represents the UNIT= value, which can range from 1 to 99.

Details

The PRINTTO procedure defines destinations for SAS procedure output and for the SAS log.

To send output directly to a printer, use a FILENAME statement with the PRINTER device-type keyword. This sends the output to the default SYS$PRINT queue. If you want to override the default queue, use the QUEUE= option in the FILENAME statement to specify a different queue.

Note: You cannot send the output directly to a member of a text library or to a remote node or tape. △

Examples

Example 1: Sending SAS Log Entries to an External File The following statements send any SAS log entries that are generated after the RUN statement to the external file that is associated with the fileref MYFILE:

```
filename myfile '[mydir]mylog.log';

proc printto log=myfile;
run;
```

Example 2: Sending Procedure Output to an External File The following statements send the procedure output from the CONTENTS procedure (and any other subsequent procedure output from the SAS session) to the external file that is associated with the OpenVMS logical name OUTPUT:

```
x 'define output [mydir]proc1.lis';
proc printto print=output;
run;

proc contents data=oranges;
run;
```

Example 3: Sending Procedure Output to a System Printer The following statements send the procedure output from the CONTENTS procedure directly to the system printer:

```
filename myfile printer '[mydir]proc2.lis';

proc printto print=myfile;
run;

proc contents data=oranges;
run;
```

Example 4: Redirecting SAS Log and Procedure Output to the Default The following statements (a PROC PRINTTO statement with no options) redirect the SAS log and procedure output to the original default destinations:

```
proc printto;
run;
```

Example 5: Sending Procedure Output to a File The following statements send any procedure output to a file named MYPRINT.DAT:

```
proc printto print=myprint;
run;
```

See Also

- "FILENAME Statement" on page 397
- Chapter 8, "Routing the SAS Log and SAS Procedure Output," on page 195.

SORT Procedure

Sorts observations in a SAS data set by one or more variables, then stores the resulting sorted observations in a new SAS data set or replaces the original data set

OpenVMS specifics: available sort routines

See: SORT Procedure in *Base SAS Procedures Guide*

Syntax

PROC SORT <*option(s)*> <*collating-sequence-option*>;

Note: This is a simplified version of the SORT procedure syntax. For the complete syntax and its explanation, see the SORT procedure in *Base SAS Procedures Guide*. △

option(s)

NODUPKEY
under OpenVMS, the observation that is returned is unpredictable; that is, the observation returned is not guaranteed to be the first observation that was encountered for that BY variable. For further explanation of the NODUPKEY option, see "NODUPKEY Option" on page 387.

SORTWKNO=*n*
specifies the number of sort work files to be used by the OpenVMS sort utility. The value for *n* can be 0 through 6. For further explanation of the SORTWKNO= option, see "SORTWKNO= Option" on page 388.

Details

The SORT procedure sorts observations in a SAS data set by one or more character or numeric variables, either replacing the original data set or creating a new, sorted data set. By default under OpenVMS, the SORT procedure uses the ASCII collating sequence.

The SORT procedure uses the sort utility specified by the SORTPGM system option. By default, when SORTPGM is set to HOST, the SORT procedure uses the OpenVMS sort utility. (An alternate host sort utility, Hypersort V04–003, is also available. For information about how the sort utility is chosen, see "SORTPGM= System Option" on page 493.)

You can use all of the options available to the SAS sort utility with your host sort. If you specify an option that is not supported by the host sort, then the SAS sort will be used instead. For a complete list of options, see the SORT procedure in the *Base SAS Procedures Guide*.

NODUPKEY Option

The SAS sort utility and the OpenVMS sort utility differ slightly in their implementation of the NODUPKEY option. If you need to use both the NODUPKEY and EQUALS options (that is, if you need to guarantee that the first observation returned is the first observation that was input), then use the SAS sort utility.

When you use the SAS sort utility, the NODUPKEY option implies the EQUALS option by default. As a result, the observation that is returned for like BY values is the first observation that was encountered for the key BY variable. That is, the observations are returned in the order in which they were input.

By contrast, the OpenVMS sort utility does not support the EQUALS option in conjunction with the NODUPKEY option. When NODUPKEY is used with the OpenVMS sort utility, the EQUALS option is set to NOEQUALS unconditionally. As a result, when NODUPKEY is specified with the OpenVMS sort utility, the observation that is returned for observations with like BY values is not guaranteed to be the first observation that was encountered for that BY variable. The observation that the OpenVMS sort utility returns when NODUPKEY is in effect is unpredictable.

SORTWKNO= Option

The SORTWKNO= option specifies the number of sort work files to be used by the OpenVMS sort utility.

The OpenVMS sort utility can support up to 10 work files. If you set SORTWKNO= to 0 and define the ten sort work files, SAS uses the ten files. To use the sort work files, you must define a SORTWORK# logical name for each sort work area. For example:

```
$DEFINE SORTWORK0  DISK1:[TEMP]
$DEFINE SORTWORK1  DISK2:[TEMP]
$DEFINE SORTWORK2  DISK3:[TEMP]
```

The SORTWORK= system option can also be used to assign up to ten work files.

The following example uses the SORTWKNO= option to specify that four work files should be used:

```
libname mylib '[mydata]';

proc sort data=mylib.june sortwkno=4;
   by revenue;
run;
```

Customizing Collating Sequences

The options EBCDIC, ASCII, NATIONAL, DANISH, SWEDISH, and REVERSE specify collating sequences that are stored in the HOST catalog.

If you want to provide your own collating sequences or change a collating sequence provided for you, use the TRANTAB procedure to create or modify translation tables. For more information about the TRANTAB procedure, see *SAS National Language Support (NLS): User's Guide*. When you create your own translation tables, they are stored in your PROFILE catalog, and they override any translation tables that have the same names in the HOST catalog.

Note: System managers can modify the HOST catalog by copying newly created tables from the PROFILE catalog to the HOST catalog. Then all users can access the new or modified translation table. △

If you are using the SAS windowing environment and want to see the names of the collating sequences that are stored in the HOST catalog, issue the following command from any window:

```
CATALOG SASHELP.HOST
```

If you are not using the SAS windowing environment, then issue the following statements to generate a list of the contents of the HOST catalog:

```
proc catalog catalog=sashelp.host;
contents;
run;
```

Entries of type TRANTAB are the collating sequences.

To see the contents of a particular translation table, use the following statements:

```
proc trantab table=table-name;
list;
run;
```

The contents of collating sequences are displayed in the SAS log.

Setting the Host Sort Utility as the Sort Algorithm

To specify a host sort utility as the sort algorithm:

1 Set the SORTPGM system option to tell SAS when to use the host sort utility.
   - □ If SORTPGM=HOST, then SAS will use the OpenVMS sort utility. If you have enabled the Hypersort utility, then SAS will use it as the host sort utility.
   - □ If SORTPGM=BEST, then SAS chooses the best sorting method (either the SAS sort or the host sort) for the situation.

   For more information, see "SORTPGM= System Option" on page 493.

Specifying the SORTSEQ= Option with a Host Sort Utility

The SORTSEQ= option enables you to specify the collating sequence for your sort. For a list of valid values, see *Base SAS Procedures 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 will 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 about the TRANTAB procedure, see *SAS National Language Support (NLS): User's Guide*.
- □ use the SAS sort. You can specify the SAS sort using the SORTPGM system option. For more information, see "SORTPGM= System Option" on page 493.
- □ 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. For an example, see "Example: Creating a View with a Dummy BY Variable" on page 390.

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 *SAS Language Reference: Dictionary*. For more information about the NOBYSORTED system option, see "BYSORTED System Option" in *SAS Language Reference: Dictionary*. △

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 no date nostimer ls-78 ps-60;
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 output is the following:

Output 17.3 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
```

See Also

- □ "TRANTAB Procedure" in *SAS National Language Support (NLS): User's Guide*
- □ "SORTPGM= System Option" on page 493
- □ "SORTSIZE= System Option" on page 494
- □ "SORTWORK= System Option" on page 495
- □ "SORTPGM= System Option" on page 493
- □ "Working with Grouped or Sorted Observations" in *Step-by-Step Programming with Base SAS Software*

VAXTOAXP Procedure

Converts the format of a SAS data set that was created in an OpenVMS VAX environment to the format that SAS supports in the OpenVMS Alpha environment

OpenVMS Alpha specifics: All aspects are specific to the OpenVMS Alpha operating environment

Syntax

PROC VAXTOAXP
DATA = <*libref.*>*member*
OUT = <*SAS-data-set*>;

DATA=*libref.member*
specifies a libref member, a fully qualified OpenVMS pathname (in quotation marks), or an OpenVMS logical name. The DATA= option is required.

OUT=*SAS-data-set*
names the SAS data set that is created to hold the converted data. The OUT= option is optional. If you do not specify a value for the OUT= option, then SAS creates a temporary SAS data set called WORK.DATA*n*.

Details

In the OpenVMS VAX operating environment, SAS stores numeric variables as D-floating data types, which means that their length varies from 2 to 8 bytes. However, in the OpenVMS Alpha operating environment, numeric variables are stored as IEEE T-floating data types, which means that their length varies from 3 to 8 bytes. If you attempt to move data with 2-byte numeric variables from an OpenVMS VAX environment to an OpenVMS Alpha environment, you will get the following error message:

```
ERROR: IEEE numbers with a length less than 3 are not supported.
```
This data set contains observations with numeric variables of length 2. The data set cannot be created/translated.

If a SAS data set that was created in the OpenVMS VAX environment contains only numeric variables with lengths of 3 bytes or greater, then SAS in the OpenVMS Alpha environment can access the data set without the need for any conversion process. However, if your OpenVMS VAX data set does contain numeric variables with 2-byte lengths, your OpenVMS Alpha environment will be unable to access the data set until you have converted it.

The VAXTOAXP procedure increases the length of all numeric variables by 1 byte up to 8 bytes. Thus, a 2-byte numeric variable becomes 3 bytes, a 3-byte numeric variable becomes 4 bytes, and so on.

If you run the VAXTOAXP procedure on a data set that does not contain numeric variables with lengths less than 8 bytes, the conversion proceeds after the following warning message is issued:

```
WARNING: No numeric variables had a length less than 8, so it was
unnecessary to invoke PROC VAXTOAXP.
```
However, the data set will still be copied as requested.

Note: You cannot use this procedure to convert SAS catalogs. On OpenVMS VAX and Alpha, catalogs must be converted with PROC CIMPORT. △

Example

Suppose you have a permanent SAS data set named CHARLIE that you created in an OpenVMS VAX environment. You know that this data set contains numeric variables with 2-byte lengths. To read that data set into SAS running in an OpenVMS Alpha environment, use the following statements:

```
libname vlib v6 'user$disk:[dir]';
libname alib v8 '[nwdir]';

proc vaxtoaxp data=vlib.charlie out=alib.charlie;
run;
```

You can verify that all 2-byte numeric variables have been converted to 3 bytes by running the CONTENTS procedure on the ALIB.CHARLIE data set. All numeric variables that have lengths less than 8 bytes will have their lengths increased by 1 byte.

Note: If you attempt to use the VAXTOAXP procedure while running in an OpenVMS VAX operating environment, you will receive the following error message:
`ERROR: Procedure VAXTOAXP is not supported on the VAX.` △

CHAPTER 18

Statements under OpenVMS

SAS Statements under OpenVMS

A SAS statement is a directive to SAS that either requests that SAS perform a certain operation or provides information to the system that might be necessary for later operations.

All SAS statements are completely described in *SAS Language Reference: Dictionary*. Those that are described here have syntax and usage that is specific to the OpenVMS operating environment.

Dictionary

ABORT Statement

Stops executing the current DATA step, SAS job, or SAS session

Valid: in a DATA step

OpenVMS specifics: action of ABEND and RETURN; maximum value of *n*

See: ABORT Statement in *SAS Language Reference: Dictionary*

Syntax

ABORT <ABEND | RETURN> <*n*>;

Note: This is a simplified explanation of the ABORT statement syntax. For the complete explanation, see *SAS Language Reference: Dictionary*. △

no argument
stops processing of the current DATA step. Additional actions and results depend on the method of operation.

ABEND
causes abnormal termination of the current SAS job or session. Results depend on the method of operation.

RETURN
causes the immediate normal termination of the current SAS job or session. Results depend on the method of operation.

n
is an integer value that enables you to specify a condition code that SAS returns to OpenVMS when it stops executing. The value of *n* can range from –2,147,483,648 to 2,147,483,647.

Details

If you specify ABORT ABEND, the symbol SAS$STATUS is set to 999. If you specify ABORT RETURN, the symbol SAS$STATUS is set to 12. Both the ABEND and RETURN arguments terminate the SAS job or session.

See Also

□ "Determining the Completion Status of a SAS Job under OpenVMS" on page 50

ATTRIB Statement

Associates a format, an informat, a label, or a length, or all four with one or more variables

Valid: in a DATA step

OpenVMS specifics: length specification

See: ATTRIB Statement in *SAS Language Reference: Dictionary*

Syntax

ATTRIB *variable-list-1 attribute-list-1*< . . . *variable-list-n attribute-list-n*>;

Note: Following is a simplified explanation of the ATTRIB statement syntax. For complete syntax and its explanation, see the ATTRIB statement in *SAS Language Reference: Dictionary*. △

attribute-list

LENGTH=<$>*length*
specifies the length of variables in *variable-list*. A dollar sign ($) is required in front of the length of character variables. For character variables, the value of *length* can be 1 to 32,767.

Details

Under OpenVMS Alpha, the minimum length that you can specify for a numeric variable is 3 bytes.

FILE Statement

Specifies the current output file for PUT statements

Valid: in a DATA step

OpenVMS specifics: valid values for *file-specification*, *host-option-list*, and *encoding-value*

See: FILE Statement in *SAS Language Reference: Dictionary*

Syntax

FILE *file-specification* <ENCODING='*encoding-value*'><*option-list*>
<*host-option-list*>;

file-specification
can be any type of file specification discussed in "Identifying External Files to SAS" on page 173.

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.

When you write data to the output file, SAS transcodes the data from the session encoding to the specified encoding.

For valid encoding values, see "Encoding Values in SAS Language Elements" in *SAS National Language Support (NLS): User's Guide*.

option-list
specifies options for the FILE statement that are valid in all operating environments. For information about these options, see the FILE statement in *SAS Language Reference: Dictionary*.

host-option-list
specifies external I/O statement options that are specific to the OpenVMS environment. These options can be any of the following:

ALQ=

CC=

DEQ=

FAC=

GSFCC=

LINESIZE=

LRECL=

MBC=

MBF=

MOD

NEW

OLD

PAGESIZE=

RECFM=

SHR=

For information about these options, see "Host-Specific External I/O Statement Options" on page 402 in the FILENAME statement.

Many of the DCL print qualifiers are also supported as host options in the FILE and FILENAME statements. For details, see "Printer Options in the FILENAME and FILE Statements" on page 412 in the FILENAME statement.

You can intersperse options from *option-list* and *host-option-list* in any order.

Note: When using the PIPE device with the FILE statement, only the LRECL host option is supported. △

Details

By default, PUT statement output is written to the SAS log. Use the FILE statement to route this output to either the same external file to which procedure output is written or to a different external file. You can indicate whether or not carriage control characters should be added to the file.

You can use the FILE statement in conditional (IF-THEN) processing because it is executable. You can also use multiple FILE statements to write to more than one external file in a single DATA step.

The ENCODING= option is valid only when the FILE statement includes a file specification that is not a reserved fileref. If the FILE statement includes the ENCODING= option and the reserved filerefs LOG or PRINT as the *file-specification*, then SAS issues an error message. The ENCODING= value in the FILE statement overrides the value of the ENCODING= system option.

Example

The following is an example of a FILE statement:

```
file prices;
```

This FILE statement uses the default filename form of the file specification (PRICES has not been assigned as a SAS fileref or OpenVMS logical name). Therefore, SAS looks for the file PRICES.DAT in the current directory.

When SAS writes a file, it creates a new version by default. For example, if your default directory contains versions 1 and 2 of the file PRICES.DAT, then this FILE statement writes PRICES.DAT;3 in your default directory.

If you want to append output lines to the most recent version of an external file, use the MOD option in the FILE statement. For instance, from the previous example your default directory contains three versions of PRICES.DAT. The following statement appends data lines to PRICES.DAT;3:

```
file prices mod;
```

To reference an explicit version of a file, use the version number as part of the file specification within a quoted string. For example, the following FILE statement writes to version 1 of the file:

```
file 'prices.dat;1';
```

See Also

- □ "FILENAME Statement" on page 397
- □ "Identifying External Files to SAS" on page 173
- □ "FILE Command" on page 258

FILENAME Statement

Associates a SAS fileref with an external file or output device

Valid: anywhere in a SAS program

OpenVMS specifics: valid values for *device-type*, *encoding-value*, *external-file*, and *host-option-list*

See: FILENAME Statement in *SAS Language Reference: Dictionary*

Syntax

FILENAME *fileref* <*device-type*>
'*external-file*' <ENCODING='*encoding-value*'><*host-option-list*>;

FILENAME *fileref device-type* <'*external-file*'><ENCODING='*encoding-value*'>
<*host-option-list*>;

Note: This is a simplified version of the FILENAME statement syntax. For the complete syntax and its explanation, see the FILENAME statement in *SAS Language Reference: Dictionary*. △

fileref
is any valid fileref and can be up to eight characters long. The first character must be a letter (A to Z), an underscore (_), a dollar sign ($), a pound sign (#), or an at sign (@). Subsequent characters can be any of these characters, or they can be numbers. Neither OpenVMS nor SAS distinguishes between uppercase and lowercase letters in filerefs or in filename specifications. This is a required argument. See "Reading from

and Writing to OpenVMS Commands (Pipes)" on page 186 for information about assigning a fileref to a pipe to read from and write to OpenVMS commands.

The following are some examples of valid filerefs:

- □ TEST_1
- □ MYFILE
- □ abc123

The following are some examples of invalid filerefs:

- □ ALONGFILENAME (longer than eight characters)
- □ 123_test (begins with a number)
- □ TEST%X (contains an invalid character (%)).

device-type

specifies an output device. For details about device types, see "Device-Type Keywords" on page 400. The device-type keyword must follow *fileref* and must precede *external-file* (if an external file is used).

'external-file'

can be any valid file specification. You must enclose the file specification in quotation marks. The file specification must be a valid OpenVMS pathname to the external file that you want to access. Therefore, the level of specification depends on your location in the directory structure. The number of characters in the quoted string must not exceed the maximum filename length that OpenVMS allows (255 characters).

Under OpenVMS, you can specify concatenations of files when reading and writing external files from within SAS. Concatenated files consist of two or more file specifications, enclosed in quotation marks and separated by commas. The following is an example of a valid concatenation specification:

```
filename alldata 'test.data1, test.data2, test.data3';
```

For a complete discussion, see "Using OpenVMS Pathnames to Identify External Files" on page 174

If you specify a version number for the file in a FILENAME statement, the version number of the file is not increased. For example, the following FILENAME statement will produce only one file, **`test.dat;1`**:

```
filename myfile 'test.dat;1';

data;
   file myfile;
   put 'hello';
run;

data;
   file myfile;
   put 'hello again';
run;
```

For more details, see "Using OpenVMS Pathnames to Identify External Files" on page 174. For more information about valid OpenVMS pathnames, refer to *OpenVMS User's Manual*.

ENCODING=*'encoding-value'*

specifies the encoding to use when reading from or writing to the external file. The value for ENCODING= indicates that the external file has a different encoding from the current session encoding.

When you read data from an external file, SAS transcodes the data from the specified encoding to the session encoding. When you write data to an external file, SAS transcodes the data from the session encoding to the specified encoding.

For valid encoding values, see “Encoding Values in SAS Language Elements” in *SAS National Language Support (NLS): User’s Guide*.

host-option-list

names any of the following external I/O statement options:

ALQ=

CC=

DEQ=

FAC=

GSFCC=

KEY=

KEYVALUE=

LRECL=

MBC=

MBF=

MOD

NEW

OLD

RECFM=

SHR=

These options control how the external file is processed and are specific to the OpenVMS environment. For information about these options, see “Host-Specific External I/O Statement Options” on page 402.

Many of the DCL print qualifiers are also supported as host options in the FILENAME and FILE statements. For details, see “Printer Options in the FILENAME and FILE Statements” on page 412.

Note: When you are using the PIPE device, only the LRECL= host option is supported. △

Details

The FILENAME statement is significantly different from the LIBNAME statement. The FILENAME statement is for external files only and references a specific filename. The LIBNAME statement is for SAS files only, and it generally specifies directory- and subdirectory-level information only (except when you are assigning a libref for use with the XPORT, OSIRIS, or SPSS engines). Also, unlike a libref, you can associate a fileref with a file that does not yet exist; when you use the fileref in a FILE statement or command, the file is created according to your specifications.

You can choose to use only a directory name in the FILENAME statement (the directory must exist, except when you are doing a concatenation). You must then use the fileref and the filename in subsequent statements as discussed in “Using Aggregate Syntax to Identify External Files” on page 175. SAS supplies a default file type.

Reserved Filerefs

Under OpenVMS, the following are reserved filerefs (the items in parentheses are the SAS statements to which each applies):

DATALINES (INFILE)
: specifies that input data immediately follows a DATALINES statement in your SAS stream. The only time you need to use the INFILE DATALINES fileref is when you want to use INFILE statement options to read in stream data.

LOG (FILE)
: specifies that output lines produced by PUT statements are written to the SAS log. LOG is the default destination for output lines.

PRINT (FILE)
: specifies that output lines produced by PUT statements are written to the procedure output file, the external file to which SAS procedure output is written.

Device-Type Keywords

When you specify a *device-type* in a FILENAME statement, the *external-file* argument is optional. If you do specify an external file, its meaning depends on which device type you specified. For example, the following SAS program sends the output file to the printer that is associated with the SYS$PRINT queue:

```
filename myfile printer;

data test;
   file myfile;
   put 'This is spooled to a printer.';
run;
```

The following are the valid device-type keywords and their meanings:

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. Refer to *SAS Language Reference: Dictionary* for a description of catalog options.

DISK
: sends the output to or reads the input from a disk device. This is the default behavior if you do not specify any device-type keywords in the FILENAME statement. You must specify an external file with this keyword.

DUMMY
: sends the output to NLA0: (the null device). If you specify an external file, the file specification is ignored. This device-type keyword is useful when you are debugging SAS programs. You can test your algorithms without actually writing output files.

EMAIL
: sends electronic mail to an address. The external file is an address and email options. See "Sending Electronic Mail Using the FILENAME Statement (E-MAIL)" on page 189 for more information.

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. See *SAS Language Reference: Dictionary* for more information.

PIPE
sends the output to or reads the input from an OpenVMS command. For more information, see "Reading from and Writing to OpenVMS Commands (Pipes)" on page 186.

Note: The PIPE device cannot be used from a captive account. For more information, see "Limitations of Using a Captive Account" on page 47. △

PLOTTER
spools the output to a printer queue that has been assigned to a plotter. This keyword works the same as the PRINTER keyword except that the file format is valid for a plotter device. The file that is created is an OpenVMS print file; it has a variable record format, with a 2-byte, fixed-length control field.

For every record, the 2-byte control field is set to NULL, indicating no carriage control.

PRINTER
spools the output to a printer queue. If you do not specify an external file, the output is sent first to a temporary file on disk and then to the SYS$PRINT queue. Then the disk file is deleted. If you do specify a file, the output is sent to that file and then sent to the SYS$PRINT queue. In this case, the disk file is not deleted. To send the output to a printer queue other than SYS$PRINT, use the QUEUE= option in the FILENAME or FILE statement. For information about printer options, see "Printer Options in the FILENAME and FILE Statements" on page 412.

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. See *SAS Language Reference: Dictionary* for more information.

TAPE
sends the output to or reads the input from a tape device. You are responsible for allocating the tape drive and mounting the tape before output is sent to the device. If you do not specify an external file, the output is sent to the tape device that is associated with the logical name SASTAPE. If you do specify a file, the device portion of the filename must be a valid tape device.

TEMP
is a temporary file that can only be accessed through the logical name and is only available 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.

TERMINAL
sends the output to or reads the input from a terminal device. If you do not specify an external file, the output goes to the SYS$OUTPUT output stream. If you do specify an external file, the file specification is ignored and SYS$OUTPUT is still used.

If you want to display and enter data in the same step, then issue two FILENAME statements and use one fileref for input and one for output.

UPRINTER
sends output to the default printer that was set up through the Print dialog box.

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
```

Refer to *SAS Language Reference: Dictionary* for more information.

These keywords are valid only in the FILENAME statement. However, a fileref for which you specified a device-type keyword can be used in the SAS windowing environment commands and in the FILE, INFILE, and %INCLUDE statements. In order to use these devices correctly, you must specify the device-type keyword in the FILENAME statement. (If you use a device specification only in the quoted file specification of a FILE or INFILE statement, the results are unpredictable.) For example, to correctly send output to the display, use the following statements:

```
filename myfile terminal;

data test;
   file myfile;
   put 'This is my test';
run;
```

By contrast, the following lines are incorrect and might yield unpredictable results:

```
data test2;
   file 'sys$output';
   put 'This may not work in all cases.';
run;
```

When you use the TERMINAL device type with the INFILE statement, you terminate input by pressing CTRL+Z.

Host-Specific External I/O Statement Options

The following external I/O statement options can be used in the FILE, INFILE, and FILENAME statements. Note that some of these options, such as ALQ=, have the same names as SAS data set options. Do not confuse the two types of options. You cannot use data set options with external files.

This list includes only options that are specific to the OpenVMS environment. For a complete list of external I/O statement options, see "Summary of External I/O Statement Options" on page 411 and the SAS statements documentation in *SAS Language Reference: Dictionary*.

The following descriptions include an explanation of the option, its valid and default values, and whether it is used for input, output, or both.

If the same option is used in both the FILENAME and FILE statements or in both the FILENAME and INFILE statements, the FILE or INFILE value takes precedence over the value used in the FILENAME statement.

ALQ=
: specifies the number of blocks initially allocated to an external file when it is created. The value can range from 0 to 2,147,483,647. If the value is 0 (the default), the minimum number of blocks required for the given file format is used.

The ALQ= option (allocation quantity) is used for output and corresponds to the FAB$L_ALQ field in OpenVMS Record Management Services (RMS). For additional details, refer to *Guide to OpenVMS File Applications*.

BLKSIZE= | BLK=
is no longer supported in the OpenVMS operating environment.

CC=
specifies the carriage-control format of the SAS log and the procedure output file. This option has three possible values:

FORTRAN
indicates FORTRAN carriage-control format. This is the default for print files.

PRINT
indicates OpenVMS print format.

CR
indicates OpenVMS carriage-return, carriage-control format. This is the default for nonprinting files.

Only SAS print files are affected by the CC= option. The CC= option is used for output.

The CC= option also exists as a SAS system option (see "CC= System Option" on page 452). If you specify this option both as a system option and in the FILENAME or FILE statement, then SAS uses the value that you specified in the FILENAME or FILE statement.

DEQ=
specifies the number of blocks added when OpenVMS RMS automatically extends an external file during a write operation. The value can range from 0 to 65,535. The default value is 0, telling OpenVMS RMS to use the process's default value. A large value results in fewer file extensions over the life of the file; a small value results in numerous file extensions over the life of the file. A file with numerous file extensions might be noncontiguous, thereby slowing record access.

The DEQ= option (default file extension quantity) is used for output and corresponds to the FAB$W_DEQ field in OpenVMS RMS. For additional details, see *Guide to OpenVMS File Applications*.

FAC=
overrides the default file access attributes used for external files. Use this option to indicate the level of access you want to allow for an external file. You can allow read, write, update, and delete access (as well as no access). By default with external files, files opened for input allow read access, files opened for output allow write access, and files opened for update allow read and write access. The form of the FAC= option is

```
FAC=access-option-list
```

where *access-option-list* can be one of the following:

DEL	specifies delete access.
GET	specifies read access.
PUT	specifies write access.
UPD	specifies update access.

You can combine these values in any order. For example, specifying the following indicates you want delete, read, and write access:

```
fac=(del,get,put)
```

By also specifying the SHR= option, you can allow other users concurrent access to an external file, either through a separate SAS session or with another application. To allow sharing, you must include the values for FAC= in the list of values for SHR= (but the reverse is not true). For more information, see the description of the SHR= option later in this section.

The FAC= option (file access) can be used for both input and output and corresponds to the FAB$B_FAC field in OpenVMS RMS or the ACCESS attribute when using File Definition Language (FDL). For additional details about file sharing, see *Guide to OpenVMS File Applications*.

GSFCC=
: specifies the file format of graphic stream files (GSF files). When specified on the FILENAME statement, it affects only the GSF files that are created using that fileref. The accepted values are

PRINT	creates a GSF file. It is a VFC format file with carriage control set to null. These files can be used with most utilities with the exception of some file transfer protocols, such as Kermit. This is the default value for this option.
CR	creates a carriage return carriage control file.
NONE	creates a file with no carriage control. This format is useful if you plan to download the file to a personal computer.

KEY=
: specifies which key SAS uses to read the records in an RMS file with indexed organization. The KEY= option is always used with the KEYVALUE= option. For details, see "Using the KEY= Option" on page 407 and "Using the KEYVALUE= Option" on page 408.

KEYVALUE=
: specifies the key value with which to begin reading an indexed file. For details, see "Using the KEYVALUE= Option" on page 408.

LRECL=
: specifies the record length of the output file. If you do not specify a record length, the default is varying length records. For input, the existing record length is used by default. If the LRECL= option is used, the input records are padded or truncated to the specified length.

The maximum record size for OpenVMS is 32,767. However, your LRECL= value might differ depending on the record format you use. LRECL values greater than 32,767 are valid only when reading and writing to tape. If an LRECL= value greater than 32,767 is specified when you are writing to a non-tape device, the value is set 32,767. You should use the maximum LRECL values for the various file types provided in the following table.

Because the FLOWOVER option on the FILE statement is the default, lines that are longer than the length specified by the LRECL= option are split.

When accessing unlabeled tapes, you must use LRECL=. The minimum value in this case is 14. For more information, see "Reading from an Unlabeled Tape" on page 184.

The LRECL= option is used for both input and output.

Table 18.1 Maximum LRECL Values for File Types

File Organization	Record Format	Maximum LRECL Value
Sequential	Fixed length	32,767
Sequential (disk)	Variable length	32,765
Sequential (disk)	VFC	32,767-FSZ

File Organization	Record Format	Maximum LRECL Value
Sequential (disk)	Stream	32,767
Sequential (disk)	Stream-CR	32,767
Sequential (disk)	Stream-LF	32,767
Sequential (ANSI Tape)	Variable length	9,995
Sequential (ANSI Tape)	VFC	9,995-FSZ
Relative	Fixed length	32,255
Relative	Variable length	32,253
Relative	VFC	32,253-FSZ
Indexed, Prolog 1 or 2	Fixed length	32,234
Indexed, Prolog 1 or 2	Variable length	32,232
Indexed, Prolog 3	Fixed length	32,224
Indexed, Prolog 3	Variable length	32,224

FSZ represents the size, in bytes, of the fixed control area in a record with VFC record format.

MBC=

specifies the size of the I/O buffers that OpenVMS RMS allocates for a particular file. The value can range from 0 to 127 and represents the number of blocks used for each buffer. By default, this option is set to 0 and the default values for the process are used.

The MBC= option (multiblock count) is used for both input and output to control the allocation for a particular file. If you want to control the allocation size for all the external files used during the current SAS session, you can use the MBC= option in every FILE, FILENAME, or INFILE statement. You can also use the DCL SET RMS_DEFAULT command to specify a process default, and let the SAS values default to the process's default values.

The MBC= option corresponds to the RAB$B_MBC field in OpenVMS RMS or the CONNECT MULTIBLOCK_COUNT attribute when using FDL. This option is not supported for DECnet operations. For additional details, see *Guide to OpenVMS File Applications*.

MBF=

specifies the number of I/O buffers you want OpenVMS RMS to allocate for a particular file. The value can range from 0 to 127 and represents the number of buffers used. By default, this option is set to 2 buffers. If a value of 0 is specified, the default value for the process is used.

The MBF= option (multibuffer count) is used for both input and output to control the number of buffers allocated for a particular file. If you want to control the number of buffers allocated for all the external files used during the SAS session, you can use the MBF= option in every FILE, FILENAME, or INFILE statement. The DCL SET RMS_DEFAULT command can be used to specify a process default. Then, you can let the SAS values default to the process's default values.

The MBF= option corresponds to the RAB$B_MBF field in OpenVMS RMS or the CONNECT MULTIBUFFER_COUNT attribute when using FDL. This option is not supported for DECnet operations. For additional details, see *Guide to OpenVMS File Applications*.

MOD
: opens the file referenced for append. This option does not take a value. An existing file of the name given in the FILENAME or FILE statement is opened and new data is appended to the end.

NEW
: opens a new file for output. This option does not take a value. This is the default action for files referenced by a FILE statement. Under OpenVMS, this option is synonymous with the OLD option.

OLD
: opens a new file for output. This option does not take a value. This is the default action for files referenced by a FILE statement. Under OpenVMS, this option is synonymous with the NEW option.

RECFM=
: specifies the record format of the output file. Values for the RECFM= option are as follows:

F	specifies fixed length.
N	specifies binary format. The file consists of a stream of bytes with no record boundaries.
D	specifies that you are accessing unlabeled tapes with the PUT and INPUT DATA step statements. For more information, see “Reading from an Unlabeled Tape” on page 184.
V	specifies variable length.

If the RECFM= option is not used, the value defaults to V for output files. For input files, the default value is the record format of the file.

This option is used for both input and output.

SHR=
: overrides the default file-sharing attributes used for external files. With this option, you can indicate the access level you want to give other users. You can allow read, write, update, and delete access (as well as no access). By default with external files, files opened for input allow shared read access, and files opened for output or update do not allow shared access.

However, you can allow other users to have read and write access to a file that you are opening for input only. To accomplish this, use the SHR= option. The syntax of the SHR= option is

```
SHR=share-option-list
```

where *share-option-list* can be one of the following:

DEL	specifies delete access.
GET	specifies shared read access.
NONE	specifies no shared access.
PUT	specifies shared write access.
UPD	specifies update access.

You can combine these values in any order. For example, specifying the following indicates that you want shared delete, read, and write access:

```
shr=(del,get,put)
```

To allow shared access, the values for FAC= must be included in the list of values for SHR= (but the reverse is not true).

This option corresponds to the FAB$B_SHR field in OpenVMS RMS or the SHARING attribute when you use FDL. For more information about file sharing, see *Guide to OpenVMS File Applications*.

The SHR= option is used for both input and output.

Note: When you are using the PIPE device, only the LRECL= host option is supported. △

Using the KEY= Option

The KEY= option is used for input. It is always used with the KEYVALUE= option. A key is a record field that identifies the record and helps you retrieve it in an indexed file. The two types of keys are primary and alternate. Data records are stored in the file in the order of their primary key. Alternate keys (also called secondary keys) create alternate indexes in the file. The alternate index can then be used to process the records in order of the alternate key. The only difference between the primary key and the alternate key is that the records are actually stored in the order of the primary key, whereas the alternate key provides a means of accessing them.

The key number is zero-based, so KEY=0 (the default) specifies that the records be read in sorted order by the primary key. KEY=1 specifies the use of the first secondary key to access the records.

To use SAS to write to an indexed file, you can either create an empty indexed file or use any existing indexed file. If you create an empty indexed file, use FDL to specify the file characteristics, including the type and location of primary and secondary keys. (For more information about FDL, see *OpenVMS File Definition Language Facility Manual*.) The following is an example program:

```
/*------------------------------------------*/
/* This SAS program accesses an empty       */
/* indexed file that has been previously    */
/* created. The data is appended to the     */
/* file. Primary key #0 is of type character */
/* and is in bytes 0-2. Secondary key #1 is  */
/* of type character and is in bytes 3-5.    */
/*------------------------------------------*/
filename myfile 'indexed.dat';
   /* Load the indexed file, primary key in */
   /* sorted order.                         */
data _null_;
   file myfile mod;
   put 'aaaccc';
   put 'bbbaaa';
run;
   /* Print out in primary key sorted order. */
data _null_;
      /* Key=0 is the default. */
   infile myfile;
   input first $3. second $3.;
   put first= second=;
run;
```

This program produces the following output:

```
first=aaa second=ccc
first=bbb second=aaa
```

In contrast, consider setting KEY=1 as in the following example:

```
/* Print out in secondary key sorted order. */
data _null_;
   infile myfile key=1;
   input first $3. second $3.;
   put first= second=;
run;
```

This program produces the following output:

```
first=bbb second=aaa
first=aaa second=ccc
```

All keys are defined in RMS when the file is created. For more information about defining and using keys in an indexed file, see *Guide to OpenVMS File Applications*.

Using the KEYVALUE= Option

The KEYVALUE= option is always used with the KEY= option, which specifies the key used by SAS to read the records in an RMS file with indexed organization. When you use the KEYVALUE= option, the file is read sequentially, beginning with the value you specified. It is similar to the FIRSTOBS= option used with a sequential-format file. You can specify a SAS variable name with the KEYVALUE= option to drive random reads from the file. The KEYVALUE= option is used for input.

Valid forms of the KEYVALUE= option are as follows:

```
KEYVALUE operator value
   AND KEYVALUE operator value

KEYVALUE=SAS-variable
```

where *operator* can be one of the following:

<	less than
<=	less than or equal to
>	greater than
>=	greater than or equal to.

where *value* can be one of the following data types:

- integer
- quoted string
- quadword (signed or unsigned)
- packed decimal
- date/time.

The key specified in the KEY= option is used with the KEYVALUE= option. The defined order of the key specified must match the direction of the operator given in the KEYVALUE= option. For example, if the key is an ascending order key, the < and <= operators are invalid operators. When the value of KEYVALUE= is a constant value, the file is processed sequentially by key, beginning with the given value. When the value of KEYVALUE= is a SAS variable, the first record with a key satisfying the criterion of the KEYVALUE= expression is read from the file. Note that the SAS variable value must match the key value of one of the records exactly or an end-of-file condition occurs.

The data type of the key specified in the KEY= option must also correspond to the type given as the value for the KEYVALUE= option. The following RMS data types are supported by the KEYVALUE= option:

- unsigned 2-byte binary
- unsigned 4-byte binary
- unsigned 8-byte binary
- signed 2-byte binary
- signed 4-byte binary
- signed 8-byte binary
- left-justified string of characters
- packed decimal string of characters.

SAS converts an integer value to the correct format of the supported numeric types. Character string values are not changed when used for the character type.

When you use date-time values, the data is stored in signed 8-byte binary RMS key fields. Use the VMSTIMEF. format to convert SAS date-time values to signed 8-byte binary values. When you access records through a date-time value key using the KEYVALUE=*SAS-variable* option, the SAS variable must have one of the following SAS formats or informats associated with it:

DATE*w*.

DATETIME*w*.

DDMMYY*w*.

JULIAN*w*.

MMDDYY*w*.

MONYY*w*.

YYMMDD*w*.

YYQ*w*.

A format or informat must be associated with the SAS variable because neither the variable value nor the field value within the record indicates that the data represents date-time values. For more information about these formats and informats, refer to *SAS Language Reference: Dictionary*.

Suppose you want to input an indexed file that has an alternate key defined as a signed 4-byte integer in descending sort order. You can process only the records with the values less than 5,000 with the following DATA step:

```
filename in 'indexed.dat' key=2 keyvalue<5000;
data _null_;
   infile in;
   input name $9. num;
   put name num;
run;
```

Using Compound Expressions You may further restrict the number of records read by using a compound KEYVALUE expression. For example, suppose you want to input an indexed file that has a primary key defined as a signed 2-byte integer in ascending sort order. You can retrieve records with key values between –10 and 10 inclusive with the following FILENAME statement:

```
filename in 'indexed.dat' keyvalue>=-10 and
   keyvalue<=10;
```

When given a compound KEYVALUE expression, SAS reads records from the input file until a record is read with a key exceeding the upper boundary, which is 10 in this example, or until the end of file is reached. Note that the AND construct has an associative property; the order of the KEYVALUE options can be reversed and the meaning preserved. However, the operators still must match the key sort order, so the following DATA step using the same indexed file described in the earlier example generates an error:

```
data wrong;
   infile 'indexed.dat' keyvalue<=-10 and
      keyvalue>=10;
   input num name $9.;
   put name num;
run;
```

This DATA step generates the following error and warning messages:

```
ERROR: Specified key on indexed file is
       defined as ascending but <, <= or
       = was used in KEYVALUE option.
NOTE: The SAS System stopped processing
      this step because of errors.

WARNING: The data set WORK.WRONG may be
         incomplete.  When this step was
         stopped there were 0 observations
         and 1 variables.
```

Using SAS Variables Using a SAS variable name as the value of the KEYVALUE= option enables you to randomly access records in the indexed file. In the previous examples of using the KEYVALUE= option, the input file was sequentially accessed. You can use any SAS variable with the KEYVALUE= option that matches the type of the key in question. When SAS reads from the file, it reads the first record with the key value that matches the value of the SAS variable.

For example, suppose you have a SAS data set named SALES that has three variables: SALESREP, ITEMNO, and QUANTITY. This data set contains the number of items each salesperson sold during the last month. You also have an indexed file keyed by the item numbers of the products the company sells. Stored in each record is the price of the item. Using these two files, SAS can easily generate a report of the revenue generated by each salesperson:

```
filename parts 'inventory.idx' key=0;
filename report 'revenue.lis';
data revenue;
   set sales;
   infile parts keyvalue=itemno;
   input itemno price;
   revenue=quantity*price;
   output @5 salesrep @30 itemno
          @50 revenue dollar3.2;
   stop;
run;
```

This sample program match-merges the observations in SALES with the records in the indexed file by item number to produce the reports. A KEYVALUE= option with a SAS variable name can be used only with the equal sign (=) operator and cannot be used in compound KEYVALUE= expressions.

Note that in the previous example, the DATA step is driven entirely by the SET statement. The DATA step terminates when all records from the data set SALES have been processed. It is possible to use the SAS variable form of the KEYVALUE= option with other types of control mechanisms. In the following example, an iterative DO loop determines the set of records read from an indexed file:

```
data example2;
   do i=1 to 20 by 2;
      infile myfile key=0 keyvalue=i;
      input var1 var2 var3 ...;
      /* .... variable processing ... */

      output var1 var2 var3 ...;
   end;
   stop;
run;
```

In this example, the DO loop is used to read every other record from MYFILE. Note that the STOP statement terminates the DATA step and closes the input file. Because the KEYVALUE=I option reads only those records specified in the DO statement, SAS cannot read an end-of-file indicator as it would if it were reading the file sequentially. Without the STOP statement to end the DATA step, SAS can get into an infinite loop by accessing the same index file repeatedly.

For more information about indexed files and keys, refer to *Guide to OpenVMS File Applications*.

Summary of External I/O Statement Options

The following table alphabetically lists all available external I/O statement options, including both options that are valid in all operating environments and options that are specific to the OpenVMS environment. The Use column indicates whether the option is used for input, output, or both. The support of the options in the FILENAME statement is host-specific. Options that are used with the FILENAME statement are not documented in *SAS Language Reference: Dictionary*.

Table 18.2 Summary of External I/O Statement Options

Option	Use	Option	Use
ALQ= **	output	LINESIZE= *	input, output
CC= **	output	LRECL= *	input, output
COLUMN= ***	input, output	MBC= **	input, output
DELIMITER= ***	input	MBF= **	input, output
DEQ= **	output	MISSOVER ***	input
DROPOVER ***	output	MOD *	output
END= ***	input	N= ***	input, output
EOF= ***	input	NEW **	output
EXPANDTABS ***	input	NOTITLES ***	output
FAC= **	input, output	OBS= ***	input
FILENAME= ***	input, output	OLD *	output
FILEVAR ***	input, output	PAD ***	input, output
FIRSTOBS= ***	input	PAGESIZE= *	output
FLOWOVER ***	input, output	PRINT ***	input, output

Option	Use	Option	Use
GSFCC **	output	RECFM= *	input, output
HEADER= ***	output	SHR= **	input, output
KEY= **	input	SHAREBUFFERS ***	input
KEYVALUE= **	input	START= ***	input
LENGTH= ***	input	STOPOVER ***	input, output
LINE= ***	output	UNBUFFERED ***	input

* This option is also documented in *SAS Language Reference: Dictionary*.
** All the information for this option is contained in this document.
***This option is completely documented in *SAS Language Reference: Dictionary*.

Printer Options in the FILENAME and FILE Statements

Many of the DCL print qualifiers are supported as host options in the FILE and FILENAME statements. If the same option is used in both the FILE and FILENAME statements, the FILE statement value overrides the FILENAME statement value. You send a file to a printer by using the PRINTER or PLOTTER device-type keyword in the FILENAME statement.

A complete list of supported options follows. For more information about the meanings of specific options, refer to *OpenVMS DCL Dictionary*.

AFTER="*quoted-string*"
specifies a time after which the file can be printed. The time can be specified as absolute time or a combination of absolute and delta times and must be enclosed in double quotation marks.

BURST=ALL | NO
specifies a burst page or not. The default value is NO.

CHAR=(,,,)
lists characteristics for the printer. The list can be one item or a group of items enclosed by parentheses. No spaces are allowed in the list.

COPIES=*n*
specifies the number of copies to print. The default value is 1.

FEED=YES | NO
specifies whether to perform a form feed at the end of the page. The default value is YES.

FLAG=ALL | NO
specifies whether to print a flag page preceding each file. The default value is NO.

FORM=*type*
defines the form name or number used.

HDR=YES | NO
controls whether a header line is printed at the top of each page. The default value is NO.

NAME=*quoted-string*
specifies the name of the submitted job shown when you issue a SHOW QUEUE command. The default is the filename. The *quoted-string* argument can contain spaces.

NOTE=*quoted-string*
: specifies a message to appear on the flag page. The *quoted-string* argument can contain spaces.

NOTIFY=YES | NO
: controls whether to notify the user when the job is finished. The default value is NO.

PARAM=<“>(,,,)<”>
: sends a list of up to eight parameters to the printer device. The PARAM= value can be one item without parentheses, or a group of items enclosed by parentheses. If the value contains blanks or nonalphanumeric characters, enclose the entire value argument in single or double quotation marks.

PASSALL=YES | NO
: specifies whether all formatting is bypassed and sent to the device driver with formatting suppressed. The default value is NO.

QUEUE=<“>*queue-name*<”>
: specifies the name of the printer queue to send the job to. If this option is not used, the job is submitted to the SYS$PRINT queue. If the queue name contains characters not recognized by SAS, it must be enclosed in single quotation marks; for example, SYS$PRINT must be enclosed in quotation marks, but CLXYJ31 does not need to be. The *queue-name* argument cannot contain any spaces.

RESTART=YES | NO
: restarts the job after a crash. The default value is YES.

SETUP=(,,,)
: sets up module names to extract from the device control library. The list can be a single item or a group of items enclosed by parentheses.

SPACE=1 | 2
: specifies double- or single-spacing. The default value is single.

TRAILER=ALL | NO
: prints a trailer page at the end of the file. The default value is NO.

Examples

Example 1: Associating a Fileref with an External File In this example, the FILENAME statement associates the fileref PGMSAS with an external file that contains a SAS program. PGMSAS is then used as the fileref in the %INCLUDE statement to read a file that contains SAS statements.

```
filename pgmsas '[yourdir]prog1.sas';
%include pgmsas;
```

Example 2: Using a File as Input to an INFILE Statement Consider the following FILENAME statement:

```
filename myfile '[mydir]';
```

If you want to use a file in [MYDIR] named SCORES02.DAT as input to an INFILE statement, issue the following statement:

```
infile myfile(scores02);
```

SAS assumes a file type of .DAT in the INFILE statement.

If you do not specify a file type in the external file specification, the default file type is .DAT. For example, the following FILENAME statement associates the fileref MYFILE with a file named SURVEY.DAT:

```
filename myfile 'survey';
```

Example 3: Using Printer Options The following statement sends a copy of the file A.LIS to the CLXYJ31 queue, holds it until 2:00 p.m., and then prints two copies:

```
filename x printer 'a.lis' queue=clxyj31
                           after="14:00:00" copies=2;
```

The following statement creates the file A.LIS but does not send it to the printer because the PRINTER device-type keyword is not used. The AFTER= option is ignored.

```
filename x 'a.lis' after="14:00:00";
```

The following statement sends the file A.LIS to the SYS$PRINT queue, holding it until 2:30 p.m.:

```
filename x printer 'a.lis' after="14:30:00";
```

The following statement creates a temporary file called SAS0000*n* and sends it to the SYS$PRINT queue. The file is deleted after printing.

```
filename x printer;
```

The following statement creates the file CLXYJ31.DAT and sends it to the SYS$PRINT queue. The file is not deleted after printing.

```
filename x printer 'clxyj31';
```

As a final example, the following lines create a file A.LIS and send it to the SYS$PRINT queue. The job name submitted is MYFILE.

```
filename x printer 'a.lis';
data a;
   file x name="myfile";
   . . . more SAS statements . . .
run;
```

See Also

- ☐ Chapter 7, "Using External Files and Devices," on page 171

FOOTNOTE Statement

Prints up to ten lines of text at the bottom of the procedure output

Valid: anywhere in a SAS program

OpenVMS specifics: maximum length of footnote

See: FOOTNOTE Statement in *SAS Language Reference: Dictionary*

Syntax

FOOTNOTE <*n*> <'*text*' | "*text*">;

no arguments
cancels all existing footnotes.

n
specifies the relative line to be occupied by the footnote.

'text' | "text"
specifies the text of the footnote that is enclosed in single or double quotation marks. For compatibility with previous releases, SAS accepts some text without quotation marks. When writing new programs or updating existing programs, *always* surround text with quotation marks.

Details

If the footnote length is greater than the value of the LINESIZE= system option, the footnote is truncated to the line size.

See Also

□ "LINESIZE= System Option" on page 470

%INCLUDE Statement

Includes SAS statements and data lines

Valid: anywhere in a SAS program

OpenVMS specifics: valid values for *encoding-value* and *source*, if a file specification is used

See: %INCLUDE Statement in *SAS Language Reference: Dictionary*

Syntax

%INCLUDE *source-1* < . . . *source-n*></
<ENCODING='*encoding-value*'><*host-options*>>;

source-1 < . . . source-n>
describes the location of the information that you want to access with the %INCLUDE statement. The three possible sources are an external file specification, previously entered SAS statements from your SAS session, or a keyboard entry. The file specification can be any of the file specification forms discussed in "Identifying External Files to SAS" on page 173.

Note: When you use aggregate syntax and the member name contains a leading digit, enclose the member name in quotation marks. If the member name contains a macro variable reference, use double quotation marks. △

This section discusses only external file specifications. For information about including lines from your terminal or from your SAS session, see "Recalling SAS Statements" on page 28 and the SAS statements portion of *SAS Language Reference: Dictionary*.

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.

When you read data from the specified source, SAS transcodes the data from the specified encoding to the session encoding.

For valid encoding values, see "Encoding Values in SAS Language Elements" in *SAS National Language Support (NLS): User's Guide*.

host-options
consists of statement options that are valid under OpenVMS. The following options are available:

BLKSIZE=*block-size*
BLK=*block-size*
specifies the number of bytes that are physically read or written in an I/O operation. The default is 8K. The maximum is 1M.

LRECL=*record-length*
specifies the record length (in bytes). Under OpenVMS, the default is 256. The value of *record-length* can range from 1 to 1,048,576 (1 megabyte).

RECFM=*record-format*
controls the record format. The following values are valid under OpenVMS:

D	default format (same as variable).
F	fixed format. That is, each record is the same length.
N	binary format. The file consists of a stream of bytes with no record boundaries.
P	print format.
V	variable format. Each record ends with a newline character.
S370V	variable S370 record format (V).
S370VB	variable block S370 record format (VB).
S370VBS	variable block with spanned records S370 record format (VBS).

The S370 values are valid with files laid out as z/OS files only. That is, files that are binary, have variable-length records, and are in EBCDIC format. If you want to use a fixed-format z/OS file, first copy it to a variable-length, binary z/OS file.

Details

When you execute a program that contains the %INCLUDE statement, SAS executes your code, including any statements or data lines that you bring into the program with %INCLUDE.

The %INCLUDE statement is most often used when you are running SAS in interactive line mode, noninteractive mode, or batch mode. Although you can use the %INCLUDE statement when you are running SAS using windows, it might be more practical to use the INCLUDE and RECALL commands to access data lines and program statements, and submit these lines again.

The %INCLUDE statement executes statements immediately.

Note: If you specify any options on the %INCLUDE statement, remember to precede the options list with a forward slash (/). △

Example

Suppose you have issued the following FILENAME statement:

```
filename mypgm '[mydir]program1.sas';
```

Then, in a SAS program you can issue the following %INCLUDE statement to copy in and execute the SAS statements stored in the file PROGRAM1.SAS:

```
%include mypgm;
```

See Also

- □ "INCLUDE Command" on page 262
- □ "RECALL Command" in the Base SAS Software section in SAS Help
- □ "Saving SAS Statements" on page 27
- □ "Recalling SAS Statements" on page 28

INFILE Statement

Specifies an external file to read with an INPUT statement

Valid: in a DATA step

OpenVMS specifics: valid values for *file-specification*, *host-options*, and *encoding-value*

See: INFILE Statement in *SAS Language Reference: Dictionary*

Syntax

INFILE *file-specification* <ENCODING='*encoding-value*'><*option-list*>
<*host-option-list*>;

file-specification
identifies the source of the input data records (usually an external file). It can be any of the file specification forms discussed in "Identifying External Files to SAS" on page 173. The reserved fileref DATALINES allows the INFILE statement to read instream data.

ENCODING='*encoding-value*'
specifies the encoding to use when reading from the external file. The value for ENCODING= indicates that the external file has a different encoding from the current session encoding.

When you read data from an external file, SAS transcodes the data from the specified encoding to the session encoding.

For valid encoding values, see "Encoding Values in SAS Language Elements" in *SAS National Language Support (NLS): User's Guide*.

option-list
names options for the INFILE statement that are valid in all operating environments. For information about these options, see the INFILE statement in *SAS Language Reference: Dictionary*.

host-option-list

names external I/O statement options for the INFILE statement that are specific to the OpenVMS environment. These options can be any of the following:

FAC=

KEY=

KEYVALUE=

LINESIZE=

LRECL=

MBC=

MBF=

RECFM=

SHR=

For an explanation of these options, see "Host-Specific External I/O Statement Options" on page 402 in the FILENAME statement.

You can intersperse options from *option-list* and *host-option-list* in any order.

Note: When you are using the PIPE device with the INFILE statement, only LRECL is supported. △

Details

Because the INFILE statement identifies the file to read, it must execute before the INPUT statement that reads the input data records. You can use the INFILE statement in conditional processing, such as an IF-THEN statement, because it is executable. This enables you to control the source of the input data records.

When you use more than one INFILE statement for the same file specification and you use options in each INFILE statement, the effect is additive. To avoid confusion, use all the options in the first INFILE statement for a given external file.

The ENCODING= option is valid only when the INFILE statement includes a file specification that is not a reserved fileref. If the INFILE statement includes the ENCODING= argument and the reserved filerefs DATALINES or DATALINES4 as a *file-specification*, then SAS issues an error message. The ENCODING= value in the INFILE statement overrides the value of the ENCODING= system option.

Example

The following is an example of an INFILE statement:

```
infile food;
```

This INFILE statement uses the default filename form of the file specification (FOOD has not been assigned as a SAS fileref or as an OpenVMS logical name). Therefore, SAS looks for the file FOOD.DAT in the current directory.

When SAS reads a file, it uses the most recent version by default. For example, if your default directory contains the files FOOD.DAT;1, FOOD.DAT;2, and FOOD.DAT;3, this INFILE statement reads FOOD.DAT;3.

See Also

- □ Chapter 7, "Using External Files and Devices," on page 171
- □ "FILENAME Statement" on page 397

LENGTH Statement

Specifies how many bytes SAS uses to store a variable's value

Valid: in a DATA step

OpenVMS specifics: valid numeric variable lengths

See: LENGTH Statement in *SAS Language Reference: Dictionary*

Syntax

LENGTH <*variable-specification-1*>
<. . .*variable-specification-n*><DEFAULT=*n*>;

length
can range from 3 to 8 bytes for numeric variables in the OpenVMS Alpha environment.

DEFAULT=*n*
changes the default number of bytes used for storing the values of newly created numeric variables from 8 to the value of *n*.

In the OpenVMS Alpha environment, *n* can range from 3 to 8 bytes.

Details

The LENGTH statement specifies the number of bytes used for storing variables.

In general, the length of a variable depends on

- □ whether the variable is numeric or character
- □ how the variable was created
- □ whether a LENGTH or ATTRIB statement is present.

Subject to the rules for assigning lengths, lengths that are assigned with the LENGTH statement can be changed in the ATTRIB statement and vice versa.

See Also

- □ "Numeric Variables in the Alpha Environment" on page 233
- □ "ATTRIB Statement" on page 394

LIBNAME Statement

Associates a libref with a SAS data library and lists file attributes for a SAS data library

Valid: anywhere in a SAS program

OpenVMS specifics: valid values for *engine-name*; specifications for *SAS-data-library*; valid values for *engine/host-option-list*

See: LIBNAME Statement in *SAS Language Reference: Dictionary*

Syntax

LIBNAME *libref <engine> 'SAS-data-library'*
<portable-options> <engine/host-options>;

LIBNAME *libref* | _ALL_ CLEAR;

LIBNAME *libref* | _ALL_ LIST;

Note: This is a simplified version of the LIBNAME statement syntax. For the complete syntax and its explanation, see the LIBNAME statement in *SAS Language Reference: Dictionary*. △

libref
is a SAS name that complies with SAS naming conventions and is used in SAS statements to point to *SAS-data-library*. This argument is required.

The *libref* can also be an OpenVMS logical name or a search-string logical name. For more information, see "Using an OpenVMS Logical Name in the LIBNAME Statement" on page 141 and "Using a Search-String Logical Name to Concatenate SAS Data Libraries" on page 141.

Under OpenVMS, the only reserved librefs are those that are reserved by SAS on all operating environments. For a list of reserved librefs, see the LIBNAME statement in *SAS Language Reference: Dictionary*.

engine
tells SAS which engine to use for accessing the library. For a list of valid engine names for OpenVMS, see "Engines Available under OpenVMS" on page 155. The engine that is associated with a libref accesses only files that were created by that engine, not other SAS files.

Note: The V5 engine is not supported in SAS 9.1. △

If you do not specify an engine, then SAS uses the procedures described in "How SAS Assigns an Engine When No Engine Is Specified" on page 147 to assign an engine for you.

SAS-data-library
is the name of the directory that contains the SAS data library. You must enclosed it in quotation marks. For example:

```
'mydisk:[mydirectory]'
```

You can refer to SAS data libraries on a network by specifying the node name, followed by the disk and directory names:

```
'mynode::mydisk:[mydirectory]'
```

You can omit the *SAS-data-library* argument if you are merely specifying the engine for a libref or an OpenVMS logical name that you previously assigned.

If the directory that you specify does not already exist, then you must create it before you attempt to use the libref that you have assigned to it. (Under OpenVMS, the LIBNAME statement does not actually create directories.)

Use the following syntax for concatenated libraries:

```
LIBNAME libref  ('SAS-data-library' '...SAS-data-library)'
```

Note that librefs can be used as part of a physical name or a previously assigned libref.

The level of specification depends on your current location in the OpenVMS file structure. For example, if you want to access a directory that is located on another node in your OpenVMS network, then the file specification in the LIBNAME statement must include the node, the device, and the directory levels.

The file specification generally must not extend beyond the directory or subdirectory level (that is, it must not include a filename), because the libref/directory association that is made in the LIBNAME statement gives you access to all SAS files in the data library, not to a single file. However, this rule does not apply if you are assigning a libref for use with the XPORT, OSIRIS, or SPSS engines.

SAS-data-library can also be an OpenVMS logical name (or a path that contains a logical name). In this case, you would be assigning a libref to the logical name, and you would subsequently use the libref in your SAS program. For examples, see “Using an OpenVMS Logical Name in the LIBNAME Statement” on page 141.

Note: Directory wildcard specifications are not supported in LIBNAME statements. If you use an asterisk (*) or an ellipsis (...) in the *SAS-data-library* argument, an error message tells you that the physical name of the library is invalid. △

portable-options

are LIBNAME statement options that are available in all operating environments. For information about these options, see the LIBNAME statement in *SAS Language Reference: Dictionary*.

engine/host-options

are one or more of the following host-specific options:

ALQ=

specifies how many disk blocks to allocate to a new SAS data set. For more information, see “ALQ= Data Set Option” on page 282.

ALQMULT=

specifies the number of pages that are preallocated to a file. For more information, see “ALQMULT= Data Set Option” on page 283.

BKS=

specifies the bucket size for a new data set. For more information, see “BKS= Data Set Option” on page 284.

CACHENUM=

specifies the number of I/O data caches used per SAS file. For more information, see “CACHENUM= Data Set Option” on page 286.

CACHESIZE=

controls the size of the I/O data cache that is allocated for a file. For more information, see “CACHESIZE= Data Set Option” on page 287.

DEQ=
: tells OpenVMS how many disk blocks to add when it automatically extends a SAS data set during a 'write' operation. For more information, see "DEQ= Data Set Option" on page 289.

DEQMULT=
: specifies the number of pages to extend a SAS file. For more information, see "DEQMULT= Data Set Option" on page 290.

MBF=
: specifies the multibuffer count for a data set. For more information, see "MBF= Data Set Option" on page 293.

Not every option is available with every engine. For information about which engine or host options are available with each engine, see Chapter 6, "Using SAS Engines," on page 153.

All of these options correspond to a data set option of the same name and have the same effect as the data set option. However, engine or host options apply to all SAS data sets that are stored in the SAS data library.

Specify as many options as you need. Separate them with a blank space.

Details

The LIBNAME statement associates a libref with a permanent SAS data library and lists the file attributes of a SAS data library.

Note: The LIBNAME statement is also used to clear a libref. For complete documentation about this use, see the LIBNAME statement in *SAS Language Reference: Dictionary*. △

Listing Data Library Attributes You can use the LIBNAME statement to list attributes of SAS data libraries by using the LIST option.

See Also

- □ "Using the LIBNAME Statement" on page 137
- □ "Using an OpenVMS Logical Name in the LIBNAME Statement" on page 141
- □ "FILE Statement" on page 395
- □ "FILENAME Statement" on page 397

SYSTASK Statement

Executes, lists, or kills asynchronous tasks

Valid: SAS Program Editor

OpenVMS specifics: all

Syntax

SYSTASK COMMAND "*host-command*"
<WAIT|NOWAIT>

<TASKNAME=*taskname*>
<MNAME=*name-variable*>
<STATUS=*status-variable*>

SYSTASK LIST <_ALL_ | *taskname*> <STATE> <STATVAR>;

SYSTASK KILL *taskname* <*taskname...*>;

COMMAND
executes the *host-command*.

LIST
lists either a specific active task or all of the active tasks in the system.

KILL
forces the termination of the specified task(s).

host-command
specifies the name of an OpenVMS command (including any command-specific options).

WAIT | NOWAIT
determines whether SYSTASK COMMAND suspends execution of the current SAS session until the task has completed. NOWAIT is the default. For tasks that start with the NOWAIT option, you can use the WAITFOR statement when necessary to suspend execution of the SAS session until the task has finished.

TASKNAME=*taskname*
specifies a name that identifies the task. Task names must be unique among all active tasks. A task is *active* if it is running, or if it has completed and has not been waited for using the WAITFOR statement. Duplicate task names generate an error in the SAS log. If you do not specify a task name, SYSTASK will automatically generate a name. If the task name contains a blank character, enclose the task name in quotation marks.

MNAME=*name-variable*
specifies a macro variable in which you want SYSTASK to store the task name that it automatically generated for the task. If you specify both the TASKNAME option and the MNAME option, SYSTASK copies the name that you specified with TASKNAME into the variable that you specified with MNAME.

STATUS=*status-variable*
specifies a macro variable in which you want SYSTASK to store the status of the task. Status variable names must be unique among all active tasks.

ALL
specifies all active tasks in the system.

STATE
displays the status of the task, which can be Start, Failed, Running, or Complete.

STATVAR
displays the status variable associated with the task. The status variable is the variable that you assigned with the STATUS option in the SYSTASK COMMAND statement.

Details

SYSTASK enables you to execute host-specific commands from within your SAS session or application. Unlike the X statement, SYSTASK runs these commands as *asynchronous* tasks, which means that these tasks execute independently of all other tasks that are currently running. Asynchronous tasks run in the background, so you can perform additional tasks while the asynchronous task is still running.

Note: You cannot execute a host-specific command asynchronously if your session is running under a captive account. For more information, see "Limitations of Using a Captive Account" on page 47. △

The output from the command is displayed in the SAS log.

Note: Program steps that follow the SYSTASK statements in SAS applications usually depend on the successful execution of the SYSTASK statements. Therefore, syntax errors in some SYSTASK statements will cause your SAS application to abort. △

There are two types of asynchronous processes that can be started from SAS:

Task
: All tasks started with SYSTASK COMMAND are of type Task. For these tasks, if you do not specify STATVAR or STATE, then SYSTASK LIST displays the task name, type, and state, and the name of the status macro variable. You can use SYSTASK KILL to kill only tasks of type Task.

SAS/CONNECT Process
: Tasks started from SAS/CONNECT with the RSUBMIT statement are of type SAS/CONNECT Process. For SAS/CONNECT processes, SYSTASK LIST displays the task name, type, and state. You can use SYSTASK KILL to kill a SAS/CONNECT process. For information about starting SAS/CONNECT processes, refer to *SAS/CONNECT User's Guide*.

  Note: The preferred method to display any task (not just SAS/CONNECT processes) is to use the LISTTASK statement instead of SYSTASK LIST. The preferred method to end a task is to use the KILLTASK statement instead of SYSTASK KILL. △

The SYSRC macro variable contains the return code for the SYSTASK statement. The status variable that you specify with the STATUS option contains the return code of the process started with SYSTASK COMMAND. To ensure that a task executes successfully, you should monitor both the status of the SYSTASK statement and the status of the process that is started by the SYSTASK statement.

If a SYSTASK statement cannot execute successfully, the SYSRC macro variable will contain a non-zero value. For example, there could be insufficient resources to complete a task, or the SYSTASK statement could contain syntax errors. With the SYSTASK KILL statement, if one or more of the processes cannot be killed, SYSRC is set to a non-zero value.

When a task is started, its status variable is set to NULL. You can use the status variables for each task to determine which tasks failed to complete. Any task whose status variable is NULL did not complete execution.

Unlike the X statement, you cannot use the SYSTASK statement to start a new interactive session.

See Also

- □ "WAITFOR Statement" on page 425
- □ "X Statement" on page 427
- □ "Issuing DCL Commands during a SAS Session" on page 43

TITLE Statement

Specifies title lines for SAS output

Valid: anywhere in a SAS program

OpenVMS specifics: maximum length of title

See: TITLE Statement in *SAS Language Reference: Dictionary*

Syntax

TITLE <*n*> <'*text*' | "*text*">;

no arguments
cancels all existing titles.

n
specifies the relative line that contains the title line.

'*text*' | "*text*"
specifies the text of the title that is enclosed in single or double quotation marks. For compatibility with previous releases, SAS accepts some text without quotation marks. When writing new programs or updating existing programs, *always* surround text with quotation marks.

Details

If the title length is greater than the value of the LINESIZE= system option, then the title is truncated to the line size.

See Also

- "LINESIZE= System Option" on page 470

WAITFOR Statement

Suspends execution of the current SAS session until the specified tasks finish executing

Valid: anywhere in a SAS program

OpenVMS specifics: all

Syntax

WAITFOR <_ANY | _ALL_> *taskname* <*taskname*...> <TIMEOUT=*seconds*>;

taskname
specifies the name of the task(s) that you want to wait for. The task name(s) that you specify must match exactly the task names assigned through the SYSTASK COMMAND statement. You cannot use wildcards to specify task names.

ANY | _ALL_
suspends execution of the current SAS session until either one or all of the specified tasks finishes executing. The default setting is _ANY_, which means that as soon as one of the specified task(s) completes executing, the WAITFOR statement will finish executing.

TIMEOUT=*seconds*
specifies the maximum number of seconds that WAITFOR should suspend the current SAS session. If you do not specify the TIMEOUT= option, WAITFOR will suspend execution of the SAS session indefinitely.

Details

The WAITFOR statement suspends execution of the current SAS session until the specified task(s) finish executing or until the TIMEOUT= interval (if specified) has elapsed. If the specified task was started with the WAIT option, then the WAITFOR statement ignores that task.

For example, the following statements start three different SAS jobs and suspend the execution of the current SAS session until those three jobs have finished executing:

```
systask command "sas myprog1.sas" taskname=sas1;
systask command "sas myprog2.sas" taskname=sas2;
systask command "sas myprog3.sas" taskname=sas3;
waitfor _all_ sas1 sas2 sas3;
```

The SYSRC macro variable contains the return code for the WAITFOR statement. If a WAITFOR statement cannot execute successfully, the SYSRC macro variable will contain a non-zero 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 SYSRC is set to a non-zero value if one of the following is true:

- you specified a single task that did not finish executing
- you specified more than one task and the _ANY_ option (which is the default setting), but none of the tasks finish executing
- you specified more than one task and the _ALL_ option and any one of the tasks did not finish executing.

Any task whose status variable is still NULL after the WAITFOR statement has executed did not complete execution.

See Also

- "SYSTASK Statement" on page 422
- "X Statement" on page 427
- "Issuing DCL Commands during a SAS Session" on page 43

X Statement

Issues an operating environment command from within a SAS session

Valid: anywhere in a SAS program

OpenVMS specifics: operating environment command; OpenVMS subprocesses

See: X Statement in *SAS Language Reference: Dictionary*

Syntax

X <*'DCL-command'*>;

no argument
spawns an OpenVMS subprocess, where you can issue DCL commands on OpenVMS Alpha.

'DCL-command'
specifies a single DCL command. The value for *DCL-command* must be enclosed in quotation marks.

Details

The X statement issues a DCL command from within a SAS session. SAS executes the X statement immediately.

For complete information about the X statement, see "Issuing DCL Commands during a SAS Session" on page 43.

CHAPTER

19

System Options under OpenVMS

SAS System Options under OpenVMS

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 data libraries. System options can be specified in various ways: at SAS invocation, in a SAS configuration file, in an OPTIONS statement (either in a SAS program or in a SAS autoexec file), in the System Options window, in SCL programs, or in the VMS_SAS_OPTIONS DCL symbol.

Most SAS system options are completely described in *SAS Language Reference: Dictionary*. Only the system options that have syntax or behavior that is specific to the OpenVMS operating environment are documented here. "Summary of SAS System Options under OpenVMS" on page 432 is a summary of all SAS system options and gives specific information about where each system option can be specified.

Once a system option is set, it affects all subsequent DATA and PROC steps in a program or SAS process until it is respecified.

Some SAS system options have the same effect (and usually the same name) as data set or statement options. For example, the BUFSIZE= system option is analogous to the BUFSIZE= data set option. In the case of overlapping options, SAS uses the following rules of precedence:

- data set option values (highest precedence)
- statement option values (precedence over system options)
- system option values (lowest precedence).

Determining How an Option Was Set under OpenVMS

Because of the relationship between some SAS system options, SAS can 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 window will display this information. The following output is displayed when you enter

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

Output 19.1 Log Output for the CATCACHE System Option

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

Options that are set by SAS will often say "Internal" in the **`How option value was set`** field.

Summary of SAS System Options under OpenVMS

The following table lists all the SAS system options that are available to SAS users under the OpenVMS operating environment. Many of these options have no system-dependent behavior and are described completely in *SAS Language Reference: Dictionary*. Others are available only under OpenVMS and are completely described here. Other options are described both in this document and in *SAS Language Reference: Dictionary*. Use the following abbreviations to determine where to find more information about an option:

ACCESS	indicates that the option is described in the SAS/ACCESS section of SAS Help and Documentation.
COMP	indicates that the option is completely described here. Some options are not applicable to the OpenVMS operating environment; these options are listed in "System Options That Are Not Applicable under OpenVMS" on page 442.
CON	indicates that the option is described in *SAS/CONNECT User's Guide*.
DQ	indicates that the option is described in *SAS Data Quality Server: Reference*.
IT	indicates that the option is described in the documentation for SAS Integration Technologies, either with the SAS Integration Technologies software or on the SAS Web site.
LR	indicates that the option is described in *SAS Language Reference: Dictionary*.
MACRO	indicates that the option is described in *SAS Macro Language: Reference*.
NLS	indicates that the option is described in *SAS National Language Support (NLS): User's Guide*.
SHAR	indicates that the option is described in *SAS/SHARE User's Guide*.
SPDE	indicates that the option is described in *SAS Scalable Performance Data Engine: Reference*.
WEB	indicates that the option is described in documentation posted on the SAS Web site (**`support.sas.com`**).

The table provides you with the following information about each SAS system option:

- □ the option name
- □ the default value that is in effect if you do not specify the option and if the option does not appear in
  - □ a configuration file
  - □ your site's default options table
  - □ your site's restricted options table
- □ where you can specify the option.

Remember that the default values listed in the following table are the default values that are hardcoded into SAS. When SAS is installed, the default values of SAS system options can be changed by specifying the options in a configuration file (when referenced by the SAS$CONFIG logical name in one or more of the CLUSTER, SYSTEM, GROUP, JOB, or PROCESS tables). Therefore, the values that you see in PROC OPTIONS output at your site might not match the values that are shown in the table. If you have a question about the default value for a particular option, use PROC OPTIONS, or ask your SAS Support Consultant. For more information about configuration files, see “Configuration Files” on page 36.

Table 19.1 Summary of SAS System Options

Options Specification	Default Value	SAS Invocation	Configuration File	System Options Window	OPTIONS Statement	See
ALQMULT=	10	X	X	X	X	COMP
ALTLOG=	none	X	X			COMP
ALTPRINT=	none	X	X			COMP
APPLETLOC	SAS$APPLETLOC logical value	X	X	X	X	LR, COMP
ARMAGENT	sasarmmg	X	X	X	X	LR
ARMLOC	none	X	X	X	X	LR
ARMSUBSYS	ARM_NONE	X	X	X	X	LR
ASYNCHIO	ASYNCHIO in all modes except DMS	X	X			LR
AUTHPROVIDERDOMAIN=	NULL	X	X			LR
AUTOEXEC=	SAS$INIT, if defined; otherwise none	X	X			COMP
AUTOSAVELOC=	none	X	X	X	X	COMP
AUTOSIGNON	FALSE	X	X	X	X	CON
BATCH	NOBATCH (windowing environment and interactive line modes); BATCH (batch)	X	X			LR
BINDING=	DEFAULT	X	X	X	X	LR
BOTTOMMARGIN=	0	X	X	X	X	LR
BUFNO=	1	X	X	X	X	LR, COMP
BUFSIZE=	0	X	X	X	X	LR, COMP
BYERR	BYERR	X	X	X	X	LR
BYLINE	BYLINE	X	X	X	X	LR
BYSORTED	BYSORTED	X	X			LR
CACHENUM=	5	X	X	X	X	COMP
CACHESIZE=	65024	X	X	X	X	COMP
CAPS	NOCAPS	X	X	X	X	LR

Options Specification	Default Value	SAS Invocation	Configuration File	System Options Window	OPTIONS Statement	See
CARDIMAGE	NOCARDIMAGE	X	X	X	X	LR
CATCACHE=	0	X	X			COMP, LR
CBUFNO=	0	X	X	X	X	LR
CC=	FORTRAN	X	X	X	X	COMP
CENTER	CENTER	X	X	X	X	LR
CHARCODE	NOCHARCODE	X	X	X	X	LR
CLEANUP	CLEANUP	X	X	X	X	LR, COMP
CMDMAC	NOCMDMAC	X	X	X	X	MACRO
CMPLIB	NULL	X	X	X	X	LR
CMPOPT	CMPOPT	X	X	X	X	LR
COLLATE	NOCOLLATE	X	X	X	X	LR
COLORPRINTING	COLORPRINTING	X	X	X	X	LR
COMAMID=	TCP	X	X	X	X	CON, SHAR
COMAUX1=	none	X	X			SHAR
COMAUX2=	none	X	X			SHAR
COMPRESS=	NO	X	X	X	X	LR
CONFIG=	SAS$CONFIG if defined; otherwise none	X				COMP
CONNECTPERSIST	YES	X	X			CON
CONNECTREMOTE=	none	X	X	X	X	LR, CON
CONNECTSTATUS	CONNECTSTATUS	X	X	X	X	LR, CON
CONNECTWAIT	CONNECTWAIT	X	X	X	X	LR, CON
COPIES=	1	X	X	X	X	LR
CPUCOUNT	8	X	X	X	X	LR
CPUID	CPUID	X	X			LR
DATASTMTCHK=	COREKEYWORDS	X	X	X	X	LR
DATE	DATE	X	X	X	X	LR
DATESTYLE	MDY	X	X	X	X	LR
DBSLICEPARM=	(THREADED_APPS, 2)	X	X	X	X	LR
DBSRVTP	NONE	X	X			ACCESS

Options Specification	Default Value	SAS Invocation	Configuration File	System Options Window	OPTIONS Statement	See
DEQMULT=	5	X	X	X	X	COMP
DETACH	DETACH					COMP
DETAILS	NODETAILS	X	X	X	X	LR
DEVICE=	none	X	X	X	X	LR, COMP
DFLANG=	ENGLISH	X	X	X	X	NLS
DKRICOND=	ERROR	X	X	X	X	LR
DKROCOND=	WARN	X	X	X	X	LR
DLDMGACTION=	FAIL for batch mode; REPAIR for interactive mode	X	X	X	X	LR
DMR	NODMR	X	X			LR, CON
DMS	DMS	X	X			LR
DMSEXP	NODMSEXP	X	X			LR
DMSLOGSIZE	99999	X	X			LR
DMSOUTSIZE	99999	X	X			LR
DMSSYNCHK	NODMSSYNCHK	X	X	X	X	LR
DQLOCALE	NULL	X	X	X	X	DQ
DQSETUPLOC	NULL	X	X	X	X	DQ
DSNFERR	DSNFERR	X	X	X	X	LR
DTRESET	NODTRESET	X	X	X	X	LR
DUMP	none	X	X	X	X	COMP
DUPLEX	NODUPLEX	X	X	X	X	LR
ECHOAUTO	NOECHOAUTO	X	X			LR
EDITCMD	EDIT/TPU	X	X	X	X	COMP
EMAILAUTHPROTOCOL=	NONE	X	X			LR
EMAILHOST=	localhost	X	X			LR
EMAILID=	none	X	X			LR
EMAILPORT=	25	X	X			LR
EMAILPW=	NULL	X	X			LR
EMAILSYS=	SMTP	X	X	X	X	COMP
ENCODING=	latin1	X	X			NLS
ENGINE=	BASE	X	X			LR, COMP
ERRORABEND	NOERRORABEND	X	X	X	X	LR
ERRORBYABEND	NOERRORBYABEND	X	X	X	X	LR

Options Specification	Default Value	SAS Invocation	Configuration File	System Options Window	OPTIONS Statement	See
ERRORCHECK=	NORMAL	X	X	X	X	LR
ERRORS=	20	X	X	X	X	LR
EXPANDLNM	EXPANDLNM	X	X	X	X	COMP
EXPLORER	NOEXPLORER	X	X			LR
FILECC	FILECC	X	X	X	X	COMP
FIRSTOBS=	1	X	X	X	X	LR
FMTERR	FMTERR	X	X	X	X	LR
FMTSEARCH=	(WORK LIBRARY)	X	X	X	X	LR, COMP
FONTSLOC	SAS$ROOT: [MISC.FONTS]	X	X			LR, COMP
FORMCHAR=	|----|+|---+=|-/ \<>*	X	X	X	X	LR
FORMDLIM=	none	X	X	X	X	LR
FORMS=	DEFAULT	X	X	X	X	LR
FULLSTIMER	NOFULLSTIMER	X	X	X	X	COMP
GISMAPS=	SAS$GISMAPS	X	X	X	X	LR, COMP
GSFCC=	PRINT	X	X	X	X	COMP
GWINDOW	GWINDOW	X	X	X	X	LR
HELPADDR	NULL	X	X	X	X	WEB
HELPBROWSER	SAS	X	X	X	X	WEB
HELPENCMD	none	X	X			LR
HELPHOST	NULL	X	X	X	X	WEB
HELPINDEX	/help/common.hlp/ index.txt, /help/common.hlp/ keywords.htm, common.hhk	X	X			LR, COMP
HELPLOC	SAS$ROOT:[HELP]	X	X			LR, COMP
HELPPORT	0	X	X	X	X	WEB
HELPTOC	/help/common.hlp/ contents.txt, /help/common.hlp/ toc.htm, common.hhc	X	X			LR, COMP
IBUFSIZE	0	X	X	X	X	LR
IMPLMAC	NOIMPLMAC	X	X	X	X	MACRO
INITCMD=	none	X	X			LR

Options Specification	Default Value	SAS Invocation	Configuration File	System Options Window	OPTIONS Statement	See
INITSTMT=	none	X	X			LR, COMP
INVALIDDATA=	a period (.)	X	X	X	X	LR
JREOPTIONS	-Djava.ext.dirs=/ SAS$ROOT/misc/ base:/SAS$ROOT/misc/ applets	X	X			COMP
LABEL	LABEL	X	X	X	X	LR
LAST=	_NULL_	X	X	X	X	LR
LEFTMARGIN=	0	X	X	X	X	LR
LINESIZE=	the display width setting for windowing environment and interactive line modes; 132 characters for noninteractive and batch modes	X	X	X	X	LR, COMP
LOADLIST=	NOLOADLIST	X	X	X	X	COMP
LOCALE=	English	X	X	X		NLS
LOG=	SYS$OUTPUT for interactive line mode, DMS, and batch modes.	X	X			COMP
LOGMULTREAD	NOLOGMULTREAD	X	X			COMP
LOGPARM=	none	X	X			LR, COMP
MACRO	MACRO	X	X			MACRO
MAPS=	SAS$MAPS logical name	X	X	X	X	LR, COMP
MAUTOLOCDISPLAY	NOMAUTOLOCDISPLAY	X	X	X	X	MACRO
MAUTOSOURCE	MAUTOSOURCE	X	X	X	X	MACRO
MAXSEGRATIO	75	X	X			SPDE
MCOMPILENOTE	NONE	X	X	X	X	MACRO
MEMSIZE=	0	X	X			COMP
MERGENOBY	NOWARN	X	X	X	X	LR
MERROR	MERROR	X	X	X	X	MACRO
METAAUTORESOURCES	NULL	X	X			LR
METACONNECT	NULL	X	X	X	X	LR
METAENCRYPTALG	NONE	X	X			LR
METAENCRYPTLEVEL	EVERYTHING	X	X			LR

Options Specification	Default Value	SAS Invocation	Configuration File	System Options Window	OPTIONS Statement	See
METAID	none	X	X			LR
METAPASS	none	X	X	X	X	LR
METAPORT	0	X	X	X	X	LR
METAPROFILE	NULL	X	X			LR
METAPROTOCOL	BRIDGE	X	X	X	X	LR
METAREPOSITORY	DEFAULT	X	X			LR
METASERVER	none	X	X	X	X	LR
METAUSER	none	X	X	X	X	LR
MFILE	NOMFILE	X	X	X	X	MACRO
MINDELIMITER	NULL	X	X	X	X	MACRO
MINPARTSIZE	0	X	X			WEB
MISSING=	a period (.)	X	X	X	X	LR
MLOGIC	NOMLOGIC	X	X	X	X	MACRO
MLOGICNEST	NOMLOGICNEST	X	X	X	X	MACRO
MPRINT	NOMPRINT	X	X	X	X	MACRO
MPRINTNEST	NOMPRINTNEST	X	X	X	X	MACRO
MRECALL	NOMRECALL	X	X	X	X	MACRO
MSG=	SAS$MSG logical name	X	X			COMP
MSGCASE	NOMSGCASE	X	X			COMP
MSGLEVEL=	N	X	X	X	X	LR, COMP
MSTORED	NOMSTORED	X	X	X	X	MACRO
MSYMTABMAX=	51,200 bytes	X	X	X	X	MACRO, COMP
MULTENVAPPL	NOMULTENVAPPL	X	X	X	X	LR
MVARSIZE=	8,192 bytes	X	X	X	X	MACRO, COMP
NETENCRYPT	NONETENCRYPT	X	X	X	X	CON
NETENCRYPTALGORITHM=	none	X	X	X	X	CON
NETENCRYPTKEYLEN=	0	X	X	X	X	CON
NETMAC	NETMAC	X	X	X	X	CON
NEWS=	SAS$NEWS, if defined	X	X			LR, COMP
NLSCOMPATMODE	NONLSCOMPATMODE	X	X			NLS
NOTES	NOTES	X	X	X	X	LR
NUMBER	NUMBER	X	X	X	X	LR

Options Specification	Default Value	SAS Invocation	Configuration File	System Options Window	OPTIONS Statement	See
OBJECTSERVER	NOOBJECTSERVER	X	X			LR
OBS=	2147483647	X	X	X	X	LR, COMP
OPLIST	NOOPLIST	X	X			COMP
ORIENTATION=	PORTRAIT	X	X	X	X	LR
OVP	NOOVP	X	X	X	X	LR
PAGEBREAKINITIAL	NOPAGEBREAKINITIAL	X	X			LR
PAGENO=	1	X	X	X	X	LR, COMP
PAGESIZE=	display page size for windowing environment and interactive line modes; 60 lines for noninteractive and batch modes	X	X	X	X	LR, COMP
PAPERDEST=	none	X	X	X	X	LR
PAPERSIZE=	LETTER	X	X	X	X	LR
PAPERSOURCE=	none	X	X	X	X	LR
PAPERTYPE=	PLAIN	X	X	X	X	LR
PARM=	none	X	X	X	X	LR
PARMCARDS=	FT15F001	X	X	X	X	LR, COMP
PRINT= arg	none for interactive line mode and the SAS windowing environment; SYS$OUTPUT for batch mode.	X	X			COMP
PRINTERPATH=	none	X	X	X	X	LR
PRINTINIT	NOPRINTINIT	X	X			LR
PRINTMSGLIST	PRINTMSGLIST	X	X	X	X	LR
PRODTOC	NULL	X	X			WEB
QUOTELENMAX	QUOTELENMAX	X	X	X	X	LR
REALMEMSIZE	0	X	X			COMP
REPLACE	REPLACE	X	X	X	X	LR
REUSE=	NO	X	X	X	X	LR
RIGHTMARGIN=	0	X	X	X	X	LR
RSASUSER	NORSASUSER	X	X			LR, COMP

Options Specification	Default Value	SAS Invocation	Configuration File	System Options Window	OPTIONS Statement	See
S=	0	X	X	X	X	LR, COMP
S2=	0	X	X	X	X	LR, COMP
SASAUTOS=	SASAUTOS logical name	X	X	X	X	MACRO, COMP
SASCMD	none	X	X	X	X	LR
SASFRSCR	none	X	X	X	X	CON
SASHELP=	SAS$HELP logical name	X	X			LR, COMP
SASMSTORE=	NONE	X	X	X	X	MACRO
SASSCRIPT=	none	X	X	X	X	CON
SASUSER=	SAS$USER logical name	X	X			LR, COMP
SEQ=	8	X	X	X	X	LR
SEQENGINE=	TAPE	X	X	X	X	COMP
SERROR	SERROR	X	X	X	X	MACRO
SETINIT	NOSETINIT	X	X			LR
SKIP=	0	X	X	X	X	LR
SOLUTIONS	SOLUTIONS	X	X			LR
SORTDUP=	PHYSICAL	X	X	X	X	LR
SORTEQUALS	SORTEQUALS	X	X	X	X	LR
SORTPGM=	BEST	X	X	X	X	COMP
SORTSEQ=	none	X	X	X	X	NLS
SORTSIZE=	MAX	X	X	X	X	COMP
SORTWORK=	none	X	X	X	X	COMP
SOURCE	SOURCE	X	X	X	X	LR
SOURCE2	NOSOURCE2	X	X	X	X	LR
SPAWN=	WAIT	X	X			COMP
SPDEINDEXSORTSIZE	32M	X	X	X	X	SPDE
SPDEMAXTHREADS	0	X	X			SPDE
SPDESORTSIZE	32M	X	X	X	X	SPDE
SPDEUTILLOC	NULL	X	X			SPDE
SPDEWHEVAL	COST	X	X			SPDE
SPOOL	NOSPOOL	X	X	X	X	LR
SSLCALISTLOC	none	X	X	X	X	CON
SSLCERTLOC	none	X	X	X	X	CON

Options Specification	Default Value	SAS Invocation	Configuration File	System Options Window	OPTIONS Statement	See
SSLCLIENTAUTH	NOSSLCLIENTAUTH	X	X	X	X	CON
SSLCRLCHECK	NOSSLCRLCHECK	X	X	X	X	CON
SSLCRLLOC	none	X	X	X	X	CON
SSLPVTKEYLOC	none	X	X	X	X	CON
SSLPVTKEYPASS	none	X	X	X	X	CON
STACK=	0	X	X	X	X	COMP
STARTLIB	STARTLIB	X	X			LR
STIMEFMT	M	X	X	X	X	COMP
STIMER	STIMER	X	X	X	X	COMP
SUMSIZE=	0	X	X	X	X	LR
SYMBOLGEN	NOSYMBOLGEN	X	X	X	X	MACRO
SYNCHIO	SYNCHIO	X	X			LR
SYNTAXCHECK	SYNTAXCHECK	X	X	X	X	LR
SYSIN=	none	X	X			COMP
SYSPARM=	none	X	X	X	X	MACRO, COMP
SYSPRINT	SYS$PRINT	X	X	X	X	COMP
SYSPRINTFONT	none	X	X			LR
SYSRPUTSYNC	NO	X	X			CON
TAPECLOSE=	LEAVE	X	X	X	X	COMP
TBUFSIZE=	0	X	X	X	X	CON
TCPPORTFIRST=	0	X	X	X	X	CON
TCPPORTLAST=	0	X	X	X	X	CON
TERMINAL	TERMINAL	X	X			LR
TERMIO=	NOBLOCK	X	X			COMP
TERMSTMT=	none	X	X			LR
TEXTURELOC	none	X	X	X	X	LR
THREADS	NOTHREADS	X	X	X	X	LR
TOOLSMENU	TOOLSMENU	X	X			LR
TOPMARGIN=	0	X	X	X	X	LR
TRAINLOC=	SAS$TRAINLOC logical value	X	X			LR
TRANTAB=	none	X	X	X	X	NLS
UNIVERSALPRINT	UNIVERSALPRINT	X	X			LR
USER=	none	X	X	X	X	LR, COMP

Options Specification	Default Value	SAS Invocation	Configuration File	System Options Window	OPTIONS Statement	See
UTILLOC	none	X	X			LR
UUIDCOUNT=	100	X	X	X	X	IT
UUIDGENDHOST=	none	X	X			IT
V6CREATEUPDATE	ERROR	X	X			LR
VALIDFMTNAME=	LONG	X	X	X	X	LR
VALIDVARNAME=	V7	X	X	X	X	LR
VERBOSE	NOVERBOSE	X				COMP
VIEWMENU	VIEWMENU	X	X			LR
VNFERR	VNFERR	X	X	X	X	LR
WORK=	SAS$WORKROOT logical name	X	X			LR, COMP
WORKINIT	WORKINIT	X	X			LR
WORKTERM	WORKTERM	X	X	X	X	LR
WORKCACHE=	65024	X	X	X	X	COMP
XCMD	XCMD	X	X			COMP
XCMDWIN	XCMDWIN	X	X			COMP
XKEYPAD	XKEYPAD	X	X	X	X	COMP
XLOG	NOXLOG	X	X	X	X	COMP
XLOGICAL	XLOGICAL	X	X	X	X	COMP
XOUTPUT	XOUTPUT	X	X	X	X	COMP
XRESOURCES=	none	X	X			COMP
XSYMBOL	XSYMBOL	X	X	X	X	COMP
XTIMEOUT=	NOXTIMEOUT	X	X	X	X	COMP
YEARCUTOFF=	1920	X	X	X	X	LR

System Options That Are Not Applicable under OpenVMS

The following SAS system options are not applicable in the OpenVMS operating environment:

- BLKSIZE=
- DBCS
- DBCSLANG
- DBCSTYPE
- LOADMEMSIZE=
- RTRACE
- RTRACELOC

Dictionary

ALQMULT= System Option

Specifies the number of pages that are preallocated to a file

Default: 10

Valid in: configuration file, SAS invocation, OPTIONS statement, SAS System Options window, VMS_SAS_OPTIONS DCL symbol

Category: Files: SAS files

PROC OPTIONS GROUP= SASFILES

OpenVMS specifics: All aspects are host-specific

Syntax

ALQMULT=*n*

n
specifies the number of pages that are allocated for a SAS file. The default value is 10.

Details

The ALQMULT= system option controls how many pages of disk blocks are allocated to a file when it is created. By default, enough space for 10 pages is allocated. This option applies to internal SAS files, such as data sets, catalogs, index files, and utility files. It does not apply to external files, such as data files, log files, and listings.

See Also

- □ "ALQMULT= Data Set Option" on page 283
- □ "DEQMULT= System Option" on page 455

ALTLOG= System Option

Specifies the destination for a copy of the SAS log

Default: none

Valid in: configuration file, SAS invocation,VMS_SAS_OPTIONS DCL symbol

Category: Environment control: Files

PROC OPTIONS GROUP= ENVFILES

OpenVMS specifics: valid values for *destination*; syntax

Syntax

ALTLOG=*destination*

NOALTLOG

ALTLOG=*destination*
can be SYS$PRINT (the default print queue); your current display, SYS$OUTPUT (the default output stream); or an OpenVMS pathname. All messages written to the SAS log are written to the destination.

NOALTLOG
specifies that the SAS log is not to be printed.

Details

The ALTLOG= system option specifies a destination to which a copy of the SAS log is written. Use the ALTLOG= system option to capture log output for printing.

To send the SAS log to a printer other than the default printer, redefine the SYS$PRINT logical name to the queue that you want to use.

Note: ALTLOG= replaces the following options from earlier releases of SAS: LDISK, LPRINT, and LTYPE. △

See Also

- “Overriding the Default Log and Output Destinations under OpenVMS” on page 196

ALTPRINT= System Option

Specifies the destination for a copy of the SAS procedure output file

Default: none

Valid in: configuration file, SAS invocation, VMS_SAS_OPTIONS DCL symbol

Category: Environment control: Files

PROC OPTIONS GROUP= ENVFILES

OpenVMS specifics: valid values for *destination*; syntax

Syntax

ALTPRINT=*destination*

NOALTPRINT

ALTPRINT=*destination*
specifies a destination for the SAS procedure output file. The value of *destination* can be SYS$PRINT (the default print queue); your current display, SYS$OUTPUT (the default output stream); or an OpenVMS pathname. All output written to the SAS log is also written to the destination.

NOALTPRINT
specifies that a copy of the SAS procedure output file is not produced.

Details

The ALTPRINT= system option specifies a destination to which a copy of the SAS procedure output file is written. Use the ALTPRINT= system option to capture procedure output for printing.

To send the procedure output to a printer queue other than the default printer, redefine the SYS$PRINT logical name to the queue that you want to use.

Note: The ALTPRINT= system option replaces the following options from earlier releases of SAS: PDISK, PPRINT, and PTYPE. △

See Also

□ Chapter 8, "Routing the SAS Log and SAS Procedure Output," on page 195

APPLETLOC= System Option

Specifies the location of Java applets

Default: value of SAS$APPLETLOC logical name

Valid in: configuration file, SAS invocation, OPTIONS statement, SAS System Options window, VMS_SAS_OPTIONS DCL symbol

Category: Environment control: Files

PROC OPTIONS GROUP= ENVFILES

OpenVMS specifics: default

See: APPLETLOC= System Option in *SAS Language Reference: Dictionary*

Syntax

APPLETLOC=*base-URL*

base-URL
specifies the address where the SAS documentation is located. The maximum address length is 256 characters. SAS$APPLETLOC is the default on OpenVMS.

Details

The APPLETLOC= system option specifies the base location (typically a URL) for Java applets. These applets can be accessed from an intranet server or a local CD-ROM.

AUTOEXEC= System Option

Specifies the autoexec file that is used when SAS is initialized

Default: SAS$INIT, if SAS$INIT is defined, otherwise no default

Valid in: configuration file, SAS invocation, VMS_SAS_OPTIONS DCL symbol

Category: Environment control: Files

PROC OPTIONS GROUP= ENVFILES

OpenVMS specifics: valid values for *file-specification*; syntax

Syntax

AUTOEXEC=*file-specification*

NOAUTOEXEC

AUTOEXEC=*file-specification*
specifies an autoexec file to use instead of any existing process-level SAS$INIT file. Even if SAS$INIT is defined in your process-level logical name table, it is ignored. However, cluster-, system-, group-, and job-level autoexec files are still processed if they exist.

The file specification can be an OpenVMS pathname or logical name. If you do not supply a file type, the type SAS is assumed.

NOAUTOEXEC
indicates that no process-level autoexec file is processed even if one exists. If no process-level logical name SAS$INIT exists, NOAUTOEXEC is the default. The cluster-, system-, group-, and job-level autoexec files are still processed if they exist.

Note: In PROC OPTIONS, this system option is listed as AUTOEXEC= rather than NOAUTOEXEC as it was in Version 6. △

Details

The AUTOEXEC= system option specifies the autoexec file. The autoexec file contains SAS statements that are executed automatically when you invoke SAS or when you start another SAS process. The autoexec file can contain any valid SAS statements. For example, you can include LIBNAME statements for SAS data libraries you access routinely in SAS sessions.

System-, group-, cluster-, and job-level SAS$INIT files are processed regardless of the value of the AUTOEXEC= system option and regardless of whether the process-level SAS$INIT logical name exists.

In SAS 9.1, whenever any level of SAS$INIT is processed as an AUTOEXEC file, the value of AUTOEXEC= from PROC OPTIONS is AUTOEXEC=SAS$AUTO. To see which files are actually processed as autoexecs, issue the following SAS statement:

```
x 'show logical SAS$AUTO';
```

Note: Although SAS$INIT is the OpenVMS logical name that is used to specify one or more autoexec files, SAS$AUTO is returned from PROC OPTIONS when SAS$INIT is processed at any level. △

See Also

- □ "Autoexec Files" on page 39

AUTOSAVELOC= System Option

Specifies the location of the Program Editor autosave file

Default: none

Valid in: configuration file, SAS invocation, OPTIONS statement, SAS System Options window

Category: Environment control: Display

PROC OPTIONS GROUP= ENVDISPLAY

OpenVMS specifics: valid values of *pathname*

Syntax

AUTOSAVELOC= *fileref* | *"pathname"*

fileref
specifies a fileref to the location where the autosave file is saved.

pathname
specifies the pathname of the autosave file. The *pathname* must be a valid OpenVMS pathname specified in double quotation marks.

Details

By default, SAS saves the Program Editor autosave file, PGM.ASV, in the current folder. You can use the AUTOSAVELOC= system option to specify a different location for the autosave file.

See Also

- □ "SETAUTOSAVE Command" in the Base SAS Software section in SAS Help and Documentation

BUFNO= System Option

Specifies the number of buffers to be allocated for processing SAS data sets

Default: 1

Valid in: configuration file, SAS invocation, OPTIONS statement, SAS System Options window, VMS_SAS_OPTIONS DCL symbol

Category: Files: SAS Files

PROC OPTIONS GROUP= SASFILES, PERFORMANCE

OpenVMS specifics: Default value; valid values of *n*

See: BUFNO= System Option in *SAS Language Reference: Dictionary*

Syntax

BUFNO= *n* | *n*K | *n*M | *n*G | *hex*X | MIN | MAX

***n* | *n*K | *n*M | *n*G**
specifies the number of buffers to be allocated 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 buffers, a value of **`.782k`** specifies 801 buffers, and a value of **`3m`** specifies 3,145,728 buffers.

***hex*X**
specifies the number of buffers as a hexadecimal value. You must specify the value beginning with a number (0–9), followed by hex digits (0–9, A-F), and then followed by an X. For example, **`2dx`** specifies 45 buffers.

MIN
sets the number of buffers to 0, and requires SAS to use the default value of 1.

MAX
sets the number of buffers to 2,147,483,647.

Details

The number of buffers is not a permanent attribute of the data set; it is valid only for the current SAS session or job.

BUFNO= applies to SAS data sets that are opened for input, output, or update.

Using BUFNO= can improve execution time by limiting the number of input/output operations that are required for a particular SAS data set. The improvement in execution time, however, comes at the expense of increased memory consumption.

Under OpenVMS, the maximum number of buffers that you can allocate is determined by the amount of memory available. However, it is unusual to specify more than 10.

You might want to vary the value of the BUFNO= system option if you are trying to maximize memory usage or the number of observations per page.

See Also

- "BUFSIZE= System Option" on page 448

BUFSIZE= System Option

Specifies the permanent buffer page size for processing output SAS data sets

Default: 0

Valid in: configuration file, SAS invocation, OPTIONS statement, SAS System Options window, VMS_SAS_OPTIONS DCL symbol

Category: Files: SAS Files

PROC OPTIONS GROUP= SASFILES, PERFORMANCE

OpenVMS specifics: valid values for *n*

See: BUFSIZE= System Option in *SAS Language Reference: Dictionary*

Syntax

BUFSIZE=*n* | *n*K | *n*M | *n*G | *hex*X | MIN | MAX

***n* | *n*K | *n*M | *n*G**
specifies the buffer page size 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 buffer page size as a hexadecimal value. You must specify the value beginning with a number (0–9), followed by hex digits (0–9, A-F), and then followed by an X. For example, the value **`2dx`** sets the buffer page size to 45 bytes.

MIN
sets the buffer page size to 0 and requires SAS to use a default value. Under OpenVMS, the default value is 0. The minimum number is –2,147,483,648.

MAX
sets the buffer page size to 2,147,483,647 bytes.

Details

The BUFSIZE= system option enables you to specify the permanent buffer page size for output SAS data sets. Under OpenVMS, the buffer page size can range from 0 to 2,147,483,647 (2 gigabytes). The value is always rounded up to the next multiple of 512 bytes. If the value is 0, the engine picks a value depending on the size of the observation. The default value is 0. The value of BUFSIZE is saved with the data set and can be viewed with PROC CONTENTS or a similar window.

You might want to vary the value of the BUFSIZE= system option if you are trying to maximize memory usage or the number of observations per page.

Comparisons The BUFSIZE= system option can be overridden by the BUFSIZE= data set option.

See Also

- “Using the BUFSIZE= Option” on page 239
- “BUFSIZE= Data Set Option” on page 285
- “BUFNO= System Option” on page 447

CACHENUM= System Option

Specifies the number of caches used per SAS file

Default: 5

Valid in: configuration file, SAS invocation, OPTIONS statement, SAS System Options window, VMS_SAS_OPTIONS DCL symbol

Category: Files: SAS Files

PROC OPTIONS GROUP= SASFILES

OpenVMS specifics: All aspects are host-specific

Syntax

CACHENUM=*n*

n
specifies the number of I/O data-cache pages to be used per SAS file. The default value is 5.

Details

Pages of SAS files are cached in memory with each cache containing multiple pages. By default, the CACHENUM= system option maintains up to 5 caches for each open file.

See Also

- □ "CACHENUM= Data Set Option" on page 286
- □ "CACHESIZE= System Option" on page 450

CACHESIZE= System Option

Specifies the size of cache that is used for each open SAS file

Default: 65024

Valid in: configuration file, SAS invocation, OPTIONS statement, SAS System Options window, VMS_SAS_OPTIONS DCL symbol

Category: Files: SAS Files

PROC OPTIONS GROUP= SASFILES

OpenVMS specifics: All aspects are host-specific

Syntax

CACHESIZE=*n* | *n*K | *hex*X | MIN | MAX

***n* | *n*K**
specifies the cache 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 8 bytes, a value of `.782k` specifies 801 bytes, and a value of `3k` specifies 3,072 bytes.

This value can range from 0 to 65,024 bytes on OpenVMS Alpha before Release 7.2. The cache size can range from 0 to 130,048 bytes on OpenVMS Alpha Release 7.2 or later.

***hex*X**
specifies the cache size as a hexadecimal value. You must specify the value beginning with a number (0–9), followed by hex digits (0–9, A-F), and then followed by an X. For example, the value **`2dx`** sets the cache size to 45 bytes.

MIN
sets the cache size to 0.

MAX
sets the cache size for your operating environment. MAX is 65,024 bytes on OpenVMS Alpha before Release 7.2 and 130,048 bytes on OpenVMS Alpha Release 7.2 or later.

Details

Pages of SAS files are cached in memory with each cache containing multiple pages. The CACHESIZE= system option controls the size (in bytes) of this data cache.

See Also

- □ "CACHESIZE= Data Set Option" on page 287
- □ "CACHENUM= System Option" on page 449
- □ "BUFSIZE= System Option" on page 448

CATCACHE= System Option

Specifies the number of SAS catalogs to keep open

Default: 0

Valid in: configuration file, SAS invocation, VMS_SAS_OPTIONS DCL symbol

Category: Files: SAS Files

PROC OPTIONS GROUP= SASFILES

OpenVMS specifics: Valid values for *n*

See: CATCACHE= System Option in *SAS Language Reference: Dictionary*

Syntax

CATCACHE = *n* | *n*K | MIN | MAX

***n* | *n*K**
specifies the number of open-file descriptors to keep in cache memory in multiples of 1 (*n*) or 1,024 (*n*K). You can specify decimal values for the number of kilobytes. For example, a value of **`8`** specifies 8 open-file descriptors, a value of **`.782k`** specifies 801 open-file descriptors, and a value of **`3k`** specifies 3,072 open-file descriptors.

If *n* > 0, SAS places up to that number of open-file descriptors in cache memory instead of closing the 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 32,767.

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 of the same catalogs.

If SAS is running on an z/OS server and the MINSTG system option is in effect, SAS sets the value of CATCACHE to 0.

See Also

- □ The section about optimizing system performance in *SAS Language Reference: Concepts*

CC= System Option

Tells SAS what type of carriage control to use when it writes to external files

Default: FORTRAN

Valid in: configuration file, SAS invocation, OPTIONS statement, SAS System Options window, VMS_SAS_OPTIONS DCL symbol

Category: Files: External Files

PROC OPTIONS GROUP= EXTFILES

OpenVMS specifics: carriage-control format

Syntax

CC=CR | FORTRAN | PRINT

CR
specifies OpenVMS carriage-return carriage-control format. The use of overprinting with CC=CR is not supported.

FORTRAN
specifies FORTRAN carriage-control format. This is the default.

PRINT
specifies OpenVMS print carriage-control format.

Details

The CC= system option specifies what type of carriage control to use when SAS writes to external files. All SAS procedure output files are affected by this option. If the CC= system option is specified when SAS is invoked, then it also affects the SAS log.

See Also

- □ "Reading and Writing SAS Print Files under OpenVMS" on page 178

CLEANUP System Option

Specifies how to handle an out-of-resource condition

Default: CLEANUP

Valid in: configuration file, SAS invocation, OPTIONS statement, SAS System Options window, VMS_SAS_OPTIONS DCL symbol

Category: Environment control: Error handling

PROC OPTIONS GROUP= ERRORHANDLING

OpenVMS specifics: operation in various modes

See: CLEANUP System Option in *SAS Language Reference: Dictionary*

Syntax

CLEANUP | NOCLEANUP

CLEANUP
specifies that during the entire session, SAS attempts to perform automatic, continuous clean up of resources that are not essential for execution. Nonessential resources include those that are not visible to the user (for example, cache memory) and those that are visible to the user (for example, the KEYS windows).

CLEANUP does not prompt you before SAS attempts to clean up your disk. However, when an out-of-disk-space condition occurs and your display is attached to the process, you are prompted with a menu selection even if the CLEANUP option is on.

When the CLEANUP option is on, SAS performs automatic continuous cleanup. If not enough resources are recovered, the request for the resource fails, and an appropriate error message is written to the SAS log.

CLEANUP is the default in batch mode because there is no display attached to the process to accommodate prompting.

NOCLEANUP
specifies that SAS allows the user to choose how to handle an out-of-resource condition. When NOCLEANUP is in effect and SAS cannot execute because of a lack of resources, SAS automatically attempts to clean up resources that are not visible to the user (for example, cache memory). However, resources that are visible to the user (for example, the KEYS windows) are not automatically cleaned up. Instead, SAS prompts you before attempting to clean up your disk.

Details

The CLEANUP system option indicates whether you are prompted with a menu of items to clean up when SAS encounters an out-of-resource condition.

When CLEANUP is on, you are not prompted for any out-of-resource condition except for out-of-disk-space conditions. If you do not want to be prompted for out-of-disk-space conditions, use the CLEANUP option in conjunction with the NOTERMINAL option.

If you specify NOCLEANUP, a dialog box prompts you for input when SAS runs out of a resource. On every menu except the out-of-disk-space menu, you can select `Continuous`. If you choose Continuous, the CLEANUP system option is turned on, and you are not prompted again in out-of-resource conditions, unless SAS runs out of disk space.

CONFIG= System Option

Specifies the configuration file that is used when initializing or overriding the values of SAS system options

Default: sasv91.cfg in SAS$ROOT:[000000]

Valid in: configuration file, SAS invocation

Category: Environment control: Files

PROC OPTIONS GROUP= ENVFILES

OpenVMS specifics: All aspects are host-specific; valid values for *file-specification*; syntax

Syntax

CONFIG=*file-specification*

NOCONFIG

CONFIG=*file-specification*
indicates that the specified file is used as the configuration file, and SAS$CONFIG in your process-level logical name table is ignored. However, cluster-, system-, group-, and job-level configuration files are still processed if they exist.

The value for *file-specification* must be a valid OpenVMS pathname or logical name. If you do not supply a file type, the type CFG is assumed.

NOCONFIG
indicates that no process-level configuration file is processed, even if one exists. The cluster-, system-, group-, and job-level configuration files are still processed if they exist.

Details

The CONFIG= system option specifies the complete filename of your configuration files. These files contain SAS options that are executed automatically whenever SAS is invoked. You can create your own configuration file and store it in a location you choose.

To see which configuration files were processed for your SAS session, submit the following code:

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

All of the configuration files that SAS processed are listed as the value of the CONFIG= system option.

Cluster-, system-, group-, and job-level SAS$CONFIG files are processed regardless of the value of the CONFIG= option and regardless of whether the process-level SAS$CONFIG logical name exists.

See Also

□ “Configuration Files” on page 36

DEQMULT= System Option

Specifies the number of pages to extend a file

Default: 5

Valid in: configuration file, SAS invocation, OPTIONS statement, SAS System Options window, VMS_SAS_OPTIONS DCL symbol

Category: Files: SAS files

PROC OPTIONS GROUP= SASFILES

OpenVMS specifics: All aspects are host-specific

Syntax

DEQMULT=*n*

n
specifies the number of pages desired to extend a SAS file. The default value is 5.

Details

The DEQMULT= system option controls how many pages of disk blocks are added to a file each time it has to be extended. By default, enough space for 5 pages is added.

See Also

- □ "DEQMULT= Data Set Option" on page 290
- □ "ALQMULT= System Option" on page 443

DETACH System Option

Specifies that the asynchronous host command uses a detached process

Default: DETACH

Valid in: configuration file, SAS invocation, VMS_SAS_OPTIONS DCL symbol

Category: Environment control: Initialization and operation

PROC OPTIONS GROUP= EXECMODES

OpenVMS specifics: All aspects are host-specific

Syntax

DETACH | NODETACH

DETACH
specifies to use a detached process for asynchronous commands. This is the default.

NODETACH
specifies that the asynchronous host command uses a subprocess.

Details

The user's **`login.com`** automatically executes when a detached process starts. Therefore, the symbols and logical names that are defined in LOGIN.COM are also defined for the detached process.

When launched, the detached process will execute the DCL command procedure that is pointed to by the SAS$DETACH_TEMPLATE logical name, if it is defined. You can use this DCL command procedure to define the symbols and logical names that are needed by the detached process, since they are not automatically inherited from the process that is running SAS. A sample command procedure can be found in SAS$ROOT:[MISC.BASE]DETACH_TEMPLATE.COM. To execute a DCL command procedure when the detached process is launched, complete the following steps:

1 Edit the command procedure to contain any needed DCL commands.
2 Issue the following DCL command before invoking SAS:

```
$ DEFINE SAS$DETACH_TEMPLATE SAS$ROOT:[MISC.BASE]DETACH_TEMPLATE.COM
```

DEVICE= System Option

Specifies a device driver for graphics output for SAS/GRAPH software

Default: none

Valid in: configuration file, SAS invocation, OPTIONS statement, SAS System Options window, VMS_SAS_OPTIONS DCL symbol

Category: Graphics: Driver settings

PROC OPTIONS GROUP= GRAPHICS

OpenVMS specifics: valid values for *device-driver-name*

See: DEVICE= System Option in *SAS Language Reference: Dictionary*

Syntax

DEVICE=*device-driver-name*

device-driver-name
specifies the name of a device driver for graphics output.

Details

To see a list of device drivers that are available under OpenVMS, use the GDEVICE procedure. If you are using the SAS windowing environment, submit the following statements:

```
proc gdevice catalog=sashelp.devices;
run;
```

If you are running SAS in interactive line mode, noninteractive mode, or batch mode, submit the following statements:

```
proc gdevice catalog=sashelp.devices nofs;
   list _all_;
run;
```

See Also

□ "GDEVICE Procedure" in *SAS/GRAPH Reference, Volumes 1 and 2*

DUMP= System Option

Specifies when to create a process dump file

Default: none

Valid in: configuration file, SAS invocation, OPTIONS statement, SAS System Options window, VMS_SAS_OPTIONS DCL symbol

Category: Environment control: Error handling

PROC OPTIONS GROUP= ERRORHANDLING

OpenVMS specifics: All aspects are host-specific

Syntax

DUMP=END_PROC | FATAL

NODUMP

DUMP
tells SAS to create a process dump file. This form of the option can take the following values:

END_PROC
causes the next procedure that runs to completion to signal a fatal error. If SET PROCESS/DUMP has been turned on, this forces a file to be created on a disk that can later be analyzed with the ANALYZE/PROCESS_DUMP utility. DUMP=END_PROC is used to gather information for debugging at any point throughout the execution of a SAS job.

FATAL
tells SAS to resignal any fatal errors that it encounters. If SET PROCESS/DUMP has been turned on, this forces a file to be created on a disk that can later be analyzed with the ANALYZE/PROCESS_DUMP utility.

NODUMP
tells SAS not to perform any dump activity.

Details

CAUTION:
Never use the DUMP= system option unless you are advised to do so by SAS Technical Support. △

The DUMP= system option is used for debugging purposes only. You use it in conjunction with the DCL command SET PROCESS/DUMP to write the contents of the address space to a file on disk when SAS terminates due to a fatal error. To create a dump file, type the following DCL command at the DCL prompt before you run your SAS job:

```
$ SET PROCESS/DUMP
```

EDITCMD System Option

Specifies the host editor to be used with the HOSTEDIT command

Default: EDIT/TPU

Valid in: configuration file, SAS invocation, OPTIONS statement, VMS_SAS_OPTIONS DCL symbol

Category: Environment control: Display

PROC OPTIONS GROUP= ENVDISPLAY

OpenVMS specifics: all aspects are host-specific

Syntax

EDITCMD=*host-editor-pathname editor-options*

host-editor-pathname
is the location of the host editor.

editor-options
are the options supplied to the host editor.

Details

The host editor that you specify is used when you issue the HOSTEDIT command. The HOSTEDIT command is valid only when you are running in a SAS windowing environment.

EMAILSYS= System Option

Specifies the e-mail protocol to use for sending electronic mail

Default: SMTP (Simple Mail Transfer Protocol)

Valid in: configuration file, SAS invocation, OPTIONS statement, SAS System Options window, VMS_SAS_OPTIONS DCL symbol

Category: Communications: Email

PROC OPTIONS GROUP= EMAIL

OpenVMS specifics: all aspects are host-specific

Syntax

EMAILSYS=SMTP | VMS

SMTP
specifies the SMTP protocol. This value is the default. This value supports sending e-mail attachments on OpenVMS.

VMS
specifies the native OpenVMS e-mail facility. This value does not support sending blind carbon copies (the BCC field) or sending e-mail attachments.

Details

The EMAILSYS= system option specifies which type of e-mail system to use for sending electronic mail from within SAS. Specifying SMTP supports sending e-mail attachments on OpenVMS, but might require changing the values of EMAILHOST= and EMAILPORT=, depending on your site configuration.

See Also

- "Sending Mail from within Your SAS Session under OpenVMS" on page 71
- "Sending Electronic Mail Using the FILENAME Statement (E-MAIL)" on page 189
- "EMAILHOST= System Option" in *SAS Language Reference: Dictionary*
- "EMAILPORT= System Option" in *SAS Language Reference: Dictionary*
- "SMTP E-mail Interface" in *SAS Language Reference: Concepts*

ENCODING= System Option

Specifies the default character-set encoding for processing external data

Default: latin1

Valid in: configuration file, SAS invocation, VMS_SAS_OPTIONS DCL symbol

Category: Environment control: Language control

PROC OPTIONS GROUP= LANGUAGECONTROL

OpenVMS specifics: valid values for *character-string*

See: ENCODING= System Option in *SAS National Language Support (NLS): User's Guide*

ENGINE= System Option

Specifies the default access method to use for SAS libraries

Default: BASE

Valid in: configuration file, SAS invocation, VMS_SAS_OPTIONS DCL symbol

Category: Files: SAS files

PROC OPTIONS GROUP= SASFILES

OpenVMS specifics: valid values for *engine-name*

See: ENGINE= System Option in *SAS Language Reference: Dictionary*

Syntax

ENGINE=*engine-name*

engine-name
can be one of the following under OpenVMS:

BASE | V9
specifies the default SAS engine for SAS 9 and SAS 9.1 files. This engine is 64-bit. Previous SAS engines were 32-bit.

V8
specifies the SAS engine for all SAS Version 8 files.

V7
specifies the SAS engine for all Version 7 files.

V6
specifies the read-only Version 6 SAS engine. This engine enables you to read your Version 6 data sets in SAS 9.1.

TAPE | V9TAPE
specifies the default sequential engine for SAS 9 and SAS 9.1 files.

V8TAPE | V7TAPE
specifies the SAS sequential engine for all Version 8 and Version 7 files. These engines are identical to the V9TAPE engine.

CONCUR
specifies the concurrency engine.

XPORT
specifies the transport engine. The XPORT engine reads or writes one or more SAS data sets in transport format.

Note: V5 and V6TAPE are no longer valid engine names. △

See Also

- Chapter 6, "Using SAS Engines," on page 153
- "Compatibility of Existing SAS Files with SAS 9.1" on page 135
- *SAS Language Reference: Concepts*

EXPANDLNM System Option

Specifies whether concealed logical names are expanded when libref paths are displayed to the user

Default: EXPANDLNM

Valid in: configuration file, SAS invocation, OPTIONS statement, SAS System Options window, VMS_SAS_OPTIONS DCL symbol

Category: Environment control: Display

PROC OPTIONS GROUP= ENVDISPLAY

OpenVMS specifics: All aspects are host-specific

Syntax

EXPANDLNM | NOEXPANDLNM

EXPANDLNM
specifies that concealed logical names are to be expanded. This is the default.

NOEXPANDLNM
specifies that concealed logical names are not to be expanded when paths are displayed.

Details

The EXPANDLNM system option controls whether concealed logical names are expanded when libref paths are displayed to the user.

In SAS 9.1, the EXPANDLNM system option can be used with all engines.

Example

For example,

```
MYDISK$:[DIRECTORY]
```

is displayed as

```
$1$DUA1:[MYDISK.DIRECTORY]
```

FILECC System Option

Specifies how to treat data in column 1 of a print file

Default: FILECC

Valid in: configuration file, SAS invocation, OPTIONS statement, SAS System Options window, VMS_SAS_OPTIONS DCL symbol

Category: Log and procedure output control: Procedure output

PROC OPTIONS GROUP= LISTCONTROL

OpenVMS specifics: All aspects are host-specific

Syntax

FILECC | NOFILECC

FILECC
specifies that data in column 1 of a print file should be treated as carriage control. This is the default.

NOFILECC
specifies that data in column 1 of a print file should be treated as data.

Details

The FILECC system option specifies whether to treat data in column 1 of a print file as carriage control or as data.

See Also

- "Reading and Writing SAS Print Files under OpenVMS" on page 178

FMTSEARCH= System Option

Controls the order in which format catalogs are searched

Default: (WORK LIBRARY)

Valid in: configuration file, SAS invocation, OPTIONS statement, SAS System Options window, VMS_SAS_OPTIONS DCL symbol

Category: Environment control: Files

PROC OPTIONS GROUP= ENVFILES

OpenVMS specifics: valid values for *catalog-specification*

See: FMTSEARCH= System Option in *SAS Language Reference: Dictionary*

Syntax

FMTSEARCH=(*catalog-specification–1 catalog-specification–2 . . . catalog-specification-n*)

catalog-specification
specifies a valid OpenVMS libref. The value of *libref* can be either *libref* or *libref.catalog*. If only the libref is given, SAS assumes that FORMATS is the catalog name.

When you specify this system option in a configuration file or on the SAS command line, you must enclose *catalog-specification* in double quotation marks. You must also separate each *catalog-specification* with a blank space, not with a comma, even though the comma is typically used as a list delimiter by OpenVMS.

FONTSLOC= System Option

Specifies the directory that contains the SAS fonts that are loaded by some Universal Printer drivers

Default: SAS$ROOT:[MISC.FONTS]

Valid in: configuration file, SAS invocation

PROC OPTIONS GROUP= ENVDISPLAY

Category: Environment control: Display

OpenVMS specifics: default value; valid directory specifications

Syntax

FONTSLOC = "*directory-specification*"

"directory-specification"
specifies the directory that contains the SAS fonts that are loaded during the SAS session. The *directory-specification* must be enclosed in double quotation marks.

Details

The directory must be a valid OpenVMS Alpha pathname.

FULLSTIMER System Option

Writes all system performance statistics to the SAS log

Default: NOFULLSTIMER

Valid in: configuration file, SAS invocation, OPTIONS statement, SAS System Options window, VMS_SAS_OPTIONS DCL symbol

Category: Log and procedure output control: SAS log

PROC OPTIONS GROUP= LOGCONTROL

OpenVMS specifics: host-specific options

Syntax

FULLSTIMER | NOFULLSTIMER

FULLSTIMER
specifies that SAS write to the SAS log a complete list of computer resources that were used for each step and for the entire SAS session.

NOFULLSTIMER
specifies that SAS does not write to the SAS log a complete list of computer resources. This is the default.

Details

The FULLSTIMER system option specifies whether all the performance statistics of your computer system that are available to SAS are written to the SAS log.
Under OpenVMS, the FULLSTIMER system option prints the following statistics:

- buffered I/O
- direct I/O
- elapsed time
- page faults
- CPU time.

If the FULLSTIMER system options is set, the FULLSTIMER and STIMER statistics are printed.

See Also

- "STIMER System Option" on page 499

GISMAPS= System Option

Specifies the location of the SAS data library that contains U.S. Census Tract maps supplied by SAS/GIS

Default: SAS$GISMAPS

Valid in: configuration file, SAS invocation, OPTIONS statement, SAS System Options window, VMS_SAS_OPTIONS DCL symbol

Category: Graphics: Driver settings

PROC OPTIONS GROUP= GRAPHICS

OpenVMS specifics: valid values for *library-specification* and *path-to-library*

See: GISMAPS= System Option in *SAS Language Reference: Dictionary*

Syntax

GISMAPS=*library-specification* | *path-to-library*

library-specification* | *path-to-library
specifies either a library or a physical path to a library that contains U.S. Census Tract maps supplied by SAS/GIS.

GSFCC= System Option

Tells SAS what type of carriage control to use for writing to graphics stream files

Default: PRINT

Valid in: configuration file, SAS invocation, OPTIONS statement, SAS System Options window, VMS_SAS_OPTIONS DCL symbol

Category: Input control: Driver settings

PROC OPTIONS GROUP= GRAPHICS

OpenVMS specifics: All aspects are host-specific

Syntax

GSFCC=CR | PRINT | NONE

CR
creates a carriage return carriage control file.

PRINT
is a VFC format file with all carriage controls set to null. These files can be used with most utilities except for some file transfer protocols, such as Kermit.

NONE
creates a file with no carriage control. This format is useful if you plan to download the file to a personal computer.

Details

The GSFCC= option determines the file format of graphics stream files. When used as a system option, GSFCC= controls all graphics files that are created in a single SAS session. To specify a different format for a single file, use the GSFCC= statement option in the FILENAME statement.

See Also

- □ FILENAME statement: “Host-Specific External I/O Statement Options” on page 402

HELPINDEX= System Option

Specifies one or more index files to be used by SAS Help and Documentation

Default: **`/help/common.hlp/index.txt`**, **`/help/common.hlp/keywords.htm`**, **`common.hhk`**

Valid in: configuration file, SAS invocation

Category: Environment control: Help

PROC OPTIONS GROUP= HELP

OpenVMS specifics: HTML files must reside in the path specified by the HELPLOC= option

Syntax

HELPINDEX = *index-pathname-1* < *index-pathname-2* < *index-pathname-3*>>

index-pathname
specifies the partial pathname for the index that is to be used by SAS Help and Documentation. The *index-pathname* can be any or all of the following:

/help/*applet-index-filename*
specifies the partial pathname of the index file that is to be used by the SAS Documentation Java applet in a UNIX environment. *applet-index-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/common.hlp/index.txt`**.

See the default index file for the format that is required for an index file.

/help/*accessible-index-filename*
specifies the partial pathname of an accessible index file that is to be used by the online SAS Documentation in UNIX, OpenVMS, or z/OS environments. An accessible index file is an HTML file that can be used by Web browsers. *accessible-index-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/keywords.htm`**.

See the default index file for the format that is required for an index file.

HTML-Help-index-pathname
specifies the pathname of the Microsoft HTML Help index that is to be used by the online SAS Documentation in Windows environments. The default pathname is **`common.hhk`**. For information about creating an index for Microsoft HTML Help, see your Microsoft HTML Help documentation.

Details

Use the HELPINDEX= option if you have a customized index that you want to use in place of the SAS-supplied index. 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 HELPINDEX= option. The order of the pathnames is not important, although only one pathname of each type can be specified.

When the HELPINDEX= option specifies a pathname for UNIX, OpenVMS, 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 specified index.

For example, when the value of HELPINDEX= is **`/help/common.hlp/myindex.htm`** and the value of HELPLOC= is **`/u/myhome/myhelp`**, the complete path to the index is **`/u/myhome/myhelp/common.hlp/myindex.htm`**.

See Also

- "HELPLOC= System Option" on page 467

HELPLOC= System Option

Specifies the location of the text and index files for the facility that is used to view SAS Help and Documentation

Default: SAS$ROOT:[HELP]

Valid in: configuration file, SAS invocation

Category: Environment control: Help

PROC OPTIONS GROUP= HELP

OpenVMS specifics: default value; valid values for *pathname*

Syntax

HELPLOC=*pathname<,pathname-2,...,pathname-n>*

pathname
specifies one or more directory pathnames in which SAS Help and Documentation files are located. The *Pathname* must be a fully qualified OpenVMS filename.

Details

Specifying a value for the HELPLOC= system option causes SAS to insert that value at the start of a list of concatenated values, the last of which is the default value. This enables you to access the help for your site without losing access to SAS Help and Documentation.

For example, after two values are supplied for HELPLOC=, the specification list has the following form:

```
helploc-specification-2, helploc-specification-1, SAS$ROOT:[HELP]
```

HELPTOC= System Option

Specifies the table of contents files to be used by SAS Help and Documentation

Default: **`/help/helpnav.hlp/config.txt`**, **`/help/common.hlp/toc.htm`**, **`common.hhc`**

Valid in: configuration file, SAS invocation

Category: Environment control: Help

PROC OPTIONS GROUP= HELP

OpenVMS specifics: HTML files must reside in the path specified by the HELPLOC= option

Syntax

HELPTOC = *TOC-pathname-1* < *TOC-pathname-2* < *TOC-pathname-3*>>

TOC-pathname

specifies a partial pathname for the table of contents that is to be used by 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 SAS Help and Documentation in UNIX, OpenVMS, 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* has 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 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= option if you have a customized table of contents that you want to use in place of the SAS supplied table of contents. 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, OpenVMS, 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” on page 467

INITSTMT= System Option

Specifies a SAS statement that is to be executed after any statements in the autoexec file and before any statements from the SYSIN file

Default: none

Valid in: configuration file, SAS invocation, VMS_SAS_OPTIONS DCL symbol

Alias: IS=

Category: Environment control: Initialization and operation

PROC OPTIONS GROUP= EXECMODES

OpenVMS specifics: valid values for *statement(s)*

See: INITSTMT= System Option in *SAS Language Reference: Dictionary*

Syntax

INITSTMT="*statement(s)*"

IS="*statement(s)*"

"statement(s)"
specifies any SAS statement or statements. The value for *statement(s)* must be enclosed in double quotation marks.

Details

In order to conform to the OpenVMS command-line syntax, the value for this option must be enclosed in double quotation marks. The quotation marks enable you to preserve case, as well as to specify a compound statement. Any value that is enclosed in single quotation marks is resolved as a symbol by OpenVMS before it is processed by SAS. If no symbol exists for the specified value, unexpected results might occur.

Note: Placing single quotation marks inside double quotation marks might not create the effect that you want. To preserve the case of the characters, enclose strings in double quotation marks. △

JREOPTIONS System Option

Identifies Java Runtime Environment (JRE) options for SAS

Default: **`-Djava.ext.dirs=/SAS$ROOT/misc/base:/SAS$ROOT/misc/applets`**

Valid in: configuration file, SAS invocation

Category: Environment control: Initialization and operation

PROC OPTIONS GROUP= EXECMODES

OpenVMS specifics: all

Syntax

JREOPTIONS= "(*-JRE-option-1* <*-JRE-option-n*>)"

-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

The set of JRE options must be enclosed in parentheses. If you specify multiple JREOPTIONS system options, SAS appends JRE options to JRE options that are currently defined. Incorrect JRE options are ignored.

Examples

```
jreoptions=''(-verbose)''
```

```
jreoptions=''(-Djava.class.path=/myjava/classes/myclasses.jar:/
myjava2/classes/myclasses.jar -oss600k)''
```

LINESIZE= System Option

Specifies the line size of the SAS Log and Output windows

Default: the display width setting for windowing environment and interactive line modes; 132 characters for noninteractive and batch modes

Valid in: configuration file, SAS invocation, OPTIONS statement, SAS System Options window, VMS_SAS_OPTIONS DCL symbol

Alias: LS=

Category: Log and procedure output control: SAS log and procedure output

PROC OPTIONS GROUP= LOG_LISTCONTROL

OpenVMS specifics: valid values for *n*; syntax

See: LINESIZE= System Option in *SAS Language Reference: Dictionary*

Syntax

LINESIZE= *n* | *hex*X | MIN | MAX

n
specifies the line size in characters. Valid values range between 64 to 256.

***hex*X**
specifies the line size as a hexadecimal value. You must specify the value beginning with a number (0–9), followed by hex digits (0–9, A–F), and then followed by an X. For example, the value `0fax` specifies 250 characters.

MIN
sets the line size to 64 characters, and requires SAS to use a default value.

MAX
sets the line size to 256 characters.

Details

Under OpenVMS, the default for interactive modes (the SAS windowing environment and interactive line mode) is the display width setting. For noninteractive and batch modes, the default is 132 characters.

See Also

- "PAGESIZE= System Option" on page 484

LOADLIST= System Option

Specifies whether to print to the specified file the information about images that SAS has loaded into memory

Default: NOLOADLIST

Valid in: configuration file, SAS invocation, OPTIONS statement, SAS System Options window, VMS_SAS_OPTIONS DCL symbol

Category: Environment control: Files

PROC OPTIONS GROUP= ENVFILES

OpenVMS specifics: All aspects are host-specific

Syntax

LOADLIST=*file-specification*

NOLOADLIST

LOADLIST=*file-specification*
identifies an external file where the information is printed. The value for *file-specification* can be either a pathname or a logical name.

Note: When you use LOADLIST= in an OPTIONS statement, you must enclose *file-specification* in double quotation marks. When you use LOADLIST= during SAS invocation or in a configuration file, do not use quotation marks. △

NOLOADLIST
specifies to not print any information. This is the default.

Details

The LOADLIST= system option helps you identify images that should be either moved to your local node or installed on your system in order to improve performance. Each time an image is loaded into memory, its name is added to the list. The images that appear most often in the list are likely candidates for performance enhancements.

The following is a partial list of a typical LOADLIST file:

```
Image Path:  $1$DUA304:[901_MASTER_SUPIO.][COM.ALPND]SAS7IO.EXE
Associated Task:  DATASTEP
Activation Time:  25-APR-2003 14:35:14.79
Size (in bytes):  327680
Requested Loads:  1
Physical Loads:  1
Beginning Address:  X013F8000
Ending Address:  x01446DFF
```

Each entry consists of the following:

Image Path
: is the image that was loaded from the SAS library.

Size
: is the size of the image, in bytes.

Requested Loads
: indicates how many times the image was requested for loading. This is a usage count for the image.

Physical Loads
: indicates how many times the image is physically loaded. This number is always 1.

Beginning and Ending Address
: describes the actual location in memory where the image was loaded. These addresses are where the Physical Load occurred.

CAUTION:

Each new OpenVMS process opens its own version of the external file that LOADLIST writes to, so version limits can cause a loss of LOADLIST information. △

Every time an image is *requested*, SAS writes another entry to the LOADLIST file. The Physical Loads number is always 1, indicating that it is physically loaded only once during the SAS session.

See Also

□ Chapter 11, "Optimizing System Performance," on page 235

LOCALE= System Option

Specifies attributes that reflect the language, local conventions, and culture for a geographic region and that are used to establish the default working environment for a SAS session

Default: English

Valid in: configuration file, SAS invocation, OPTIONS statement, SAS System Options window, VMS_SAS_OPTIONS DCL symbol

Category: Environment control: Language control

PROC OPTIONS GROUP= LANGUAGECONTROL

OpenVMS specifics: Valid values for *locale-name*

See: LOCALE= System Option in *SAS National Language Support (NLS): User's Guide*

LOG= System Option

Specifies where the SAS log is written when running SAS programs in any mode other than the windowing environment

Default: SYS$OUTPUT for interactive line mode, noninteractive, batch, and SAS windowing environment mode

Valid in: configuration file, SAS invocation, VMS_SAS_OPTIONS DCL symbol

Category: Environment control: Files

PROC OPTIONS GROUP= ENVFILES

OpenVMS specifics: valid values for *destination*; syntax

Syntax

LOG=*destination*

NOLOG

LOG=*destination*
specifies either an external file or a device where the SAS log is written. The value of *destination* can be SYS$PRINT (the default printer queue); your current display; SYS$OUTPUT (the default output stream); or an OpenVMS pathname.

NOLOG
specifies that the SAS log is not written to a file. NOLOG is valid only in noninteractive mode and batch mode.

Details

The LOG= system option specifies a destination to which the SAS log is written when executing SAS programs in modes other than the windowing environment.

To send the log to a printer other than the default printer, redefine the SYS$PRINT logical name to the queue that you want to use.

The LOG= option is valid in interactive line mode, noninteractive mode, and batch mode. It is ignored in the SAS windowing environment. NOLOG is valid in noninteractive mode and batch mode; it is ignored in interactive line mode and the SAS windowing environment.

See Also

- Chapter 8, “Routing the SAS Log and SAS Procedure Output,” on page 195

LOGMULTREAD System Option

Specifies the session log file to be opened for shared read access

Default: NOLOGMULTREAD

Valid in: configuration file, SAS invocation, VMS_SAS_OPTIONS DCL symbol

Category: Log and procedure output control: SAS log

PROC OPTIONS GROUP= LOGCONTROL

OpenVMS specifics: All aspects are host-specific

Syntax

LOGMULTREAD | NOLOGMULTREAD

LOGMULTREAD
opens the session log file for shared read access.

NOLOGMULTREAD
closes the session log file. This is the default.

Details

The LOGMULTREAD system option enables you to open the session log file for shared read access. The default is NOLOGMULTREAD. Specifying LOGMULTREAD degrades performance, because data is written to the log more frequently.

LOGPARM= System Option

Controls when SAS log files are opened, closed, and, in conjunction with the LOG= system option, how they are named

Default: none

Valid in: configuration file, SAS invocation

Category: Log and procedure output control: SAS log

PROC OPTIONS GROUP= LOGCONTROL

OpenVMS specifics: behavior of ROLLOVER=NONE; must enclose log name in quotation marks if the directive is lowercase

See: LOGPARM= System Option in *SAS Language Reference: Dictionary*

Syntax

LOGPARM=
“<**OPEN**= APPEND | REPLACE | REPLACEOLD>
<**ROLLOVER**= AUTO | NONE | SESSION>
<**WRITE**= BUFFERED | IMMEDIATE>”

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.

REPLACE
: overwrites the current contents when opening an existing file. If the file does not already exist, a new file is created.

REPLACEOLD
: replaces files that are more than one day old. If the file does not already exist, a new file is created.

ROLLOVER=
controls when or if the SAS log “rolls over,” that is, when the current log is closed and a new one is opened.

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.

NONE
: specifies that rollover does not occur, even when a change occurs in the name that is specified with the LOG= option.

Note: Under OpenVMS, because the % symbol is not valid in a filename, you cannot specify a directive with ROLLOVER=NONE. For example, if you invoke SAS using the following code:

```
sas91/sysin=oranges/log=mylog%m/logparm=''rollover=none''
```

then an error appears and the SAS job fails. △

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.

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.

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=.

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, etc. For a list of directives, see LOGPARM= System Option in *SAS Language Reference: Dictionary*.

Some of the directives require lowercase values. By default, OpenVMS will uppercase any text that is not enclosed in quotation marks. To specify a lowercase directive, you must enclose the name of the log file in quotation marks.

For example, if you want to include the value of the current month in the name of the log file (specified by the %m directive), then you must include quotation marks around the value of LOG=:

```
sas91/sysin=oranges/log=''mylog%m''/logparm=''rollover=auto''
```

If you omit the quotation marks, then OpenVMS will resolve %m to %M, and the name of the log file will contain the value of the minute that the log was created rather than the month.

Note: Under OpenVMS, you cannot specify directives using the # symbol. △

See Also

□ "LOG= System Option" on page 473

MAPS= System Option

Specifies the name of the SAS library that holds the SAS/GRAPH map data sets

Default: SAS$MAPS logical name

Valid in: configuration file, SAS invocation, OPTIONS statement, SAS System Options window, VMS_SAS_OPTIONS DCL symbol

Category: Graphics: Driver settings

PROC OPTIONS GROUP= GRAPHICS

OpenVMS specifics: default; valid values for *location-of-maps*

See: MAPS= System Option in *SAS Language Reference: Dictionary*

Syntax

MAPS=*location-of-maps*

location-of-maps
specifies a libref, an OpenVMS logical name, or a pathname to the directory or subdirectory level. Do not use a specific filename.

MEMSIZE= System Option

Specifies the limit on the total amount of memory to be used by SAS

Default: 0 (unlimited memory)

Valid in: configuration file, SAS invocation, VMS_SAS_OPTIONS DCL symbol

Category: System administration: Memory

PROC OPTIONS GROUP= MEMORY

OpenVMS specifics: All aspects are host-specific

Syntax

MEMSIZE=*n* | *n*K | *n*M | *n*G | *hex*X | MIN | MAX

***n* | *n*K | *n*M | *n*G**
specifies the amount of memory 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.
The default is 0, or unlimited memory.

***hex*X**
specifies the amount of memory as a hexadecimal value. You must specify the value beginning with a number (0–9), followed by hex digits (0–9, A-F), and then followed by an X. For example, the value **2dx** sets the memory to 45 bytes.

MIN
specifies 0, which specifies that there is no limit.

MAX
specifies to set the total memory size to the largest possible setting.

Details

The MEMSIZE= system option specifies a limit on the total amount of memory SAS uses at any one time. The operating system may use additional amounts of memory. A value of 0 or MIN indicates that there is no limit. Too low a value will result in out-of-memory conditions.

On OpenVMS, the default value for the MEMSIZE system option is 0. However, the amount of memory available to a SAS process depends on your process quotas and maximum working set.

MSG= System Option

Specifies the library that contains SAS error messages

Default: SAS$MSG logical name

Valid in: configuration file, SAS invocation, VMS_SAS_OPTIONS DCL symbol

Category: Environment control: Files

PROC OPTIONS GROUP= ENVFILES

OpenVMS specifics: All aspects are host-specific

Syntax

MSG=*library-specification*

library-specification
can be an OpenVMS logical name (including search strings) or pathname. Do not use a specific filename.

Details

In the OpenVMS environment, the default value for the MSG= system option is the directory that is pointed to by the SAS$MSG logical name. If no SAS$MSG logical name is defined, SAS cannot start.

The MSG= system option replaces the SASMSG= system option.

MSGCASE System Option

Specifies whether notes, warnings, and error messages that are generated by SAS are displayed in uppercase characters

Default: NOMSGCASE

Valid in: configuration file, SAS invocation, VMS_SAS_OPTIONS DCL symbol

Category: Log and procedure output control: SAS log

PROC OPTIONS GROUP= LOGCONTROL

OpenVMS specifics: All aspects are host-specific

Syntax

MSGCASE | NOMSGCASE

MSGCASE
specifies that messages are displayed in uppercase characters.

NOMSGCASE
specifies that messages are displayed in uppercase and lowercase characters. This is the default.

Details

The MSGCASE system option specifies whether or not messages from the message file are uppercased before they are written out. User-generated messages and source lines are not affected by this system option.

MSYMTABMAX= System Option

Specifies the maximum amount of memory that is available to the macro variable symbol table(s)

Default: 51,200 bytes

Valid in: configuration file, SAS invocation, OPTIONS statement, SAS System Options window, VMS_SAS_OPTIONS DCL symbol

Category: Macro: SAS macro

PROC OPTIONS GROUP= MACRO

OpenVMS specifics: default; valid values for *n*

See: MSYMTABMAX= System Option in *SAS Macro Language: Reference*

Syntax

MSYMTABMAX=*n* | *n*K | *n*M | *n*G | *hex*X | MIN | MAX

***n* | *n*K | *n*M | *n*G**
specifies the maximum amount of memory that is available 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 maximum amount of memory that is available as a hexadecimal value. You must specify the value beginning with a number (0–9), followed by hex digits (0–9, A-F), and then followed by an X. For example, the value **2dx** sets the amount of memory that is available to 45 bytes.

MIN
sets the amount of memory that is available to the minimum setting, which is 0 bytes.

MAX
sets the amount of memory that is available to the maximum setting, which is 2,147,483,647 bytes.

Details

Under OpenVMS, the range for the MSYMTABMAX= system option is 0 to 2,147,483,647 bytes. After the MSYMTABMAX value is reached, SAS writes any additional macro variables to disk.

MVARSIZE= System Option

Specifies the maximum size for in-memory macro variable values

Default: 8,192 bytes

Valid in: configuration file, SAS invocation, OPTIONS statement, SAS System Options window, VMS_SAS_OPTIONS DCL symbol

Category: Macro: SAS macro

PROC OPTIONS GROUP= MACRO

OpenVMS specifics: default; valid values for *n*

See: MVARSIZE= System Option in *SAS Macro Language: Reference*

Syntax

MVARSIZE=*n* | *n*K | *n*M | *n*G | *hex*X | MIN | MAX

***n* | *n*K | *n*M | *n*G**
specifies the maximum macro variable size 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 maximum macro variable size as a hexadecimal value. You must specify the value beginning with a number (0–9), followed by hex digits (0–9, A-F), and then followed by an X. For example, the value `2dx` sets the maximum macro variable size to 45 bytes.

MIN
sets macro variable size to the minimum setting, which is 0. This value causes all macro variables to be written to disk.

MAX
sets the macro variable size to the maximum setting, which is 65,534.

Details

The MVARSIZE= system option specifies the maximum size for macro variables that are stored in memory. If the size of the macro variable is larger than the maximum value that is specified, variables are written out to disk.

The value of the MVARSIZE= system option can affect system performance. Before you specify the value for production jobs, run tests to determine the optimum value.

NEWS= System Option

Specifies a file that contains messages to be written to the SAS log

Default: SAS$NEWS, if defined. If no SAS$NEWS logical name exists, no news is written to the SAS log.

Valid in: configuration file, SAS invocation, VMS_SAS_OPTIONS DCL symbol

Category: Environment control: Files

PROC OPTIONS GROUP= ENVFILES

OpenVMS specifics: valid values for *file-specification*

See: NEWS= System Option in *SAS Language Reference: Dictionary*

Syntax

NEWS=*file-specification*

NONEWS

NEWS=*file-specification*
specifies an external file. The value for *file-specification* can be a valid OpenVMS pathname or logical name.

NONEWS
specifies that the contents of the NEWS file is not displayed in the SAS log, even if the file exists.

Details

Under OpenVMS, the default behavior is to search for the SAS$NEWS logical name. If it is found, the contents of the NEWS file are displayed in the SAS log immediately after the SAS header.

NLSCOMPATMODE System Option

Provides national language compatibility with previous releases of SAS

Default: NONLSCOMPATMODE

Valid in: configuration file, SAS invocation, VMS_SAS_OPTIONS DCL symbol

Category: Environment control: Language control

PROC OPTIONS GROUP= LANGUAGECONTROL

OpenVMS specifics: all aspects are host specific

See: NLSCOMPATMODE System Option in *SAS National Language Support (NLS): User's Guide*

OBS= System Option

Specifies when to stop processing observations or records

Default: 2,147,483,647

Valid in: configuration file, SAS invocation, OPTIONS statement, SAS System Options window, VMS_SAS_OPTIONS DCL symbol

Category: Files: SAS files

PROC OPTIONS GROUP= SASFILES

OpenVMS specifics: valid values for *n*; valid value for MAX

See: OBS= System Option in *SAS Language Reference: Dictionary*

Syntax

OBS=*n* | *n*K | *n*M | *n*G | *n*T | *hex*X | MIN | MAX

***n* | *n*K | *n*M | *n*G| *n*T**
specifies a number to indicate when to stop processing. Using one of the letter notations results in multiplying the integer by a specific value. That is, specifying K (kilo) multiplies the integer by 1,024, M (mega) multiplies by 1,048,576, G (giga) multiplies by 1,073,741,824, T (tera) multiplies by 1,099,511,627,776. You can specify a decimal value for *n* when it is used to specify a K, M, G, or T value. For example, a value of **`20`** specifies 20 observations or records, a value of **`.782k`** specifies 801 observations or records, and a value of **`3m`** specifies 3,145,728 observations or records.

***hex*X**
specifies a number to indicate when to stop processing as a hexadecimal value. You must specify the value beginning with a number (0–9), followed by hex digits (0–9, A-F), and then followed by an X. For example, the hexadecimal value F8 must be **`0F8x`** in order to specify the decimal equivalent of 248. The value **`2dx`** specifies the decimal equivalent of 45.

MIN
sets the number to indicate when to stop processing to 0. MIN requires SAS to use a default value.

MAX
sets the number to indicate when to stop processing to 2,147,483,647. This number is the default.

OPLIST System Option

Controls whether the settings of SAS system options are written to the SAS log

Default: NOOPLIST

Valid in: configuration file, SAS invocation, VMS_SAS_OPTIONS DCL symbol

Category: Log and procedure output control: SAS log

PROC OPTIONS GROUP= LOGCONTROL

OpenVMS specifics: All aspects are host-specific

Syntax

OPLIST | NOOPLIST

OPLIST
specifies that SAS write the settings of options to the SAS log.

NOOPLIST
specifies that SAS does not write the settings of options to the SAS log.

Details

Under OpenVMS, the OPLIST system option echoes only the system options specified when SAS is invoked; it does not echo any system options specified in a configuration file. If you want to echo the contents of the configuration file, use the VERBOSE system option.

You cannot change the settings of SAS system options with the OPLIST system option.

Example

Suppose you invoke SAS with the following command:

```
$ SAS/NODMS/FULLSTIMER/OPLIST
```

The following line is then written to the SAS log:

```
/NODMS/FULLSTIMER/OPLIST
```

See Also

- “VERBOSE System Option” on page 505

PAGENO= System Option

Resets the page number

Default: 1

Valid in: configuration file, SAS invocation, OPTIONS statement, SAS System Options window, VMS_SAS_OPTIONS DCL symbol

Category: Log and procedure output control: Procedure output

PROC OPTIONS GROUP= LISTCONTROL

OpenVMS specifics: valid values for *n*; syntax

See: PAGENO= System Option in *SAS Language Reference: Dictionary*

Syntax

PAGENO=*n* | *n*K | *n*M | *n*G | *hex*X | MIN | MAX

***n* | *n*K | *n*M | *n*G**
specifies the page number in multiples of 1 (*n*); 1,024 (*n*K); 1,048,576 (*n*M); or 1,073,741,824 (*n*G). You can specify a decimal value for *n* when it is used to specify a K, M, or G value. For example, a value of **`8`** sets the page number to 8, a value of **`.782k`** sets the page number to 801, and a value of **`3m`** sets the page number to 3,145,728.

***hex*X**
specifies the page number as a hexadecimal value. You must specify the value beginning with a number (0–9), followed by hex digits (0–9, A-F), and then followed by an X. For example, the value **`2dx`** sets the page number to 45.

MIN
sets the page number to the minimum number, which is 1.

MAX
sets the page number to the maximum number, which is 2,147,483,647.

Details

The PAGENO= system option specifies a beginning page number for the next page of output that SAS produces. Under OpenVMS, 1 is the default.

If you specify the PAGENO= system option when you invoke SAS or in a configuration file, you can use the command-line alias, PAGNO.

PAGESIZE= System Option

Specifies the number of lines that compose a page of SAS output

Default: display page-size for windowing environment and interactive line modes; 60 lines for noninteractive and batch modes

Valid in: configuration file, SAS invocation, OPTIONS statement, SAS System Options window, VMS_SAS_OPTIONS DCL symbol

Alias: PS=

Category: Log and procedure output control: SAS log and procedure output

PROC OPTIONS GROUP= LOG_LISTCONTROL

OpenVMS specifics: syntax

See: PAGESIZE= System Option in *SAS Language Reference: Dictionary*

Syntax

PAGESIZE=*n* | *n*K | *hex*X | MIN | MAX

***n* | *n*K**
specifies the number of lines that compose a page in multiples of 1 (*n*) or 1,024 (*n*K). You can specify decimal values for the number of kilobytes. For example, a value of `800` specifies 800 lines, a value of `.782k` specifies 801 lines, and a value of `3k` specifies 3,072 lines.

***hex*X**
specifies the number of lines that compose a page as a hexadecimal value. You must specify the value beginning with a number (0–9), followed by hex digits (0–9, A-F), and then followed by an X. For example, the value `2dx` specifies 45 lines.

MIN
sets the number of lines that compose a page to the minimum setting, which is 15.

MAX
sets the number of lines that compose a page to the maximum setting, which is 32,767.

Details

Under OpenVMS, the default for interactive modes (interactive line mode and the SAS windowing environment) is your display page-size setting. For noninteractive and batch modes, the default is 60 lines.

See Also

- "LINESIZE= System Option" on page 470

PARMCARDS= System Option

Specifies the file reference to use as the PARMCARDS file

Default: FT15F001

Valid in: configuration file, SAS invocation, OPTIONS statement, SAS System Options window, VMS_SAS_OPTIONS DCL symbol

Category: Environment control: Files

PROC OPTIONS GROUP= ENVFILES

OpenVMS specifics: valid values for *fileref*

See: PARMCARDS= System Option in *SAS Language Reference: Dictionary*

Syntax

PARMCARDS=*fileref*

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.

If you specify the PARMCARDS= system option when you invoke SAS or in a configuration file, you can use the command-line alias, PRMCARDS.

PRINT= System Option

Specifies the destination of the procedure output

Default: none for line mode or windowing environment; SYS$OUTPUT for batch.

Valid in: configuration file, SAS invocation, VMS_SAS_OPTIONS DCL symbol

Category: Environment control: Files

PROC OPTIONS GROUP= ENVFILES

OpenVMS specifics: All aspects are host-specific

Syntax

PRINT=*destination*

NOPRINT

PRINT=*destination*
specifies to print either to an external file or to a device. The value of *destination* can be SYS$PRINT (the default print queue); your current display, SYS$OUTPUT (the default output stream); or an OpenVMS pathname.

NOPRINT
specifies to print to SYS$OUTPUT.

Details

The PRINT= system option specifies the destination to which SAS output is written when executing SAS programs in modes other than the interactive windowing environment.

To send the procedure output to a printer queue other than the default printer, redefine the SYS$PRINT logical name to the queue that you want to use.

The PRINT= system option is valid in interactive line mode, noninteractive mode, and batch mode; it is ignored in the SAS windowing environment.

See Also

- Chapter 8, "Routing the SAS Log and SAS Procedure Output," on page 195

REALMEMSIZE= System Option

Indicates the amount of real memory SAS can expect to allocate

Default: 0

Valid in: configuration file, SAS invocation, VMS_SAS_OPTIONS DCL symbol

Category: System administration: Memory

PROC OPTIONS GROUP= MEMORY

OpenVMS specifics: valid values

Syntax

REALMEMSIZE= *n* | *n*K | *n*M | 1G | *hex*X | MIN | MAX

***n* | *n*K | *n*M**
specifies the amount of memory to reserve 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.

1G
specifies the amount of memory to reserve is 1,073,741,824 bytes (1 gigabyte).

***hex*X**
specifies the amount of memory as a hexadecimal value. You must specify the value beginning with a number (0–9), followed by hex digits (0–9, A-F), and then followed by an X. For example, the value **`2dx`** sets the amount of memory to 45 bytes.

MIN
specifies a value of 0, which indicates that the memory usage is determined by SAS when SAS starts. This is the default value and should not be changed under normal conditions.

MAX
specifies to set the memory size to the largest permissible value.

Details

Use the REALMEMSIZE= system option to optimize the performance of SAS procedures that alter their algorithms and memory usage. Setting the value of REALMEMSIZE= too low might result in less than optimal performance.

RSASUSER System Option

Controls access to members in the SASUSER data library

Default: NORSASUSER

Valid in: configuration file, SAS invocation, VMS_SAS_OPTIONS DCL symbol

Category: Environment control: Files

PROC OPTIONS GROUP= ENVFILES

OpenVMS specifics: availability of SASUSER data library to users

See: RSASUSER System Option in *SAS Language Reference: Dictionary*

Syntax

RSASUSER | NORSASUSER

RSASUSER
limits access to the SASUSER data library to read-only access.

NORSASUSER
prevents users from sharing SASUSER library members, because it allows a user to open a SASUSER library member for update access. Update access requires exclusive rights to the library member. When NORSASUSER is in effect and another user tries to share the PROFILE catalog, a temporary PROFILE catalog is created in the WORK directory.

Details

Under the OpenVMS environment, it is common to have a SASUSER data library that is shared by a group of users. By default, if one user has a library member open for update, all other users are denied access to that library member. For example, if one user is writing data to the SASUSER.PROFILE catalog, no other user can even read data from the PROFILE catalog. Specifying RSASUSER enables a group of users to share SASUSER library members by allowing all the users only read-only access to members. In this PROFILE catalog example, if RSASUSER is in effect, each user can open the PROFILE catalog for read-only access, allowing other users to concurrently read from the PROFILE catalog. However, no user would be able to write information to the PROFILE catalog.

Specifying RSASUSER in a SAS session affects only that session's access to files. To enable a group of users to share members in the SASUSER library, the system manager should set RSASUSER in a configuration file that is shared by all the users who will be accessing the files. For example, RSASUSER can be contained in a file referenced by a group-level SAS$CONFIG logical name.

Note: The usefulness of the RSASUSER option depends on how SAS is being used. Although the RSASUSER system option is extremely useful when users must share information (such as the PROFILE catalog) that is stored in the SASUSER data library, it is not useful if these same users are using SAS/ASSIST software. SAS/ASSIST software requires update access to the SASUSER library. △

S= System Option

Specifies the length of statements in each line of source statements and the length of data in the line following a DATALINES statement

Default: 0

Valid in: configuration file, SAS invocation, OPTIONS statement, SAS System Options window, VMS_SAS_OPTIONS DCL symbol

Category: Input control: Data processing

PROC OPTIONS GROUP= INPUTCONTROL

OpenVMS specifics: valid values for *n*

See: S= System Option in *SAS Language Reference: Dictionary*

Syntax

S=*n* | *n*K | *n*M | *n*G | *hex*X | MIN | MAX

***n* | *n*K | *n*M | *n*G**

specifies the length of statements and data 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 length of statements and data as a hexadecimal value. You must specify the value beginning with a number (0–9), followed by hex digits (0–9, A-F), and then followed by an X. For example, the value `2dx` sets the length of statements and data to 45 bytes.

MIN

sets the length of statements and data to 0, and requires SAS to use a default value.

MAX
sets the length of statements and data to the maximum, which under OpenVMS is 2,147,483,647.

Details

Input can be from either fixed- or variable-length records. Both fixed-length and variable-length records can be either unsequenced or sequenced. Unsequenced records do not contain sequence fields.

SAS determines whether the input contains sequence numbers that are based on the value of S. The S= system option specifies the length of statements, exclusive of sequence numbers, on each line of SAS source statements and the length of data, exclusive of sequence numbers, on lines following a DATALINES statement.

Under OpenVMS, the value of the S= system option can range from 0 to 2,147,483,647.

S2= System Option

Specifies the length of secondary source statements

Default: 0

Valid in: configuration file, SAS invocation, OPTIONS statement, SAS System Options window, VMS_SAS_OPTIONS DCL symbol

Category: Input control: Data processing

PROC OPTIONS GROUP= INPUTCONTROL

OpenVMS specifics: valid values for *n*

See: S2= System Option in *SAS Language Reference: Dictionary*

Syntax

S2= S | *n* | *n*K | *n*M | *n*G | *hex*X | MIN | MAX

S
uses the current value of the S= system option to compute the record length of text that comes from the %INCLUDE statement, an autoexec file, or an autocall macro file.

***n* | *n*K | *n*M | *n*G**
specifies the value by which to compute the record length of text that comes from an %INCLUDE statement, an autoexec file, or an autocall macro file. It specifies this value 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 length of statements and data as a hexadecimal value. You must specify the value beginning with a number (0–9), followed by hex digits (0–9, A-F), and then

followed by an X. For example, the value `2dx` sets the length of statements and data to 45 bytes.

MIN
sets the length of statements and data to 0, and requires SAS to use a default value.

MAX
sets the length of statements and data to the maximum, which under OpenVMS is 2,147,483,647.

Details

The S2= system option operates exactly like the S= system option except that the S2= system option controls input from only an %INCLUDE statement, an autoexec file, or an autocall macro file.

SASAUTOS= System Option

Specifies the autocall macro library

Default: SASAUTOS logical name

Valid in: configuration file, SAS invocation, OPTIONS statement, SAS System Options window, VMS_SAS_OPTIONS DCL symbol

Category: Environment control: Files
Macro: SAS macro

PROC OPTIONS GROUP= ENVFILES
MACRO

OpenVMS specifics: valid values for *library-specification*

See: SASAUTOS System Option in *SAS Macro Language: Reference*

Syntax

SASAUTOS=*library-specification* | (*library-specification-1*, . . . , *library-specification-n)*

library-specification
can be any valid reference to an aggregate storage location under OpenVMS (directories or OpenVMS text libraries). The specification can be a fileref or an OpenVMS logical name (including search strings) or pathname. OpenVMS pathnames must be enclosed in quotation marks. (Remember that quotation marks used in the SAS command must be double quotation marks unless a symbol is implied, as discussed in "INITSTMT= System Option" on page 468.) Any aggregate storage location specifications that are not enclosed in quotation marks are considered logical names.

Details

Under OpenVMS, the default is the SASAUTOS logical name. If no SASAUTOS logical name is defined and an autocall library is referenced, the following message appears:

```
ERROR: No file referenced by SASAUTOS OPTION can
  be opened.
WARNING: Source level autocall is not found or
  cannot be opened.
Autocall has been suspended and OPTION
  NOMAUTOSOURCE has been set.
To use the autocall facility again, set OPTION
  MAUTOSOURCE.
```

CAUTION:

Do not override the definition of the SASAUTOS logical name. Several parts of SAS require the macros that are defined in the supplied SASAUTOS files. These parts include SAS/ASSIST software and the PMENU facility under the SAS windowing environment autocall libraries. △

When you specify two or more autocall libraries in the SAS command, you must enclose the specifications in parentheses and use commas to separate multiple specifications. Blanks are not acceptable delimiters in the SAS command, but they are accepted if you specify the SASAUTOS option in the OPTIONS statement.

See Also

- "INITSTMT= System Option" on page 468
- "Autocall Libraries under OpenVMS" on page 520
- *SAS Macro Language: Reference*

SASHELP= System Option

Specifies the directory or directories to be searched for SAS help files, default forms, device lists, dictionaries, and other entries in the SASHELP catalog

Default: SAS$HELP logical name

Valid in: configuration file, SAS invocation, VMS_SAS_OPTIONS DCL symbol

Category: Environment control: Files

PROC OPTIONS GROUP= ENVFILES

OpenVMS specifics: valid values for *library-specification*

See: SASHELP= System Option in *SAS Language Reference: Dictionary*

Syntax

SASHELP=*library-specification*

library-specification
can be an OpenVMS logical name (including search strings) or pathname. Do not use a specific filename.

Details

The SASHELP= system option is set during the installation process and normally is not changed after installation.

Under OpenVMS, the default value for the SASHELP= system option is the directory that the SAS$HELP logical name points to. If no SAS$HELP logical name is defined, SAS cannot start.

SASUSER= System Option

Specifies the name of the SASUSER library

Default: SAS$USER logical name

Valid in: configuration file, SAS invocation, VMS_SAS_OPTIONS DCL symbol

Category: Environment control: Files

PROC OPTIONS GROUP= ENVFILES

OpenVMS specifics: valid values for *library-specification*; syntax

See: SASUSER= System Option in *SAS Language Reference: Dictionary*

Syntax

SASUSER=*library-specification*

library-specification
specifies an OpenVMS logical name or pathname to the directory or subdirectory level for a SAS data library. Do not use a specific filename.

Details

The SASUSER= system option specifies the SAS data library that contains a user's profile catalog.

Under OpenVMS, the default value for the SASUSER= system option is the value of the SAS$USER logical. By default, the SAS$USER logical points to the SASUSER91 subdirectory of the SYS$LOGIN directory. If this directory does not exist and it cannot be created, then SAS cannot start.

See Also

- "The SASUSER Data Library" on page 134

SEQENGINE= System Option

Specifies the default access method for SAS sequential data libraries

Default: V9TAPE

Valid in: configuration file, SAS invocation, OPTIONS statement, SAS System Options window, VMS_SAS_OPTIONS DCL symbol

Category: Files: SAS files

PROC OPTIONS GROUP= SASFILES

OpenVMS specifics: All aspects are host-specific

Syntax

SEQENGINE=*engine-name*

engine-name
can be one of the following under OpenVMS:

V9TAPE
specifies the sequential engine for SAS 9 and SAS 9.1. This is the default.

V8TAPE
specifies the sequential engine for SAS Version 8.

V7TAPE
specifies the sequential engine for Version 7.

Details

The SEQENGINE= option specifies the default access method, or engine, that is used when you are creating new sequential-format SAS data libraries. The engine that is used with an existing sequential library is determined by the first data set in that library and is not affected by this option.

See Also

- Chapter 6, "Using SAS Engines," on page 153

SORTPGM= System Option

Specifies the name of the sort utility

Default: BEST

Valid in: configuration file, SAS invocation, OPTIONS statement, SAS System Options window, VMS_SAS_OPTIONS DCL symbol

Category: Sort: Procedure options

PROC OPTIONS GROUP= SORT

OpenVMS specifics: valid values for sort utility; syntax

Syntax

SORTPGM=BEST | HOST | SAS

BEST
specifies the sort utility that is best suited for the data. This is the default.

HOST
specifies the host sort utility that is available under OpenVMS. The host sort utility might be more suitable than the sort utility supplied by SAS for data sets that contain many observations.

SAS
specifies the sort utility to be supplied by the SAS, which is more efficient for sorting small files than invoking the host sort utility.

Details

The SORTPGM= system option specifies the name of the system sort utility to be invoked by SAS.

Under OpenVMS, if SORTPGM=BEST and the data set to be sorted contains 50,000 observations or fewer, the SAS sort is used; otherwise, the Host sort is used. The informational message that describes which sort was used when SORTPGM=BEST is suppressed unless the value of the MSGLEVEL= system option is I (informational).

Note: An alternate host sort utility, Hypersort V04–003, is also available. For more information about this version of Hypersort, contact the Compaq Computer Corporation. For information about enabling the Hypersort utility, refer to the OpenVMS help topic, **`sort`**. After you enable this sort utility on your system, then you can use SORTPGM=HOST to have SAS invoke Hypersort. △

See Also

- "MSGLEVEL System Option" in *SAS Language Reference: Dictionary*

SORTSIZE= System Option

Specifies the amount of memory that is available to the SORT procedure

Default: MAX

Valid in: configuration file, SAS invocation, OPTIONS statement, SAS System Options window, VMS_SAS_OPTIONS DCL symbol

Category: Sort: Procedure options
System administration: Memory

PROC OPTIONS GROUP= SORT
MEMORY

OpenVMS specifics: default value

See: SORTSIZE= System Option in *SAS Language Reference: Dictionary*

Syntax

SORTSIZE=*n* | *n*K | *n*M | *n*G | *hex* X | MIN | MAX

***n* | *n*K | *n*M | *n*G**
specifies the amount of memory 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.

If *n*=0, the sort utility uses its default.

***hex*X**
specifies the amount of memory as a hexadecimal value. You must specify the value beginning with a number (0–9), followed by hex digits (0–9, A-F), and then followed by an X. For example, the value **`2dx`** sets the amount of memory to 45 bytes.

MIN
specifies the minimum amount of memory available.

MAX
specifies 2,147,483,647 bytes.

Details

Generally, the value of the SORTSIZE= system option should be less than the physical memory available to your process. If the SORT procedure needs more memory than you specify, the system creates a temporary utility file.

For OpenVMS, the default value for SORTSIZE is MAX.

Note: Proper specification of SORTSIZE= can improve sort performance by restricting the swapping of memory that is controlled by the operating environment. △

See Also

- “SORT Procedure” on page 387

SORTWORK= System Option

Defines locations for host sort work files

Default: none

Valid in: configuration file, SAS invocation, OPTIONS statement, SAS System Options window, VMS_SAS_OPTIONS DCL symbol

Category: Sort: Procedure options

PROC OPTIONS GROUP= SASFILES

OpenVMS specifics: number of work files specified

Syntax

SORTWORK=<*libref*>;

SORTWORK=*path*;

SORTWORK=(<*libref1*> | *path1*,<*libref2*> | *path2*, ... <*libref10*> | *path10*)

NOSORTWORK

libref
specifies a data library. Librefs must be assigned using a LIBNAME statement. When more than one *libref* is specified, they must be enclosed in parentheses.

path
specifies an OpenVMS pathname. The value for *path* must be enclosed in single or double quotation marks.

NOSORTWORK
deassigns the librefs or paths assigned using SORTWORK=.

Details

The SORTWORK= system option enables you to specify up to ten work files for the OpenVMS host sort. The paths and librefs defined in the SORTWORK= system option are assigned to the OpenVMS logical names SORTWORK0 through SORTWORK9. The OpenVMS host sort uses these logical names to determine where to create the host sort work files.

You can specify the NOSORTWORK option to deassign the logical names that are set using SORTWORK=. Otherwise, they stay assigned until the SAS session is terminated.

The SORTWORK*n* logical names are not assigned during options processing. They are assigned during processing of the SORT procedure. The same applies to deassigning the logical names. If you specify OPTIONS NOSORTWORK, the deassigning of the logical names will not take place until another SORT procedure is submitted.

The SORT procedure option, SORTWKNO=, overrides SORTWORK=. SORTWKNO= enables the user to specify how many work files the host sort should use. Valid values range from 0 through 6. No matter how many sort work file locations have been assigned through SORTWORK=, the number that is specified with SORTWKNO= determines how many of the locations are used.

Since the SORTWKNO= option is limited, you can use the OpenVMS maximum of 10 sort work files by defining SORTWORK0 through SORTWORK9. If you specify locations with SORTWORK=, SAS tells the sort utility how many work files to create (one per location). If you specify some number of SORTWORK= locations, but do not want to use them all for a particular PROC SORT command, use SORTWKNO= in the SORT procedure to specify exactly how many to use.

If you specify fewer SORTWORK= locations than the number that was specified with SORTWKNO=, the extra work files will be created in SYS$SCRATCH.

Not specifying SORTWKNO= and specifying SORTWKNO=0 have the same effect: if SORTWORK= locations have been defined, the OpenVMS host sorting algorithm will determine which of these locations to use. To insure that all of the defined SORTWORK= locations are used simultaneously, use the Hypersort V04–003 utility. For more information about this version of Hypersort, contact the Compaq Computer Corporation. For information about enabling the Hypersort utility, refer to the OpenVMS help topic, `sort`.

If the SORTWORK= locations have not been defined, then 0 will be sent to the sort utility as the number of work files; this is the OpenVMS default. The default action is to create a work file if needed in SYS$SCRATCH.

See Also

- "SORT Procedure" on page 387
- "LIBNAME Statement" on page 420

SPAWN= System Option

Specifies that SAS is invoked in a SPAWN/NOWAIT subprocess

Default: WAIT

Valid in: configuration file, SAS invocation, VMS_SAS_OPTIONS DCL symbol

Category: Environment control: Initialization and operation

PROC OPTIONS GROUP= EXECMODES

OpenVMS specifics: All aspects are host-specific

Syntax

SPAWN=WAIT | NOWAIT

WAIT
causes SAS to assume that the terminal can be used to take input from the user. This is the default.

NOWAIT
causes SAS to assume that the terminal cannot be used to take input from the user. Therefore, SAS will not run in interactive line mode. Attention handling is disabled. However, you can run SAS in batch mode or in the Motif environment. The following is an example of using this option:

```
$ SPAWN/NOWAIT SAS/SPAWN=NOWAIT MYFILE.SAS
```

Specifying SPAWN=NOWAIT in this situation is highly recommended. If you do not specify it, unnecessary interactions occur between the spawned SAS session and your terminal.

Details

The SPAWN= system option facilitates smooth operation of SAS in a SPAWN/NOWAIT subprocess.

To terminate the subprocess that runs SAS, use the DCL STOP command.

See Also

- “Running SAS in a SPAWN/NOWAIT Subprocess” on page 29

STACK= System Option

Specifies the size of the procedure stack in bytes

Default: 0

Valid in: configuration file, SAS invocation, OPTIONS statement, SAS System Options window, VMS_SAS_OPTIONS DCL symbol

Category: System administration: Memory

PROC OPTIONS GROUP= MEMORY

OpenVMS specifics: All aspects are host-specific

Syntax

STACK=*stack-size*

NOSTACK

STACK=*stack-size*
must be an integer between 65,535 and 5,242,880.

NOSTACK
uses the default size for most procedures, which is 1,048,576 bytes.

Details

The STACK= system option specifies the size of the procedure stack in bytes. The *stack* is an area of memory that the procedure uses to store information, such as call-frame data and local variables. In general, the larger the procedure, the more stack space the procedure needs. If you are running large jobs, you might see the following message:

```
%SAS-W-LOWSTACK, low stack encountered for task
   task-name
```

This message indicates that the current procedure is using up most of its stack space. You can use the STACK= option to increase the stack size for the procedure. The default for most procedures is 1,048,576 bytes. If you use the STACK= system option, you change the size of the stack for all procedures. Therefore, you might need to set the stack size back to the default after certain procedures.

STIMEFMT System Option

Specifies the format to use for displaying the time on STIMER output

Default: M

Valid in: configuration file, SAS invocation, OPTIONS statement, SAS System Options window, VMS_SAS_OPTIONS DCL symbol

Category: Log and procedure output control: SAS log

PROC OPTIONS GROUP= LOGCONTROL

OpenVMS specifics: All aspects are host-specific

Syntax

STIMEFMT=H | M | S

H
: specifies that SAS display the STIMER output time in hours, minutes, and seconds in the following format: **`hours:minutes:seconds`**.

M
: specifies that SAS display the STIMER output time in minutes and seconds in the following format: **`minutes:seconds`**. This is the default.

S
: specifies that SAS display the STIMER output time in seconds.

Details

The STIMEFMT system option specifies the format to use for displaying the time on STIMER output as either **`seconds`**, **`minutes:seconds`**, or **`hours:minutes:seconds`**.

See Also

- "STIMER System Option" on page 499

STIMER System Option

Writes a subset of system performance statistics to the SAS log

Default: STIMER

Valid in: configuration file, SAS invocation, OPTIONS statement, SAS System Options window, VMS_SAS_OPTIONS DCL symbol

Category: Log and procedure output control: SAS log

PROC OPTIONS GROUP= LOGCONTROL

OpenVMS specifics: All aspects are host-specific

Syntax

STIMER | NOSTIMER

STIMER
: specifies that SAS write the statistics. When STIMER is in effect, SAS writes to the SAS log a list of computer resources used for each step and the entire SAS session.

NOSTIMER
: specifies that SAS not write performance statistics to the SAS log.

Details

The STIMER system option specifies whether performance statistics of your operating environment are written to the SAS log.

Under OpenVMS, the STIMER option writes the following statistics:

- elapsed time
- CPU time.

If both STIMER and FULLSTIMER are set, the FULLSTIMER statistics are printed.

Comparisons

The STIMER system option specifies whether a subset of all the performance statistics of your operating environment that are available to SAS are written to the SAS log. The FULLSTIMER system option specifies whether all of the available performance statistics are written to the SAS log.

See Also

- "FULLSTIMER System Option" on page 463
- "STIMEFMT System Option" on page 498

SYSIN= System Option

Specifies the default location of SAS source programs

Default: none

Valid in: configuration file, SAS invocation, VMS_SAS_OPTIONS DCL symbol

Category: Environment control: Files

PROC OPTIONS GROUP= ENVFILES

OpenVMS specifics: All aspects are host-specific

Syntax

SYSIN=*file-specification*

NOSYSIN

SYSIN=*file-specification*
identifies an external file. The value for *file-specification* can be an OpenVMS logical name or pathname.

NOSYSIN
invokes SAS, processes the autoexec file, and then terminates SAS, returning you to the DCL prompt.

Details

The SYSIN= system option specifies a file containing a SAS program. This option indicates to SAS that you are executing in noninteractive mode and can be specified only in the SAS invocation.

The default value for the SYSIN= system option under interactive line mode and the SAS windowing environment is the SYS$INPUT logical name. Any value other than SYS$INPUT for *file-specification* prevents SAS from running interactively. The value for *file-specification* can be a valid OpenVMS pathname or logical name. The default value for SYSIN= in noninteractive and batch modes is the file specification that you provided with the SAS command. For example, if you invoke SAS with the following command, the value for *file-specification* is ORANGES.SAS:

```
$ SAS ORANGES
```

You can also explicitly specify the SYSIN= system option as an option in the SAS command when you invoke SAS in noninteractive or batch mode, as in the following example:

```
$ SAS/SYSIN=ORANGES
```

This technique allows you to include your source file specification in a configuration file.

Under OpenVMS, the syntax of this system option also enables you to specify NOSYSIN. If you specify NOSYSIN, as in the following example, SAS is invoked, the autoexec file is processed, and then SAS terminates, returning you to the DCL prompt:

```
$ SAS/NOSYSIN/AUTOEXEC=MYEXEC.SAS
```

This technique is useful if you want to test an autoexec file without actually running a complete SAS session.

The SYSIN= system option is associated with an automatic macro variable, VMSSASIN. This variable contains the value of the SYSIN= option, and provides you with the name of the SAS job that is currently being run. When SAS is run in an interactive mode the value is SYS$INPUT.

Also, the SYSIN= option accepts wildcard specifications. For example, you could use the following SAS command to invoke SAS:

```
SAS/SYSIN=*.SAS
```

This command causes SAS to execute all the files with an extension of .SAS in the current directory. Only one log and one procedure output file are created. By default, the name of the first job run is used for these files.

SYSPARM= System Option

Specifies a character string that can be passed to SAS programs

Default: none

Valid in: configuration file, SAS invocation, OPTIONS statement, SAS System Options window, VMS_SAS_OPTIONS DCL symbol

Category: Environment control: Files

PROC OPTIONS GROUP= ENVFILES

OpenVMS specifics: valid values and syntax for *characters*

See: SYSPARM= System Option in *SAS Language Reference: Dictionary*

Syntax

SYSPARM=<“>*characters*<”>

characters
writes the character string in all uppercase.

"characters"
preserves the case of the character string.

Details

The SYSPARM= system option specifies a character string that can be passed to SAS programs.

By default, the value of the SYSPARM= system option is uppercased under OpenVMS. To preserve the case of the string, enclose it in double quotation marks.

Example

If you specify the following command,

```
$ SAS/SYSPARM=mytext
```

the string **`MYTEXT`** is passed to your SAS session.

However, if you specify the following command,

```
$ SAS/SYSPARM="mytext"
```

the string **`mytext`** is passed to your SAS session.

SYSPRINT System Option

Specifies the destination for printed output

Default: SYS$PRINT

Valid in: configuration file, SAS invocation, OPTIONS statement, VMS_SAS_OPTIONS DCL symbol

Category: Files: SAS files

PROC OPTIONS GROUP= SASFILES

OpenVMS specifics: All aspects are host-specific

Syntax

SYSPRINT="*print-queue-name*"<"*destination*">

"print-queue-name"
specifies the name of the printer as it is installed under OpenVMS. The value for *printer-name* must be enclosed in double quotation marks.

"destination"
optionally specifies a filename to write the print file to disk. If specified, then all printer output that is generated by SAS is routed to this file. Even though the output

is not sent directly to a printer, it is still formatted using the printer driver associated with *printer-name*. The value for *destination* must be enclosed in double quotation marks.

Details

The SYSPRINT system option specifies the destination of a printer where you want to print your SAS output.

If you do not specify the SYSPRINT system option, the *printer-name* and *destination* arguments use the default system printer values.

See Also

- □ Chapter 8, "Routing the SAS Log and SAS Procedure Output," on page 195

TAPECLOSE= System Option

Specifies the default CLOSE disposition for a SAS data library on tape

Default: LEAVE

Valid in: configuration file, SAS invocation, OPTIONS statement, SAS System Options window, VMS_SAS_OPTIONS DCL symbol

Category: Files: SAS files

PROC OPTIONS GROUP= SASFILES

OpenVMS specifics: All aspects are host-specific

Syntax

TAPECLOSE=*disposition*

disposition
can be one of the following under OpenVMS:

REWIND
rewinds to the beginning of the tape after closing each member.

LEAVE
performs no tape positioning when you close a member.

FREE
rewinds and dismounts the tape when the next member is closed.

Details

The only valid value for tape libraries that are accessed by the COPY procedure is LEAVE; it cannot be overridden.

See Also

- “COPY Procedure” in *Base SAS Procedures Guide*

TERMIO= System Option

Specifies whether terminal I/O is blocking or non-blocking

Default: NOBLOCK

Valid in: only at session startup in configuration file, SAS invocation, VMS_SAS_OPTIONS DCL symbol

Category: System administration: Performance

PROC OPTIONS GROUP= PERFORMANCE

OpenVMS specifics: All aspects are host-specific

Syntax

TERMIO=BLOCK | NOBLOCK

BLOCK
specifies that terminal I/O is blocking.

NOBLOCK
specifies that terminal I/O is non-blocking.

Details

TERMIO controls whether terminal I/O in line mode SAS is blocking or non-blocking. NOBLOCK, the default, allows other processes, such as ODS, to execute while the line mode process waits for terminal input. While NOBLOCK is set, command line recall is limited to one previous command. Specify TERMIO=BLOCK to enable full command line recall functionality.

USER= System Option

Specifies the default permanent SAS data library

Default: none

Valid in: configuration file, SAS invocation, OPTIONS statement, SAS System Options window, VMS_SAS_OPTIONS DCL symbol

Category: Environment control: Files

PROC OPTIONS GROUP= ENVFILES

OpenVMS specifics: valid values for *library-specification*

See: USER= System Option in *SAS Language Reference: Dictionary*

Syntax

USER=*library-specification*

library-specification
can be a libref, an OpenVMS logical name, or a pathname to the directory or subdirectory level. Do not use a specific filename.

Details

If the USER= system option is specified, you can use one-level names to reference permanent SAS files in SAS statements. However, if USER=WORK is specified, SAS assumes that files referenced with one-level names refer to temporary work files.

See Also

- "Directing Temporary SAS Data Sets to the USER Library" on page 131

VERBOSE System Option

Controls whether SAS writes the settings of all the system options specified in the configuration file, either to the terminal or the batch log

Default: NOVERBOSE

Valid in: SAS invocation, VMS_SAS_OPTIONS DCL symbol

Category: Log and procedure output control: SAS log

PROC OPTIONS GROUP= LOGCONTROL

OpenVMS specifics: All aspects are host-specific

Syntax

VERBOSE | NOVERBOSE

VERBOSE
specifies that SAS writes the settings of the system options.

NOVERBOSE
specifies that SAS does not write the settings of the system options.

Details

The VERBOSE system option is valid only on the command line at SAS invocation or in the VMS_SAS_OPTIONS DCL symbol.

Under OpenVMS, the settings are written to your display in any method of running SAS except batch mode. If you invoke SAS as a part of a batch job, the settings are written to the OpenVMS batch log.

If you specify the VERBOSE system option in a configuration file, no error message is generated, but the option is ignored.

The output from the VERBOSE system option shows the following:

- □ all of the configuration files that are found (except the default configuration file)
- □ all of the options that have been set along with their current values.

Note: Since some options are set by default, more options are displayed than are specified in the configuration files. The host specific options are listed first followed by the options that are found in all operating environments. △

See Also

- □ "OPLIST System Option" on page 482
- □ "Configuration Files" on page 36
- □ "Displaying the Contents of Configuration Files" on page 38

WORK= System Option

Specifies the name of the directory under which the SAS WORK directory is created

Default: SAS$WORKROOT logical name

Valid in: configuration file, SAS invocation, VMS_SAS_OPTIONS DCL symbol

Category: Environment control: Files

PROC OPTIONS GROUP= ENVFILES

OpenVMS specifics: valid values for *library-specification*

See: WORK= System Option in *SAS Language Reference: Dictionary*

Syntax

WORK=*library-specification*

library-specification
can be an OpenVMS logical name or pathname to the directory or subdirectory level. Do not use a specific filename.

Details

You can define a logical name SAS$WORKROOT to override the system default.

See Also

- □ "The WORK Data Library under OpenVMS" on page 129

WORKCACHE= System Option

Specifies the size of the I/O data cache allocated for a file in the WORK data library

Default: 65024

Valid in: configuration file, SAS invocation, OPTIONS statement, SAS System Options window, VMS_SAS_OPTIONS DCL symbol

Category: Files: SAS files

PROC OPTIONS GROUP= SASFILES

OpenVMS specifics: All aspects are host-specific

Syntax

WORKCACHE=*n* | *n*K | *hex*X | MIN | MAX

***n* | *n*K**
specifies the size of the I/O data cache 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, a value of **`.782k`** specifies 801 bytes, and a value of **`3k`** specifies 3,072 bytes.

This value can range from 0 to 65,024 bytes on OpenVMS Alpha before Release 7.2. The size of the data cache can range from 0 to 130,048 bytes on OpenVMS Alpha Release 7.2 or later.

***hex*X**
specifies the size of the I/O data cache as a hexadecimal value. You must specify the value beginning with a number (0–9), followed by hex digits (0–9, A-F), and then followed by an X. For example, the value **`2dx`** sets the size of the I/O data cache to 45 bytes.

MIN
sets the size of the I/O data cache to 0.

MAX
sets the size of the I/O data cache for your operating environment. MAX is 65,024 bytes on OpenVMS Alpha before Release 7.2 and 130,048 bytes on OpenVMS Alpha Release 7.2 or later.

Details

The WORKCACHE= system option controls the size (in bytes) of the data cache used to buffer I/O pages for files that are created in the WORK data library. This option functions exactly like the CACHESIZE= data set option, which you can use in a LIBNAME statement. However, because no LIBNAME statement is explicitly issued for the WORK data library, the WORKCACHE= system option is necessary to enable you to specify a default cache size for all files that are created in the WORK data library by the V8, V8TAPE, or V6 engines. The value of *n* must be a positive integer.

See Also

- □ "WORKCACHE= Data Set Option" on page 295
- □ "CACHESIZE= Data Set Option" on page 287
- □ "CACHESIZE= System Option" on page 450
- □ "LIBNAME Statement" on page 420

XCMD System Option

Specifies whether the X command is valid in the current SAS session

Default: XCMD

Valid in: configuration file, SAS invocation, VMS_SAS_OPTIONS DCL symbol

Category: Environment control: Display

PROC OPTIONS GROUP= ENVDISPLAY

OpenVMS specifics: All aspects are host-specific

Syntax

XCMD | NOXCMD

XCMD
specifies that the X command is valid in the current SAS session.

NOXCMD
specifies that the X command is not valid in the current SAS session.

Details

The XCMD system option specifies whether the X command is valid in the current SAS session.

See Also

- □ "X Command" on page 270
- □ "XCMDWIN System Option" on page 508

XCMDWIN System Option

Specifies whether to create a DECTERM window for X command output when in the SAS windowing environment

Default: XCMDWIN

Valid in: configuration file, SAS invocation, VMS_SAS_OPTIONS DCL symbol

Category: Environment control: Display

PROC OPTIONS GROUP= ENVDISPLAY

OpenVMS specifics: All aspects are host-specific; valid only on OpenVMS Alpha

Syntax

XCMDWIN | NOXCMDWIN

XCMDWIN
specifies that a DECTERM window should be created for X command output when in the SAS windowing environment.

NOXCMDWIN
specifies that no DECTERM window should be created.

Details

The XCMDWIN option specifies whether to create a DECTERM window for X command output when in the SAS windowing environment. This option is ignored when running line mode, non-interactive mode, or batch mode.

See Also

- □ "Issuing DCL Commands during a SAS Session" on page 43
- □ "X Statement" on page 427
- □ "X Command" on page 270

XKEYPAD System Option

Specifies that subprocesses use the keypad settings that were in effect before you invoked SAS

Default: XKEYPAD

Valid in: configuration file, SAS invocation, OPTIONS statement, SAS System Options window, VMS_SAS_OPTIONS DCL symbol

Category: Environment control: Initialization and operation

PROC OPTIONS GROUP= EXECMODES

OpenVMS specifics: All aspects are host-specific

Syntax

XKEYPAD | NOXKEYPAD

XKEYPAD
specifies that SAS uses the previous settings in the subprocess.

NOXKEYPAD
specifies that SAS uses the SAS keypad settings currently in the subprocess.

Details

The XKEYPAD system option specifies whether a subprocess that was spawned by an X statement or X command uses the keypad settings in effect before you invoked SAS.

The XKEYPAD system option is valid in interactive line mode and in the SAS windowing environment.

See Also

- "X Statement" on page 427
- "X Command" on page 270

XLOG System Option

Specifies whether to display the output from the X command in the SAS log file

Default: NOXLOG

Valid in: configuration file, SAS invocation, OPTIONS statement, SAS System Options window, VMS_SAS_OPTIONS DCL symbol

Category: Log and procedure output control: SAS log

PROC OPTIONS GROUP= LOGCONTROL

OpenVMS specifics: All aspects are host-specific

Syntax

XLOG | NOXLOG

XLOG
specifies that SAS displays the X command output in the SAS log file.

NOXLOG
specifies that SAS does not display the X command output in the SAS log file.

Details

The XLOG system option specifies whether to display the X command output in the SAS log file.

See Also

- "XOUTPUT System Option" on page 511
- "XCMD System Option" on page 508
- "X Command" on page 270

XLOGICAL System Option

Specifies that process-level logical names are passed to the subprocess that is spawned by an X statement or X command

Default: XLOGICAL

Valid in: configuration file, SAS invocation, OPTIONS statement, SAS System Options window, VMS_SAS_OPTIONS DCL symbol

Category: Environment control: Initialization and operation

PROC OPTIONS GROUP= EXECMODES

OpenVMS specifics: All aspects are host-specific

Syntax

XLOGICAL | NOXLOGICAL

XLOGICAL
passes the logical names to the subprocess.

NOXLOGICAL
does not pass the logical names to the subprocess.

Details

The XLOGICAL system option specifies whether to pass the process-level logical names to the subprocess that is spawned by an X statement or X command.

The XLOGICAL system option takes effect only after a subprocess is spawned. For information about when a subprocess is spawned, see “XTIMEOUT= System Option” on page 514.

See Also

- “X Statement” on page 427
- “X Command” on page 270
- “XTIMEOUT= System Option” on page 514

XOUTPUT System Option

Specifies whether to display the output from the X command

Default: XOUTPUT

Valid in: configuration file, SAS invocation, OPTIONS statement, SAS System Options window, VMS_SAS_OPTIONS DCL symbol

Category: Log and procedure output control: SAS log and procedure output

PROC OPTIONS GROUP= LOG_LISTCONTROL

OpenVMS specifics: All aspects are host-specific

Syntax

XOUTPUT | NOXOUTPUT

XOUTPUT
specifies that SAS displays the output from the X command.

NOXOUTPUT
specifies that SAS does not display the output from the X command.

Details

The XOUTPUT system option enables you to suppress output that is created by the X command. The XOUTPUT system option is intended for SAS/AF applications that issue operating environment commands behind the scenes.

See Also

- “X Command” on page 270

XRESOURCES= System Option

Specifies a character string of X resource options or the application instance name for the SAS interface to Motif

Default: none

Valid in: configuration file, SAS invocation, VMS_SAS_OPTIONS DCL symbol

Category: Environment control: Display

PROC OPTIONS GROUP= ENVDISPLAY

OpenVMS specifics: All aspects are host-specific

Syntax

XRESOURCES=“*resource-list*”

“resource-list”
specifies the resource setting to be passed to SAS. The value for *resource-list* must be enclosed in double quotation marks.

Details

For the SAS interface to Motif, the XRESOURCES= system option enables you to pass any valid X window system command-line options as well as **-xrm** options to the interface. The **xrm** option enables you to set any resource used by SAS. For a complete list of resource and class names used by SAS, see “Summary of X Resources for SAS under OpenVMS” on page 122. The first argument in the resource list can also be used to specify the application instance name.

In order to conform to the OpenVMS command-line syntax, this option must be enclosed in double quotation marks. This enables you to preserve case, as well as to specify a compound statement. Any value that is enclosed in single quotation marks is resolved as a symbol by OpenVMS before it is processed by SAS. If no symbol exists for the specified value, unexpected results might occur.

Note: Placing single quotation marks inside double quotation marks might not create the effect you want. To preserve the case of the characters, enclose the string in double quotation marks. △

Example

In the following example, the XRESOURCES= system option does three things:

- It uses the **`AXPSAS`** argument to define this application instance name as AXPSAS. The application class is always SAS. Therefore, SAS will use any application instance resources that are prefixed with AXPSAS, as well as any application class resources that are prefixed by SAS.
- It uses the **`-display`** command-line option to specify that the SAS windows for the session should be displayed on node MYNODE.
- It uses the **`-xrm`** option to set the **`AXPSAS.sessionGravity`** resource to the value **`SouthWestGravity`**. When the SAS windows are displayed on the node, they are positioned in the southwest region of the screen. If you want to specify more than one resource setting, you must issue a separate **`-xrm`** option.

```
$ SAS /XRESOURCES="AXPSAS
    -display mynode:0
    -xrm=(AXPSAS.sessionGravity: SouthWestGravity)"
```

See Also

- "Summary of X Resources for SAS under OpenVMS" on page 122

XSYMBOL System Option

Specifies that global symbols are passed to the subprocess that is spawned by an X statement or X command

Default: XSYMBOL

Valid in: configuration file, SAS invocation, OPTIONS statement, SAS System Options window, VMS_SAS_OPTIONS DCL symbol

Category: Environment control: Initialization and operation

PROC OPTIONS GROUP= EXECMODES

OpenVMS specifics: All aspects are host-specific

Syntax

XSYMBOL | NOXSYMBOL

XSYMBOL
passes the global symbols to the subprocess.

NOXSYMBOL
does not pass the global symbols to the subprocess.

Details

The XSYMBOL system option specifies whether to pass the global symbols to the subprocess that is spawned by an X statement or X command.

Local symbols are not passed to a subprocess that is created using the X '*DCL-command*' form of the X statement or X command. Thus, if you define a process-level symbol, MYSYMBOL, before you invoke SAS, and then you issue the following X statement during your SAS session, SAS cannot find MYSYMBOL:

```
x 'show symbol mysymbol';
```

To see the value of MYSYMBOL, issue the following X statement and then issue the SHOW SYMBOL MYSYMBOL command at the SAS_$ prompt:

```
x '';
```

This option takes effect only after a subprocess is spawned. For information about when a subprocess is spawned, see "XTIMEOUT= System Option" on page 514.

See Also

- "X Statement" on page 427
- "X Command" on page 270
- "XTIMEOUT= System Option" on page 514
- "Issuing DCL Commands during a SAS Session" on page 43

XTIMEOUT= System Option

Specifies how long a subprocess that has been spawned by an X statement or X command remains inactive before being deleted

Default: NOXTIMEOUT

Valid in: configuration file, SAS invocation, OPTIONS statement, SAS System Options window, VMS_SAS_OPTIONS DCL symbol

Category: Environment control: Initialization and operation

PROC OPTIONS GROUP= EXECMODES

OpenVMS specifics: All aspects are host-specific

Syntax

XTIMEOUT=*time-span*

NOXTIMEOUT

XTIMEOUT=*time-span*
specifies the number of minutes until an inactive subprocess is deleted. The value of *time-span* can range from 0 to 59. XTIMEOUT=0 indicates that the subprocess is deleted immediately when control returns to SAS.

NOXTIMEOUT
indicates that the subprocess never times out, and it is not deleted until the SAS session terminates.

Details

This option affects only the following form of the X command or X statement:

```
X 'DCL-command'
```

When an X statement or X command spawns a subprocess to issue one specific DCL command, the subprocess is not automatically deleted when control returns to SAS; it remains active based on the value of the XTIMEOUT= system option.

Each time an X statement or X command is issued, the timer is reset to the value specified in the XTIMEOUT= system option. When the subprocess remains inactive for the time period specified by XTIMEOUT=, the subprocess is deleted.

Note: When certain DCL commands are submitted by an X statement or X command, any existing subprocess is deleted regardless of the value of the XTIMEOUT= system option. △

See Also

- □ "X Statement" on page 427
- □ "X Command" on page 270
- □ "Issuing DCL Commands during a SAS Session" on page 43

CHAPTER
20

Macro Facility under OpenVMS

About the SAS Macro Facility under OpenVMS

In general, the SAS macro language is portable across operating environments. However, some components of the macro facility have details that are specific to OpenVMS. For more information, see

- *SAS Macro Language: Reference*
- *SAS Macro Facility Tips and Techniques*
- the online help for the macro facility.

Automatic Macro Variables under OpenVMS

The following automatic macro variables have aspects that are specific to the OpenVMS operating environment:

SYSCC
: contains the current SAS condition code that SAS will return to the OpenVMS Alpha operating environment when SAS exits. Upon exit, SAS translates this condition code to a return code that has a meaningful value for the operating system. For OpenVMS, a successful completion returns a code of $STATUS=1.

SYSDEVIC
gives the name of the current graphics device.

SYSENV
is provided for compatibility with SAS running on other operating environments, but it is not relevant in the OpenVMS operating environment. In the OpenVMS environment, its value is always **FORE**.

SYSJOBID
lists the OpenVMS process ID (PID) of the process that is running SAS, (for example, **27A0D1D2**).

SYSPARM
specifies a character string that can be passed to SAS programs. By default, the value of SYSPARM is in uppercase in the OpenVMS operating environment. To preserve the case of the string, enclose it in double quotation marks.

SYSRC
holds the OpenVMS status of DCL commands that were issued during your SAS session. The variable holds a character string that is the text form of the decimal value of the OpenVMS command status. For example, consider the following statements:

```
x 'dirf'; /* an invalid OpenVMS command */
%put This OpenVMS status is &sysrc;

x 'dir'; /* a valid OpenVMS command */
%put The corrected OpenVMS status is &sysrc;
```

When these statements are issued, the following lines are written to the SAS log:

```
This OpenVMS status is 229520
The corrected OpenVMS status is 0
```

SYSSCP
in the OpenVMS Alpha operating environment, SYSSCP returns the value **VMS_AXP**.

SYSSCPL
returns the value **OpenVMS** for the OpenVMS Alpha operating environment.

SYSSESID
returns the client name of an application. The client name of a SAS session consists of either the value of the **xresources=''name''** or the word **SAS** plus the SAS session ID. **SAS** is the default. The SAS session ID is incremented once for each concurrent session that is started. For example, if you start a second SAS session without ending the first session, then the default client name for the second session is **SAS2**.

VMSSASIN
contains the value of the SYSIN= system option and provides you with the name of the SAS job that is currently being run. When SAS is run in interactive mode, the value of VMSSASIN is SYS$INPUT.

The following is an example using this macro variable:

```
data test;
   infile '[school]roster.dat';
   input name $ age grade $;
run;

proc print data=test;
```

```
   title "Output generated by &vmssasin program.";
run;
```

Alternatively, you could put the value of the VMSSASIN macro variable into a variable in your data set:

```
data test;
   infile '[school]roster.dat';
   input name $ age grade $;
   job=symget("vmssasin");
run;
```

Macro Statements under OpenVMS

The following macro statement has operating dependencies that are specific to the OpenVMS environment:

%SYSEXEC
issues DCL commands immediately and places the operating environment return code in the automatic variable SYSRC. The syntax of the %SYSEXEC statement is

%SYSEXEC <*DCL-command*>;

where *DCL-command* can be any OpenVMS operating environment command or any sequence of macro operations that generates an operating environment command.

The %SYSEXEC statement is similar to the X statement, which is described in "Issuing DCL Commands during a SAS Session" on page 43. You can use the %SYSEXEC statement either inside a macro or in open code.

Omitting *DCL-command* puts you in an interactive OpenVMS subprocess and sets the value of the SYSRC automatic variable to 0. To return to your SAS session, type **LOGOFF** at the subprocess prompt.

The following is an example of %SYSEXEC:

```
%sysexec show time;
```

The output looks something like this:

```
12-JAN-1998 16:02:52
```

Macro Functions under OpenVMS

The following macro function has details that are specific to the OpenVMS operating environment:

%SYSGET
returns the character-string value of the OpenVMS symbol that you specified as the argument. The syntax of this function is

%SYSGET(*OpenVMS-symbol-name*);

You can use %SYSGET to translate either local or global OpenVMS symbols. If the symbol that you specify does not exist, SAS prints a warning message in the log.

Example: Using the %SYSGET Function

The following example writes square brackets (`[]`) to the SAS log.

1 Issue the following command to define a global symbol, HERE, to be `[]`:

```
$ HERE == "[]"
```

2 Invoke SAS, using the invocation command that is used at your site (usually **`$ SAS`**).

3 In your SAS session, assign the value of the %SYSGET function to the macro variable VAR1, using the symbol HERE as the argument.

```
%let var1=%sysget(here);
%put &var1;
```

Autocall Libraries under OpenVMS

What Is an Autocall Library?

An autocall library contains files or members that define SAS macros. The autocall facility enables you to invoke a macro without having previously defined that macro in the same SAS program. In order to use the autocall facility, the SAS system option MAUTOSOURCE must be in effect. (For information about the MAUTOSOURCE system option, see *SAS Language Reference: Dictionary*.)

Available Autocall Macros

SAS supplies some autocall macros. When SAS is installed, a SASAUTOS logical name is defined. This OpenVMS logical name refers to the location of the default macros that are supplied by SAS. Whether this logical name is placed in the system-level logical name table or in the process-level logical name table is site-dependent.

You can also define your own autocall macros in a user autocall library.

Creating an Autocall Macro

To create an autocall macro, perform the following tasks:

1 Create either an OpenVMS directory or an OpenVMS text library to function as an autocall library, or use an existing autocall library.

2 In the autocall library, create a file (filetype .SAS) or member (filetype .TLB) that contains the source statements for the macro. The filename or member name must be the same as the name of the macro. For example, if a file named PRTDATA.SAS is stored in an OpenVMS directory, then the file must define a macro named PRTDATA. Similarly, if the text library MYLIB.TLB contains the member DATACONT, then that member must define a macro named DATACONT.

Specifying a User Autocall Library

Use the SAS system option SASAUTOS to specify the location of one or more user autocall libraries. (For more information about this option, see “SASAUTOS= System

Option" on page 490.) You can specify autocall libraries either when you invoke SAS or during a SAS session, as follows:

- When you invoke SAS:

  single autocall library:

  ```
  SAS/MAUTOSOURCE/SASAUTOS=''[mydir]''
     [dir]program
  ```

  concatenated autocall library:

  ```
  SAS/MAUTOSOURCE/SASAUTOS=(''[mydir1]'',
     ''[mydir2]'',sasautos) [dir]program
  ```

  Note: Invocation options are separated by slashes following the SAS command. △

- During a SAS session (using an OPTIONS statement in your program):

  single autocall library:

  ```
  options mautosource sasautos='[mydir]';
  ```

  concatenated autocall library:

  ```
  options mautosource sasautos=('[mydir1]',
     '[mydir2]',sasautos);
  ```

Stored Compiled Macro Facility under OpenVMS

Introduction to 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 system option MSTORED must be in effect. In addition, you use the SAS system option SASMSTORE= to specify the libref of a SAS data library that contains a catalog of stored compiled SAS macros. For more information about these options, see *SAS Language Reference: Concepts*.

Advantages of Using the Stored Compiled Macros

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. △

Making Your Stored Compiled Macros Accessible to Your SAS Session

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
- using the autocall facility to search predefined source libraries for macro definitions.

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 '[dir]';
options mstored sasmstore=mylib;

%macro myfiles / store;
   filename file1 '[dir]first.dat';
   filename file2 '[dir]second.dat';
%mend;

/*  Use a Stored Compiled Macro     */
/*     in a Later Session           */
libname mylib '[dir]';
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;
```

Controlling Memory Availability for Storing Macro Variables

Two system options control the maximum amount of memory available for storage of macro variables:

MVARSIZE=*n*
: specifies the maximum number of bytes for any macro variable stored in memory (0 <= *n* <= 32768). The default setting for this option in the OpenVMS operating environment is 8192.

MSYMTABMAX=*n*
: specifies the maximum amount of memory available to all symbol tables (global and local combined). The value of *n* can be expressed as an integer or MAX (the largest integer your operating environment can represent). The default setting for this option in the OpenVMS operating environment is 51200.

You can specify these system options in the following places:

- at SAS invocation
- in the configuration file
- during execution with an OPTIONS statement or in the System Options window

Other Host-Specific Aspects of the Macro Facility under OpenVMS

Collating Sequence for Macro Character Evaluation

Under OpenVMS, the macro facility uses ASCII collating sequences for %EVAL, %SYSEVALF, and for implicit evaluation of macro characters.

SAS System Options Used by the Macro Facility

The following table lists the SAS system options that are used by the macro facility and that have host-specific characteristics. The table also tells you where to look for more information about these system options.

Table 20.1 SAS System 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 OpenVMS, the default value for this option is 51,200 bytes.	"MSYMTABMAX= System Option" on page 478
MVARSIZE=	Specifies the maximum number of bytes for any macro variable stored in memory (0 <= *n* <= 32767). Under OpenVMS, the default setting for this option is 8,192.	"MVARSIZE= System Option" on page 479
SASAUTOS=	Specifies the autocall library.	"SASAUTOS= System Option" on page 490 and "Specifying a User Autocall Library" on page 520

PART *4*

Appendices

APPENDIX 1

Error Messages

Overview of Error Messages under OpenVMS

Error messages can be of several different types:

informational
: is usually not serious. It simply provides helpful information.

warning
: is more serious than informational messages but does not stop processing. Usually, warnings indicate that something works but not the way that you intended.

error
: is usually serious and can be caused by either a user mistake or an internal SAS error. Report internal errors to your SAS Support Consultant.

fatal error
: is serious. It stops SAS. Fatal errors can be caused by either a user mistake or an internal SAS error. Report internal errors to your SAS Support Consultant.

Note: If the SAS log cannot be used, any error messages that SAS issues are written to the SAS console log. Under OpenVMS, the SYS$OUTPUT logical name specifies the location of the Console Log. For more information, see "Messages in the SAS Console Log" on page 53. △

OpenVMS Operating Environment Messages

`%SHOW-S-NOTRAN, no translation for logical name SAS*`
Severity Level: informational

You can use the following command to see if the SAS logical names are defined for SAS 9.1:

```
$ SHOW LOGICAL SAS*
```

If you receive this error message, SAS logical names are not defined on your system. Notify your SAS Installation Representative immediately. Refer your SAS

Installation Representative to the *Installation Instructions and System Manager's Guide for the SAS System for OpenVMS Alpha* for information about how to set up the SAS logical names on your system.

Host Subsystem Messages under OpenVMS

`ERROR: Bad parameter value`
`ERROR: Insufficient space in file xxx.xxxxx.DATA`

Severity Level: error

SAS data sets are limited in size to 4,294,967,294 (or 4 gigabyte) blocks. When this value is exceeded, you receive these errors.

`ERROR: Broadcast trapping disabled due to internal errors`

Severity Level: error

This message indicates that a non-fatal error occurred while SAS was trying to establish broadcast message trapping. Although your SAS session will initialize, broadcast messages will not be trapped properly if you are running SAS in the windowing environment.

`ERROR: Cannot create mailbox for subprocess.  Check quotas and privileges`

Severity Level: error

SAS encountered an error while trying to create the mailbox used by the X '*DCL-command*' form of the X statement or command. This message might be preceded by an OpenVMS message indicating the exact nature of the problem. Check your process privileges and quotas.

`ERROR: Cannot spawn subprocess.  Check process limit quotas and privileges`

Severity Level: error

SAS encountered an error while trying to spawn a subprocess from the X command or statement. This message might be preceded by an OpenVMS message indicating the exact nature of the problem. Check your process quotas and privileges.

`ERROR: Data overrun.  Tape device mounted with blocksize smaller than used to write data`

Severity Level: error

The block size specified in the DCL MOUNT command is smaller than the actual block size of the tape. Remount the tape with the correct block size.

`ERROR: Error attempting terminal input with /SPAWN=NOWAIT in effect`

Severity Level: error

You cannot invoke SAS interactively in a SPAWN/NOWAIT subprocess. For additional details, see "Running SAS in a SPAWN/NOWAIT Subprocess" on page 29.

`ERROR: Error while loading image` ***`image-name`***

Severity Level: error

SAS was unable to load the named image, but processing continues if possible. Ensure that you have spelled all procedures, functions, and formats correctly. If you are unable to determine the cause of this error, contact your SAS Installation Representative.

`ERROR: Error while opening loadlist file` ***`file-specification`***

Severity Level: error

An error occurred when SAS was opening the LOADLIST file. Check the filename for valid OpenVMS filename specifications. For more information about specifying OpenVMS filenames, see “OpenVMS Filenames” on page 8.

`ERROR: Error while writing to loadlist file` ***`file-specification`***

Severity Level: error

An error occurred when SAS was writing to the LOADLIST file. Ensure that you have write access to the LOADLIST file.

`ERROR: IEEE numbers with a length less than 3 are not supported`

Severity Level: error

This data set contains observations with numeric variables of length 2. The data set cannot be created or translated. For information about converting 2-byte variables to 3-byte variables, see “VAXTOAXP Procedure” on page 391.

`ERROR: Insufficient memory to initialize the SAS System`

Severity Level: error

There is not enough memory for SAS to initialize.

`ERROR: Interactive SAS invocation unsupported with /SPAWN=NOWAIT in effect`

Severity Level: error

You cannot invoke SAS interactively in a SPAWN/NOWAIT subprocess. For additional details, see “Running SAS in a SPAWN/NOWAIT Subprocess” on page 29.

`ERROR: Insufficient virtual memory to load image` ***`image-name`***

Severity Level: error

Insufficient memory was obtained to load the image.

`ERROR: Invalid conversion of KEYVALUE to data type of specified key on indexed file`

Severity Level: error

A conversion error, such as overflow, underflow, or value is not an integer, has occurred. Check the defined key data type on the indexed file and modify the KEYVALUE= value accordingly.

`ERROR: LRECL must be specified when RECFM equals FIXED`

Severity Level: error

If you are writing records to a file that uses fixed-length records, you must use the LRECL= external I/O statement option to specify the record length.

`ERROR: LRECL must be specified with RECFM=D`

Severity Level: error

A record format of D (DATA step unlabeled tape) was specified but the LRECL= option was not specified. Correct your program and resubmit it.

`ERROR: Maximum of 8 parameters exceeded for PARAMETERS= option`

Severity Level: error

Due to DCL restrictions, a maximum of eight parameters can be specified for a job that was submitted to a printer queue. Correct your program and resubmit it.

`ERROR: Module` ***`module-name`*** **`signalled fatal error condition`**

Severity Level: fatal error

SAS encountered a fatal internal error. Report this error to your SAS Support Consultant.

ERROR: Output open of a text library requires exclusive access. File is already open

Severity Level: error

The OpenVMS system enables you to write to only one member of a text library at a time. Modify your SAS job accordingly.

ERROR: Specified key on indexed file is defined as *key-data-type-1*, but *key-data-type-2* was used in KEYVALUE option

Severity Level: error

The specified KEYVALUE= value has a data type that conflicts with the defined key data type on the indexed file. Check the defined key data type on the indexed file and modify the KEYVALUE= value accordingly.

ERROR: Specified key on indexed file is of unsupported type for KEYVALUE option

Severity Level: error

SAS does not support the following key data types: unsigned 8-byte binary, signed 8-byte integer, collating key, and packed decimal string.

ERROR: Subordinate image *image-name* not found

Severity Level: error

SAS could not find the named subordinate image while trying to load a higher-level image. This message is preceded by a message that indicates which high-level image was being loaded. Report this error to your SAS Installation Representative.

ERROR: This option can be used on command line only

Severity Level: error

A host system option that can be used only in the SAS command or configuration file was specified in the OPTIONS statement.

ERROR: Trying to write block shorter than 14 bytes. File will not be complete

Severity Level: error

While writing to tape, SAS attempted to write a block that is less than 14 bytes long. This error typically indicates that the entire file is less than 14 bytes. Use the LRECL= option to extend the length of each record.

ERROR: Unable to print fatal condition

Severity Level: error

SAS encountered a fatal internal error. Report this error to your SAS Support Consultant.

ERROR: Update access to indexed files is not supported

Severity Level: error

You have specified both a FILE and an INFILE statement that access the same indexed file. Update access is currently not supported. Correct your program and resubmit it.

ERROR: Update or random access to members of text libraries is not supported

Severity Level: error

You have tried to update a member of an OpenVMS text library (perhaps with a FILE statement), or used the FSLIST procedure with an OpenVMS text library. This access is currently not supported. Correct your program and resubmit it.

ERROR: Wildcard or concatenated filespec not allowed for output

Severity Level: error

While wildcards and concatenated file specifications are allowed for input, they are not allowed for output. Correct your program and resubmit it.

`Full screen SAS could not obtain a channel to the terminal`

Severity Level: error

Without a channel to the terminal, the windowing method of running SAS cannot run. Your process may have reached the SYSGEN CHANNELCNT limit.

`Illegal use of` ***`dms-command`*****`. Key processing terminated prematurely.`**

`Illegal use of` ***`dms-command`*** **`in a DM statement or from a command line`**

Severity Level: informational

Certain SAS commands are supported only under the OpenVMS operating environment. Their use is constrained. Only one of these commands can be assigned to a single function key. The commands cannot be mixed with each other or with other windowing commands. These commands cannot be used in DM statements or typed manually on the command line. These commands are

CHINSERT

CURSORDOWN

CURSORLEFT

CURSORRIGHT

CURSORUP

DELCHAR

DELLINE

DELPCHAR

DELTOEOL

DELWORD

MOVEBOL

MOVEEOL

NEWLINE

NEXTFIELD

NEXTWORD

PREVFIELD

PREVWORD

`NOTE: BUFSIZE value too large. Maximum allowed for this file is 16776704.`

Severity Level: informational

The largest I/O transfer size allowed under OpenVMS is 16,776,704 bytes. SAS uses this for the BUFSIZE= value.

`NOTE: CC=CR and OVERPRINT may yield unexpected results. Use options NOOVP with CC=CR`

Severity Level: informational

With the CR (carriage return) file format, there is no overprint character. Therefore, set the OVP system option to NOOVP to suppress overprinting.

`NOTE: CC=PRINT and RECFM=F are conflicting attributes. CC=CR will be used`

Severity Level: informational

CC=PRINT corresponds to the variable with fixed control (VFC) file format. Therefore, a fixed record format is incompatible. CC=CR (carriage return) is compatible with a fixed record format.

`NOTE: Could not load image SASMSG`
Severity Level: informational
The SASMSG image, which contains the text of all host messages, could not be loaded. Although SAS is able to run without this image, report this error to your SAS Installation Representative.

`NOTE: LRECL option ignored for PRINT files when RECFM equals VARIABLE`
Severity Level: informational
The LRECL= external I/O statement option specifies record lengths when RECFM=FIXED; it is not valid when RECFM=VARIABLE. Modify your SAS job accordingly.

`NOTE: OVERPRINT ignored when specified with option CC=CR`
Severity Level: warning
Overprinting is not allowed when you write to files with carriage-return carriage control.

`NOTE: Previous value of` ***`logical-name`*** **`has been superseded`**
Severity Level: informational
The OpenVMS logical name has been superseded by a new value.

`NOTE: Some records have been truncated to existing length of variable length record`
Severity Level: informational
During an update to an external file, the length of the new record exceeded the length of the existing record. The new record was truncated to the length of the existing record.

`NOTE: Some records have been truncated to length specified by LRECL option`
Severity Level: informational
This message is printed if you are writing records that are larger than those specified by the LRECL= external I/O statement option. You may want to modify the LRECL= value accordingly.

`NOTE: Text library members cannot be spooled.  Device type of PRINTER or PLOTTER ignored`
Severity Level: informational
You have specified the PRINTER or PLOTTER device type keyword in a FILENAME statement with an OpenVMS text library. OpenVMS does not allow spooling of text library members.

`NOTE: Unable to queue job to printer due to the following error:`
Severity Level: informational
This message is followed by an OpenVMS message describing the error. Correct the problem and perform the operation again.

`%SAS-E-BADCHECK, bad image header for image` ***`image-name`***
Severity Level: fatal error
While loading the named image, SAS encountered invalid data in the image and could not proceed. Ask your SAS Installation Representative to check the installation of the product. Ensure that your site is licensed for the product that you are trying to use.

`%SAS-E-NOIMAGE, image` ***`image-name`*** **`not found`**
Severity Level: fatal error
SAS was unable to load the named image because it could not find the image. Ask your SAS Installation Representative to check the installation of the product. Ensure that your site is licensed for the product that you are trying to use.

`%SAS-E-NOMSG, unable to print fatal condition`
Severity Level: error
SAS was unable to print the fatal condition that it encountered. Report this error to your SAS Support Consultant.

`%SAS-E-NOPGMCON, no program constants found for image` ***`image-name`***
Severity Level: fatal error
The named image contains invalid internal data. Report this error to your SAS Installation Representative.

`%SAS-F-ASNERR, error assigning files during CLI processing`
Severity Level: fatal error
If SAS encounters an error while assigning a logical name when parsing options, this message is printed, along with the name of the file that SAS was trying to assign. Correct the problem and perform the operation again.

`%SAS-F-ASNTERM, error assigning filename to terminal`
Severity Level: fatal error
SAS encountered an error while trying to connect to the terminal. An OpenVMS message follows this message and indicates the exact nature of the problem. Correct the problem and perform the operation again.

`%SAS-F-ASTERR, error establishing CTRL-C AST handler`
Severity Level: fatal error
SAS encountered an error while creating a handler for the CTRL-C attention sequence. The OpenVMS return code is printed along with this message. Correct the problem and perform the operation again.

`%SAS-F-AUTOEXECFNF, autoexec file` ***`file-specification`*** **`not found`**
Severity Level: fatal error
SAS could not find the autoexec file specified. Check the file specification in any AUTOEXEC= options that you have used. Also, check the file that is indicated by the SAS$INIT logical name. Make sure that you have access to the file.

`%SAS-F-BADOPTION, option syntax error in configuration file, SAS cannot initialize`
Severity Level: fatal error
SAS encountered a system option that was not valid in the configuration file. Check all options in the SAS command and in your configuration file for accuracy.

`%SAS-F-BADRANGE, value for` ***`option-name`*** **`host option is out of range`**
Severity Level: fatal error
A host system option with an integer value was assigned a value outside the valid range.

`%SAS-F-BADTRNLNM, Unable to translate logical name for` ***`logical-name`***
Severity Level: fatal error
An error occurred when SAS was translating the named logical name. This message is followed by an OpenVMS return code that indicates the exact nature of the problem. Correct the problem and perform the operation again.

`%SAS-F-BRGLOOP, transfer vector` ***`stub-name/image-name`*** **`not fixed`**
Severity Level: fatal error
An internal error occurred in SAS. Report this error to your SAS Support Consultant.

`%SAS-F-CALLREP, please contact your SAS Site Representative and report the following error:`
Severity Level: fatal error

This message is printed for all fatal errors encountered during a SAS session. Check for old or duplicate versions of the named image in your default directory and in the path that is defined by SAS$LIBRARY search list logical. Report this error to your SAS Installation Representative.

`%SAS-F-CLSERR, error closing configuration file` ***`file-specification`***
Severity Level: fatal error
An error occurred when SAS was closing the configuration file *file-specification*. Report this error to your SAS Support Consultant.

`%SAS-F-CONFIGOPEN, error opening` ***`file-level filename`***
Severity Level: fatal error
SAS encountered an error while trying to open a configuration file. *File-level* indicates whether the configuration file was at the process, group, system, or cluster level. *file-specification* is the full pathname for the file. Ensure that you spelled any configuration filenames correctly. Also, check with your system manager to ensure that you have privileges for the group- and system-level configuration files. Finally, check that the file that is pointed to by the OpenVMS logical name SAS$CONFIG exists.

`%SAS-F-CORRUPT, image` ***`image-name`*** **`is corrupt`**
Severity Level: fatal error
SAS detected an error in the named image while trying to load it. Report this error to your SAS Installation Representative.

`%SAS-F-DELETE, error deleting file` ***`file-specification`***
Severity Level: fatal error
An error occurred when SAS was deleting a file in the WORK subdirectory. For more information, see “The CLEANUP Tool” on page 132.

`%SAS-F-ERRCREWRK, error creating work library subdirectory` ***`directory-name`***
Severity Level: fatal error
An error occurred when SAS was creating the WORK subdirectory. An OpenVMS return code is printed to give you more information. Correct the problem and perform the operation again.

`%SAS-F-INTSASERR, A SAS error has occurred`
Severity Level: fatal error
This message is printed for all fatal errors that are encountered during a SAS session. Report this error and the full text of any error message that follows it to your SAS Support Consultant.

`%SAS-F-INVOPTVALUE, value for` ***`host-option`*** **`host option is invalid`**
Severity Level: fatal error
You specified an invalid value for the *host-option* option. For the valid values for the option, see Chapter 19, “System Options under OpenVMS,” on page 429. Specify a valid value and perform the operation again.

`%SAS-F-INVWRKLIB, work library specified contains invalid directory path`
Severity Level: fatal error
The directory path that was specified for the data library has invalid OpenVMS directory syntax. Correct the problem and perform the operation again.

`%SAS-F-LOADERR, error while loading image` ***`image-name`***
Severity Level: fatal error
SAS was unable to load the named image. This message is followed by an OpenVMS return code that indicates the exact nature of the problem. Correct the problem and perform the operation again.

%SAS-F-NOMEM, insufficient virtual memory
Severity Level: fatal error
Memory that is needed for the internal use of the SAS memory manager could not be allocated. This message is equivalent to the message %SAS-F-CLIMEM.

%SAS-F-NOMEM, SAS memory manager ran out of memory for internal use
Severity Level: fatal error
Memory that is needed for the internal use of the SAS memory manager could not be allocated. This message is equivalent to the message %SAS-F-CLIMEM.

%SAS-F-NOTPRNTQ, value for *option-name* specifies a queue that is not an output queue
Severity Level: fatal error
An invalid queue name was specified for the given option. Correct your program and resubmit it.

%SAS-F-NOWRKFILCRE, unable to create files in the work library subdirectory *directory-name*
Severity Level: fatal error
SAS was unable to create files in the WORK data library subdirectory. An OpenVMS message follows this message and indicates the exact nature of the problem. Correct the problem and perform the operation again.

%SAS-F-NOWRKFILDEL, unable to delete files in the work library subdirectory *directory-name*
Severity Level: fatal error
SAS was unable to delete files in the WORK data library subdirectory. An OpenVMS message follows this message and indicates the exact nature of the problem. Correct the problem and perform the operation again.

%SAS-F-OPENERR, unable to open image *image-name*
Severity Level: fatal error
SAS received an error while opening the named image to load it. This message is followed by an OpenVMS return code that indicates the exact nature of the problem. Correct the problem and perform the operation again.

%SAS-F-OPENIN, error opening *file-specification* as input
Severity Level: fatal error
An error occurred when SAS was opening one of several files: the configuration file, the input SAS file, or a device. An OpenVMS return code is printed after this message that indicates the exact nature of the problem. Correct the problem and perform the operation again.

%SAS-F-OPENTERM, error opening terminal device
Severity Level: fatal error
SAS encountered an error while trying to connect to the terminal. An OpenVMS message follows this message that indicates the exact nature of the problem. Correct the problem and perform the operation again.

%SAS-F-REAERR, Error reading configuration file *file-specification*
Severity Level: fatal error
An error occurred when SAS was reading the configuration file *file-specification*. Correct the problem and perform the operation again.

%SAS-I-ALTOPT, option *old-option* has been converted to *new-option*
Severity Level: informational
The option that was specified was converted to its new name under the current release of SAS.

%SAS-I-NOMSG, unable to retrieve resource thief messages

Severity Level: informational

SAS encountered an error while trying to read a message file. This error does not keep SAS from running, but if you encounter resource-critical situations (such as out-of-disk conditions), title messages will not appear. Report this error to your SAS Support Consultant.

%SAS-I-OBSOPT, ignoring obsolete option *option-name*

Severity Level: informational

The option that was specified was a valid option in an earlier version of SAS, but it is no longer valid and is ignored.

%SAS-W-ALTNOTPRNTQ, value for *option-name* specifies a queue that is not an output queue

Severity Level: warning

You specified an invalid queue name for the given option. Correct your program and resubmit it.

%SAS-W-INVNOLOG, interactive mode prohibits use of /NOLOG, qualifier ignored

Severity Level: warning

If you are entering SAS in interactive line mode, the NOLOG option is prohibited. This option is valid only in noninteractive and batch modes.

%SAS-W-NOLOGNAM, no logical name match

Severity Level: warning

You attempted to use an X command to deassign a logical name that does not exist.

%SAS-W-NOLOGTAB, no logical name table match

Severity Level: warning

You issued an ASSIGN or DEFINE command from the X command and specified a logical name table that does not exist.

%SAS-W-NOPRIV, no privilege for attempted operation

Severity Level: warning

You issued an ASSIGN or DEFINE command from the X command and attempted an operation for which your process does not have privilege.

%SAS-W-UNSUPPORTED, the qualifier *qualifier-name* is unsupported and will be ignored

Severity Level: warning

You specified a MOUNT command from the X command and specified a MOUNT qualifier that is not supported by the X command.

%SAS-W-X_NORC, unable to retrieve status from X command

Severity Level: warning

The X command status could not be retrieved from the subprocess.

The GOLD key is not supported in numeric mode

Severity Level: informational

In the SAS windowing environment, you cannot use the Gold key while in numeric mode. Turn numeric mode off with the APPLICATION command before you press the Gold key.

`Type LOGOFF to return to SAS`
Severity Level: informational
You entered one of the following forms of the X statement and spawned a subprocess:

- **`X '';`**
- **`X;`**

`Warning: CC option may be specified for print files only. Option ignored`
Severity Level: warning
You specified the CC= option for a nonprint file. This option is valid only for print files. Modify your SAS job accordingly.

`WARNING: low stack encountered for task` ***task-name***
Severity Level: warning
The task named has a stack size that is too small for the attempted job. You can use the STACK system option to modify the amount of stack space allocated for the job. Report this message to your SAS Support Consultant.

`X command submode not supported in batch`
Severity Level: informational
You used one of the following forms of the X statement in a SAS job that is running in batch mode:

- **`X '';`**
- **`X;`**

The X statement is not supported in batch mode.

TPU Interface Errors under OpenVMS

`Error creating Host Editor task`
Severity Level: error
An internal error occurred in SAS. Report this error to your SAS Support Consultant.

`Error executing Host Editor`
Severity Level: error
An internal error occurred in SAS. Report this error to your SAS Support Consultant.

`Error executing Host Editor initialization and/or command file`
Severity Level: error
Check the initialization and command file that you have defined for errors.

`Error initializing Host Editor section file`
Severity Level: error
The logical name SAS$SECTION points to the section file that is provided by SAS. If the logical name has been misassigned, you can reassign it. If the TPU file is bad, locate the problem and correct it.
If you redefined this logical name to point to your own file, then check that file for errors.

`The Host Editor is not available from this window`
Severity Level: informational
The TPU Editor can be invoked only from the Log, Output, and Program Editor windows.

Concurrency Engine Errors under OpenVMS

`ERROR: Creating files with concurrency engine requires version limit greater than one`
Severity Level: error
When a concurrency engine data set is created, there is a brief span of time when two versions of the file exist. If you can keep only one version of a file, you cannot use the concurrency engine. See your system manager for information about increasing your version limit.

`ERROR: Observation length greater than maximum length of 32,255 for concurrency engine`
Severity Level: error
Observations in a concurrency engine data set cannot be greater than 32,255 bytes (32K) because of the restrictions of the RMS relative file format. Correct your program and resubmit it.

`ERROR: Node specification not allowed with concurrency engine for update access`
Severity Level: error
The concurrency engine does not support update access on a remote node. Note that the concurrency engine allows a node specification in the LIBNAME statement (that is, it allows DECnet access) when the data set is opened for input or output, but not for update.

`ERROR: Requested function not performed because there is no current record on (`*`libref-datasetname`*`). Probably the last read failed.`
Severity Level: error
This is a limitation of the CONCUR engine. An attempt to update an observation in a CONCUR data set with the MODIFY statement fails when an earlier observation in the same data set is locked by another process.

APPENDIX 2

The SAS$ROOT Directory

Introduction to the SAS$ROOT Directory

When SAS is installed, its entire directory structure is placed on a in a subdirectory in your file system. This subdirectory, which forms the root of SAS, is called the SAS$ROOT directory.

Contents of the SAS$ROOT Directory

The SAS$ROOT directory contains the files required to use SAS. This directory includes invocation points, configuration files, sample programs, catalogs, data sets, and executable files. You do not need to know the organization of these directories to use SAS.

The following tables list the files and directories that are found in the SAS$ROOT directory:

Table A2.1 SAS Files in the SAS$ROOT Directory

SAS File	Description of Contents
SASSETUP.COM	is the invocation point for SAS Setup, the installation program for SAS.
SASV9.CFG	is the system configuration file for SAS.
SETINIT.SAS	is the SAS program used for updating licensing information.

Table A2.2 SAS Directories in the SAS$ROOT Directory

SAS Directory	Description of Contents
GISMAPS	contains Census Tract maps for SAS/GIS software.
HELP	contains the SAS help files, data sets, and catalogs.

SAS Directory	Description of Contents
INSTALL	contains configuration information about the current SAS installation. Do not remove or change the contents of this directory. Removing this directory will result in incorrect behavior for future sessions of the SAS Setup program and inhibit SAS Technical Support's ability to diagnose any problems that might arise.
MAPS	contains the map data sets if you have SAS/GRAPH or SAS/GIS software. You receive some maps with SAS/GRAPH software. Additional maps are available in the SAS Map Data Library Series.
MESSAGE	contains the SAS message files.
MISC	contains subdirectories with miscellaneous product files, such as applets, fonts, and scripts.
NLS	contains subdirectories for national language support. For example, the EN directory contains English versions of SAS files.
SAMPLES	contains subdirectories for different SAS products. Each subdirectory contains sample SAS programs, but subdirectories are not created unless the samples are installed. Since the installation procedure lets the system administrator decide whether to copy the sample programs, this directory might be empty.
SASAUTOS	contains predefined SAS macros. See "Autocall Libraries under OpenVMS" on page 520.
SASCFG	contains miscellaneous configuration files.
SASEXE	contains SAS executable images.
SASTEST	contains files that are used by the Feature Testing Tool.
TOOLS	contains startup command procedures, configuration programs, and support files.
USER	contains user-written functions and procedures.
X11	contains the subdirectories with the files needed for the X Window system.

APPENDIX 3

Recommended Reading

Recommended Reading

Here is the recommended reading list for this title:

- □ *SAS Language Reference: Concepts*
- □ *SAS Language Reference: Dictionary*
- □ *Base SAS Procedures Guide*
- □ *SAS Macro Language: Reference*
- □ *SAS National Language Support (NLS): User's Guide*

For a complete list of SAS publications, see the current *SAS Publishing Catalog*. To order the most current publications or to receive a free copy of the catalog, contact a SAS representative at

SAS Publishing Sales
SAS Campus Drive
Cary, NC 27513
Telephone: (800) 727-3228*
Fax: (919) 677-8166
E-mail: **`sasbook@sas.com`**
Web address: **`support.sas.com/publishing`**
* For other SAS Institute business, call (919) 677-8000.

Customers outside the United States should contact their local SAS office.

Glossary

ACL
See access control list.

active window
a window that is open and displayed, and to which keyboard input is directed. Only one window can be active at a time.

aggregate syntax
a convenient way of referring to individual files in a single directory or folder. Instead of assigning a unique fileref to each file, you assign a fileref to the directory or folder. Then, to refer to a specific file in that folder, you enclose the filename in parentheses following the fileref. In the OpenVMS operating environment, aggregate syntax is used in the FILE, INFILE, and %INCLUDE statements.

American Standard Code for Information Interchange
See ASCII.

application workspace (AWS)
(1) a window that contains other windows (child windows) or from which other windows can be invoked, but which is not contained within any parent window that is part of the same software application. (2) under OpenVMS, an application from which you can interact with the DECwindows window manager. See also child window.

ASCII (American Standard Code for Information Interchange)
a 7-bit character coding scheme (8 bits when a parity check bit is included) that includes both graphic (printable) codes and control (nonprintable) codes.

ASCII collating sequence
an ordering of characters that follows the order of the characters in the American Standard Code for Information Interchange (ASCII) character coding scheme. SAS uses the same collating sequence as its host operating environment. See also EBCDIC collating sequence.

autoexec file
a file that contains SAS statements that are executed automatically when SAS is invoked. The autoexec file can be used to specify some of the SAS system options, as well as to assign librefs and filerefs to data sources that are used frequently. See also libref, fileref.

batch file
a file that contains operating-system commands, which are processed sequentially when the file is executed.

batch mode
a method of executing SAS programs in which a file that contains SAS statements plus any necessary operating environment commands is submitted to the computer's batch queue. After you submit the program, control returns to your terminal or workstation, where you can perform other tasks. Batch mode is sometimes referred to as running in the background. The program output can be written to files or printed on an output device. Under OpenVMS, a Status window that is associated with the SAS job indicates which SAS job is running and tells you which device or files the log file and the procedure output file will be routed to.

buffer
an area of computer memory that is reserved for use in performing input/output (I/O) operations.

button
a component of a graphical user interface. A button is usually in the form of a rectangle or square that contains a label. The button is programmed to execute a command, to open a window, or to perform some other function when a user selects it. For example, many graphical user interfaces include buttons that have labels such as OK, Cancel, and Help.

captive account
a type of OpenVMS account that limits the user to the commands that are listed in the LOGIN.COM file.

carriage-control character
a specific symbol that tells the printer how many lines to advance the paper, when to begin a new page, when to skip a line, and when to hold the current line for overprinting.

catalog
See SAS catalog.

catalog entry
See SAS catalog entry.

child window
a window that is invoked from or contained in another window (the parent window).

client
(1) a computer or application that requests services, data, or other resources from a server. (2) in DECwindows, a requestor of visual services. For example, SAS is a client because it requests windows to be created, results to be displayed, and so on. See also server.

command file
Under OpenVMS, command files usually have a .COM file extension.

command procedure
an OpenVMS file that contains DCL commands, which are processed sequentially when the file is executed. The file extension for command procedures is .com.

command prompt
Under OpenVMS, the default command prompt is $.

converting SAS files
the process of changing the format of a SAS file from the format that is appropriate for one version of SAS to the format that is appropriate for another version in the same operating environment.

CPU
See central processing unit (CPU).

current directory
the directory that you are working in at any given time. When you log on, your current directory is the starting point for relative pathnames. See also working directory.

DCL (Digital Command Language)
the command language that is used in the OpenVMS operating environment.

DECwindows
a windowing interface that is based on the X Window System.

DECwindows Session Manager
a facility that provides desktop administrative services and utility services in the workstation environment, such as default color settings, default window characteristics, foreign language support, and display capture and printing.

DECwindows window manager
a facility that oversees the placement, sizing, and stacking of windows, their appearance (title bar and so on), and the keyboard input in the DECwindows interface to SAS.

default directory
the directory that you are working in at any given time. When you log in, your default directory is usually your home directory.

descriptor information
information about the contents and attributes of a SAS data set. For example, the descriptor information includes the data types and lengths of the variables, as well as which engine was used to create the data. SAS creates and maintains descriptor information within every SAS data set.

dialog box
a type of window that opens to prompt you for additional information or to ask you to confirm a request.

directory
a named subdivision on a disk or diskette, used in organizing files. A directory also contains information about the file, such as size and date of last change.

download
to copy a file from a remote host to a local host.

drag
to press and hold a mouse button while moving the mouse.

dummy variable
in some statistical applications, a numeric variable whose value is limited to 1 or 0.

engine
a component of SAS software that reads from or writes to a file. Each engine enables SAS to access files that are in a particular format. There are several types of engines. See also interface engine, library engine, native engine, view engine.

engine/host option
an option that is specified in a LIBNAME statement. Engine/host options specify attributes that apply to all SAS data sets in a SAS data library. See also data set option.

entry type
a characteristic of a SAS catalog entry that identifies the catalog entry's structure and attributes to SAS. When you create an entry, SAS automatically assigns the entry type as part of the name.

external file
a file that is created and maintained by a host operating system or by another vendor's software application. SAS can read data from and route output to external files. External files can contain raw data, SAS programming statements, procedure output, or output that was created by the PUT statement. An external file is not a SAS data set. See also fileref.

file extension
the classification of a file in a directory that identifies what type of information is stored in the file. For example, .SCAT is the file extension for SAS catalogs. See also member type.

file type
the classification of a file in an OpenVMS directory that identifies what type of information is stored in the file. For example, SASEB$CATALOG is the file type for SAS catalogs. See also member type.

filename
under DOS, the identifier used for a file (including the file extension), such as PROFILE.SC2. See also fully qualified filename, pathname.

fileref
a name that is temporarily assigned to an external file or to an aggregate storage location such as a directory or folder. The fileref identifies the file or the storage location to SAS. Under OpenVMS, you can assign a fileref with a FILENAME statement, with the SET system option, or from the New File Shortcut dialog box in the SAS Explorer window. See also OpenVMS logical name.

font
a complete set of all the characters of the same design and style. The characters in a font can be figures or symbols as well as alphanumeric characters. See also type style.

fully qualified name
an OpenVMS filename that specifies how the file fits into the file structure. A fully qualified name contains specifications for node, device, directory, filename, file type, and version. VMSMB::MUAO:[MYDIR] MYFILE.SAS;3 is an example of a fully qualified name.

function key
a keyboard key that can be defined to have a specific action in a specific software environment. For example, Keypad 3 is defined as PASTE in the PROGRAM EDITOR window, but in the context of the FSEDIT procedure, Keypad 3 is defined as DUP. See also hard key.

gravity
See session gravity.

hard key
a keyboard key that performs a specific action, regardless of the software environment. For example, the RETURN and BACKSPACE keys are hard keys. See also function key.

home directory
under OpenVMS and UNIX operating systems, the directory in which a user is placed after logging in. The home directory is also called the login directory.

icon
in windowing environments, a pictorial representation of an object. An icon usually represents a window or an object associated with an action such as printing or filing.

index
in SAS software, a component of a SAS data set that enables SAS to access observations in the SAS data set quickly and efficiently. The purpose of SAS indexes is to optimize WHERE-clause processing and to facilitate BY-group processing.

interactive line mode
a method of running SAS programs in which you enter one line of a SAS program at a time at the SAS session prompt. SAS processes each line immediately after you press the ENTER or RETURN key. Procedure output and informative messages are returned directly to your display device.

interface engine
a SAS engine that reads and writes file formats supported by other vendors' software. See also engine, native engine.

library engine
an engine that accesses groups of files and puts them into the correct form for processing by SAS utility windows and procedures. A library engine also determines the fundamental processing characteristics of the library, presents lists of files for the library directory, and supports view engines. See also engine, view engine.

libref
a name that is temporarily associated with a SAS data library. The complete name of a SAS file consists of two words, separated by a period. The libref, which is the first word, indicates the library. The second word is the name of the specific SAS file. For example, in VLIB.NEWBDAY, the libref VLIB tells SAS which library contains the file NEWBDAY. You assign a libref with a LIBNAME statement or with an operating system command. See also first-level name.

listing file
an obsolete term that refers to the procedure output file. Do not use this term. See SAS procedure output file, print file.

local node
the computer that you are currently logged in to.

logical name
under OpenVMS, an equivalence string that is created with the DEFINE command or with the ASSIGN command. Logical names are associated with file specifications, device names, or other logical names. Logical names can be used on the command line, in command files, or in programs. Logical names are stored in the logical name table.

logical name table
a table that contains each logical name and the equivalence string that is associated with each logical name. See also logical name.

login directory
See home directory.

login file
the file that contains the DCL commands and utilities that are commonly used at your site. When you log in, OpenVMS automatically executes the commands in this

file. Under OpenVMS, the login file is called LOGIN.COM and is located in your home directory.

MEA
See Multi-Engine Architecture (MEA).

member
(1) a SAS file in a SAS library. (2) under OpenVMS, a component of an OpenVMS text library.

member name
a name that is assigned to a SAS file in a SAS library. Under OpenVMS, the member name is the same as the filename for files that are stored in a SAS data library.

member type
a SAS name that identifies the type of information that is stored in a SAS file. Member types include ACCESS, DATA, CATALOG, ITEMSTOR, MDDB, PROGRAM, and VIEW.

menu bar
the primary list of items at the top of a window which represent the actions or classes of actions that can be executed. Selecting an item executes an action, opens a pull-down menu, or opens a dialog box that requests additional information. See also pop-up menu, pull-down menu.

methods of running SAS
standard methods of operation used to run SAS programs. These methods are SAS/ASSIST software, interactive line mode, noninteractive mode, and batch mode.

Multiple Engine Architecture (MEA)
a feature of SAS that enables it to access a variety of file formats through sets of instructions called engines. See also engine.

native engine
an engine that accesses forms of SAS files created and processed only by SAS. See also engine.

network
an interconnected group of computers.

node
a computer on a network.

noninteractive mode
a method of running SAS programs in which you prepare a file of SAS statements and submit the program to the operating system. The program runs immediately and occupies your current session.

ODS-5 syntax
a file-naming convention that was introduced by Compaq Computer Corporation for OpenVMS Release 7.2. ODS-5 syntax allows longer filenames, supports more legal characters within filenames, preserves case within a filename, and supports deeper directory structures. This syntax is supported only on volumes for which ODS-5 has been enabled.

page size
the number of bytes of data that SAS moves between external storage and memory in one input/output operation. Page size is analogous to buffer size for SAS data sets.

path
the route through a hierarchical file system that leads to a particular file or directory.

/
PDS
See partitioned data set (PDS).

permanent SAS data library
a SAS library that is not deleted when a SAS session ends, and which is therefore available to subsequent SAS sessions. Unless the USER libref is defined, you use a two-level name to access a file in a permanent library. The first-level name is the libref, and the second-level name is the member name.

physical filename
the name the operating system uses to identify a file.

PMENU facility
a menuing system in SAS that is used instead of the command line as a way to execute commands. The PMENU facility consists of a menu bar, pull-down menus, and dialog boxes.

primary windows
in the SAS windowing environment, the PROGRAM EDITOR, LOG, OUTPUT (LISTING), and OUTPUT MANAGER windows.

print file
an external file containing carriage-control (printer-control) information. See also carriage-control character, external file.

procedure output file
an external file that contains the result of the analysis or the report produced. Most procedures write output to the procedure output file by default. Reports that DATA steps produce using PUT statements and a FILE statement with the PRINT destination also go to this file.

random access
the ability to retrieve records in a file without reading all records sequentially.

Record Management Services (RMS)
a group of OpenVMS procedures that applications use for processing files as well as records within files.

remote node
any computer on a network other than the computer that you are currently logged in to.

resource
in system performance, a part of the computer system, such as memory or CPU time.

resource file
See X resource file.

return code
a code passed to the operating system that indicates whether a command or job step has executed successfully.

RMS
See Record Management Services (RMS).

SAS catalog
a SAS file that stores many different kinds of information in smaller units called catalog entries. A single SAS catalog can contain several different types of catalog entries. See also SAS catalog entry.

SAS catalog entry
a separate storage unit within a SAS catalog. Each entry has an entry type that identifies its purpose to SAS. Some catalog entries contain system information such as key definitions. Other catalog entries contain application information such as window definitions, Help windows, formats, informats, macros, or graphics output. See also entry type.

SAS command
a command that invokes SAS. This command may vary depending on operating environment and site. See also SAS invocation.

SAS data file
a SAS data set that contains data values as well as descriptor information that is associated with the data. The descriptor information includes information such as the data types and lengths of the variables, as well as which engine was used to create the data. SAS data files are of member type DATA. See also SAS data set, SAS data view.

SAS data library
a collection of one or more SAS files that are recognized by SAS and which are referenced and stored as a unit. Each file is a member of the library.

SAS data set
a file whose contents are in one of the native SAS file formats. There are two types of SAS data sets: SAS data files and SAS data views. SAS data files contain data values in addition to descriptor information that is associated with the data. SAS data views contain only the descriptor information plus other information that is required for retrieving data values from other SAS data sets or from files whose contents are in other software vendors' file formats. See also descriptor information.

SAS data set option
an option that appears in parentheses after a SAS data set name. Data set options specify actions that apply only to the processing of that SAS data set. See also engine/host option, SAS system option.

SAS data view
a type of SAS data set that retrieves data values from other files. A SAS data view contains only descriptor information such as the data types and lengths of the variables (columns), plus other information that is required for retrieving data values from other SAS data sets or from files that are stored in other software vendors' file formats. SAS data views are of member type VIEW.

SAS file
a specially structured file that is created, organized, and, optionally, maintained by SAS. A SAS file can be a SAS data set, a catalog, a stored program, or an access descriptor.

SAS initialization
the setting of global characteristics that must be in place at start-up for a SAS programming environment. SAS performs initialization by setting certain SAS system options called initialization options. Invoking SAS software initiates SAS initialization. See also SAS invocation.

SAS invocation
the process of calling or starting up SAS software by an individual user through execution of the SAS command. Invoking SAS initiates SAS initialization. See also SAS initialization.

SAS log
a file that contains a record of the SAS statements that you enter as well as messages about the execution of your program.

SAS system option
an option that affects the processing of an entire SAS program or interactive SAS session from the time the option is specified until it is changed. Examples of items that are controlled by SAS system options include the appearance of SAS output, the handling of some files that are used by SAS, the use of system variables, the processing of observations in SAS data sets, features of SAS initialization, and the way SAS interacts with your host operating environment.

SAS windowing environment
an interactive windowing interface to SAS software. In this environment you can issue commands by typing them on the command line, by pressing function keys, or by selecting items from menus or menu bars. Within one session, you can perform many different tasks, including preparing and submitting programs, viewing and printing results, and debugging and resubmitting programs.

SASHELP library
a SAS data library supplied by SAS software that stores the text for HELP windows, default function-key definitions and window definitions, and menus.

SASUSER library
a default, permanent SAS data library that is created at the beginning of your first SAS session. The SASUSER library contains a PROFILE catalog that stores the customized features or settings that you specify for SAS. You can also store other SAS files in this library. See also PROFILE catalog, SAS data library.

SASUSER.PROFILE catalog
a SAS catalog in which SAS stores information about attributes of your SAS windowing environment. For example, this catalog contains function-key definitions, fonts for graphics applications, window attributes, and other information that is used by interactive SAS procedures.

sequential access
a method of file access in which the records are read or written one after the other from the beginning of the file to the end.

server
(1) in a network, a computer that is reserved for servicing other computers in the network. Servers can provide several different types of services, such as file services and communication services. Servers can also enable users to access shared resources such as disks, data, and modems. (2) in DECwindows, a provider of visual services. A server is capable of being shared between, and providing services to, several clients at one time. See also client.

session gravity
in the X Window interface and the DECwindows interface to SAS, the resource that controls the region of the workstation display in which SAS attempts to place its windows.

session ID
a number from 1 to 99 that appears in the window title bar of each SAS window when using the DECwindows interface to SAS. The session ID enables you to differentiate between SAS windows when running multiple SAS sessions.

session workspace
in the X Window interface to SAS, a component that defines a rectangular region that represents a virtual screen in which SAS windows are initially created and

constrained. By default, SAS windows are placed in this workspace area relative to the upper-left corner of the rectangular region.

site number
the number that SAS uses to identify the company or organization to which SAS software is licensed. The site number appears near the top of the log in every SAS session.

subprocess
a process that is started within another process. If you terminate the initial process, then the subprocess will also end.

swapping
the action of moving segments from memory to disk and vice versa.

system option
See SAS system option.

temporary SAS data library
a library that exists only for the current SAS session or job. The most common temporary library is the WORK library. See also WORK data library.

Text Processing Utility (TPU) editor
a native VAX editor that you can access with SAS.

toggle
an option, parameter, or other mechanism that enables you to turn on or turn off a processing feature.

Toolbox
a feature of SAS that enables you to associate an icon with any SAS command or macro. Selecting the icon executes its associated command or string of commands.

UAF
See user authorization file (UAF).

UIC
See user identification code (UIC).

Universal Printing
a feature of SAS software that enables you to send SAS output to PDF, Postscript, and PCL files, as well as directly to printers. The Universal Printing system also provides many options that enable you to customize your output, and it is available in all of the operating environments that SAS supports.

upload
to copy a file from the local host to the remote host.

user authorization file (UAF)
a file that contains the user ID, password, default disk, default directory, and user identification code for each user on the system. OpenVMS accesses this file during the login procedure to verify your user ID, password, and directory permissions. See also user identification code (UIC).

USER data library
a SAS data library to which the libref USER has been assigned. When the libref USER is defined, SAS uses it as the default libref for one-level names.

user identification code (UIC)
a numeric code that specifies what type of access privileges an OpenVMS user has. Each UIC consists of a member identifier and can include a group identifier. The UIC is stored in the user authorization file. See also user authorization file (UAF).

view engine
an engine that enables SAS to process SAS data views. A view engine performs in a transparent manner. See also SAS data view.

window session ID
See session ID.

WORK data library
a SAS data library that is automatically defined by SAS at the beginning of each SAS session or SAS job. The WORK library contains SAS files that are temporary by default. When the libref USER is not defined, SAS uses WORK as the default library for SAS files that are created with one-level names.

working directory
the directory in which a software application is stored. When the application is started, the working directory becomes the current directory unless you specify a different current directory. Therefore, the working directory for a SAS session is usually the directory from which you invoked SAS.

X resource file
in the X Window System, a file that stores attribute specifications for the windowing environment, such as color, gravity, font types and sizes, and window sizes.

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Your Turn

If you have comments or suggestions about *SAS® 9.1 Companion for OpenVMS Alpha*, please send them to us on a photocopy of this page, or send us electronic mail.

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