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Syntax Conventions for the SAS Language

Overview of Syntax Conventions for the SAS Language

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

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

Syntax Components

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

Keyword

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

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

- **CHAR** *(string, position)*
- **CALL RANBIN** *(seed, n, p, x)*;
- **ALTER** *(alter-password)*
- **BEST** *w.*
- **REMOVE** *<data-set-name>*

In this example, the first two words of the CALL routine are the keywords:
CALL RANBIN(seed, n, p, x)

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

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

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

DUPLEX | NODUPLEX

Some procedure statements have multiple keywords throughout the statement syntax:

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

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

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

CHAR (string, position)

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

x=char('summer', 4);

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

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

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

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

MISSING character(s);

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

The BY statement is an example of this argument:

BY <DESCENDING> variable-1 <<DESCENDING> variable-2 ...>;
option. The ellipsis (…) indicates that additional arguments with an associated option are allowed.

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

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

argument-1=value-1 <argument-2=value-2 ...>

specifies that the argument must be assigned a value and that you can specify multiple arguments. The ellipsis (…) indicates that additional arguments are allowed. No punctuation is required between arguments.

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

```
LABEL variable-1=label-1 <variable-2=label-2 ...;)
```

argument-1, argument-2, ...

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

Here are examples of this form of multiple arguments:

```
AUTHPROVIDERDOMAIN (provider-1:domain-1 <, provider-2:domain-2, ...>
INTO :macro-variable-specification-1 <, :macro-variable-specification-2, ...>
```

Note: In most cases, example code in SAS documentation is written in lowercase with a monospace font. You can use uppercase, lowercase, or mixed case in the code that you write.
nonliteral arguments. In this example of the LINK statement, the argument
*label* is a user-supplied value and therefore appears in italic:

```
LINK label;
```

nonliteral values that are assigned to an argument.

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

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

Special Characters

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

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

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

```
MAPS=location-of-maps
```

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

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

```
CAT (item-1 <, item-2, …>)
```

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

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

```
CMPMODEL=BOTH | CATALOG | XML
```

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

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

```
CAT (item-1 <, item-2, …>)
```

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

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

```
FOOTNOTE <n> <ods-format-options 'text' | "text">;
```
a semicolon indicates the end of a statement or CALL routine.

In this example, each statement ends with a semicolon:

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

References to SAS Libraries and External Files

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

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

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

infile file-specification obs = 100;
libname libref 'SAS-library';
Syntax Conventions for the SAS Language
What’s New in SAS 9.4 Global Statements

Overview

This document supports global statements for SAS 9.4 and SAS Viya. A highlighted, abbreviated notation of the SAS version and maintenance release specifies when a feature was added to SAS. For example, SAS 9.4M5 indicates that a feature was added during the fifth maintenance release of SAS 9.4.

These are the new SAS Viya 3.5 features, designated using the notation SAS Viya 3.5:

- The FILENAME statement Azure access method enables access to data in Microsoft Azure Data Lake Storage.
- The FILENAME statement S3 access method enables access to data in Amazon S3 files.

These are the new SAS Viya 3.4 features, designated using the notation SAS Viya 3.4:

- The LIBNAME statement now supports the LIBRARYDEFINITION option.
- The JSON LIBNAME statement now supports a NOALLDATA option.
- The LOCKDOWN statement for SAS Viya has moved to SAS Viya Administration: Programming Run-Time Servers. For more information, see SAS Viya LOCKDOWN Statement.

For information about LOCKDOWN on SAS 9.4, see SAS 9.4 LOCKDOWN Statement.

Support for the FILENAME statement, FILESRVC access method is new for SAS Viya 3.3.

Beginning with SAS 9.4M5, DATA step statements are available in the new SAS DATA Step Statements: Reference.

These are the new and enhanced features for SAS 9.4M5:

- The FILENAME statement, ZIP access method supports the GZIP option to specify an external GZIP file.
- The FILENAME statement, EMAIL (SMTP) access method now supports attaching more than one file using multiple !EM_ATTACH! directives.
- The JSON LIBNAME statement now supports an ALLDATA="name" option.
These are the new and enhanced features for **SAS 9.4M4**:

- The `FILENAME` statement, `EMAIL (SMTP)` access method supports the `SENSITIVITY=` option to specify the sensitivity of an email message.
- The default behavior of the `CFG=` option has changed for the `FILENAME` statement, Hadoop access method. If `CFG=` is not provided, the `SAS_HADOOP_CONFIG_PATH` and `SAS_HADOOP_JAR_PATH` environment variables are scanned for the location of the required configuration files.
- The `FILENAME` statement, Hadoop access method supports Knox security.
- The `JSON LIBNAME` statement enables you to associate a libref with a JSON document.
- The `CVP LIBNAME` statement enables you to associate a libref with the character variable padding (CVP) engine.

These are the new and enhanced features for **SAS 9.4M3**:

- The `FILENAME` statement, Hadoop access method now supports the `SAS_HADOOP_CONFIG_PATH` environment variable.
- Wildcards (*) are now supported in the `FILENAME` statement, ZIP access method’s `MEMBER=` syntax for reading or checking the existence of entries in the ZIP file.
- For the `FILENAME` statement, ZIP access method, a new option, `NAMEENCODING=`, enables you to specify an encoding for ZIP file entry names and comments that is different from the current session encoding.

These are the new and enhanced features for **SAS 9.4**:

- read data from user-specified text and to access ZIP files
- specify the name of an authentication domain metadata object in order to connect to the WebDAV server, delete a directory and all of its members, and create a new directory off the parent directory when using the WebDAV access method
- automatically create SAS data files with an enhanced file format that extends the observation count beyond the 32-bit long limitation
- specify whether SAS creates compressed data sets whose observations can be randomly accessed or sequentially accessed
- specify an `Accept:` header and create a connection between the client and the proxy and between the proxy and the server when accessing a URL through a proxy when using the URL access method
- transfer data in image (binary) mode when using the SFTP access method
- control whether your SAS client has access to a set of directories and files
- embed attachments in an email using HTML. In addition, you can now specify a `message/rfc822` content type.
- submit HDFS commands through WebHDFS
- open an AES (Advanced Encryption Standard) encrypted SAS data file
New SAS Statements

These SAS statements are new:

FILENAME Statement: Azure Access Method
enables you to access data in Microsoft Azure Data Lake Storage.

FILENAME Statement: S3 Access Method
enables you to access objects in the Simple Storage Service (S3) of Amazon Web Services (AWS).

FILENAME, FILESRVC Access Method
enables you to store and access files within the SAS Viya file service.

FILENAME, DATAURL Access Method
enables you to read data from user-specified text.

FILENAME, ZIP Access Method
enables you to access ZIP files.

LIBNAME, JSON Engine
associates a libref with a JSON data table and enables you to read JSON data tables.

LIBNAME, CVP Engine
associates a libref with the character variable padding (CVP) engine to expand character variable lengths so that character data truncation does not occur when a file requires transcoding.

Enhanced SAS Statements

These SAS statements have been enhanced:

FILENAME, EMAIL (SMTP) Access Method
- In SAS 9.4M5, you can attach more than one file to an email using multiple !EM_ATTACH! directives.
- In SAS 9.4M4, you can set an email sensitivity flag on emails that originate from SAS.
- In SAS 9.4M2, you can embed attachments in an email using HTML. In addition, you can now specify a message/rfc822 content type.
- The default time-out that the EMAIL access method waits for the SMTP server to respond is 30 seconds. Some SMTP servers require more time before they send an acknowledgment to a command from the client. You can use the new EMAILACKWAIT= system option to specify the wait time.
- You can use the EMAIL access method with secure SMTP servers by specifying either the new SSL or TLS protocol options in the EMAILHOST system option. TLS and SSL encrypt data between the client and the outgoing SMTP Server. This encryption does not guarantee an encrypted
connection between the client (sender) and the recipient of the message. Message-level encryption and digital signing are currently not supported.

FILENAME, FTP Access Method
In SAS 9.4M3, the following enhancements were made:

- Filenames can contain UTF-8 characters. Only hosts whose FTP servers support the OPTS UTF8 ON or OPTS UTF-8 ON FTP protocol commands can read these filenames.
- The FTP access method now supports Secure FTP by using Transport Layer Security (TLS). Three new statement options, AUTHTLS, PBSZ=, and PROT=, enable you to issue the FTP AUTH TLS command, specify the FTP Data Channel Protection Buffer Size, and specify the FTP Data Channel security command, respectively. A new environment variable, SAS_FTP_AUTHTLS, lets you specify how TLS authentication is enabled.

FILENAME, Hadoop Access Method
- In SAS 9.4M4, the default behavior of the FILENAME statement, Hadoop access method CFG= option has changed. If CFG= is not provided, the SAS_HADOOP_CONFIG_PATH and SAS_HADOOP_JAR_PATH environment variables are scanned for the location of the required configuration files. In addition, Knox security is now supported.
- In SAS 9.4M3, the Hadoop access method now supports the SAS_HADOOP_CONFIG_PATH environment variable. You no longer have to merge properties from multiple Hadoop configuration files into a single configuration file and specify the CFG= option. In addition, the Hadoop CONCAT= and DIR= options are now mutually exclusive because the SAS_HADOOP_CONFIG_PATH environment variable is available.
- In SAS 9.4M2, you can now submit HDFS commands through WebHDFS. The new SAS environment variable SAS_HADOOP_RESTFUL must be defined and set to the value 1. In addition, the Hadoop configuration file must include the properties for the WebHDFS location.
- A new option, NEW, is used in output mode in conjunction with the DIR option to create the directory that is specified in the FILENAME Hadoop statement.

FILENAME, SFTP Access Method
- Stream-record format has been added to the RECFM= option. Data is transferred in image (binary) mode. The amount of data that is read is controlled by the current LRECL value or by the value of the NBYTE= variable in the INFILE statement.
- A new option, OPTIONSX, enable you to submit private keys and passphrases that are blotted in the SAS log. Private keys and passphrases are necessary when you submit code that contains a FILENAME SFTP statement from SAS Enterprise Guide that runs on a Windows workspace server and authentication is required.

FILENAME, URL Access Method
- A new option, ACCEPT, specifies an Accept: header.
- A new option, CONNECT, creates a connection between the client and the proxy and between the proxy and the server when accessing a URL through a proxy.

FILENAME, WebDAV Access Method
- A new option, AUTHDOMAIN, specifies the name of an authentication domain metadata object in order to connect to the WebDAV server. The
authentication domain references credentials (user ID and password) without your having to explicitly specify the credentials.

- A new option, DEL_ALL, enables you to delete a directory and all of its members.
- A new option, MKDIR, specifies a new directory that is created off the parent directory that was specified in the external file option.

FILENAME, ZIP Access Method

In SAS 9.4M5, you can use the GZIP option to specify an external GZIP file.

In SAS 9.4M3, the following enhancements were made:

- A new option, NAMEENCODING=, enables you to specify an encoding for ZIP file entry names and comments that is different from the current session encoding.
- Wildcards (*) are now supported in the MEMBER= syntax for reading or checking the existence of entries in the ZIP file.

LIBNAME

- In SAS Viya 3.4, a new library definition option, LIBRARYDEFINITION, specifies to generate and execute the LIBNAME statement using predefined option name/value pairs stored by the Data Sources microservice.
- The EXTENDOBSNUMBER= option is now set to YES by default, which creates SAS data files with an enhanced file format. The enhanced file format extends the observation count beyond the 32-bit-long limitation.
- A new option, POINTOBS, specifies whether SAS creates compressed data sets whose observations can be randomly accessed or sequentially accessed.

LOCK

- A new option, NOMSG, disables error and warning messages to the SAS log.

SASFILE

- The new option ENCRYPTKEY= enables the SASFILE statement to open an AES (Advanced Encryption Standard) encrypted SAS data file.

Locked-Down State Restrictions

The LOCKDOWN statement and LOCKDOWN system option are new in SAS 9.4M1. With LOCKDOWN, if you are running in a client/server environment (for example, you use SAS Enterprise Guide), the SAS server administrator can create an environment where your SAS client has access to a set of directories and files. All other directories and files would be inaccessible. In addition to there being restrictions on directories and files, several language elements are not available when SAS is in a locked-down state.

In SAS 9.4M2, the following FILENAME statement access methods are not available when SAS is in a locked-down state:

- EMAIL (SMTP)
- FTP
- Hadoop
However, your server administrator can re-enable the access method so that it is accessible in the locked-down state. When the Hadoop and URL access methods are in a locked-down state, the HADOOP, HTTP, and SOAP procedures are also placed in a locked-down state. If the Hadoop or URL access method is re-enabled, the HADOOP, HTTP, and SOAP procedures are automatically re-enabled.

For more information, see “SAS Processing Restrictions for Servers in a Locked-Down State” in SAS Language Reference: Concepts.
Definition of Global Statements

A SAS global statement is a string of SAS keywords, SAS names, special characters, and operators that instructs SAS to perform an operation or that gives information to SAS. Each SAS global statement ends with a semicolon and can be used anywhere in a SAS program.

Using Global Statements

Global statements generally provide information to SAS, request information or data, move between different modes of execution, or set values for system options. Other global statements (ODS statements) deliver output in a variety of formats, such as in Hypertext Markup Language (HTML). You can use global statements anywhere in a SAS program. However, global statements are not supported on the CAS server. Global statements are not executable; they take effect as soon as SAS compiles program statements.

Global statements can be divided into functional categories. For a list of global statements by category, see "Global Statements by Category" on page 4.

Other SAS software products have additional statements that are used with those products. For more information, see "Other Statement Documentation" on page 1.

Other Statement Documentation

In addition to the statements documented in SAS Global Statements: Reference, statements are also documented in these publications:
Chapter 1 / About SAS Global Statements

- SAS DATA Step Statements: Reference
- Base SAS Procedures Guide
- SAS Cloud Analytic Services: User’s Guide
- SAS Viya Administration: Programming Run-Time Servers
- SAS Companion for Windows
- SAS Companion for UNIX Environments
- SAS Companion for z/OS
- SAS Language Interfaces to Metadata
- SAS Macro Language: Reference
- SAS Scalable Performance Data Engine: Reference
- SAS XMLV2 and XML LIBNAME Engines: User’s Guide
- SAS/ACCESS for Relational Databases: Reference
- SAS/CONNECT User’s Guide
- SAS/SHARE User’s Guide
- Application Messaging with SAS
- SAS DS2 Language Reference
- SAS FedSQL Language Reference
Dictionary of SAS Global Statements

Global Statements by Category

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Global Statements by Category

This table lists and describes SAS global statements, organized by function into these categories:

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<td>Allows access to the host operating environment.</td>
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<td>Data Access</td>
<td>Associates reference names with SAS libraries, SAS catalogs, external files and output devices, and accesses remote files.</td>
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<td>Governs how SAS processes your SAS program.</td>
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This table provides brief descriptions of SAS global statements. For more detailed information, see the individual statements.

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<td>Signals the end of data lines or acts as a placeholder.</td>
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<td>Enables you to reference a SAS catalog as an external file.</td>
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<td>Enables you to read text data from and write text data to the clipboard on the host computer.</td>
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<td>Enables you to read data from user-specified text.</td>
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Dictionary

**CATNAME Statement**

Logically combines two or more catalogs into one by associating them with a catref (a shortcut name); clears one or all catrefs; lists the concatenated catalogs in one concatenation or in all concatenations.

Valid in: Anywhere
Category: Data Access

**Syntax**

```
CATNAME <libref.> catref
   < (libref-1.catalog-1 <(ACCESS=READONLY)>
      <...libref-n.catalog–n <(ACCESS=READONLY)>>)>;

CATNAME <libref.> catref CLEAR | _ALL_ CLEAR;

CATNAME <libref.> catref LIST | _ALL_ LIST;
```

**Arguments**

*libref*  
is any previously assigned SAS libref. If you do not specify a libref, SAS concatenates the catalog in the Work library, using the catref that you specify.

Range  
1 to 8 bytes

Restriction  
The libref must have been previously assigned.
catref

is a unique catalog reference name for a catalog or a catalog concatenation that is specified in the statement. Separate the catref from the libref with a period, as in libref.catref. Any SAS name can be used for this catref.

catalog

is the name of a catalog that is available for use in the catalog concatenation.

Options

CLEAR

disassociates a currently assigned catref or libref.catref.

Tip Specify a specific catref or libref.catref to disassociate it from a single concatenation. Specify _ALL_ CLEAR to disassociate all currently assigned catref or libref.catref concatenations.

_ALL_ CLEAR

disassociates all currently assigned catref or libref.catref concatenations.

LIST

writes the catalog names that are included in the specified concatenation to the SAS log.

Tip Specify catref or libref.catref to list the attributes of a single concatenation. Specify _ALL_ to list the attributes of all catalog concatenations in your current session.

_ALL_ LIST

writes all catalog names that are included in any current catalog concatenation to the SAS log.

ACCESS=READONLY

assigns a read-only attribute to the catalog. SAS allows users to read from the catalog entries but not to update information or to write new information.

Details

Why Use CATNAME?

CATNAME is useful because it enables you to access entries in multiple catalogs by specifying a single catalog reference name (libref.catref or catref). After you create a catalog concatenation, you can specify the catref in any context that accepts a simple (non-concatenated) catref.

Rules for Catalog Concatenation

To use catalog concatenation effectively, you must understand the rules that determine how catalog entries are located among the concatenated catalogs:

- When a catalog entry is opened for input or update, the concatenated catalogs are searched and the first occurrence of the specified entry is used.
- When a catalog entry is opened for output, it is created in the first catalog that is listed in the concatenation.

Note: A new catalog entry is created in the first catalog even if there is an entry with the same name in another part of the concatenation.
Note: If the first catalog in a concatenation that is opened for update does not exist, the item is written to the next catalog that exists in the concatenation.

- When you want to delete or rename a catalog entry, only the first occurrence of the entry is affected.
- Anytime a list of catalog entries is displayed, only one occurrence of a catalog entry name is shown.

Note: Even if the name occurs multiple times in the concatenation, only the first occurrence is shown.

Comparisons

- The CATNAME statement is like a LIBNAME statement for catalogs. The LIBNAME statement enables you to assign a shortcut name to a SAS library so that you can use the shortcut name to find the files and use the data that they contain. CATNAME enables you to assign a short name <libref.>catref (libref is optional) to one or more catalogs so that SAS can find the catalogs and use all or some of the entries in each catalog.
- The CATNAME statement explicitly concatenates SAS catalogs. You can use the LIBNAME statement to implicitly concatenate SAS catalogs.

Examples:

Example 1: Assigning and Using a Catalog Concatenation

You might need to access entries in several SAS catalogs. The most efficient way to access the information is to logically concatenate the catalogs. Catalog concatenation enables access to the information without actually creating a new, separate, and possibly very large catalog.

Assign librefs to the SAS libraries that contain the catalogs that you want to concatenate:

```
libname mylib1 'data-library-1';
libname mylib2 'data-library-2';
```

Assign a catref, which can be any valid SAS name, to the list of catalogs that you want to logically concatenate:

```
catname allcats (mylib1.catalog1 mylib2.catalog2);
```

The SAS log displays this message:

**Example Code 2.1 Log Output from CATNAME Statement**

```
NOTE: Catalog concatenation WORK.ALLCATS has been created.
```

Because no libref is specified, the libref is Work by default. When you want to access a catalog entry in either of these catalogs, use the libref Work and the catalog reference name ALLCATS instead of the original librefs and catalog names. For example, to access a catalog entry named APPKEYS.KEYS in the catalog MYLIB1.CATALOG1, specify
Example 2: Creating a Nested Catalog Concatenation

After you create a concatenated catalog, you can use CATNAME to combine your concatenation with other single catalogs or other concatenated catalogs. Nested catalog concatenation is useful, because you can use a single catref to access many different catalog combinations.

```sas
libname local 'my_dir';
libname main  'public_dir';
catname private_catalog (local.my_application_code
                         local.my_frames
                         local.my_formats);
catname combined_catalogs (private_catalog
                            main.public_catalog);
```

In the above example, you could work on private copies of your application entries by using PRIVATE_CATALOG. If you want to see how your entries function when they are combined with the public version of the application, you can use COMBINED_CATALOGS.

See Also

Statements:

- "FILENAME Statement" on page 15
- "FILENAME Statement: CATALOG Access Method" on page 27
- "LIBNAME Statement" on page 126 for a discussion of implicitly concatenating SAS catalogs

CHECKPOINT EXECUTE_ALWAYS Statement

Indicates to execute the DATA step or PROC step that immediately follows without considering the checkpoint-restart data.

Valid in: Anywhere
Category: Program Control

Syntax

```
CHECKPOINT EXECUTE_ALWAYS;
```

Without Arguments

The CHECKPOINT EXECUTE_ALWAYS statement indicates to SAS that the DATA step or PROC step that immediately follows is to be executed without considering the checkpoint data.
Details

If checkpoint-restart mode is enabled and a batch program terminates without completing, the program can be rerun beginning with the DATA step or PROC step that was executing when it terminated. DATA or PROC steps that completed before the batch program terminated are not reexecuted. If a DATA step or a PROC step must be reexecuted, you can add the CHECKPOINT EXECUTE_ALWAYS statement before the step. Using the CHECKPOINT EXECUTE_ALWAYS statement ensures that SAS always executes the step without regard to the checkpoint-restart data.

See Also

- “Checkpoint Mode and Restart Mode” in SAS Language Reference: Concepts
- "STEPCHKPT System Option" in SAS System Options: Reference
- "STEPCHKPTLIB= System Option" in SAS System Options: Reference
- "STEPRESTART System Option" in SAS System Options: Reference

Comment Statement

Specifies the purpose of the statement or program.

Valid in: Anywhere
Category: Log Control

Syntax

*message;

or

/*message*/

Arguments

*message;

specifies the text that explains or documents the statement or program.

Range

These comments can be any length and are terminated with a semicolon.

Restrictions

These comments must be written as separate statements.

These comments cannot contain internal semicolons.

A macro statement or macro variable reference that is contained inside this form of comment is processed by the SAS macro facility. This form of comment cannot be used to hide text from the SAS macro facility.
When using comments within a macro definition or to hide text from the SAS macro facility, use this style comment:

```
/* message */
```

Tip
---

/*message*/
specifies the text that explains or documents the statement or program.

Range
---
These comments can be any length.

Restriction
---
This type of comment cannot be nested.

Windows specifics
---
If you use the Enhanced Editor, you can comment out a block of code by highlighting the block and then pressing CTRL-/ (forward slash). To uncomment a block of code, highlight the block and press CTRL-SHIFT-/ (forward slash).

Tips
---
These comments can contain semicolons and unmatched quotation marks.

You can write these comments within statements or anywhere a single blank can appear in your SAS code.

Details
---
You can use the comment statement anywhere in a SAS program to document the purpose of the program, explain unusual segments of the program, or describe steps in a complex program or calculation. SAS ignores text in comment statements during processing.

**CAUTION**
Avoid placing the /* comment symbols in columns 1 and 2.** In some operating environments, SAS might interpret a /* in columns 1 and 2 as a request to end the SAS program or session.

Note: You can add these lines to your code to fix unmatched comment tags, unmatched quotation marks, and missing semicolons.

```
/* '; * ''; */
quit;
run;
```

Example: Using the Comment Statement
---
These examples illustrate the two types of comments:

- This example uses the *message; format:
  ```
  *This code finds the number in the BY group;
  ```

- This example uses the *message; format:
  ```
  *---------------------------------------------------------------------*
  | This uses one comment statement                                  |
  | to draw a box.                                                   |
  *---------------------------------------------------------------------*;
  ```
This example uses the /*message*/ format:

```sas
input @1 name $20. /* last name */
  @200 test 8. /* score test */
  @50 age 3.; /* customer age */
```

This example uses the /*message*/ format:

```sas
/* For example 1 use: x=abc;
for example 2 use: y=ghi; */
```

## DM Statement

Submits SAS Program Editor, Log, Procedure Output or text editor commands as SAS statements.

### Syntax

```sas
DM <window> 'command(s)' <window> <CONTINUE> ;
```

### Arguments

- **window**
  - specifies the active window.
  - **Default** If you omit the window name, SAS uses the Program Editor window as the default.

- **'command(s)'**
  - can be any windowing command or text editor command and must be enclosed in single quotation marks. If you want to issue several commands, separate them with semicolons.

- **CONTINUE**
  - causes SAS to execute any SAS statements that follow the DM statement in the Program Editor window and, if a windowing command in the DM statement called a window, makes that window active.

### Note

For example, if you specify Log as the active window and have other SAS statements that follow the DM statement (for example, in an autoexec file), those statements are not submitted to SAS until control returns to the SAS interface.

### Tip

Any windows that are activated by the SAS statements (such as the Output window) appear before the window that is to be made active.

## Details

Execution occurs when the DM statement is submitted to SAS. You can use this statement to modify the windowing environment:

- Change SAS interface features during a SAS session.
Change SAS interface features at the beginning of each SAS session by placing the DM statement in an autoexec file.

Perform utility functions in windowing applications, such as saving a file with the FILE command or clearing a window with the CLEAR command.

Window placement affects the outcome of the statement:

- If you name a window before the commands, those commands apply to that window.
- If you name a window after the commands, SAS executes the commands and then makes that window the active window. The active window is opened and contains the cursor.

Examples:

Example 1: Using the DM Statement

- `dm 'color text cyan; color command red';`
- `dm log 'clear; pgm; color numbers green' output;`
- `dm 'caps on';`
- `dm log 'clear' output;`

Example 2: Using the CONTINUE Option with SAS Statements That Do Not Activate a Window

This example causes SAS to display the first window of the SAS/AF application, executes the DATA step, moves the cursor to the first field of the SAS/AF application window, and makes that window active.

```sas
dm 'af c=your-program' continue;
data temp;
   . . . more SAS statements . . .
run;
```

Example 3: Using the CONTINUE Option with SAS Statements That Activate a Window

This example displays the first window of the SAS/AF application and executes the PROC PRINT step, which activates the Output window. Closing the Output window moves the cursor to the last active window.

```sas
dm 'af c=your-program' continue;
proc print data=temp;
run;
```

Example 4: Using the DM Statement to Display the Results Viewer Window

This examples causes SAS to display the Results Viewer window. You can also define a function key to perform this action.

```sas
dm 'next "results viewer"' continue;
```
ENDSAS Statement

Terminates a SAS job or session after the current DATA or PROC step executes.

Valid in: Anywhere
Category: Program Control

Syntax

ENDSAS;

Without Arguments
The ENDSAS statement terminates a SAS job or session.

Details
ENDSAS is most useful in interactive or windowing sessions.

Note: ENDSAS statements are always executed at the point that they are encountered in a DATA step. Use the ABORT RETURN statement to stop processing when an error condition occurs (for example, in the clause of an IF-THEN statement or a SELECT statement).

Comparisons
You can also terminate a SAS job or session by using the BYE or the ENDSAS command from any SAS window command line. For more information, see the online Help for SAS windows.

See Also
“SYSSTARTID Automatic Macro Variable” in SAS Macro Language: Reference

FILENAME Statement

Associates a SAS fileref with an external file or an output device, disassociates a fileref and external file, or lists attributes of external files.

Valid in: Anywhere
Category: Data Access
Restriction: When SAS is in a locked-down state, the FILENAME statement is not available for files that are not in the lockdown path list. For more information, see “SAS Processing Restrictions for Servers in a Locked-Down State” in SAS Language Reference: Concepts.
Syntax

Form 1:   FILENAME fileref <device-type> 'external-file' <ENCODING='encoding-value'> <options> <operating-environment-options> ;
Form 2:   FILENAME fileref <device-type> <options> <operating-environment-options> ;
Form 3:   FILENAME fileref CLEAR | _ALL_ CLEAR;
Form 4:   FILENAME fileref LIST | _ALL_ LIST ;

Arguments

fileref

is any SAS name that you use when you assign a new fileref. When you disassociate a currently assigned fileref or when you list file attributes with the FILENAME statement, specify a fileref that was previously assigned with a FILENAME statement or an operating environment-level command.

Range 1 to 8 bytes

Tip The association between a fileref and an external file lasts only for the duration of the SAS session or until you change it or discontinue it by using another FILENAME statement. Change the fileref for a file as often as you want.

device-type

specifies the type of device or the access method that is used if the fileref points to an input or output device or location that is not a physical file:

ACTIVEMQ

specifies an access method that enables you to access an ActiveMQ messaging broker.

Interaction If the DATA step does not recognize the access method option, the DATA step passes the option to the access method for handling.

See "FILENAME Statement: ACTIVEMQ Access Method" in Application Messaging with SAS

AZURE

specifies an access method that enables you to access data in Microsoft Azure Data Lake Storage.

See "FILENAME Statement: Azure Access Method" on page 25

CATALOG

specifies an access method that enables you to reference a SAS catalog as an external file.

See "FILENAME Statement: CATALOG Access Method" on page 27

DATAURL

specifies an access method that enables you to read data from user-specified text.
DISK
specifies that the device is a disk drive.

Tip  When you assign a fileref to a file on disk, you are not required to specify DISK.

DUMMY
specifies that the output to the file is discarded.

Tip  Specifying DUMMY can be useful for testing.

EMAIL
specifies an access method that enables you to send electronic mail programmatically from SAS by using the SMTP (Simple Mail Transfer Protocol) email interface.

See  “FILENAME Statement: EMAIL (SMTP) Access Method” on page 35

FTP
specifies an access method that enables you to access remote files by using the FTP protocol.

See  “FILENAME Statement: FTP Access Method” on page 58

GTERM
indicates that the output device type is a graphics device that receives graphics data.

HADOOP
specifies an access method that enables you to access files on a Hadoop Distributed File System (HDFS) whose location is specified in a configuration file.

See  “FILENAME Statement: Hadoop Access Method” on page 75

JMS
specifies a Java Message Service (JMS) destination.

PIPE
specifies an unnamed pipe.

Note  Some operating environments do not support pipes.

PLOTTER
specifies an unbuffered graphics output device.

PRINTER
specifies a printer or printer spool file.

S3
specifies an access method that enables you to access Amazon S3 files.

See  “FILENAME Statement: S3 Access Method” on page 81

SFTP
specifies an access method that enables you to access remote files by using the SFTP protocol.
### SOCKET
specifies an access method that enables you to read from or write to a TCP/IP socket.

See “FILENAME Statement: SOCKET Access Method” on page 93

### TAPE
specifies a tape drive.

### TEMP
creates a temporary file that exists only as long as the filename is assigned. The temporary file can be accessed only through the logical name and is available only while the logical name exists.

#### Restriction
Do not specify a physical pathname. If you do, SAS returns an error.

#### Tip
Files manipulated by the TEMP device can have the same attributes and behave identically to DISK files.

### TERMINAL
specifies the user’s terminal.

### UPRINTER
specifies a Universal Printing printer definition name.

#### Tip
If you do not specify the printer name in the FILENAME statement, the PRINTERPATH options control which Universal Printer is used and the destination of the output.

### URL
specifies an access method that enables you to access remote files by using the URL access method.

See “FILENAME Statement: URL Access Method” on page 97

### WEBDAV
specifies an access method that enables you to access remote files by using the WebDAV protocol.

See “FILENAME Statement: WebDAV Access Method” on page 103

### ZIP
specifies an access method that enables you to access ZIP files.

See “FILENAME Statement: ZIP Access Method” on page 111

### Requirement
`device-type` must immediately follow `fileref` in the statement.

### Operating environment
Additional specifications might be required when you specify some devices. See the SAS documentation for your operating environment before specifying a value other than DISK. Values in addition to the ones listed here might be available in some operating environments.

See “FILENAME Statement: SFTP Access Method” on page 85
'external-file' is the physical name of an external file. The physical name is the name that is recognized by the operating environment.

Operating environment
For more information about specifying the physical names of external files, see the SAS documentation for your operating environment.

Tips
Specify external-file when you assign a fileref to an external file.

You can associate a fileref with a single file or with an aggregate file storage location.

ENCODING= 'encoding-value' specifies the encoding to use when SAS is reading from or writing to an 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.

Default
SAS assumes that an external file is in the same encoding as the session encoding.

Restrictions
The UPRINTER device type does not support the ENCODING= argument.

Not all device types support the encoding option. For more information, see the documentation for your operating system.

You cannot use the FILENAME statement to specify an encoding for a transport file that is created with PROC CPORT. In order for a transport file to be imported successfully, the encodings of the source and target SAS sessions must be compatible.

See

Examples
“Example 5: Specifying an Encoding When Reading an External File” on page 23

“Example 6: Specifying an Encoding When Writing to an External File” on page 24

CLEAR disassociates one or more currently assigned filerefs.

Tip Specify fileref to disassociate a single fileref. Specify _ALL_ to disassociate all currently assigned filerefs.

_ALL_
specifies that the CLEAR or LIST argument applies to all currently assigned filerefs.

LIST
writes the attributes of one or more files to the SAS log.
Interaction Specify *fileref* to list the attributes of a single file. Specify _ALL_ to list the attributes of all files that have filerefs in your current session.

Options

**RECFM=record-format**

specifies the record format of the external file.

Interaction In SAS 9.4, the default value for the global LRECL system option is 32767. If you are using fixed-length records (RECFM=F), the default value for LRECL is 256.

Operating environment Values for *record-format* are dependent on the operating environment. For more information, see the SAS documentation for your operating environment.

Operating Environment Options

Operating environment options specify details, such as file attributes and processing attributes, that are specific to your operating environment.

Operating Environment Information: For a list of valid specifications, see the SAS documentation for your operating environment.

Details

Operating Environment Information

Operating Environment Information: Using the FILENAME statement requires operating environment-specific information. See the SAS documentation for your operating environment before using this statement. Note also that commands are available in some operating environments that associate a fileref with a file and that break that association.

Definitions

external file

is a file that is created and maintained in the operating environment from which you need to read data, SAS programming statements, or autocall macros, or to which you want to write output. An external file can be a single file or an aggregate storage location that contains many individual external files. See “Example 3: Associating a Fileref with an Aggregate Storage Location” on page 22.

Operating Environment Information: Different operating environments call an aggregate grouping of files by different names, such as a directory, a MACLIB, or a partitioned data set. For more information about specifying external files, see the SAS documentation for your operating environment.

fileref

(a file reference name) is a shorthand reference to an external file. After you associate a fileref with an external file, you can use it as a shorthand reference for that file in SAS programming statements (such as INFILE, FILE, and %INCLUDE) and in other commands and statements in SAS software that access external files.
Reading Delimited Data from an External File

Anytime a text file originates from anywhere other than the local encoding environment, it might be necessary to specify the ENCODING= option in either EBCDIC or ASCII environments.

For example, when you read an EBCDIC text file on an ASCII platform, it is recommended that you specify the ENCODING= option in the FILENAME statement. However, if you use the DSD and the DLM or DLMSTR= options in the INFILE statement, the ENCODING= option is a requirement because these options must contain certain characters in the session encoding (such as quotation marks, commas, and blanks).

The use of encoding-specific informats should be reserved for use with true binary files. That is, the files contain both character and non-character fields.

Associating a Fileref with an External File (Form 1)

Use this form of the FILENAME statement to associate a fileref with an external file on disk:

FILENAME fileref 'external-file' <operating-environment-options>;

To associate a fileref with a file other than a disk file, you might need to specify a device type, depending on your operating environment, as shown in this form:

FILENAME fileref <device-type> <operating-environment-options>;

The association between a fileref and an external file lasts only for the duration of the SAS session or until you change it or discontinue it with another FILENAME statement. Change the fileref for a file as often as you want.

To specify a character-set encoding, use this form:

FILENAME fileref <device-type> <operating-environment-options>;

Associating a Fileref with a Terminal, Printer, Universal Printer, or Plotter (Form 2)

To associate a fileref with an output device, use this form:

FILENAME fileref device-type <operating-environment-options>;

Disassociating a Fileref from an External File (Form 3)

To disassociate a fileref from a file, use a FILENAME statement that specifies the fileref and the CLEAR option.

FILENAME fileref CLEAR | _ALL_ CLEAR;

Writing File Attributes to the SAS Log (Form 4)

Use a FILENAME statement to write the attributes of one or more external files to the SAS log. Specify fileref to list the attributes of one file; use _ALL_ to list the attributes of all the files that have been assigned filerefs in your current SAS session.

FILENAME fileref LIST | _ALL_ LIST;
Comparisons

The FILENAME statement assigns a fileref to an external file. The LIBNAME statement assigns a libref to a SAS library. Use the LIBNAME, SAS/ACCESS statement to access DBMS tables.

Examples:

Example 1: Specifying a Fileref or a Physical Filename
You can specify an external file either by associating a fileref with the file and then specifying the fileref or by specifying the physical filename in quotation marks:

```sas
filename sales 'your-input-file';
data jansales;
    /* specifying a fileref */
    infile sales;
    input salesrep $20. +6 jansales febsales marsales;
run;
data jansales;
    /* physical filename in quotation marks */
    infile 'your-input-file';
    input salesrep $20. +6 jansales febsales marsales;
run;
```

Example 2: Using a FILENAME and a LIBNAME Statement
This example reads data from a file that has been associated with the fileref GREEN and creates a permanent SAS data set stored in a SAS library that has been associated with the libref SAVE.

```sas
filename green 'your-input-file';
libname save 'SAS-library';
data save.vegetable;
    infile green;
    input lettuce cabbage broccoli;
run;
```

Example 3: Associating a Fileref with an Aggregate Storage Location
If you associate a fileref with an aggregate storage location, use the fileref, followed in parentheses by an individual filename, to read from or write to any of the individual external files that are stored there.

**Operating Environment Information:** Some operating environments enable you to read from but not write to members of aggregate storage locations. For more information, see the SAS documentation for your operating environment.

In this example, each DATA step reads from an external file (REGION1 and REGION2, respectively) that is stored in the same aggregate storage location and that is referenced by the fileref SALES.

```sas
filename sales 'aggregate-storage-location';
data total1;
    infile sales(region1);
    input machine $ jansales febsales marsales;
```
Example 4: Routing PUT Statement Output

In this example, the FILENAME statement associates the fileref OUT with a printer that is specified with an operating environment-dependent option. The FILE statement directs PUT statement output to that printer.

```sas
filename out print operating-environment-option;
data sales;
file out print;
input salesrep $20. +6 jansales febsales marsales;
put _infile_;
datalines;
Jones, E. A.   124357 155321 167895
Lee, C. R.     111245 127564 143255
Desmond, R. T. 97631 101345 117865
;
```

You can use the FILENAME and FILE statements to route PUT statement output to several devices during the same session. To route PUT statement output to your display monitor, use the TERMINAL option in the FILENAME statement, as shown here:

```sas
filename show terminal;
data sales;
file show;
input salesrep $20. +6 jansales febsales marsales;
put _infile_;
datalines;
Jones, E. A.   124357 155321 167895
Lee, C. R.     111245 127564 143255
Desmond, R. T. 97631 101345 117865
;
```

Example 5: Specifying an Encoding When Reading an External File

This example creates a SAS data set from an external file. The external file is in UTF-8 character-set encoding, and the current SAS session is in the Wlatin1 encoding. By default, SAS assumes that an external file is in the same encoding as the session encoding, which causes the character data to be written to the new SAS data set incorrectly.

To tell SAS what encoding to use when reading the external file, specify the ENCODING= option. When you tell SAS that the external file is in UTF-8, SAS then transcodes the external file from UTF-8 to the current session encoding when writing to the new SAS data set. Therefore, the data is written to the new data set correctly in Wlatin1.

```sas
libname myfiles 'SAS-library';
```
FILENAME extfile 'external-file' encoding="utf-8";
DATA myfiles.unicode;
   INFILE extfile;
   INPUT Make $ Model $ Year;
RUN;

Note: You cannot use the FILENAME statement to specify an encoding for a transport file that is created with PROC CPORT. In order for a transport file to be imported successfully, the encodings of the source and target SAS sessions must be compatible.

Example 6: Specifying an Encoding When Writing to an External File

This example creates an external file from a SAS data set. The current session encoding is Wlatin1, but the external file's encoding needs to be UTF-8. By default, SAS writes the external file using the current session encoding.

To tell SAS what encoding to use when writing data to the external file, specify the ENCODING= option. When you tell SAS that the external file is to be in UTF-8 encoding, SAS then transcodes the data from Wlatin1 to the specified UTF-8 encoding when writing to the external file.

LIBNAME myfiles 'SAS-library';
FILENAME outfile 'external-file' encoding="utf-8";

DATA _null_
   SET myfiles.cars;
   FILE outfile;
   PUT Make Model Year;
RUN;

See Also

Statements:
- “FILE Statement” in SAS DATA Step Statements: Reference
- “%INCLUDE Statement” on page 119
- “INFILE Statement” in SAS DATA Step Statements: Reference
- “FILENAME Statement: CATALOG Access Method” on page 27
- “FILENAME Statement: ACTIVEMQ Access Method” in Application Messaging with SAS
- “FILENAME Statement: DATAURL Access Method” on page 33
- “FILENAME Statement: EMAIL (SMTP) Access Method” on page 35
- “FILENAME Statement: FTP Access Method” on page 58
- “FILENAME Statement: Hadoop Access Method” on page 75
- “FILENAME Statement: JMS Access Method” in Application Messaging with SAS
- “FILENAME Statement: SFTP Access Method” on page 85
- “FILENAME Statement: SOCKET Access Method” on page 93
FILENAME Statement: Azure Access Method

Enables you to access data in Microsoft Azure Data Lake Storage.

Valid in: Anywhere

Category: Data Access

Restrictions: The Azure access method is supported for SAS Viya only.
The ADLS access method requires the SAS system option AZURETENANTID.

See:
“AZUREAUTHCACHELOC System Option” in SAS System Options: Reference
“AZURETENANTID= System Option” in SAS System Options: Reference

Syntax

FILENAME fileref ADLS "object path" <adls-options>;

Arguments

fileref

is a valid fileref.

ADLS

specifies the Azure Data Lake Storage (ADLS) access method.

object-path

specifies the Azure object that you want to access.

Required Options

The ADLS access method accepts these options:

ACCOUNTNAME="account name"

specifies the name of the Azure storage account.
APPLICATIONID="application id"
    specifies the Azure application ID that is created in the Azure Active Directory.

FILESYSTEM="file system"
    specifies the name of the Azure file system.

Details

Creating an Azure Account

Azure Data Lake Storage (ADLS) is a Microsoft cloud computing service. The
FILENAME statement's Azure access method enables you to access your data on
ADLS.

To use ADLS, set up an account with Microsoft Azure. For information about setting
up an account, see the Microsoft Azure portal. You also have to set up your system
to use OAuth authentication tokens. Contact your system administrator for
information about using OAuth tokens.

Example: Obtaining an OAuth Device Code and Accessing
ADLS Data

This example uses the SAS DATA step to create the file example.txt on the
Microsoft Azure server. The DATA step uses the ADLS access method and fileref to
write the four lines of code to the file. The example also obtains a device code that
enables you to connect to a device such as a printer or a device on the Internet of
Things (IoT).

Note: If you have a current credential file, SAS does not produce the error
messages that appear in the log that follows the example. If your credential file has
expired, or if you specify a new or different authentication file, SAS produces the
error messages. Follow the directions in the error messages to repeat the
authentication step.

```sas
options azuretenantid="user-tenant-id"; /* 1*/
filename out adls "path/example.txt"
    applicationid="application-id"
    accountname="account-name"
    filesystem="filesystem-name"
;

data _null_
    file out;
    put 'line 1';
run;
```

1 AZURETENANTID is your tenant ID for connecting to an Azure storage system.
For more information about the AZURETENANTID system option, see
"AZURETENANTID= System Option" in SAS System Options: Reference.
messages do not indicate a problem with the code that you submitted. After you use the generated code to sign in, the code should authenticate correctly.

```plaintext
ERROR: Cannot obtain connection to ADLS. Check options and tokens.
ERROR: To sign in, use a web browser to open the page
https://microsoft.com/devicelogin and enter the code <CODE> to authenticate. /* 1 */
```

1 `<CODE>` is a unique string that is generated each time you run the code. Enter the generated code on the Microsoft device login page.

---

**FILENAME Statement: CATALOG Access Method**

Enables you to reference a SAS catalog as an external file.

<table>
<thead>
<tr>
<th>Valid in</th>
<th>Anywhere</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category</td>
<td>Data Access</td>
</tr>
</tbody>
</table>

**Syntax**

```
FILENAME fileref CATALOG 'catalog' <catalog-options>;
```

**Arguments**

- `fileref`
  - is a valid fileref.
  - Range: 1 to 8 bytes

- `CATALOG`
  - specifies the access method that enables you to reference a SAS catalog as an external file. You can then use any SAS commands, statements, or procedures that can access external files to access a SAS catalog.

**Alias**

- `LIBRARY`

**Tips**

- This access method makes it possible for you to invoke an autocall macro directly from a SAS catalog.

  - With this access method, you can read any type of catalog entry, but you can write only to entries of type LOG, OUTPUT, SOURCE, and CATAMS.
  - If you want to access an entire catalog (instead of a single entry), you must specify its two-level name in the `catalog` parameter.

- `'catalog'`
  - is a valid two-, three-, or four-part SAS catalog name, where the parts represent `library.catalog.entry.entrytype`.

**Default**

- The default entry type is CATAMS.

**Restriction**

- The CATAMS entry type is used only by the CATALOG access method. The CPORT and CIMPORT procedures do not support this entry type.
Catalog Options

catalog-options can be any of these values:

**LRECL=lrecl**
where lrecl is the maximum record length for the data in bytes.

**Default**
For input, the actual LRECL value of the file is the default. For output, the default is 132.

**Interaction** Alternatively, you can specify a global logical record length by using the "LRECL= System Option" in SAS System Options: Reference. In SAS 9.4, the default value for the global LRECL system option is 32767. If you are using fixed-length records (RECFM=F), the default value for LRECL is 256.

**RECFM=rcfm**
where rcfm is one of four record formats:

**F**
is a fixed-record format. Data is transferred in image (binary) mode.

**P**
is a print format.

**S**
is a stream-record format. Data is transferred in image (binary) mode.

**Default**

**DESC=description**
where description is a text description of the catalog.

**MOD**
specifies to append to the file.

**Default**
If you omit MOD, the file is replaced.

Details

The CATALOG access method in the FILENAME statement enables you to reference a SAS catalog as an external file. You can then use any SAS commands, statements, or procedures that can access external files to access a SAS catalog. For example, the catalog access method makes it possible for you to invoke an
autocall macro directly from a SAS catalog. See “Example 5: Executing an Autocall Macro from a SAS Catalog” on page 30.

With the CATALOG access method, you can read any type of catalog entry, but you can write to only entries of type LOG, OUTPUT, SOURCE, and CATAMS. If you want to access an entire catalog (instead of a single entry), you must specify its two-level name in the catalog argument.

Examples:

Example 1: Using %INCLUDE with a Catalog Entry

This example submits the source program that is contained in SASUSER.PROFILE.SASINP.SOURCE:

```sas
filename fileref1 catalog 'sasuser.profile.sasinp.source';
%include fileref1;
```

Example 2: Using %INCLUDE with Several Entries in a Single Catalog

This example submits the source code from three entries in the catalog MYLIB.INCLUDE. When no entry type is specified, the default is CATAMS.

```sas
filename dir catalog 'mylib.include';
%include dir(mem1);
%include dir(mem2);
%include dir(mem3);
```

Example 3: Reading and Writing a CATAMS Entry

This example uses a DATA step to write data to a CATAMS entry, and another DATA step to read it back in:

```sas
filename mydata catalog 'sasuser.data.update.catams'; /* write data to catalog entry update.catams */
data _null_; file mydata; do i=1 to 10; put i; end; run; /* read data from catalog entry update.catams */
data _null_; infile mydata; input; put _INFILE_; run;
```

Example 4: Writing to a SOURCE Entry

This example writes code to a catalog SOURCE entry and then submits it for processing:
Example 5: Executing an Autocall Macro from a SAS Catalog

If you store an autocall macro in a SOURCE entry in a SAS catalog, you can point to that entry and invoke the macro in a SAS job. Use these steps:

1. Store the source code for the macro in a SOURCE entry in a SAS catalog. The name of the entry is the macro name.
2. Use a LIBNAME statement to assign a libref to that SAS library.
3. Use a FILENAME statement with the CATALOG specification to assign a fileref to the catalog: `libref.catalog`.
4. Use the SASAUTOS= option and specify the fileref so that the system knows where to locate the macro. Also set MAUTOSOURCE to activate the autocall facility.

This example points to a SAS catalog named `MYSAS.MYCAT`. It then invokes a macro named `REPORTS`, which is stored as a SAS catalog entry named `MYSAS.MYCAT.REPORTS.SOURCE`:

```
libname mysas 'SAS-library';
filename mymacros catalog 'mysas.mycat';
options sasautos=mymacros mautosource;
%reports
```

See Also

**Statements:**

- "FILENAME Statement" on page 15

FILENAME Statement: CLIPBOARD Access Method

Enables you to read text data from and write text data to the clipboard on the host computer.

**Valid in:** Anywhere

**Category:** Data Access

**Syntax**

```
FILENAME fileref CLIPBRD <BUFFER=paste-buffer-name>;
```
Arguments

*fileref*

is a valid fileref.

**Range** 1 to 8 bytes

**CLIPBRD**

specifies the access method that enables you to read data from or write data to the clipboard on the host computer.

**BUFFER=paste-buffer-name**

creates and names the paste buffer. You can create any number of paste buffers by naming them with the BUFFER= argument in the STORE command.

Details

The FILENAME statement, CLIPBOARD Access Method enables you to share data within SAS and between SAS and applications other than SAS.

Comparisons

The STORE command copies marked text in the current window and stores the copy in a paste buffer.

You can also copy data to the clipboard by using the Explorer pop-up menu item *Copy Contents to Clipboard*.

Examples:

**Example 1: Using ODS to Write a Data Set as HTML to the Clipboard**

This example uses the Sashelp.Air data set as the input file. The ODS is used to write the data set in HTML format to the clipboard.

```plaintext
filename _temp_ clipbrd;
ods noresults;
ods html file=_temp_ rs=none style=minimal;
proc print data=Sashelp.'Air'N noobs;
run;
ods results;
filename _temp_; 
```

**Example 2: Using the DATA Step to Write a Data Set as Comma-separated Values to the Clipboard**

This example uses the Sashelp.Air data set as the input file. The data is written in the DATA step as comma-separated values to the clipboard.

```plaintext
filename _temp1_ temp;
filename _temp2_ clipbrd;
proc contents data=Sashelp."Air"N out=info noprint;
proc sort data=info;
   by npos;
run;
data _null_; 
```
set info end=eof;
;
file _temp1_ dsd;
put name @@;
if _n_=1 then do;
call execute("data _null_; 
set Sashelp."Air"N;
file _temp1_ dsd mod; 
put");
end;
call execute(trim(name));
if eof then call execute('; run;');
run;
data _null_; 
infile _temp1_; 
file _temp2_; 
input; 
put _infile_; 
run;
filename _temp1_ clear; 
filename _temp2_ clear;

Example 3: Using the DATA Step to Write Text to the Clipboard

This example writes three lines to the clipboard.

filename clippy clipbrd;
data _null_; 
file clippy; 
put 'Line 1'; 
put 'Line 2'; 
put 'Line 3'; 
run;

data _null_; 
infile clippy; 
input; 
put _infile_; 
run;

Example 4: Using the DATA Step to Retrieve Text from the Clipboard

This example writes three lines to the clipboard and then retrieves them.

filename clippy clipbrd;
data _null_; 
file clippy; 
put 'Line 1'; 
put 'Line 2'; 
put 'Line 3'; 
run;
data _null_; 
infile clippy; 
input; 
put _infile_; 
run;

See Also

Commands:
- The STORE command in the Base SAS Help and Documentation
FILENAME Statement: DATAURL Access Method

Enables you to read data from user-specified text.

Valid in: Anywhere
Category: Data Access

Syntax

FILENAME fileref DATAURL 'data-url-specification' <data-url-options>;

Arguments

fileref
is a valid fileref.

Range 1 to 8 bytes

DATAURL specifies the access method that enables you to read data from data-url-specification.

'data-url-specification' specifies the data.

Requirement The data must be in one of these formats:

- data:, file-data, where data can consist of characters and URL-encoded characters. Examples are %20 and %00. data must be lowercase.
- data: ;base64, base64-data, where data consists of base64-encoded data. data must be lowercase.

Example "Example 2: Base64 Encoded Data" on page 34

data-url-options can be any of these values:

LRECL=record-length
where lrecl is the logical record length of the data.

Interaction In SAS 9.4, the default value for the global LRECL system option is 32767. If you are using fixed-length records (RECFM=F), the default value for LRECL is 256.

RECFM=recfm
where recfm is one of three record formats:
F  is a fixed-record format. Thus, all records are of size LRECL with no line delimiters. Data is transferred in image (binary) mode.

S  is a stream-record format. Data is transferred in image (binary) mode.

V  is a variable-record format (the default). In this format, records have varying lengths, and the records are transferred in text mode.

Interaction    In SAS 9.4, the default value for the global LRECL system option is 32767. If you are using fixed-length records (RECFM=F), the default value for LRECL is 256.

Details

The DATAURL access method is similar to the URL access method. The DATAURL access method reads small amounts of data directly from a data URL specification instead of reading data from a network location.

Multiple lines of data can be read from data-url-specification. A null byte is a line delimiter.

Examples:

Example 1: Accessing Simple Data

This example accesses three lines of data by using %00 as URL-encoded null bytes to terminate each line.

```sas
filename in dataurl "data:,line one%00line two%00line three%00";
  data _NULL_;
  infile in;
  input;
  list;
  run;
```

NOTE: The infile IN is:
Filename=data:,line one%00line two%00line three%00, Lrecl=256,Recfm=Variable

RULE:   ----+----1----+----2----+----3----+----4----+----5----+----6----+---
        1         line one 8
        2         line two 8
        3         line three 10

NOTE: 3 records were read from the infile IN.
The minimum record length was 8.
The maximum record length was 10.

Example 2: Base64 Encoded Data

This example accesses data by using base64-encoded data.

```sas
filename in dataurl "data:;base64,dGhpcyBpcyBhIGJhc2UgNjQgZW5jb2RpbmcgZXhhbXBsZS4=" ;
  data _NULL_;
  infile in;
```
FILENAME Statement: EMAIL (SMTP) Access Method

Enables you to send electronic mail programmatically from SAS using the SMTP (Simple Mail Transfer Protocol) email interface.

Valid in: Anywhere
Category: Data Access
Restriction: When SAS is in a locked-down state, the FILENAME statement, EMAIL access method is not available. Your server administrator can re-enable this access method so that it is accessible in the locked-down state. For more information, see “SAS Processing Restrictions for Servers in a Locked-Down State” in SAS Language Reference: Concepts.

Syntax
FILENAME fileref EMAIL '<address' > <email-options>;

Arguments
fileref
is a valid file reference. The fileref is a name that is temporarily assigned to an external file or to a device type. Note that the fileref cannot exceed eight bytes.

Range 1 to 8 bytes

EMAIL specifies the EMAIL device type, which provides the access method that enables you to send electronic mail programmatically from SAS. In order to use SAS to send a message to an SMTP server, you must enable SMTP email. For more information, see “The SMTP E-Mail Interface” in SAS Language Reference: Concepts.
'address'
is the email address to which you want to send the message. You must enclose the address in single or double quotation marks. To specify more than one address, you must enclose the group of addresses in parentheses, enclose each address in single or double quotation marks, and separate each address with either a comma or a space. To specify a real name along with an address, enclose the address in angle brackets (< >). Specifying an address as a FILENAME statement argument is optional if you specify the TO= email option or the PUT statement !EM_TO! directive, which overrides an address specification.

Email Options
You can use any of these email options in the FILENAME statement to specify attributes for the electronic message. You can also specify these options in the FILE statement. Email options that you specify in the FILE statement override any corresponding email options that you specified in the FILENAME statement.

\texttt{ATTACH='filename.ext' | ATTACH= ('filename.ext' attachment-options)}
specifies the physical name of the file or files to be attached to the message and any options to modify attachment specifications. The physical name is the name that is recognized by the operating environment. Enclose the physical name in quotation marks. To attach more than one file, enclose the group of files in parentheses, enclose each file in quotation marks, and separate each with a space. Here are examples:

\begin{verbatim}
attach="/u/userid/opinion.txt"
attach=('C:\Status\June2001.txt' 'C:\Status\July2001.txt')
attach="user.misc.pds\{member}\"
\end{verbatim}

The attachment-options include these values:

\texttt{CONTENT_TYPE='content/type'}
specifies the content type for the attached file. You must enclose the value in quotation marks. If you do not specify a content type, SAS tries to determine the correct content type based on the filename. For example, if you do not specify a content type, a filename of \texttt{home.html} is sent with a content type of \texttt{text/html}.

<table>
<thead>
<tr>
<th>Alias</th>
<th>CT= and TYPE=</th>
</tr>
</thead>
<tbody>
<tr>
<td>Default</td>
<td>If SAS cannot determine a content type based on the filename and extension, the default value is text/plain.</td>
</tr>
</tbody>
</table>

\texttt{ENCODING='encoding-value'}
specifies the text encoding of the attachment that is read into SAS. You must enclose the value in quotation marks.


\texttt{EXTENSION='extension'}
specifies a different file extension to be used for the specified attachment. You must enclose the value in quotation marks. This extension is used by the recipient's email program for selecting the appropriate utility to use for displaying the attachment. This example results in the attachment \texttt{home.html} being received as \texttt{index.htm}.

\begin{verbatim}
attach=('home.html' name="index" ext="htm")
\end{verbatim}
Alias  EXT=

Note  If you specify extension="", the specified attachment has no file extension.

INLINED="reference-name"
   specifies a reference name that can be used to embed attachments in an email by using HTML. To embed an attachment, set content_type="text/html"; and reference the attachment from the email text with SRC="cid:reference-name". The reference-name is specified with the INLINE= option.

An example is attach=\("image.jpg" inlined="myimage"\). From the email text, you reference this image by using <IMG SRC="cid:myimage">.

Note  If the image is not referenced, then the recipients see it as a regular attachment.

See  “Example 6: Creating an Email with an Embedded Image” on page 50

LRECL=irecl
   where irecl is the logical record length of the data.

Default  256

Interaction  Alternatively, you can specify a global logical record length by using the "LRECL= System Option" in SAS System Options: Reference. In SAS 9.4, the default value for the global LRECL system option is 32767. If you are using fixed-length records (RECFM=F), the default value for LRCEL is 256.

NAME='filename'
   specifies a different name to be used for the specified attachment. You must enclose the value in quotation marks. This example results in the attachment home.html being received as index.html.

   attach=\("home.html" name="index"\)

OUTENCODING='encoding-value'
   specifies the resulting text encoding for the attachment to be sent. You must enclose the value in quotation marks.

Restriction  Do not specify EBCDIC encoding values, because the SMTP email interface does not support EBCDIC.


BCC='bcc-address'
   specifies the recipient or recipients that you want to receive a blind carbon copy of the email. Individuals that are listed in the bcc field receive a copy of the email. The BCC field does not appear in the email header, so that these email addresses cannot be viewed by other recipients.

If a BCC address contains more than one word, then enclose the address in single or double quotation marks. To specify more than one address, you must enclose the group of addresses in parentheses, enclose each address in single or double quotation marks, and separate each address with either a comma or a
space. To specify a real name as well as an address, enclose the address in angle brackets (< >). Here are examples:

bcc="joe@site.com"
bcc=("joe@site.com" "jane@home.net")
bcc="Joe Smith <joe@site.com>"

CC='cc-address'
specifies the recipient or recipients to receive a carbon copy of the email message. You must enclose the address in single or double quotation marks. To specify more than one address, enclose the group of addresses in parentheses, enclose each address in single or double quotation marks, and separate each address with either a comma or a space. To specify a real name as well as an address, enclose the address in angle brackets (< >). Here are examples:

cc='joe@site.com'
cc=('joe@site.com" "jane@home.net")
cc="Joe Smith <joe@site.com>"

CONTENT_TYPE='content/type'
specifies the content type for the message body. If you do not specify a content type, SAS tries to determine the correct content type. You must enclose the value in quotation marks.

If you do not specify a content type, SAS uses the default 'text/plain'. When you use 'message/rfc822', SAS lets you create the entire email. SAS includes only the FROM, SUBJECT, DATE, and other email options that you specify that are not part of the MIME standard and that are expected to be in the email before the first MIME header. Creating the entire email enables you to send HTML files and to format emails in any way that you want.

Alias CT= and TYPE=

Default text/plain

See “Example 5: Using the MESSAGE/RFC822 Content Type” on page 50

DELIVERYRECEIPT
specifies that a notification be sent when the email message is delivered to the recipient.

Note If the recipient’s email client does not support “delivery receipt” requests or if the recipient does not allow these requests, the sender does not receive a “delivery receipt” notification when the email is delivered.

ENCODING='encoding-value'
specifies the text encoding to use for the message body. For valid encoding values, see “Encoding Values in SAS Language Elements” in SAS National Language Support (NLS): Reference Guide.

EXPIRES='dd mon yyyy hh:mm'
specifies the expiration date for the email message.

The format dd mon hh:mm parameters are defined as follows:

dd
is an integer from 01 to 31 that represents the day of the month.

mon
are the first three letters of the month name in English.
yyyy is a four-digit integer that represents the year.

hh is the number of hours that range from 00 through 23.

mm is the number of minutes that range from 00 through 59.

Tip If the date and time have passed the current date and time, an error message occurs and no email is sent.

FROM='from-address'
specifies the email address of the author of the message that is being sent. Specify this option when the person who is sending the message is not the author. You must enclose an address in quotation marks. You can specify only one email address. To specify the author's real name along with the address, enclose the address in angle brackets (< >). Here are examples:

    from='martin@home.com'
    from="Brad Martin <martin@home.com>"

Default The default value for FROM= is the email address of the user who is running SAS. Beginning in SAS 9.4M6, if the SENDER= option is specified, the default value for FROM= is the email address that is specified in the SENDER= option.

Requirement The FROM option is required if the EMAILFROM system option is set. For more information, see “EMAILFROM System Option” in SAS System Options: Reference.

Interaction Use the SENDER= option to specify a return email address that is different from the author specified in the FROM= option.

See “SENDER='sender-address'” on page 40

IMPORTANCE='LOW' | NORMAL | HIGH
specifies the priority of the email message. You must enclose the value in quotation marks. You can specify the priority in the language that matches your session encoding. However, SAS translates the priority into English because the actual message header must contain English in accordance with the RFC-2076 specification (Common Internet Message Headers). Here are examples:

    filename inventory email 'name@mycompany.com' importance='high';
    filename inventory email 'name@mycompany.com' importance='hoch';

Default NORMAL

LRECL=lrecl
where lrecl is the logical record length of the data.

Default 256

Interaction Alternatively, you can specify a global logical record length by using the "LRECL= System Option" in SAS System Options: Reference. In SAS 9.4, the default value for the global LRECL system option is 32767. If you are using fixed-length records (RECFM=F), the default value for LRCEL is 256.
READRECEIPT
specifies that a notification be sent when the email message is read by the recipient.

Note: If the recipient’s email client does not support “read receipt” requests or if the recipient does not allow these return requests, the sender does not receive a “read receipt” notification when the recipient reads the email.

REPLYTO='replyto-address'
specifies the email address or addresses of who receives replies. You must enclose the address in single or double quotation marks. To specify more than one address, enclose the group of addresses in parentheses, enclose each address in single or double quotation marks, and separate each address with either a comma or a space. To specify a real name along with an address, enclose the address in angle brackets (< >). Here are examples:

replyto='hiroshi@home.com'
replyto=('hiroshi@home.com' 'akiko@site.com')
replyto="Hiroshi Mori <mori@site.com>"

SENDER='sender-address'
specifies the return email address for the message that is being sent. If a message cannot be delivered, a notification is sent to the sender email address. To specify the author’s real name along with the address, enclose the address in angle brackets (< >). Here are examples:

sender='martin@home.com'
sender='Brad Martin <martin@home.com>'

Default: The default value for SENDER= is the email address of the user who is running SAS. Beginning in SAS 9.4M6, if the FROM= option is specified, the default value for SENDER= is the email address that is specified in the FROM= option.

Interaction: The SENDER= address can be different from the FROM= address. This allows for the message to be sent on behalf of the email address specified in the FROM= option.

See: “FROM='from-address’” on page 39

SENSITIVITY="NORMAL" | PRIVATE | PERSONAL | CONFIDENTIAL" | COMPANY"
specifies the sensitivity of the email message. You must enclose the value in single quotation marks. Here is an example that results in a confidential header being added to the email message:

FILENAME mymail EMAIL TO='to-address' SUBJECT='a subject line'
SENSITIVITY='CONFIDENTIAL';

Default: NORMAL

Notes: If NORMAL is specified, no sensitivity header is added to the message.

The flags "company-confidential" and "confidential" are equivalent and have the same effect. The "company-confidential" flag is in compliance with RFC 2156.
**SUBJECT=subject**
specifies the subject of the message. If the subject contains special characters or more than one word (that is, it contains at least one blank space), you must enclose the text in quotation marks. Here are examples:

subject=Sales
subject="June Sales Report"

**Note** If you do not enclose a one-word subject in quotation marks, it is converted to uppercase.

**TO='to-address'**
specifies the primary recipient or recipients of the email message. You must enclose the address in single or double quotation marks. To specify more than one address, enclose the group of addresses in parentheses, enclose each address in single or double quotation marks, and separate each address with either a comma or a space. To specify a real name as well as an address, enclose the address in angle brackets (< >). Here are examples:

to='joe@site.com'
to=("joe@site.com" "jane@home.net")
to="Joe Smith <joe@site.com>"

**Tip** Specifying TO= overrides the ‘address’ argument.

**PUT Statement Email Directives**
The directives that you can specify in a PUT statement to change the attributes of a message are as follows:

**'!EM_ABORT!'**
abnormally end the current message. You can use this directive to stop SAS from automatically sending the message at the end of the DATA step. By default, SAS sends a message for each FILE statement.

**'!EM_ATTACH! filename.ext' | '!EM_ATTACH! ("filename.ext" attachment-options)**
replaces the physical name of the file or files to be attached to the message and any options to modify attachment specifications. The physical name is the name that is recognized by the operating environment. The directive must be enclosed in quotation marks and contain a maximum of 256 characters.

To attach more than one file, enclose the group of files in parentheses, enclose each file in single or double quotation marks, and separate each file with either a comma or a space. To add attachment-options, enclose the file and the attachment-options in parentheses, and enclose the file in single or double quotation marks. Here is an example:

```
put '!em_attach! ("C:\Status\June2001.txt" "C:\Status\July2001.txt");
```

In **SAS 9.4M5**, you can also attach more than one file using multiple !EM_ATTACH! directives. Here is an example:

```
put '!em_attach! opinion.txt';
put '!em_attach! report.html';
```

The **attachment-options** include these values:

**CONTENT_TYPE='content/type'**
specifies the content type for the attached file. You must enclose the value in quotation marks. If you do not specify a content type, SAS tries to determine
the correct content type based on the filename. For example, if you do not
specify a content type, a filename of home.html is sent with a content type of
text/html. Here is an example:

```
put '!em_attach! ('small.png' ct='image/png');
```

**ENCODING=**`encoding-value`

specifies the text encoding to use for the attachment as it is read into SAS.
You must enclose the value in quotation marks. For valid encoding values,
see "Encoding Values in SAS Language Elements" in SAS National

**EXTENSION=**`extension`

specifies a different file extension to be used for the specified attachment.
You must enclose the value in quotation marks. This extension is used by the
recipient's email program for selecting the appropriate utility to use for
displaying the attachment. This example results in the attachment home.html
being received as index.htm.

```
put '!em_attach! ('"home.html" name="index" ext="htm");
```

**NAME=**`filename`

specifies a different name to be used for the specified attachment. You must
enclose the value in quotation marks. This example results in the attachment
home.html being received as index.html.

```
put '!em_attach! ('"home.html" name="index");
```

**LRECL=**`lrecl`

where lrecl is the logical record length of the data.

```
LRECL=256
```

Alternatively, you can specify a global logical record length by
using the "LRECL= System Option" in SAS System Options:
Reference. In SAS 9.4, the default value for the global LRECL
system option is 32767. If you are using fixed-length records
(RECFM=F), the default value for LRECL is 256.

**OUTENCODING=**`encoding-value`

specifies the resulting text encoding for the attachment to be sent. You must
enclose the value in quotation marks.

**Restriction**

Do not specify EBCDIC encoding values, because the SMTP
email interface does not support EBCDIC.

**See**

"Encoding Values in SAS Language Elements" in SAS National
Language Support (NLS): Reference Guide
"!EM_BCC! bcc-address"
specifies the recipient or recipients that you want to receive a blind carbon copy of the email. Individuals that are listed in the bcc field receive a copy of the email. The BCC field does not appear in the email header, so that these email addresses cannot be viewed by other recipients.

If a BCC address contains more than one word, then enclose the address in single or double quotation marks. To specify more than one address, you must enclose the group of addresses in parentheses, enclose each address in single or double quotation marks, and separate each address with either a comma or a space. To specify a real name as well as an address, enclose the address in angle brackets (< >).

put '!em_bcc! joe@site.com';
put '!em_bcc! ("joe@site.com" "jane@home.net");
put '!em_bcc! Joe Smith <joe@site.com>;

"!EM_CC! cc-address"
specifies the recipient or recipients to receive a carbon copy of the email message. You must enclose the address in single or double quotation marks. To specify more than one address, enclose the group of addresses in parentheses, enclose each address in single or double quotation marks, and separate each address with either a comma or a space. To specify a real name as well as an address, enclose the address in angle brackets (< >). Here are examples:

put '!em_cc! joe@site.com';
put '!em_cc! ("joe@site.com" "jane@home.com");
put '!em_cc! Joe Smith <joe@site.com>;

"!EM_CONTENTTYPE! content/type"
specifies the content type for the attached file. If you do not specify a content type, SAS tries to determine the correct content type based on the filename. For example, if you do not specify a content type, a filename of home.html is sent with a content type of text/html.

Alias !EM_CT! and !EM_TYPE!
Default If SAS cannot determine a content type based on the filename and extension, the default value is text/plain.

"!EM_DELIVERYRECEIPT!"
specifies that a notification be sent when the email message is delivered to the recipient.

Note If the recipient's email client does not support "delivery receipt" requests or if the recipient does not allow these requests, the sender does not receive a "delivery receipt" notification when the email is delivered.

"!EM_EXPIRES! dd mon yyyy hh:mm"
replaces the current expiration date for the email message. Here are examples:

put '!em_expires! 15 Aug 2010 08:00';
put '!em_expires! 28 Feb 2011 23:00';

The format dd mon hh:mm parameters are defined as follows:

dd is an integer from 01 to 31 that represents the day of the month.
mon are the first three letters of the month name in English.
yyyy
    is a four-digit integer that represents the year.

hh
    is the number of hours that range from 00 through 23.

mm
    is the number of minutes that range from 00 through 59.

Tip  If the date and time have passed the current date and time, an error message occurs and no email is sent.

'!EM_FROM! from-address'
    replaces the current address of the author of the message being sent, which could be either the default or the address that is specified by the FROM= email option. The directive must be enclosed in quotation marks. You can specify only one email address. To specify the author's real name along with the address, enclose the address in angle brackets (< >). Here are examples:

    put '!em_from! martin@home.com';
    put '!em_from! Brad Martin <martin@home.com>,'

Default  The default value for !EM_FROM! is the email address of the user who is running SAS. Beginning in SAS 9.4M6, if the SENDER= option or the !EM_SENDER! option is specified, the default !EM_FROM! value is the email address that is specified in the SENDER= option or the !EM_SENDER! option.

Interaction  Use the !EM_SENDER! option to specify a return email address that is different from the author-specified email address in the !EM_FROM! option.

See  "'!EM_SENDER! sender-address'' on page 45

'!EM_IMPORTANCE! LOW | NORMAL | HIGH'
    specifies the priority of the email message. The directive must be enclosed in quotation marks. You can specify the priority in the language that matches your session encoding. However, SAS translates the priority into English because the actual message header must contain English in accordance with the RFC-2076 specification (Common Internet Message Headers). Here are examples:

    put '!em_importance! high';
    put '!em_importance! haut';

Default  NORMAL

'!EM_NEWMSG!'  clears all attributes of the current message that were set using PUT statement directives.

'!EM_READRECEIPT!
    specifies that a notification be sent when the email message is read by the recipient.

Note  If the recipient’s email client does not support “read receipt” requests or if the recipient does not allow these requests, the sender does not receive a “read receipt” notification when the recipient reads the email.
"!EM_REPLYTO! replyto-address"
specifies the email address or addresses of who receives replies. You must
close the address in single or double quotation marks. To specify more than
one address, enclose the group of addresses in parentheses, enclose each
address in single or double quotation marks, and separate each address with
either a comma or a space. To specify a real name along with an address,
enclose the address in angle brackets (< >). Here are examples:

put '"em_replyto! hiroshi@home.com"';
put '"em_replyto! ("hiroshi@home.com" "akiko@site.com")";
put '"em_replyto! Hiroshi Mori <mori@site.com>";

"!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. This directive is useful for writing DATA step programs that
conditionally send messages or use a loop to send multiple messages.

"!EM_SENDER! sender-address"
specifies the return email address for the message that is being sent. If a
message cannot be delivered, a notification is sent to the sender email address.
The default value for !EM_SENDER! is the email address of the user who is
running SAS. To specify the author's real name along with the address, enclose
the address in angle brackets (< >). Here are examples:

put '"EM_SENDER! martin@home.com";
put '"EM_SENDER! Brad Martin <martin@home.com>";

Default The default value for !EM_SENDER! is the email address of the user
who is running SAS. Beginning in SAS 9.4M6, if the FROM= option
or the !EM_FROM= option is specified, the default !EM_SENDER!
value is the email address that is specified in the FROM= option or
the !EM_FROM= option.

Interaction The !EM_SENDER!= address can be different from the FROM= or !
EM_FROM!= address. This allows for the message to be sent on
behalf of the email address that is specified in the FROM= or !
EM_FROM!= option.

See ""!EM_FROM! from-address"" on page 44

"!EM_SENSITIVITY! NORMAL | PRIVATE | PERSONAL | CONFIDENTIAL |
COMPANY-CONFIDENTIAL"
marks the email message with the specified sensitivity. For example:

put '"EMSENSITIVITY! CONFIDENTIAL"';

Notes If NORMAL is specified, no sensitivity header is added to the message.
The flags "company-confidential" and "confidential" are equivalent and
have the same effect. The "company-confidential" flag is in compliance
with RFC 2156.

"!EM_SUBJECT! subject"
replaces the current subject of the message. The directive must be enclosed in
quotation marks. If the subject contains special characters or more than one
word (that is, it contains at least one blank space), you must enclose the text in
quotation marks. Here are examples:
You can use encoded email passwords. When a password is encoded with PROC PWENCODE, the output string includes a tag that identifies the string as having been encoded. An example of a tag is \{sas001\}. The tag indicates the encoding method. Encoding a password enables you to avoid email access authentication with a password in plaintext. Passwords that start with "\{sas" trigger an attempt to be decoded. If the decoding succeeds, then the decoded password is used. If the decoding fails, then the password is used as is. For more information, see PROC PWENCODE in the Base SAS Procedures Guide.

For email messages that you send to another time zone, you can use the EMAILUTCOFFSET= system option to ensure that the email message has the UTC offset that represents your local time. You might use this option this if the time on your computer is not set to a time that uses a UTC offset or your computer does not
account for daylight saving time. The UTC offset specified in the 
EMAILUTCOFFSET= system option adds or replaces a UTC offset to the time in the 
email’s Date: header field. For more information, see “EMAILUTCOFFSET= System 
Option” in SAS System Options: Reference.

The default amount of time that the EMAIL access method waits for the SMTP 
server to respond is 30 seconds. Some SMTP servers require more time before 
they send an acknowledgment to a command from the client. You can use the 
EMAILACKWAIT= system option to specify the wait time. For more information, see 

You can use the EMAIL access method with secure SMTP servers by specifying the 
Transport Layer Security (TLS) protocol in the EMAILHOST= system option. TLS 
encrypts data between the client and the outgoing SMTP Server. This action does 
not guarantee an encrypted connection between the client (sender) and the 
recipient of the message. Message-level encryption and digital signing are currently 
not supported. For more information, see “EMAILHOST= System Option” in SAS 
System Options: Reference.

Note: All discussion of TLS is also applicable to the predecessor protocol, Secure 
Sockets Layer (SSL).

PUT Statement Syntax for EMAIL (SMTP) Access Method

In the DATA step, after using the FILE statement to define your email fileref as the 
output destination, use PUT statements to define the body of the message. Here is 
an example.

```sas
options emailsys=smtp;
filename mymail email 'martin@site.com' subject='Sending Email';
data _null_; 
  file mymail;
  put 'Hi';
  put 'This message is sent from SAS...';
run;
```

You can also use PUT statements to specify email directives that override the 
attributes of your message (the email options like TO=, CC=, SUBJECT=, 
CONTENT_TYPE=, ATTACH=), or to perform actions such as send, end 
abnormally, or start a new message. Specify only one directive in each PUT 
statement; each PUT statement can contain only the text that is associated with the 
directive that it specifies.

For a list of email directives, see “PUT Statement Email Directives” on page 41.

Examples:

Example 1: Sending Email with an Attachment Using a DATA Step

In order to share a copy of your SAS configuration file with another user, you could 
send it by submitting this program. The email options are specified in the 
FILENAME statement.

```sas
options emailsys=smtp;
```
Example 2: Using Conditional Logic in a DATA Step

You can use conditional logic in a DATA step in order to send multiple messages and control which recipients get which message. For example, in order to send customized reports to members of two different departments, this program produces an email message and attachments that are dependent on the department to which the recipient belongs. In the program, these actions occur:

- In the first PUT statement, the !EM_TO! directive assigns the TO attribute.
- The second PUT statement assigns the SUBJECT attribute using the !EM_SUBJECT! directive.
- The !EM_SEND! directive sends the message.
- The !EM_NEWMSG! directive clears the message attributes, which must be used to clear message attributes between recipients.
- The !EM_ABORT! directive abnormally ends the message before the RUN statement causes it to be sent again. The !EM_ABORT! directive prevents the message from being automatically sent at the end of the DATA step.

```sas
options emailsys=smtp;
filename mymail email "JBrown@site.com"
   subject="My SAS Configuration File"
   attach="/u/sas/sasv8.cfg";
data _null_;  
   file mymail;  
   put 'Jim,';  
   put 'This is my SAS configuration file.';  
   put 'I think you might like the';  
   put 'new options I added.';  
run;

This program sends a message and two file attachments to multiple recipients. For this example, the email options are specified in the FILE statement instead of the FILENAME statement.

```sas
options emailsys=smtp;
filename outbox email "ron@acme.com";
data _null_;  
   file outbox  
      to=("ron@acme.com" "humberto@acme.com")  
         /* Overrides value in */  
         /* filename statement */  
      cc=("miguel@acme.com" "loren@acme.com")  
      subject="My SAS Output"  
      attach=('C:\sas\results.out' 'C:\sas\code.sas')  
;  
   put 'Folks,';  
   put 'Attached is my output from the SAS';  
   put 'program I ran last night.';  
   put 'It worked great!';  
run;
```

Example 2: Using Conditional Logic in a DATA Step

You can use conditional logic in a DATA step in order to send multiple messages and control which recipients get which message. For example, in order to send customized reports to members of two different departments, this program produces an email message and attachments that are dependent on the department to which the recipient belongs. In the program, these actions occur:

- In the first PUT statement, the !EM_TO! directive assigns the TO attribute.
- The second PUT statement assigns the SUBJECT attribute using the !EM_SUBJECT! directive.
- The !EM_SEND! directive sends the message.
- The !EM_NEWMSG! directive clears the message attributes, which must be used to clear message attributes between recipients.
- The !EM_ABORT! directive abnormally ends the message before the RUN statement causes it to be sent again. The !EM_ABORT! directive prevents the message from being automatically sent at the end of the DATA step.

```sas
options emailsys=smtp;
filename reports email "Jim.Smith@work.com";
data _null_;  
   file reports;
```
Example 3: Sending Procedure Output in Email

You can use email to send procedure output. This example illustrates how to send ODS HTML in the body of an email message. The ODS HTML procedure output must be sent with the RECORD_SEPARATOR (RS) option set to NONE.

```sas
options emailsys=smtp;

filename outbox email
to='susan@site.com' type='text/html'
subject='Temperature Conversions';
data temperatures;
do centigrade = -40 to 100 by 10;
   fahrenheit = centigrade*9/5+32;
   output;
end;
run;
ods html
   body=outbox /* Mail it! */
   rs=none;
title 'Centigrade to Fahrenheit Conversion Table';
proc print;
id centigrade;
var fahrenheit;
run;
```

Example 4: Creating and Emailing an Image

This example illustrates how to create a GIF image and send it from SAS as an attachment to an email message.

```sas
options emailsys=smtp;

filename gsasfile email
to='Jim@acme.com'
```
Example 5: Using the MESSAGE/RFC822 Content Type

This example sends an email from an .mht file.

```sas
options emailsys=smtp;
filename myemail email
to="Jim@acme.com"
from="Wiley <wcoyote@acme.com>"
sender="Wiley <wcoyote@acme.com>"
subject="Message/RFC822 Example"
content_type="message/rfc822"
data _null_;    
    file myemail;
    infile 'C:\temp\customer.mht';
    input @;
    put _infile_; 
run;
```

Example 6: Creating an Email with an Embedded Image

This example creates an email that contains an embedded image.

```sas
options emailsys=smtp;
filename myemail email
to="Jim@acme.com"
from="Wiley <wcoyote@acme.com>"
sender="Wiley <wcoyote@sas.com>"
attach=('C:\Public\Pictures\Sample Pictures\sasLogo.gif' NAME="sasLogo" INLINED="logo"
     'C:\temp\reportToEmail.html' NAME='myreport')
subject="Embedded Image Example"
content_type="text/html"

data _null_;    
    file myemail;
    put 'Dear customer,<br><br>
    This is an example email with content type text/html, an attached report<br>
    and an embedded image.<br><br>
    Sincerely,<br><br>
    Wiley Coyote<br>
    Developer<br>
    SAS Research & Development<br>
    1234 Any Street<br>
    Sampletown<br>
    NC 45678<br><br><br>
    <IMG SRC="cid:logo" height="40" width="160">';
run;
```
FILENAME Statement: FILESRVC Access Method

Enables you to store and retrieve user content using the SAS Viya Files service.

Valid in: Anywhere
Category: Data Access

Syntax

Form 1: Use this form to access SAS Viya files using a file Uniform Resource Identifier (URI).

FILENAME fileref FILESRVC ‘file-uri’ <filesrvc-options>;

Form 2: Use this form to access a SAS Viya file using a collection option.

FILENAME fileref FILESRVC collection-option <filesrvc-options>;

Arguments

fileref
is a valid fileref.

Range 1 to 8 characters

FILESRVC
specifies the access method that enables you to create and access user content (such as reports) stored within the SAS Viya system.

file-uri
is a valid Uniform Resource Identifier (URI) of the content in the Files service. Here is an example. Note the file identifier contains a universally unique identifier (UUID) that is generated by the Files service when the content is created.

/files/files/<UUID>
Collection Options

The *collection-option* is one of these values:

**FOLDERPATH='path'**

specifies a path to a SAS Viya folder for directory access.

The fileref is used to access files that are members of the folder.

Here is an example:

```sas
filename jobout filesrvc folderpath='/output/user6/log';
```

**Restriction**

This option cannot be used with the FOLDERURI or PARENTURI options.

**Interaction**

If the FILENAME= option is specified, the fileref accesses the named file that is a member of the provided folder. If the FILENAME= option is not specified, the fileref is a directory fileref that presents all file members of the folder as directory members.

**FOLDERURI='uri'**

specifies a path to a SAS Viya folder by URI.

The fileref is used to access files that are members of the folder. Here is an example:

```sas
filename jobout filesrvc folderuri='/folders/folders/5a308aa7-1c3a-4465-a14c-fd69a9091926';
```

**Restriction**

This option cannot be used with the FOLDERPATH or PARENTURI options.

**Interaction**

If the FILENAME= option is specified, the fileref accesses the named file that is a member of the provided folder. If FILENAME= is not specified, the fileref is a directory fileref that presents all file members of the folder as directory members.

**PARENTURI='uri'**

specifies a SAS Viya object by Uniform Resource Identifier (URI).

The fileref is used to access files that are associated with the parent object. Here is an example:

```sas
filename jobout filesrvc parenturi='/jobExecution/jobs/5a308aa7-1c3a-4465-a14c-fd69a9091926';
```

**Restriction**

This option cannot be used with the FOLDERPATH or FOLDERURI options.

**Interaction**

If the FILENAME= option is specified, the fileref accesses the named file that has the provided PARENTURI. If FILENAME= is not specified, the fileref is a directory fileref that presents all file associations of the object as directory members.

**Note**

Files with the PARENTURI association are deleted when the parent object is deleted.
FILENAME Statement: FILESRVC Access Method 53

FILESRVC Options

The filesrvc-options can include these values:

**CONTENTTYPE='content-type'**
specifies a default HTTP Content-Type header to be returned with the file when
the file's content is retrieved from the Files service.

**Default**
The provided file extension is mapped to a default content type. If a
mapping is not found for a provided file extension, the default content
type is set to application/octet-stream.

**CONTENTDISP='string'**
specifies how to deliver the file.

Here is an example that displays content as a file attachment:

```
CD='attachment; filename="name.ext"
```

**DEBUG=ERROR | HTTP**
writes debugging information to the SAS log.

**ERROR**
indicates to write debugging information when HTTP calls fail.

**HTTP**
indicates to write debugging information for all HTTP calls.

**DESCRIPTION='string'**
specifies a description for the file.

**DOCUMENTTYPE='document-type'**
sets the document type attribute of the file.

**ENCODING='encoding-value'**
specifies the encoding to use when SAS is reading from or writing to an 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.

**DEFAULT**
SAS assumes that an external file is in the same encoding as the
session encoding.

**See**
“Encoding Values in SAS Language Elements” in SAS National
Language Support (NLS): Reference Guide

**FILENAME='name'**
specifies the name of a file.
When specifying a FILENAME, a file collection option must also be specified using the FOLDERPATH, FOLDERURI, or PARENTURI option.

Default content-type for a file is mapped using the file extension specified in the provided filename. If no mapping is found for a provided file extension, the content-type is `application/octet-stream` unless specified differently with CONTENTTYPE.

**LRECL=**

specifies the logical record length. The LRECL value specifies the maximum number of bytes that can be accessed in one read or write call. Records that are longer than the specified LRECL might be truncated.

Beginning in SAS Viya 3.4, if files are created in the Files Service using the FILESRVC filename, LRECL and RECFM attributes are saved in the Files Service file. If you write a file using the Files Service with an LRECL= value and then read the file without specifying a value for LRECL=, the file is read using the value specified during the write.

<table>
<thead>
<tr>
<th>Range</th>
<th>1 to 1G</th>
</tr>
</thead>
<tbody>
<tr>
<td>Default</td>
<td>32,767 bytes</td>
</tr>
</tbody>
</table>

**MOD**

indicates that data written to the file should be appended to the file instead of overwriting the file.

**RECFM=**

specifies the record format. The RECFM= option is used for both input and output. The RECFM= option can be one of these values:

- **F**
  - is a fixed record format. That is, each record has the same length.

- **N**
  - is a binary format. The file consists of a stream of bytes with no record boundaries.

- **S**

- **V**
  - is a variable record format. Each record ends with a newline character. You can specify the record delimiter using the TERMSTR= option.

**TERMSTR=**

specifies the record delimiter used for variable record format files (RECFM=V). Accepted values are CR, CRLF, LF, and NULL.

**Defaults**

CRLF for Windows.
Details

Basics of the FILESRVC Access Method

The FILESRVC access method enables you to store and retrieve user content using the SAS Viya Files service. The FILESRVC access method stores files and associates files to folders, but it does not create or delete the folders. The FILESRVC access method can support all file encodings that are supported by the Files service. For more information, see “Encoding Values in SAS Language Elements” in SAS National Language Support (NLS): Reference Guide.

In order to use the FILESRVC access method, you must set the SERVICESBASEURL= system option and define the SAS_VIYA_TOKEN environment variable.

The SERVICESBASEURL= system option must be set before the invocation of your SAS session. This option specifies the host and port for Files service requests. The FILENAME statement fails at assignment time if the SERVICESBASEURL= option is not specified. For more information, see “SERVICESBASEURL= System Option” in SAS System Options: Reference.

The SAS_VIYA_TOKEN environment variable must also be defined. For more information about defining this variable, see “SAS_VIYA_TOKEN Environment Variable” in Encryption in SAS. For more information about obtaining the access token, see “Obtain an Access Token Using Password Credentials” in SAS Viya Administration.

Interacting with the Files Service

The Files service enables you to store, retrieve, and delete user content that is maintained in the SAS Infrastructure Data Server database repository. The repository is not considered a complete 'file system.' Rather, the repository contains individual files that are directly accessible by their file identifier. This file identifier contains a universally unique identifier (UUID) that is generated by the Files service when a file is created.

The Files service also assigns a unique name to each file in the repository, but the name is not human-friendly. A user can change the name, but the name might not be unique within the repository.

You can access a file in the Files service by using the file identifier. The file identifier is contained in the URI that is stored in the file information. Use the system-generated name or user-assigned name to find the file URI and the file identifier. After you find the file identifier, you can use it to access the file directly in the Files service.

The Files service does not have a concept of 'folders' in its repository. However, you can associate files by using a PARENTURI. A PARENTURI is a relative URI for any object in SAS Viya. You can create a collection of files by specifying the same PARENTURI for each file.

For information about the SAS Infrastructure Data Server database, see "SAS Infrastructure Data Server" in SAS Viya Administration.

For more information about the Files service, see the SAS Viya Files API.
SAS Viya Folders Service

Unlike the Files service, the SAS Viya Folders service does provide support for folders. The Folders service also supports associating objects from other SAS Viya services (including the file objects in the Files service) with the Folders service folders as members.

The FILESRVC access method provides file operations for interacting with the Files service. Part of this interaction involves using the Folders service to provide grouping and directory operations and member operations. The access method can create files, associate files to a folder, and delete them from a folder. However, the access method does not support the creation or deletion of folders in the Folders service.

For more information about the Folders service, see the SAS Viya Folders API.

Generating a FILESRVC Macro Variable

When a single file or a folder is assigned to a FILESRVC fileref, a macro variable is generated. This macro variable allows for an easy way to access the file or folder. The macro variable name is _FILESRVC__fileref__URI. For a single file, this macro variable value is the Uniform Resource Identifier (URI) for the file (for example, /files/files/UUID). If the file does not exist, the value is blank. When you create a file using the FILESRVC access method, the macro variable is updated with the file's URI. For a folder, the macro variable value is the value of the folder URI.

Note: The FILESRVC access method does not create folders. The folder must already exist when the folder is specified using the FOLDERPATH= or FOLDERURI= collection options.

FILESRVC macro variables exist until the end of the SAS session. The value of the variable is changed only if the fileref is successfully re-assigned to a different Files service file. If the file is deleted using the FILESRVC access method, the macro variable remains, but the value of the variable is set to null.

Examples:

Example 1: Accessing a File by Name and Folder

This example accesses the sales.csv file in the /Shared Data/Sales folder.

    filename myfldr2 filesrvc folderpath='/Shared Data/Sales' filename='sales.csv';

This example accesses the sales.csv file in the folder denoted by the provided folder URI.

    filename myfldr filesrvc
       folderuri='/folders/folders/5a308aa7-1c3a-4465-a14c-fd69a9091926'
       filename='sales.csv';

Example 2: Reading a File from a Folder

This example reads a file using the directory member syntax and displays the contents.

    filename myfldr filesrvc folderPath='/Users/Test/My Folder';
    data work.mydata;
infile myfldr('mytest.dat');
input f_name $ l_name $ age weight;
put _all_; run;

Here is the log:

MYFLDR('mytest.dat') is:
   Filename=mytest.dat,
   URI path=/files/files/8309f9f4-57b6-46d0-8925-93e5ada65636,
NOTE: The infile library MYFLDR is:
   Directory=/Users/Test/My Folder,
   Description=My Folder for Test,
   Folder Identifier=6ba02f63-9fa4-4843-bd76-441efe1cf9df,
   Last Modified=26Oct2017:13:57:11
NOTE: The infile
   File Identifier=8309f9f4-57b6-46d0-8925-93e5ada65636,
   Content Type=application/octet-stream, RECFM=V,
   LRECL=32767, File Size (bytes)=328,
   Last Modified=26Oct2017:13:59:59,
   Create Time=26Oct2017:13:57:10
f_name=Fred l_name=Jones age=45 weight=187 _ERROR_=0 _N_=1
f_name=Wanda l_name=Smith age=33 weight=115 _ERROR_=0 _N_=2
f_name=Sylvia l_name=Holman age=67 weight=101 _ERROR_=0 _N_=3
f_name=Dean l_name=Felton age=58 weight=172 _ERROR_=0 _N_=4
NOTE: A total of 4 records were read from the infile library MYFLDR.
   The minimum record length was 80.
   The maximum record length was 80.
NOTE: 4 records were read from the infile MYFLDR('mytest.dat').
   The minimum record length was 80.
   The maximum record length was 80.
NOTE: The data set WORK.MYDATA has 4 observations and 4 variables.

Example 3: Listing Members of a Folder

This example shows how you can write out a list of members of a folder.

filename myfldr filesrvc folderPath='/Users/Test/My Folder';
data _null_;
did = dopen('myfldr');
mcount = dnum(did);
put 'MYFLDR contains ' mcount ' member(s)...';
do i=1 to mcount;
   memname = dread(did, i);
   put i @5 memname;
end;
rc = dclose(did);
run;

Here is the partial log:
Example 4: Creating a File and Associating It with a Parent URI

This example creates the file `class.csv` and associates the file with a job object referenced in the fileref `jobout`.

```sas
filename jobout filesrvc
  parenturi='/jobExecution/jobs/5a308aa7-1c3a-4465-a14c-fd69a9091926';
data _null_
  set sashelp.class;
  file jobout('class.csv');
  put name "", sex "", age "", height "", weight;
run;
```

Example 5: Accessing an Associated File Using a Parent URI

This example accesses the `class.csv` file by using a parent object URI.

```sas
filename jobout filesrvc
  parenturi='/jobExecution/jobs/5a308aa7-1c3a-4465-a14c-fd69a9091926';
data _null_
  length name $8 sex $1;
  infile jobout('class.csv') dlm=',';
  input name sex age height weight;
run;
```

See Also

Environment Variables:

- “SAS_VIYA_TOKEN Environment Variable” in *Encryption in SAS*

Statements:

- “FILENAME Statement” on page 15

System Options:

- “SERVICESBASEURL= System Option” in *SAS System Options: Reference*

FILENAME Statement: FTP Access Method

Enables you to access remote files by using the FTP protocol.
Valid in: Anywhere
Category: Data Access
Restriction: When SAS is in a locked-down state, the FILENAME statement, FTP access method is not available. Your server administrator can re-enable this access method so that it is accessible in the locked-down state. For more information, see “SAS Processing Restrictions for Servers in a Locked-Down State” in SAS Language Reference: Concepts.

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

Arguments
fileref
is a valid fileref.

Range 1 to 8 bytes

Note In SAS 9.4M3, the locale in which the SAS job is being run must support UTF-8 characters or your transcoded characters might not be what you expect. If the SAS program is running on z/OS, the OPTS UTF8 ON protocol command is not issued and no UTF-8 transcoding occurs.

Tip The association between a fileref and an external file lasts only for the duration of the SAS session or until you change it or discontinue it with another FILENAME statement. You can change the fileref for a file as often as you want.

FTP
specifies the access method that enables you to use File Transfer Protocol (FTP) to read from or write to a file from any host computer that you can connect to on a network with an FTP server running.

Tip Use FILENAME with FTP when you want to connect to the host computer, to log on to the FTP server, to make records in the specified file available for reading or writing, and to disconnect from the host computer.

'external-file'
specifies the physical name of an external file that you want to read from or write to. The physical name is the name that is recognized by the operating environment.

If the file has an IBM 370 format and a record format of FB or FBA, and if the ENCODING= option is specified, you must also specify the LRECL= option. If the length of a record is shorter than the value of LRECL, then SAS pads the record with blanks until the record length is equal to the value of LRECL.

Operating environment
For details about specifying the physical names of external files, see the SAS documentation for your operating environment.

Tips If you are not transferring a file but performing a task such as retrieving a directory listing, then you do not need to specify a filename. Instead, put empty quotation marks in the statement. See “Example 1: Retrieving a Directory Listing” on page 70.
You can associate a fileref with a single file or with an aggregate file storage location.

If you use the DIR option, specify the directory in this argument.

**ftp-options**

specifies details that are specific to your operating environment such as file attributes and processing attributes.

<table>
<thead>
<tr>
<th>Operating environment</th>
<th>For more information about some of these FTP options, see the SAS documentation for your operating environment.</th>
</tr>
</thead>
<tbody>
<tr>
<td>See</td>
<td>“FTP Options” on page 60</td>
</tr>
</tbody>
</table>

### FTP Options

**AUTHDOMAIN=**"auth-domain"

specifies the name of an authentication domain metadata object in order to connect to the FTP server. The authentication domain references credentials (user ID and password) without your having to explicitly specify the credentials. The *auth-domain* name is case sensitive, and it must be enclosed in double quotation marks.

An administrator creates authentication domain definitions while creating a user definition with the User Manager in SAS Management Console. The authentication domain is associated with one or more login metadata objects that provide access to the FTP server and is resolved by the BASE engine calling the SAS Metadata Server and returning the authentication credentials.

**Requirement**
The authentication domain and the associated login definition must be stored in a metadata repository, and the metadata server must be running in order to resolve the metadata object specification.

**Interaction**
If you specify AUTHDOMAIN=, you do not need to specify USER= and PASS=.

**See**
For more information about creating and using authentication domains, see the discussion on credential management in SAS Intelligence Platform: Security Administration Guide.

**AUTHTLS**

issues the FTP AUTH TLS command to the FTP server that requests TLS authentication. The Secure Command Channel Mode is entered by issuing the AUTH TLS command.

**Requirement**
The AUTH TLS command must be issued to set up Control Channel protection before the Data Channel can be protected.

**Interactions**
If you specify either the AUTHTLS, PROT=, or PBSZ= option, the AUTH TLS command is issued. An attempt to negotiate the TLS security with the FTP server occurs to protect the FTP Control Channel. If you specify the PROT= or PBSZ= option either independently or in conjunction with the AUTHTLS option, then an attempt to negotiate TLS security with the FTP server occurs to protect the FTP Control and Data Channels.

Instead of using the FILENAME FTP statement to turn TLS authentication on, you can define the SAS_FTP_AUTHTLS
FILENAME Statement: FTP Access Method

environment variable. For more information, see “SAS_FTP_AUTHTLS Environment Variable” on page 203.

See

“PBSZ=protection-buffer-size” on page 65
“PROT=protection-level” on page 66

**BINARY**

is fixed-record format. Thus, all records are of size LRECL with no line delimiters. Data is transferred in image (binary) mode.

The BINARY option overrides the value of RECFM= in the FILENAME FTP statement, if specified, and forces a binary transfer.

Alias RECFM=F

Interaction If you specify the BINARY option and the S370V or S370VS option, then SAS ignores the BINARY option.

**BLOCKSIZE=blocksizewhere blocksizewhere is the size of the data buffer in bytes.**

Default 32768

**CD=directoryissuesacommandthatchangestheworkingdirectoryforthefiletransfertothedirectorythatyouspecify.**

Restriction The CD option cannot be used to specify a directory to delete files. Use the FDELETE= function:

```
filename delfile ftp 'mydir/myfile.txt' host='myhost.sas.com'
   user='user1' prompt;
data _null_
   rc=fdelete('delfile');
   put rc=;
run;
```

Interaction The CD and DIR options are mutually exclusive. If both are specified, FTP ignores the CD option and SAS writes an informational note to the log.

**DEBUG**

writes to the SAS log informational messages that are sent to and received from the FTP server.

**DIR**

enables you to access directory files, PDS members, or PDSE members. Specify the directory name in the *external-file* argument. You must use valid directory syntax for the specified host.

Interaction The CD and DIR options are mutually exclusive. If both are specified, FTP ignores the CD option and SAS writes an informational note to the log.

Tips If you want FTP to append a file extension of DATA to the member name that is specified in the FILE or INFILE statement, then use the FILEEXT option in conjunction with the DIR option. The FILEEXT
option is ignored if you specify a file extension in the FILE or INFILE statement.

If you want FTP to create the directory, then use the NEW option in conjunction with the DIR option. The NEW option is ignored if the directory exists.

If the NEW option is omitted and you specify an invalid directory, then a new directory is not created and you receive an error message.

The maximum number of directory or z/OS PDSE members that can be open simultaneously is limited by the number of sockets that can be open simultaneously on an FTP server. The number of sockets that can be open simultaneously is proportional to the number of connections that are set up during the installation of the FTP server. You might want to limit the number of sockets that are open simultaneously to avoid performance degradation.

Example  "Example 10: Reading and Writing from Directories" on page 73

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.

Default SAS assumes that an external file is in the same encoding as the session encoding.

Tip The data is transferred in image or binary format and is in local data format. Thus, you must use appropriate SAS informats to read the data correctly.


FILEEXT specifies that the member type of DATA is automatically appended to the member name in the FILE or INFILE statement when you use the DIR option.

Tip The FILEEXT option is ignored if you specify a file extension in the FILE or INFILE statement.

See LOWCASE_MEMNAME option on page 63

Example  "Example 10: Reading and Writing from Directories" on page 73

HOST='host'
where host is the network name of the remote host with the FTP server running.

You can specify either the name of the host (for example, server.pc.mydomain.com) or the IP address of the computer (for example, 2001:db8::).
HOSTRESPONSELEN='size'
where size is the length of the FTP server response message.

<table>
<thead>
<tr>
<th>Default</th>
<th>2048 bytes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range</td>
<td>2048 to 16384 bytes</td>
</tr>
<tr>
<td>Restriction</td>
<td>If you specify a size that is less than 2048 or is greater than 16384, the size is set to 2048.</td>
</tr>
</tbody>
</table>

LIST
issues the LIST command to the FTP server. LIST returns the contents of the working directory as records that contain all of the file attributes that are listed for each file.

Tip  The file attributes that are returned vary, depending on the FTP server that is being accessed.

LOWCASE_MEMNAME
enables autocall macro retrieval of lowercase directory or member names from FTP servers.

Restriction  SAS autocall macro retrieval always searches for uppercase directory member names. Mixed case directory or member names are not supported.

Interaction  If you access files off FTP servers by using the %INCLUDE, FILE, INFILE, or other DATA step I/O statements, case sensitivity is preserved.

See  FILEEXT option on page 62

LRECL=lrecl
where lrecl is the logical record length of the data.

<table>
<thead>
<tr>
<th>Default</th>
<th>32767</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interaction</td>
<td>Alternatively, you can specify a global logical record length by using the &quot;LRECL= System Option&quot; in SAS System Options: Reference. In SAS 9.4, the default value for the LRECL system option is 32767. If you are using fixed-length records (RECFM=F), the default value for LRECL is 256.</td>
</tr>
</tbody>
</table>

LS
issues the LS command to the FTP server. LS returns the contents of the working directory as records with no file attributes.

Tips  The file attributes that are returned vary, depending on the FTP server that is being accessed.

To return a listing of a subset of files, use the LSFILE= option in addition to LS.

LSFILE='character-string'
in combination with the LS option, specifies a character string that enables you to request a listing of a subset of files from the working directory. Enclose the character string in quotation marks.
LSFILE= can be used only if LS is specified.

Tips
You can specify a wildcard as part of 'character-string'.

The file attributes that are returned vary, depending on the FTP server that is being accessed.

Example
This statement lists all of the files that start with sales and end with sas:
filename myfile ftp '' ls lsfile='sales*.sas'
other-ftp-options;

MGET
transfers multiple files, similar to the FTP command MGET.

Tips
The whole transfer is treated as one file. However, as the transfer of each new file is started, the EOV= variable is set to 1.

Specify MPROMPT to prompt the user before each file is sent.

MPROMPT
specifies whether to prompt for confirmation that a file is to be read, if necessary, when the user executes the MGET option.

Restriction
The MPROMPT option is not available on z/OS for batch processing.

NEW
specifies that you want FTP to create the directory when you use the DIR option.

Restriction
The NEW option is not available under z/OS.

Tip
The NEW option is ignored if the directory exists.

PASS='password'
where password is the password to use with the user name specified in the USER= option.

Tips
You can specify the PROMPT option instead of the PASS option, which tells the system to prompt you for the password.

If the user name is anonymous, then the remote host might require that you specify your email address as the password.

To use an encoded password, use the PWENCODE procedure in order to disguise the text string, and then enter the encoded password for the PASS= option. For more information, see “PWENCODE Procedure” in Base SAS Procedures Guide.

Example
"Example 6: Using an Encoded Password" on page 72

PASSIVE
specifies that an attempt is made for passive mode FTP.

In passive mode FTP, the client initiates the control and data connections to the server. This action solves the problem of firewalls filtering the incoming data port connection to the client from the server.

Note
Not all FTP servers support the passive mode. If an attempt is made by the FILENAME statement FTP access method to issue the PASV
command and the command fails or the server does not accept the command, then active mode FTP is used for the connection.

**PBSZ=** *protection-buffer-size*

specifies the FTP data channel Protection Buffer Size.

<table>
<thead>
<tr>
<th>Default</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range</td>
<td>0–2147483647 bytes</td>
</tr>
</tbody>
</table>

**Interactions**

If you specify either the AUTHTLS, PROT=, or PBSZ= option, the AUTH TLS command is issued. An attempt to negotiate the TLS security with the FTP server occurs to protect the FTP Control Channel. If you specify the PROT= or PBSZ= option either independently or in conjunction with the AUTHTLS option, then an attempt to negotiate TLS security with the FTP server occurs to protect the FTP Control and Data Channels.

Instead of using the FILENAME FTP statement to turn TLS authentication on, you can define the SAS_FTP_AUTHTLS environment variable. For more information, see “SAS_FTP_AUTHTLS Environment Variable” on page 203.

**Note**

IBM Mainframe FTP servers typically change whatever value you specify with the PBSZ= option to 0.

**Tip**

If you specify a buffer size that is not within the range, the default value of 0 is used.

**See**

“AUTHTLS” on page 60

“PROT=**protection-level**” on page 66

**PORT=** *portno*

where *portno* is the port that the FTP daemon monitors on the respective host. The *portno* can be any number between 0 and 65535 that uniquely identifies a service.

**Tip**

In the internet community, there is a list of predefined port numbers for specific services. For example, the default port for FTP is 21. A partial list of port numbers is usually available in the */etc/services* file on any UNIX computer.

**PROMPT**

specifies to prompt for the user login password, if necessary.

**Restriction**

The PROMPT option is not available for batch processing under z/OS.

**Interaction**

If PROMPT is specified without USER=, then the user is prompted for an ID, as well as a password.

**Tip**

You can use the SAVEUSER option on page 68 to save the user ID and password after the user ID and password prompt is successfully executed.
**PROT=protection-level**
issues the FTP Data Channel protection level command. *protection-level* can be one of these values:

- **C** provides only FTP Control Channel security. The Data Channel is not protected.
- **E** provides Confidentiality Protection.
- **S** provides Integrity checking.
- **P** provides both Integrity checking and Confidentiality Protection.

**Default**
P

**Interactions**
If you specify either the AUTHTLS, PROT=, or PBSZ= option, the AUTH TLS command is issued. An attempt to negotiate the TLS security with the FTP server occurs to protect the FTP Control Channel. If you specify the PROT= or PBSZ= option either independently or in conjunction with the AUTHTLS option, then an attempt to negotiate TLS security with the FTP server occurs to protect the FTP Control and Data Channels.

Instead of using the FILENAME FTP statement to turn TLS authentication on, you can define the SAS_FTP_AUTHTLS environment variable. For more information, see “SAS_FTP_AUTHTLS Environment Variable” on page 203.

**See**
- “AUTHTLS” on page 60
- “PBSZ=protection-buffer-size” on page 65

**RCMD= 'command'**
where *command* is the FTP 'SITE' or 'service' command to send to the FTP server.

FTP servers use SITE commands to provide services that are specific to a system and are essential to file transfer but not common enough to be included in the protocol.

For example, `rcmd='site rdw'` preserves the record descriptor word (RDW) of a z/OS variable blocked data set as a part of the data. For more information, see “S370V” on page 68 and “S370VS” on page 68.

**Interaction**
Some FTP service commands might not run at a particular client site depending on the security permissions and the availability of the commands.

**Tips**
If you transfer a file with the FTP access method and then cannot read the file, you might need to change the FTP server's UMASK setting.

If the FTP server supports a SITE UMASK setting, you can change the permissions of the file as shown in this example:

```plaintext
filename in ftp '/mydir/accounting/file2.dat'
host="xxx.fyi.xxx.com"
```

FILENAME Statement: FTP Access Method

user="john"
rcmd='site umask 022'
prompt;
data _null;
file in;
put a $80;
run;

You can specify multiple FTP service commands if you separate them by semicolons. Here are examples:
rcmd='ascii;site umask 002'
rcmd='stat;site chmod 0400 -mydir/abc.txt'

**RECFM=recfm**

where *recfm* is one of three record formats:

**F**

is a fixed-record format. Thus, all records are of size LRECL with no line delimiters. Data is transferred in image (binary) mode.

**Aliases**

**BINARY**

The BINARY option overrides the value of RECFM= in the FILENAME FTP statement, if specified, and forces a binary transfer.

**Interaction**

The default value for the LRECL system option is 32767. If you are using fixed-length records (RECFM=F), the default value for LRECL is 256.

**S**

is a stream-record format. Data is transferred in image (binary) mode.

**Interaction**

The amount of data that is read is controlled by the current LRECL value or by the value of the NBYTE= variable in the INFILE statement. The NBYTE= option specifies a variable that is equal to the amount of data to be read. This amount must be less than or equal to LRECL.

**See**

The NBYTE= option in the INFILE statement.

**V**

is a variable-record format (the default). In this format, records have varying lengths, and the records are transferred in text mode.

**Interaction**

Any record larger than LRECL is truncated.

**Tip**

If you are using files with the IBM 370 Variable format or the IBM 370 Spanned Variable format, then you might want to use the S370V or S370VS options instead of the RECFM= option. For more information, see “S370V” on page 68 and “S370VS” on page 68.

**Default**

**V**

**Interaction**

If you specify the RECFM= option and the S370V or S370VS option, then SAS ignores the RECFM= option.
RHELP
issues the HELP command to the FTP server. The results of this command are
returned as records.

RSTAT
issues the RSTAT command to the FTP server. The results of this command are
returned as records.

SAVEUSER
saves the user ID and password after the user ID and password prompt are
successfully executed.

Interaction The user ID and password are saved only for the duration of the SAS
session or until you change the association between the fileref and
the external file, or discontinue it with another FILENAME statement.

S370V
indicates that the file being read is in IBM 370 variable format.

Interaction If you specify this option and the RECFM= option, then SAS ignores
the RECFM= option.

Tips The data is transferred in image or binary format and is in local data
format. Thus, you must use appropriate SAS informats to read the
data correctly on non-EBCDIC hosts.

Use the rcmd='site rdw' option when you transfer a z/OS data set
with a variable-record format to another z/OS data set with a
variable-record format to preserve the record descriptor word (rdw)
of each record. By default, most FTP servers remove the rdw that
exists in each record before it is transferred.

Typically, the 'SITE RDW' command is not necessary when you
transfer a data set with a z/OS variable-record format to ASCII, or
when you transfer an ASCII file to a z/OS variable-record format.

S370VS
indicates that the file that is being read is in IBM 370 variable-spanned format.

Interaction If you specify this option and the RECFM= option, then SAS ignores
the RECFM= option.

Tips The data is transferred in image or binary format and is in local data
format. Thus, you must use appropriate SAS informats to read the
data correctly on non-EBCDIC hosts.

Use the rcmd='site rdw' option when you transfer a z/OS data set
with a variable-record format to another z/OS data set with a
variable-record format to preserve the record descriptor word (rdw)
of each record. By default, most FTP servers remove the rdw that
exists in each record before it is transferred.

Typically, the 'SITE RDW' command is not necessary when you
transfer a data set with a z/OS variable-record format to ASCII, or
when you transfer an ASCII file to a z/OS variable-record format.

TERMSTR='eol-char'
where eol-char is the line delimiter to use when RECFM=V. There are three valid
values:
CRLF  carriage return (CR) followed by line feed (LF).
LF    line feed only (the default).
NULL  NULL character (0x00).

Default LF
Restriction Use this option only when RECFM=V.

**USER='username'**

where *username* is used to log on to the FTP server.

Restriction The FTP access method does not support FTP proxy servers that require user ID authentication.

Interaction If PROMPT is specified, but USER= is not, then the user is prompted for an ID.

Tip You can specify a proxy server and credentials for an FTP server when using the FTP access method. The user ID and password that you need to log on to the FTP server is sent via the proxy server by using the *user=*userid@ftpsservername* pass=*password*
*host=*proxy.server.xxx.com* syntax. Both anonymous and user ID validation are supported.

Example "Example 1: Retrieving a Directory Listing" on page 70

**WAIT_MILLISECONDS=milliseconds**
specifies the FTP response time in milliseconds.

Default 1,000 milliseconds

Tips If you receive a "connection closed; transfer aborted" or "network name is no longer available" message in the log, use the **WAIT_MILLISECONDS** option to increase the response time.

If you use the FEXIST function and the function reports a data set not found but the data set is cataloged, use the **WAIT_MILLISECONDS** option to increase the response time.

Details

The FTP access method lets you download and upload files. This method directly reads files into your SAS session without first storing them on your system.

In **SAS 9.4M3**, the FTP access method also supports Secure FTP (FTPS). FTPS includes full support for the Transport Layer Security (TLS) and Secure Socket Layer (SSL) cryptographic protocols, including the use of server-side public key authentication certificates and client-side authorization certificates.

The Transport Layer Security (TLS) protocol is used when the URL begins with "ftps" instead of "ftp". TLS and its predecessor, Secure Sockets Layer (SSL), are cryptographic protocols that are designed to provide communication security over the internet. TLS and SSL are protocols that provide network data privacy, data integrity, and authentication. In addition to providing encryption services, TLS performs client and server authentication, and it uses message authentication codes to ensure data integrity. The TLS protocol allows client/server applications to
communicate across a network in a way that is designed to prevent eavesdropping and tampering. TLS is supported by all major browser software.

The name of the FTP server being accessed must match the TLS or SSL certificate name created for that server. For UNIX and z/OS operating environments, the TLS or SSL certificate must be stored in an ASCII file and referred to by the SSLCALISTLOC= system option. The SSLCALISTLOC= system option specifies the location of a single file that contains the public certificate or certificates for all of the trusted certification authorities (CA) in the trust chain. On Windows operating environments, the TLS or SSL certificate needs to be imported to the certificate store for the computer.

**Note:** All discussion of TLS is also applicable to the predecessor protocol, SSL.

**Note:** If you do not specify the AUTHTLS, PROT=, or PBSZ= option in the FILENAME statement, FTP Access Method, TLS authentication is attempted. If the FTP server does not accept TLS authentication, then basic FTP authentication is used.

**Comparisons**

As with the FTP `get` and `put` commands, the FTP access method enables you to download and upload files. However, this method directly reads files into your SAS session without first storing them on your system.

**Examples:**

**Example 1: Retrieving a Directory Listing**

This example retrieves a directory listing from a host named `mvshost1` for user `smythe`, and prompts `smythe` for a password:

```sas
filename dir ftp '' ls user='smythe'
    host='mvshost1.mvs.sas.com' prompt;
data _null_;infile dir;input;put _INFILE_;run;
```

**Note:** The quotation marks are empty because no file is being transferred. However, because quotation marks are required by the syntax, you must include them.

**Example 2: Reading a File from a Remote Host**

This example reads a file called `sales` in the directory `/u/kudzu/mydata` from the remote UNIX host `hp720`.

```sas
filename myfile ftp 'sales' cd='/u/kudzu/mydata'
    user='guest' host='hp720.hp.sas.com'
```
Example 3: Creating a File on a Remote Host

This example creates a file called test.dat in a directory called c:\remote for the user bbailey on the host winnt.pc.

``` SAS
filename create ftp 'c:\remote\test.dat'
    host='winnt.pc'
    user='bbailey' prompt recfm=v;
```

``` SAS
data _null_;
    file create;
    do i=1 to 10;
        put i=;
    end;
run;
```

Example 4: Reading an S370V-Format File on z/OS

This example reads an S370V-format file from a z/OS system. For more information about RCMD=site rdw, see RCMD= option on page 66.

``` SAS
filename viewdata ftp 'sluggo.stat.data'
    user='sluggo' host='zoshost1'
    s370v prompt rcmd='site rdw';
```

``` SAS
data mydata / view=mydata;   /* Create a view */
    infile viewdata;
    input x $ebcdic8.;
run;
```

Example 5: Anonymously Logging In to FTP

This example shows how to log on to FTP anonymously, if the host accepts anonymous logins.

Note: Some anonymous FTP servers require a password. If required, your email address is usually used. See PASS= option on page 64 under “FTP Options.”

``` SAS
filename anon ftp ''' ls host='130.96.6.1'
    user='anonymous';
```

``` SAS
data _null_;
    infile anon;
    input;
    list;
run;
```
Note: The quotation marks following the argument FTP are empty. A filename is needed only when transferring a file, not when routing a command. However, the quotation marks are required.

---

Example 6: Using an Encoded Password

This example shows you how to use an encoded password in the FILENAME statement.

In a separate SAS session, use the PWENCODE procedure to encode your password and make note of the output.

```sas
proc pwencode in= "MyPass1";
run;
```

This output appears in the SAS log:

```
(sas001)TX1QYXNzMQ==
```

You can now use the entire encoded password string in your batch program.

```sas
filename myfile ftp 'sales' cd='/u/kudzu/mydata'
user='tjbarry' host='hp720.hp.mycompany.com'
pass="(sas001)TX1QYXMZ==";
```

Example 7: Importing a Transport Data Set

This example uses the CIMPORT procedure to import a transport data set from a host named myshost1 for user calvin. The new data set resides locally in the Sasuser library. Note that user and password can be SAS macro variables. If you specify a fully qualified data set name, then use double quotation marks and single quotation marks. Otherwise, the system appends the profile prefix to the name that you specify.

```sas
%let user=calvin;
%let pw=xxxxx;
filename inp ftp 'calvin.mat1.cpo' user=&user
    pass=&pw rcmd='binary'
    host='mvshost1';
proc cimport library=sasuser infile=inp;
run;
```

Example 8: Transporting a SAS Library

This example uses the CPORT procedure to transport a SAS library to a host named mvshost1 for user calvin. It creates a new sequential file on the host called userid.mat64.cpo with the record format of fb, lrecl of 80, and blocksize of 8000.

```sas
filename inp ftp 'mat64.cpo' user='calvin'
    pass='xxxxx' host='mvshost1'
    lrecl=80 recfm=f blocksize=8000
    rcmd='site blocksize=800 recfm=fb lrecl=80';
proc cport library=mylib file=inp;
run;
```
Example 9: Creating a Transport Library with Transport Engine

This example creates a new SAS library on host **mvshost1**. The **FILENAME** statement assigns a fileref to the new data set. Note the use of the **RCMD=** option to specify important file attributes. The **LIBNAME** statement uses a libref that is the same as the fileref and assigns it to the XPORT engine. The **PROC COPY** step copies all data sets from the SAS library that are referenced by **MYLIB** to the XPORT engine. Output from the **PROC CONTENTS** step confirms that the copy was successful:

```sas
filename inp ftp 'mat65.cpo' user='calvin'
   pass='xxxx' host='mvshost1'
   lrecl=80 recfm=f blocksize=8000
   rcmd='site blocksize=8000 recfm=fb lrecl=80';
libname mylib 'SAS-library';
libname inp xport;
proc copy in=mylib out=inp mt=data;
run;
proc contents data=inp._all_;run;
```

**Note:** For more information about the XPORT engine, see “Transport Engine” in *SAS Language Reference: Concepts* and “XPORT Engine Limitations” in *Moving and Accessing SAS Files*.

---

Example 10: Reading and Writing from Directories

This example reads the file **ftpmem1** from a directory on a UNIX host, and writes the file **ftpout1** to a different directory on another UNIX host.

```sas
filename indir ftp '/usr/proj2/dir1' DIR
   host='host1.mycompany.com'
   user='xxxx' prompt;
filename outdir ftp '/usr/proj2/dir2' DIR FILEEXT
   host='host2.mycompany.com'
   user='xxxx' prompt;
data _null_;
   infile indir(ftpmem1) truncover;
   input;
   file outdir(ftpout1);
   put _infile_;run;
```

The file **ftpout1** is written to `/usr/proj2/dir2/ftpout1.DATA`. Note that a member type of **DATA** is appended to the **ftpout1** file because the **FILEEXT** option was specified in the output file's **FILENAME** statement. For more information, see **FILEEXT option on page 62**.

**Note:** The **DIR** option is not needed for some ODS destinations.

---

This example writes an output file and transfers it to an ODS-specified destination. The **DIR** option is not needed.

```sas
filename output ftp *'-user/ftpdir/* host='host.fyi.company.com' user='userid'
```
pass="userpass" recfm=s debug;
ods html body='body.html' path=output;
proc print data=sashelp.class;run;

To export multiple graph files to a remote directory location, the DIR option must be specified in the FILENAME statement. Accordingly, when creating external graph files with the ODS HTML destination, two FILENAME statements are needed: one for the HTML files, and one for the graph files. This example illustrates the need for two FILENAME statements.

filename output1 ftp "~user/dir" fileext host="host.unx.company.com" user="userid" pass="userpass" recfm=s debug;
filename output2 ftp "~user/dir" dir fileext host="host.unx.company.com" user="userid" pass="userpass" recfm=s debug;
ods html body='body.html' path=output1 gpath=output2
frames='frames.html' contents='contents.html';
proc gtestit;
run;
quit;
;

Example 11: Using a Proxy Server
This example uses a proxy server with the FTP access method. The user ID and password are sent via the proxy server.

filename test ftp ' ' ls
    host='proxy.server.xxx.com'
    user='userid@ftpservername'
    pass='xxxxxx'
    cd='pubsdir/';
data _null_;   
    infile test truncover;
    input a $256.;
    put a=;
run;

See Also

Environment Variables:
- “SAS_FTP_AUTHTLS Environment Variable” on page 203

Statements:
- “FILENAME Statement” on page 15
- “LIBNAME Statement” on page 126
- “LOCKDOWN Statement” in SAS Intelligence Platform: Application Server Administration Guide

System Options:
- “SSLCALISTLOC= System Option” in Encryption in SAS
FILENAME Statement: Hadoop Access Method

Enables you to access files on a Hadoop Distributed File System (HDFS) whose location is specified in a configuration file.

Valid in: Anywhere
Category: Data Access
Restrictions: Access is restricted to Hadoop configurations on systems based on UNIX

When SAS is in a locked-down state, the FILENAME statement, Hadoop access method is not available. Your server administrator can re-enable this access method so that it is accessible in the locked-down state. If the FILENAME statement, Hadoop access method is re-enabled using the LOCKDOWN ENABLE_AMS= statement, the HADOOP procedure is automatically re-enabled. For more information, see “SAS Processing Restrictions for Servers in a Locked-Down State” in SAS Language Reference: Concepts.

Requirements: In SAS 9.4M3, to connect to the Hadoop cluster, the Hadoop configuration files must be copied from the specific Hadoop cluster to a physical location that is accessible to the SAS client machine. The SAS environment variable SAS_HADOOP_CONFIG_PATH must be set to the location of the Hadoop configuration files. For more information, see SAS Hadoop Configuration Guide for Base SAS and SAS/ACCESS.

To use the FILENAME statement, Hadoop access method by using a Java native API, the Hadoop distribution JAR files must be copied to a physical location that is accessible to the SAS client machine. The SAS environment variable SAS_HADOOP_JAR_PATH must be defined and point to the location of the Hadoop JAR files. For more information, see SAS Hadoop Configuration Guide for Base SAS and SAS/ACCESS.

To use the FILENAME statement, Hadoop access method through WebHDFS by using the REST API, the SAS environment variable SAS_HADOOP_RESTFUL 1 must be defined. In addition, the Hadoop configuration file hdfs-site.xml must include the properties for the WebHDFS location. For more information, see SAS 9.4 Hadoop Configuration Guide for Base SAS and SAS/ACCESS.

Syntax
FILENAME fileref HADOOP 'external-file' <hadoop-options>;

Required Arguments
fileref
is a valid fileref.
Range 1 to 8 bytes
Tip The association between a fileref and an external file lasts only for the duration of the SAS session or until you change it or discontinue it with another FILENAME statement.

HADOOP
specifies the access method that enables you to use Hadoop to read from or write to a file from any host machine that you can connect to on a Hadoop configuration.
'external-file'
specifies the physical name of the file that you want to read from or write in an
HDFS system. The physical name is the name that is recognized by the
operating environment.

<table>
<thead>
<tr>
<th>Operating environment</th>
<th>For more information about specifying the physical names of external files, see the SAS documentation for your operating environment.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tip</td>
<td>Specify external-file when you assign a fileref to an external file. You can associate a fileref with a single file or with an aggregate file storage location.</td>
</tr>
</tbody>
</table>

Hadoop Options

hadoop-options can be any of these values:

**BUFFERLEN=bufferlen**
specifies the maximum buffer length of the data that is passed to Hadoop for its I/O operations.

<table>
<thead>
<tr>
<th>Default</th>
<th>503808</th>
</tr>
</thead>
<tbody>
<tr>
<td>Restriction</td>
<td>The maximum buffer length is 1000000.</td>
</tr>
<tr>
<td>Tip</td>
<td>Specifying a buffer length that is larger than the default could result in performance improvements.</td>
</tr>
</tbody>
</table>

**CFG="physical-pathname-of-hadoop-configuration-file" | fileref-that-references-a-hadoop-configuration-file**
specifies the configuration file that contains the connections settings for a specific Hadoop cluster.

**Note:** If a file is specified, it is the only file that is used to obtain configuration information.

**Note:** If a directory is specified, the directory is used to obtain the required configuration files.

**Interaction**
If CFG is not specified, the SAS_HADOOP_CONFIG_PATH and SAS_HADOOP_JAR_PATH environment variables are used to obtain the required configuration files.

**CONCAT**
specifies that the HDFS directory name that is specified on the FILENAME HADOOP statement is considered a wildcard specification. The concatenation of all the files in the directory is treated as a single logical file and read as one file.

<table>
<thead>
<tr>
<th>Restriction</th>
<th>This works for input only.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interaction</td>
<td>The CONCAT and DIR options are mutually exclusive. If both options are specified, Hadoop ignores the DIR option and SAS writes an informational note to the log.</td>
</tr>
<tr>
<td>Tip</td>
<td>For best results, do not concatenate text and binary files.</td>
</tr>
</tbody>
</table>
DEBUG enables additional messages that are displayed on the SAS log.

DIR enables you to access files in an HDFS directory.

Requirement You must use valid directory syntax for the specified host.

Interactions The CONCAT and DIR options are mutually exclusive. If both options are specified, Hadoop ignores the DIR option and SAS writes an informational note to the log.

Specify the HDFS directory name in the external-file argument.

If you want to create the directory, use the NEW option in conjunction with the DIR option. The NEW option is ignored if the directory exists. If the NEW option is omitted and you specify an invalid directory, then a new directory is not created and you receive an error message.

See “FILEEXT” on page 77

“NEW” on page 78

ENCODING="encoding-value"

specifies the encoding to use when SAS is reading from or writing to an external file. The value for ENCODING= indicates that the external file has a different encoding from the current session encoding.

Default SAS assumes that an external file is in the same encoding as the session encoding.

Note 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.


FILEEXT specifies that a file extension is automatically appended to the filename when you use the DIR option.

Interaction The autocall macro facility always passes the extension .SAS to the file access method as the extension to use when opening files in the autocall library. The DATA step always passes the extension .DATA. If you define a fileref for an autocall macro library and the files in that library have a file extension of .SAS, use the FILEEXT option. If the files in that library do not have an extension, do not use the FILEEXT option. For example, if you define a fileref for an input file in the DATA step and the file X has an extension of .DATA, you would use the FILEEXT option to read the file X.DATA. If you use the INFILE or FILE statement, enclose the member name and extension in quotation marks to preserve case.

Tip The FILEEXT option is ignored if you specify a file extension on the FILE or INFILE statement.
See “LOWCASE_MEMNAME” on page 78

**LOWCASE_MEMNAME**

enables autocall macro retrieval of lowercase directory or member names from HDFS systems.

**Restriction**
SAS autocall macro retrieval always searches for uppercase directory member names. Mixed-case directory or member names are not supported.

See “FILEEXT” on page 77

**LRECL=** logical-record-length

specifies the logical record length of the data.

Default 65536

**MOD**

places the file in Update mode and appends updates to the bottom of the file.

**MAXWAIT=** wait-interval

specifies the HTTP status response time when using WebHDFS.

Default 40000 milliseconds

**Requirement**
The environment variable SAS_HADOOP_RESTFUL 1 must be set.

**Tip**
If you receive a time-out message in the log, use the MAXWAIT to increase the wait period.

**NEW**

specifies that you want to create the directory when you use the DIR option.

**Interaction**
If you want to create the directory, use the NEW option in conjunction with the DIR option. The NEW option is ignored if the directory exists. If the NEW option is omitted and you specify an invalid directory, then a new directory is not created and you receive an error message.

See “DIR” on page 77

**PASS=’password’**

specifies the password to use with the user name that is specified in the USER option.

**Requirement**
The password is case sensitive and it must be enclosed in single or double quotation marks.

**Tip**
To use an encoded password, use the PWENCODE procedure in order to disguise the text string, and then enter the encoded password for the PASS= option. For more information see the PWENCODE procedure in *Base SAS Procedures Guide*.

**PROMPT**

specifies to prompt for the user login, the password, or both, if necessary.

**Interaction**
The USER= and PASS= options override the PROMPT option if all three options are specified. If you specify the PROMPT option and
do not specify the USER= or PASS= option, you are prompted for a user ID and password.

**RECFM=record-format**

where *record-format* is one of three record formats:

- **F**
  is a fixed-record format. In this format, records have fixed lengths, and they are read in binary mode.

- **S**
  is a binary-record format. The file consists of a series of bytes with no record boundaries.

  Tip  The amount of data that is read is controlled by the current LRECL value or the value of the NBYTE= variable in the INFILE statement. The NBYTE= option specifies a variable that is equal to the amount of data to be read. This amount must be less than or equal to LRECL. To avoid problems when you read large binary files like PDF or GIF, set NBYTE=1 to read one byte at a time.

  See  The NBYTE= option in the INFILE statement in *SAS Statements: Reference*

- **V**
  is a variable-record format (the default). In this format, records in the file have varying lengths.

  Tip  Any record larger than LRECL is truncated.

**Default**  

- **V**

**Interaction**  

In SAS 9.4, the default value for the global LRECL system option is 32767. If you are using fixed-length records (RECFM=F), the default value for LRECL is 256.

**USER=’username’**

where *username* is used to log on to the Hadoop system.

**Requirements**  

If you connect to Hadoop without specifying the USER= option, you must start SAS with this option:

```
-jreoptions "(-Djavax.security.auth.useSubjectCredsOnly=false)"
```

The user name is case sensitive, and it must be enclosed in single or double quotation marks.

**Details**

An HDFS system has levels of permissions at both the directory and file level. The Hadoop access method honors those permissions. For example, if a file is available as read-only, you cannot modify it.

**Operating Environment Information:** Using the FILENAME statement requires information that is specific to your operating environment. The Hadoop access method is fully documented here. For more information about how to specify filenames, see the SAS documentation for your operating environment.
Examples:

Example 1: Writing to a New Member of a Directory
This example writes the file shoes to the directory testing.

```sas
set=SAS_HADOOP_CONFIG_PATH="/u/hadoopcfg/cdh52p1";

filename out hadoop '/user/testing/' user='xxxx'
   pass='xxxx' recfm=v lrecl=32167 dir ;

data _null_;
   file out(shoes) ;
   put 'write data to shoes file';
run;
```

Example 2: Creating and Using a Configuration File
This example accesses the file acctdata.dat at site xxx.unx.sas.com. The configuration file is accessed from the "cfg" fileref assignment.

```sas
filename cfg 'U:/test.cfg';

data _null_;
   file cfg;
   input;
   put _infile_;
   datalines4;
<configuration>
<property>
   <name>fs.default.name</name>
   <value>hdfs://xxx.unx.sas.com:8020</value>
</property>
<property>
   <name>mapred.job.tracker</name>
   <value>xxx.unx.sas.com:8021</value>
</property>
</configuration>

filename foo hadoop '/user/xxxx/acctdata.dat' cfg=cfg user='xxxx'
   pass='xxxx' debug recfm=s lrecl=65536 bufferlen=65536;

data _null_;
   infile foo truncover;
   input a $1024.;
   put a;
run;
```

Example 3: Buffering 1MB of Data during a File Read
This example uses the BUFFERLEN option to buffer 1MB of data at a time during the file read. The records of length 1024 are read from this buffer.

```sas
set=SAS_HADOOP_CONFIG_PATH="/u/hadoopcfg/cdh52p1";
```
FILENAME Statement: S3 Access Method

Enables you to access Amazon S3 files.

Valid in: Anywhere
Category: Data Access
Restriction: The S3 access method is supported for SAS Viya only.
See: “S3 Procedure” in Base SAS Procedures Guide

Syntax

FILENAME fileref S3 “object path” <s3-options>;

Example 4: Using the CONCAT Option

This example uses the CONCAT option to read all members of DIRECTORY1 as if they are one file.

```sas
set=SAS_HADOOP_CONFIG_PATH="/u/hadoopcfg/cdh52p1";

filename foo hadoop '/directory1/' user='user' pass='apass' recfm=s lrecl=1024 concat;

data _null_;  
  infile foo truncover;
  input a $1024.;
  put a;
run;
```

See Also

**Statements:**
- "FILENAME Statement" on page 15
- "LOCKDOWN Statement" in SAS Intelligence Platform: Application Server Administration Guide
Required Arguments

fileref

is a valid fileref.

S3

specifies the S3 access method.

object-path

specifies the S3 object that you want to access.

Optional Arguments

The S3 access method supports the PROC S3 statement options.

AWSCONFIG="AWS-CLI-file-path"

specifies the path of the AWS CLI configuration file, called config. This file contains connection parameters to access AWS S3. If a value is specified in the AWS CLI configuration file and in the PROC S3 configuration file, the value in the AWS CLI file takes precedence.

Note: Support for this option was added in SAS 9.4M5.

AWSCREDENTIALS="AWS-credentials-file-path"

specifies the path of the AWS credentials file. This file contains the credentials that are used to access AWS S3.

Note: Support for this option was added in SAS Viya 3.4.

CONFIG="local-configuration-file-path"

specifies the path and filename of the PROC S3 configuration file that contains connection parameters to access AWS S3. If you specify this option, then the specified configuration file is read instead of the default PROC S3 configuration file in the default location.

The default PROC S3 configuration file is file .tks3.conf in your home directory in UNIX or file tks3.conf in your home directory in Windows. You do not need to specify the CONFIG= option if your configuration file is in the default location.

For more information, see "PROC S3 Configuration File" in Base SAS Procedures Guide.

CREDENTIALSPROFILE="credentials-profile-name"

specifies the name of the profile that contains the credentials that you want to use to access AWS S3. Sets of credential options are grouped into profiles. If you do not specify the CREDENTIALSPROFILE= option, PROC S3 uses the default profile.

Note: Support for this option was added in SAS Viya 3.4.

KEYID="AWS-key-ID"

specifies the AWS access key ID. This value is a 20-character, alphanumeric string. A sample key ID value is AKIAIOSFODNN7EXAMPLE.

PROFILE="profile-name"

specifies the profile to use in the AWS CLI file config. Sets of options are grouped into profiles. If you do not specify the PROFILE= option, PROC S3 uses the default profile.
REGION=AWS-region
specifies the AWS region to connect to. Here are the valid region values.

Table 2.2  PROC S3 Region Values

<table>
<thead>
<tr>
<th>PROC S3 Region Value</th>
<th>Description</th>
<th>Corresponding AWS S3 Region</th>
</tr>
</thead>
<tbody>
<tr>
<td>apindia</td>
<td>Asia Pacific (India)</td>
<td>ap-south-1</td>
</tr>
<tr>
<td>apseoul</td>
<td>Asia Pacific (Seoul)</td>
<td>ap-northeast-2</td>
</tr>
<tr>
<td>apsingapore</td>
<td>Asia Pacific (Singapore)</td>
<td>ap-southeast-1</td>
</tr>
<tr>
<td>apsydney</td>
<td>Asia Pacific (Sydney)</td>
<td>ap-southeast-2</td>
</tr>
<tr>
<td>aptokyo</td>
<td>Asia Pacific (Tokyo)</td>
<td>ap-northeast-1</td>
</tr>
<tr>
<td>cacentral</td>
<td>Canada (Central)</td>
<td>ca-central-1</td>
</tr>
<tr>
<td>cnbeijing</td>
<td>China (Beijing)</td>
<td>cn-north-1</td>
</tr>
<tr>
<td>cnningxia</td>
<td>China (Ningxia)</td>
<td>cn-northwest-1</td>
</tr>
<tr>
<td>eufrankfurt</td>
<td>EU (Frankfurt)</td>
<td>eu-central-1</td>
</tr>
<tr>
<td>euireland</td>
<td>EU (Ireland)</td>
<td>eu-west-1</td>
</tr>
<tr>
<td>eulondon</td>
<td>EU (London)</td>
<td>eu-west-2</td>
</tr>
<tr>
<td>euparis</td>
<td>EU (Paris)</td>
<td>eu-west-3</td>
</tr>
<tr>
<td>fips</td>
<td>US Government Cloud (FIPS)</td>
<td>fips-us-gov-west-1</td>
</tr>
<tr>
<td>sa</td>
<td>South America (Sao Paulo)</td>
<td>sa-east-1</td>
</tr>
<tr>
<td>useast</td>
<td>US East (Virginia)</td>
<td>us-east-1</td>
</tr>
<tr>
<td>useastoh</td>
<td>US East (Ohio)</td>
<td>us-east-2</td>
</tr>
<tr>
<td>usgov</td>
<td>US Government Cloud</td>
<td>us-gov-west-1</td>
</tr>
<tr>
<td>usstd</td>
<td>US Standard</td>
<td>us-east-1</td>
</tr>
<tr>
<td>uswest</td>
<td>US West (Oregon)</td>
<td>us-west-2</td>
</tr>
<tr>
<td>uswestca</td>
<td>US West (California)</td>
<td>us-west-1</td>
</tr>
</tbody>
</table>
Details

Using the S3 Access Method

The S3 access method enables you to access objects in the Simple Storage Service (S3) of Amazon Web Services (AWS).

Before you can use the S3 access method, you need an AWS access key ID and a secret access key. When using temporary credentials, you also need a security token. For more information, see the Amazon S3 documentation.

Support for the ENCKEY Statement

The S3 access method supports the ENCKEY statement of PROC S3. The ENCKEY statement supports server-side encryption in an Amazon Web Services (AWS) S3 environment. For an example that shows how to encrypt data in an AWS S3 environment, see “Example 4: Using the S3 Access Method with the ENCKEY Statement” on page 85. For information about the ENCKEY statement, see “ENCKEY Statement” in Base SAS Procedures Guide.

Examples:

Example 1: Reading a File by Using the S3 Access Method

This example uses the S3 access method to read a file in an AWS S3 environment. The FILENAME statement creates an alias (fileref) called myfile, which points to the location of the file, filename.txt, on the AWS S3 server. The DATA step reads the file and writes its contents to the SAS log.

```sas
filename myfile s3 '/directory1/filename.txt';

data _null_;
  infile myfile;
  input;
  put _infile_;
run;
```

Example 2: Sending a Log Output to a New Destination by Using the S3 Access Method

This example uses the S3 access method with PROC PRINTTO to route a log output to a file, log.txt, on the AWS S3 server. The NEW option removes any information that is in the file and prepares the file to receive the output. For more information, see “PROC PRINTTO Statement” in Base SAS Procedures Guide.

The S3 access method in the FILENAME statement provides an alias and pointer to the location of the log.txt file on AWS. The LOG= option in PROC PRINTTO specifies that all log output is sent to the external file on AWS. You can also specify the PRINT= option in the PRINTTO statement so that all procedure output is sent to an external file.

```sas
filename mylog s3 '/directory1/userid/log.txt' ;

proc printto log=mylog new;
run;

proc print data=sashelp.cars;
```
run;
proc printto;
run;

Example 3: Importing a File by Using the S3 Access Method
This example uses PROC IMPORT with the S3 access method to import a file to a SAS data set from an AWS S3 environment.

filename i s3 '/directory1/i.cvs' ;

proc import datafile=i out=work.i replace dbms=csv debug;
   getnames=yes;
   datarow=2;
   guessingrows=all;
run;

Example 4: Using the S3 Access Method with the ENCKEY Statement
This example uses the SAS DATA step with PROC S3 and the ENCKEY statement to encrypt a server-side file in an AWS S3 environment.

proc s3;
enckey add name="mykey" /* 1 */
   hexkey="7468697349734d6f726565666f726d49735550506f79656168" ;
run;

filename myfile s3 "'/directory1/filename.txt' enckey=mykey" ; /* 2 */
data _null_;
   file myfile; /* 3 */
   put 'Write with enckey';
run;

1 The ENCKEY statement in PROC S3 creates the encryption key and stores it in the name mykey.

2 The FILENAME statement creates an alias named myfile and uses the S3 access method to associate the alias with the S3 server file, filename.txt. The S3 access method uses the ENCKEY= option to send the encryption information to the S3 server where the data in filename.txt is encrypted.

3 The FILE statement in the DATA step uses the alias for the S3 server file to specify that the PUT statement output is written to the server file.

FILENAME Statement: SFTP Access Method
Enables you to access remote files by using the SFTP protocol.

Valid in: Anywhere
Category: Data Access
Syntax

FILENAME fileref SFTP 'external-file' <sftp-options>;

Arguments

fileref
is a valid fileref.

Range 1 to 8 bytes

Tip The association between a fileref and an external file lasts only for the
duration of the SAS session or until you change it or discontinue it with
another FILENAME statement. You can change the fileref for a file as
often as you want.

SFTP
specifies the access method that enables you to use Secure File Transfer
Protocol (SFTP) to read from or write to a file from any host computer that you
can connect to on a network with an OpenSSH SSHD server running.

'external-file'
specifies the physical name of an external file that you want to read from or write
to. The physical name is the name that is recognized by the operating
environment.

Operating environment
For more information about specifying the physical names of
external files, see the SAS documentation for your operating
environment.

Tips If you are not transferring a file but performing a task such as
retrieving a directory listing, then you do not need to specify an
external filename. Instead, put empty quotation marks in the
statement.

You can associate a fileref with a single file or with an aggregate
file storage location.

sftp-options
specifies details that are specific to your operating environment such as file
attributes and processing attributes.

Operating environment
For more information about some of these SFTP options,
see the SAS documentation for your operating environment.

See “SFTP Options” on page 86

SFTP Options

sftp-options can be any of these values:

BATCHFILE='path'
specifies the fully qualified pathname and the filename of the batch file that
contains the SFTP commands. These commands are submitted when the SFTP
access method is executed. After the batch file processing ends, the SFTP
connection is closed.

Requirement The path must be enclosed in quotation marks.
### Tip

After the batch file processing ends, the SFTP connection is closed and the filename assignment is no longer available. If subsequent DATA step processing requires the FILENAME SFTP statement, then another FILENAME SFTP statement is required.

### Example

“Example 5: Using a Batch File” on page 92

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CD='directory'</strong></td>
<td>issues a command that changes the working directory for the file transfer to the directory that you specify.</td>
</tr>
<tr>
<td><strong>DEBUG</strong></td>
<td>writes informational messages to the SAS log.</td>
</tr>
<tr>
<td><strong>DIR</strong></td>
<td>enables you to access directory files. Specify the directory name in the external-file argument. You must use valid directory syntax for the specified host.</td>
</tr>
<tr>
<td><strong>HOST='host'</strong></td>
<td>where host is the network name of the remote host with the OpenSSH SSHD server running. You can specify either the name of the host (for example, server.pc.mydomain.com) or the IP address of the computer (for example, 2001:db8::).</td>
</tr>
<tr>
<td><strong>LRECL=lrecl</strong></td>
<td>where lrecl is the logical record length of the data. Default 256. Interaction Alternatively, you can specify a global logical record length by using the “LRECL= System Option” in SAS System Options: Reference. In SAS 9.4, the default value for the global LRECL system option is 32767. If you are using fixed-length records (RECFM=F), the default value for LRECL is 256.</td>
</tr>
<tr>
<td><strong>LS</strong></td>
<td>issues the LS command to the SFTP server. LS returns the contents of the working directory as records with no file attributes. Restriction The LS option does display files with leading periods. An example is .xAuthority. Interaction The LS and LSA options are mutually exclusive. If you specify both options, the LSA option takes precedence.</td>
</tr>
<tr>
<td><strong>Tips</strong></td>
<td>If you want SFTP to create the directory, then use the NEW option in conjunction with the DIR option. The NEW option is ignored if the directory exists. If the NEW option is omitted and you specify an invalid directory, then a new directory is not created and you receive an error message.</td>
</tr>
</tbody>
</table>
Tip

To return a listing of a subset of files, use the LSFILE= option in addition to LS.

LSA

issues the LS command to the SFTP server. LSA returns all the contents of the working directory as records with no file attributes.

Interactions

The LS and LSA options are mutually exclusive. If you specify both options, the LSA option takes precedence.

Tip

To display files without leading periods. For example, use the LS= option with .xAuthority.

LSFILE='character-string'

in combination with the LS option, specifies a character string that enables you to request a listing of a subset of files from the working directory. Enclose the character string in quotation marks.

Restriction

LSFILE= can be used only if LS or LSA is specified.

Tip

You can specify a wildcard as part of 'character-string'.

Example

This statement lists all of the files that start with sales and end with sas:

```
filename myfile sftp '' ls lsfile='sales*.sas'
other-sftp-options;
```

MGET

transfers multiple files, similar to the SFTP command MGET.

Tip

The whole transfer is treated as one file. However, as the transfer of each new file is started, the EOV= variable is set to 1.

NEW

specifies that you want SFTP to create the directory when you use the DIR option.

Restriction

The NEW option is not available under z/OS.

Tip

The NEW option is ignored if the directory exists.

OPTIONS='option-string'

specifies SFTP configuration options such as port numbers and verbose.

Requirement

When you submit code that contains a FILENAME SFTP statement from SAS Enterprise Guide that runs on a Windows workspace server, you must specify authentication by using the OPTIONS or OPTIONSX option.

Note

If you need to blot any information in the OPTIONS string, use the OPTIONSX option.

See

“Example 6: Connecting a Windows PUTTY Client to an SSHD Server By Using Authentication Specified on the OPTIONSX Parameter in SAS Enterprise Guide” on page 92
OPTIONSX='option-string'
specifies SFTP configuration options such as private keys and passphrases. All information in the option-string is blotted when written to the SAS log.

Requirements
When you submit code that contains a FILENAME SFTP statement from SAS Enterprise Guide that runs on a Windows workspace server, you must specify authentication by using the OPTIONS or OPTIONSX option.

If the passphrase in the OPTIONSX string contains one or more spaces, then the passphrase must be enclosed in double quotation marks and the OPTIONSX string must be enclosed in single quotation marks.

Tip
The passphrase is passed using the -pw parameter.

See
“Example 6: Connecting a Windows PUTTY Client to an SSHD Server By Using Authentication Specified on the OPTIONSX Parameter in SAS Enterprise Guide” on page 92

PATH
specifies the location of the SFTP executable if it is not installed in the PATH or $PATH search path.

Tip
It is recommended that the OpenSSH “SFTP” executable or PUTTY “PSFTP” executable be installed in a directory that is accessible via the PATH or $PATH search path.

RECFM=recfm
where recfm is one of three record formats:

F
is a fixed-record format. Thus, all records are of size LRECL with no line delimiters.

Interaction
In SAS 9.4, the default value for the global LRECL system option is 32767. If you are using fixed length records (RECFM=F), the default value for LRECL is 256.

S
is a stream-record format. Data is transferred in image (binary) mode.

Interaction
The amount of data that is read is controlled by the current LRECL value or by the value of the NBYTE= variable in the INFILE statement. The NBYTE= option specifies a variable that is equal to the amount of data to be read. This amount must be less than or equal to LRECL.

See
The NBYTE= option in the INFILE statement.

V
is variable-record format (the default). In this format, records have varying lengths, and they are separated by newlines.

Default V

USER='username'
specifies the user name.
Requirement
The *username* is required by the PUTTY client on the Windows host.

Tips
The *username* is not typically required on LINUX or UNIX hosts when using public key authentication.

Public key authentication using an SSH agent is the recommended way to connect to a remote SSHD server.

**WAIT_MILLISECONDS=milliseconds**
specifies the SFTP response time in milliseconds.

Default 1,500 milliseconds

Tip If you receive a time-out message in the log, use the WAIT_MILLISECONDS option to increase the response time.

Details

The Basics
The Secure File Transfer Protocol (SFTP) provides a secure connection and file transfers between two hosts (client and server) over a network. Both commands and data are encrypted. The client machine initiates a connection with the remote host (OpenSSH SSHD server).

With the SFTP access method, you can read from or write to any host computer that you can connect to on a network with an OpenSSH SSHD server running. The client and server applications can reside on the same computer or on different computers that are connected by a network.

Specific implementation details are dependent on the OpenSSH SSHD server version and how that site is configured.

The SFTP access method relies on default send and reply messages to OpenSSH commands. Custom installs of OpenSSH that modify these messages disable the SFTP access method.

To use the SFTP access method, the applicable client software must be installed. The SFTP access method supports only these SSH clients.

- OpenSSH – UNIX
- PUTTY – Windows

**Note:** Password validation is not supported for the SFTP access method.

**Note:** Public key authentication using an SSH agent is the recommended way to connect to a remote SSHD server.

**Note:** If you have trouble running the SFTP access method, try to manually validate SFTP client access to an OpenSSH SSHD server without involving the SAS system. Manually validating SFTP client access without involving the SAS system ensures that your SSH or SSHD configuration and key authentication is setup correctly.
SFTP Access Methods and SFTP Prompts

The SFTP access method supports only these prompts. Changing the prompt disables the SFTP access method.

- For OpenSSH:
  ```
sftp>
sftp >
  ```

- For PUTTY:
  ```
psftp>
  ```

Comparisons

As with the SFTP `get` and `put` commands, the SFTP access method lets you download and upload files. However, this method directly reads files into your SAS session without first storing them on your system.

Examples:

Example 1: Connecting to an SSHD Server at a Standard Port

This example reads a file called `test.dat` using the SFTP access method after connecting to the SSHD server a standard port:

```sas
filename myfile sftp '/users/xxxx/test.dat' host="unixhost1";
data _null_;  	infile myfile truncover;  
input a $25.;  
run;
```

Example 2: Connecting to an SSHD Server at a Nonstandard Port

This example reads a file called `test.dat` using the SFTP access method after connecting to the SSHD server at port 4117:

```sas
filename myfile sftp '/users/xxxx/test.dat' host="unixhost1" options="-oPort=4117";
data _null_;  
infile myfile truncover;  
input a $25.;  
run;
```

Example 3: Connecting a Windows PUTTY Client to an SSHD Server

This example writes a file called `test.dat` using the SFTP access method after connecting a Windows PUTTY client to the SSHD server with a user ID of `userid`:

```sas
filename outfile sftp '/users/xxxx/test.dat' host="unixhost1" user="userid";
data _null_;  
file outfile;  
do i=1 to 10;  
  put i=;  
end;  
run;
```
Example 4: Reading Files from a Directory on the Remote Host

This example reads the files test.dat and test2.dat from a directory on the remote host.

```sas
filename infile sftp '/users/xxxx/' host="unixhost1" dir;
data _null_;       
  infile infile(test.dat) truncover;  
  input a $25.;       
  infile infile(test2.dat) truncover;  
  input b $25.;       
run;
```

Example 5: Using a Batch File

In this example, when the INFILE statement is processed, the batch file associated with the FILENAME SFTP statement, sftpcmds, is executed.

```sas
filename process sftp ' ' host="unixhost1" user="userid" batchfile="c:/stfpdir/sftpcmds.bat";
data _null_;       
  infile process;    
run;
```

Example 6: Connecting a Windows PUTTY Client to an SSHD Server By Using Authentication Specified on the OPTIONSX Parameter in SAS Enterprise Guide

This example writes a file, test.dat, by using the SFTP access method after connecting a Windows PUTTY client to the SSHD server. Public key authentication occurs with the private key and passphrase specified on the OPTIONSX parameter. The OPTIONSX string values are blotted with X characters in the SAS log. The passphrase is passed using the -pw parameter. If the passphrase contains spaces, then the passphrase must be enclosed in double quotation marks and the OPTIONSX string must be enclosed in single quotation marks.

```sas
filename outfile sftp '/users/xxxx/test.dat' host="unixhost1" optionsx='-i C:\privatekey.ppk -pw "pass phrase"' user="userid";
data _null_;       
  file outfile;       
  do i=1 to 10;       
    put i=;            
  end;                
run;
```

See Also


Statements:

- “FILENAME Statement” on page 15
- “LIBNAME Statement” on page 126
FILENAME Statement: SOCKET Access Method

Enables you to read from or write to a TCP/IP socket.

Valid in: Anywhere
Category: Data Access
Restriction: When SAS is in a locked-down state, the FILENAME statement, SOCKET access method is not available. Your server administrator can re-enable this access method so that it is accessible in the locked-down state. For more information, see “SAS Processing Restrictions for Servers in a Locked-Down State” in SAS Language Reference: Concepts.

Syntax

Form 1: FILENAME fileref SOCKET 'hostname:portno' <tcpip-options>;
Form 2: FILENAME fileref SOCKET ':portno' SERVER <tcpip-options>;

Arguments

fileref
is a valid fileref.

Range 1 to 8 bytes

Tip The association between a fileref and an external file lasts only for the duration of the SAS session or until you change it or discontinue it with another FILENAME statement. You can change the fileref for a file as often as you want.

SOCKET
specifies the access method that enables you to read from or write to a Transmission Control Protocol/Internet Protocol (TCP/IP) socket.

'hostname:portno'
is the name or IP address of the host and the TCP/IP port number to connect to.

Tip Use this specification for client access to the socket.

'::portno'
is the port number to create for listening.

Tips Use this specification for server mode.

If you specify :0, the system chooses a number.

SERVER
sets the TCP/IP socket to be a listening socket, thereby enabling the system to act as a server that is waiting for a connection.
Tip  The system accepts all connections serially; only one connection is active at any one time.

See  The RECONN= option on page 95 under TCPIP Options.

**tcpip-options**

specifies details that are specific to your operating system such as the number of connections that the server accepts.

**Operating Environment Information:** For more information about some of these TCP/IP options, see the SAS documentation for your operating environment

See  “TCP/IP Options” on page 94

TCP/IP Options

tcpip-options can be any of these values:

**BLOCKSIZE=blocksize**

where blocksize is the size of the socket data buffer in bytes.

Default 8192

**ENCODING=encoding-value**

specifies the encoding to use when reading from or writing to the socket. The value for ENCODING= indicates that the socket has a different encoding from the current session encoding.

When you read data from a socket, SAS transcodes the data from the specified encoding to the session encoding. When you write data to a socket, SAS transcodes the data from the session encoding to the specified encoding.


**LRECL=lrecl**

where lrecl is the logical record length.

Default 256

Interaction  Alternatively, you can specify a global logical record length by using the “LRECL= System Option” in SAS System Options: Reference. In SAS 9.4, the default value for the global LRECL system option is 32767. If you are using fixed-length records (RECFM=F), the default value for LRECL is 256.

**RECFM=recfm**

where recfm is one of three record formats:

F  
is a fixed-record format. Thus, all records are of size LRECL with no line delimiters. Data is transferred in image (binary) mode.

Interaction  In SAS 9.4, the default value for the global LRECL system option is 32767. If you are using fixed-length records (RECFM=F), the default value for LRECL is 256.

S  
is a stream-record format.
**Interaction**
The amount of data that is read is controlled by the current LRECL value or the value of the NBYTE= variable in the INFILE statement. The NBYTE= option specifies a variable equal to the amount of data to be read. This amount must be less than or equal to LRECL.

**Tip**
Data is transferred in image (binary) mode.

**See**
The NBYTE= option in the INFILE statement.

V is a variable-record format (the default).

**Tips**
In this format, records have varying lengths, and they are transferred in text mode.

Any record larger than LRECL is truncated.

**Default**
V

**RECONN=conn-limit**
where conn-limit is the maximum number of connections that the server accepts.

**Note**
Because only one connection can be active at a time, a connection must be disconnected before the server can accept another connection. When a new connection is accepted, the EOV= variable is set to 1. The server continues to accept connections, one at a time, until conn-limit has been reached.

**TERMSTR='eol-char'**
where eol-char is the line delimiter to use when RECFM=V. There are three valid values:

- **CRLF**
  carriage return (CR) followed by line feed (LF).

- **LF**
  line feed only (the default).

- **NULL**
  NULL character (0x00).

**Default**
LF

**Restriction**
Use this option only when RECFM=V.

**Details**

**The Basics**
A TCP/IP socket is a communication link between two applications. The server application creates the socket and waits for a connection. The client application connects to the socket. With the SOCKET access method, you can use SAS to communicate with another application over a socket in either client or server mode. The client and server applications can reside on the same computer or on different computers that are connected by a network.
For example, you can develop an application using Microsoft Visual Basic that communicates with a SAS session that uses the TCP/IP sockets. Note that Visual Basic does not provide inherent TCP/IP support. You can obtain a custom control (VBX) from SAS Technical Support (free of charge) that allows a Visual Basic application to communicate through the sockets.

Using the SOCKET Access Method in Client Mode (*Form 1*)

In client mode, a local SAS application can use the SOCKET access method to communicate with a remote application that acts as a server (and waits for a connection). Before you can connect to a server, you must know this information:

- the network name or IP address of the host computer running the server
- the port number that the remote application is listening to for new connections

The remote application can be another SAS application, but it does not need to be. When the local SAS application connects to the remote application through the TCP/IP socket, the two applications can communicate by reading from and writing to the socket as if it were an external file. If at any time the remote side of the socket is disconnected, the local side also automatically terminates.

Using the SOCKET Access Method in Server Mode (*Form 2*)

When the local SAS application is in server mode, it remains in a wait state until a remote application connects to it. To use the SOCKET access method in server mode, you need to know only the port number that you want the server to listen to for a connection. Typically, servers use *well-known ports* to listen for connections. These port numbers are reserved by the system for specific server applications. For more information about how well-known ports are defined on your system, see the documentation for your TCP/IP software or ask your system administrator.

If the server application does not use a well-known port, then the system assigns a port number when it establishes the socket from the local application. However, because any client application that waits to connect to the server must know the port number, you should try to use a well-known port.

While a local SAS server application is waiting for a connection, SAS is in a wait state. Each time a new connection is established, the EOV= variable in the DATA step is set to 1. Because the server accepts only one connection at a time, no new connections can be established until the current connection is closed. The connection closes automatically when the remote client application disconnects. The SOCKET access method continues to accept new connections until it reaches the limit set in the RECONN option.

Example: Communicating between Two SAS Applications over a TCP/IP Socket

This example shows how two SAS applications can talk over a TCP/IP socket. The local application is in server mode; the remote application is the client that connects to the server. This example assumes that the server host name is *hp720.unx.sas.com*, that the well-known port number is 5000, and that the server allows a maximum of three connections before closing the socket.

Here is the program for the server application:

```plaintext
filename local socket ':5000' server reconn=3;
  /*The server is using a reserved */
  /*port number of 5000. */
```
data tcipip;
  infile local eov=v;
  input x $10;
  if v=1 then
    do;              /* new connection when v=1 */
      put 'new connection received';
    end;
    output;
  run;

Here is the program for the remote client application:

filename remote socket 'hp720.unx.sas.com:5000';
data _null_; 
  file remote;
  do i=1 to 10;
    put i;
  end;
run;

See Also

Statements:
- “FILENAME Statement” on page 15
- “LOCKDOWN Statement” in SAS Intelligence Platform: Application Server Administration Guide

FILENAME Statement: URL Access Method

Enables you to access remote files by using the URL access method.

Valid in: Anywhere
Category: Data Access
Restriction: When SAS is in a locked-down state, the FILENAME statement, URL access method is not available. Your server administrator can re-enable this access method so that it is accessible in the locked-down state. If the FILENAME statement, URL access method is re-enabled, the SOAP procedure is automatically re-enabled. For more information, see “SAS Processing Restrictions for Servers in a Locked-Down State” in SAS Language Reference: Concepts.

Syntax

FILENAME fileref URL 'external-file' <url-options>;

Arguments

fileref
  is a valid fileref.

Range  1 to 8 bytes
Tip
The association between a fileref and an external file lasts only for the duration of the SAS session or until you change it or discontinue it with another FILENAME statement. You can change the fileref for a file as often as you want.

URL
specifies the access method that enables you to read a file from any host computer that you can connect to on a network with a URL server running.

Alias HTTP

'external-file'
specifies the name of the file that you want to read from on a URL server. The Transport Layer Security (TLS) protocol, https, can also be used to access the files. The file must be specified in one of these formats:
- http://hostname/file
- https://hostname/file
- http://hostname:portno/file
- https://hostname:portno/file

Operating environment For more information about specifying the physical names of external files, see the SAS documentation for your operating environment.

URL Options
url-options can be any of these values:

ACCEPT='header-type'
specifies the Accept: header. The Accept: header can be used to specify certain media types, which are acceptable for the response.

Default */*

Requirement header-type must be enclosed in either single or double quotation marks.

AUTHDOMAIN="auth-domain"
specifies the name of an authentication domain metadata object in order to connect to the proxy or web server. The authentication domain references credentials (user ID and password) without your having to explicitly specify the credentials. The auth-domain name is case sensitive, and it must be enclosed in double quotation marks.

An administrator creates authentication domain definitions while creating a user definition with the User Manager in SAS Management Console. The authentication domain is associated with one or more login metadata objects that provide access to the proxy or web server and is resolved by the BASE engine calling the SAS Metadata Server and returning the authentication credentials.

Requirement The authentication domain and the associated login definition must be stored in a metadata repository, and the metadata server must be running in order to resolve the metadata object specification.
If you specify AUTHDOMAIN=, you do not need to specify USER= and PASS=.

For more information about creating and using authentication domains, see the discussion on credential management in SAS Intelligence Platform: Security Administration Guide.

**BLOCKSIZE=blocksize**

specifies the size of the URL data buffer in bytes.

**Default** 8K

**CONNECT**

creates a connection between the client and the proxy and between the proxy and the server when accessing a URL through a proxy.

**Requirement** You must use the PROXY= option with the CONNECT option. No connection is made if the CONNECT option is used without the PROXY= option.

**Interaction** If you use "http" in the external-file argument, a connection is made, but the TLS protocol is not used.

**See** “PROXY=url” on page 100

**DEBUG**

writes debugging information to the SAS log.

**Tip** The result of the HELP command is returned as records.

**HEADERS=fileref**

specifies the fileref to which the header information is written when a file is opened by using the URL access method. The header information is the same information that is written to the SAS log.

**Requirement** The fileref must be defined in a previous FILENAME statement.

**Interactions**

If you specify the HEADERS= option without specifying the DEBUG option, the DEBUG option is automatically turned on.

By default, log information is overwritten. To append the log information, you must specify the MOD option in the FILENAME statement that creates the fileref.

**LRECL=lrecl**

specifies the logical record length of the data.

**Default** 256

**Interaction** Alternatively, you can specify a global logical record length by using the "LRECL= System Option" in SAS System Options: Reference. In SAS 9.4, the default value for the global LRECL system option is 32767. If you are using fixed-length records (RECFM=F), the default value is 256.

**PASS='password'**

where password is the password to use with the user name that is specified in the USER option.
Tips You can specify the PROMPT option instead of the PASS option, which tells the system to prompt you for the password.

To use an encoded password, use the PWENCODE procedure in order to disguise the text string, and then enter the encoded password for the PASS= option. For more information, see “PWENCODE Procedure” in Base SAS Procedures Guide.

PPASS='password'
where password is the password to use with the user name that is specified in the PUSER option. The PPASS option is used to access the proxy server.

Tips You can specify the PROMPT option instead of the PPASS option, which tells the system to prompt you for the password.

To use an encoded password, use the PWENCODE procedure to disguise the text string, and then enter the encoded password for the PASS= option. For more information, see “PWENCODE Procedure” in Base SAS Procedures Guide.

PROMPT specifies to prompt for the user login password if necessary.

Tip If you specify PROMPT, you do not need to specify PASS= or PPASS=.

PROXY=url
specifies the Uniform Resource Locator (URL) for the proxy server in one of these forms:

http://hostname/
http://hostname:portno/

See “CONNECT” on page 99

PUSER='username'
where username is used to log on to the URL proxy server.

Interactions If you specify the PUSER option, the USER option goes to the web server regardless of whether you specify a proxy server.

If PROMPT is specified, but PUSER is not, the user is prompted for an ID as well as a password.

Tip If you specify puser='*', then the user is prompted for an ID.

RECFM=rcfm
specifies one of three record formats:

F  is a fixed-record format. Thus, all records are of size LRECL with no line delimiters. Data is transferred in image (binary) mode.

Interaction In SAS 9.4, the default value for the global LRECL system option is 32767. If you are using fixed-length records (RECFM=F), the default value for LRECL is 256.

S  is a stream-record format. Data is transferred in image (binary) mode.
Alias N

Tip The amount of data that is read is controlled by the current LRECL value or the value of the NBYTE= variable in the INFILE statement. The NBYTE= option specifies a variable that is equal to the amount of data to be read. This amount must be less than or equal to LRECL.

See The NBYTE= option in the INFILE statement.

V is a variable-record format (the default). In this format, records have varying lengths, and the records are transferred in text mode.

Tip Any record larger than LRECL is truncated.

Default V

TERMSTR='eol-char'
specifies the line delimiter to use when RECFM=V. There are four valid values:

- CR carriage return (CR).
- CRLF carriage return (CR) followed by line feed (LF).
- LF line feed only (the default).
- NULL NULL character (0x00).

Default LF

Restriction Use this option only when RECFM=V.

USER='username'
specifies the username that is used to log on to the URL server.

Interactions If you specify the USER option but do not specify the PUSER option, where the USER option goes depends on whether you specify a proxy server. If you do not specify a proxy server, USER goes to the web server. If you do specify a proxy server, USER goes to the proxy server.

If you specify the PUSER option, the USER option goes to the web server regardless of whether you specify a proxy server.

If PROMPT is specified, but USER or PUSER is not, the user is prompted for an ID as well as a password.

Tip If you specify user='*', then the user is prompted for an ID.

Details

The Transport Layer Security (TLS) protocol is used when the URL begins with “https” instead of “http”. TLS and its predecessor, Secure Sockets Layer (SSL), are cryptographic protocols that are designed to provide communication security over the internet. TLS and SSL are protocols that provide network data privacy, data integrity, and authentication. In addition to providing encryption services, TLS performs client and server authentication, and it uses message authentication codes to ensure data integrity. The TLS protocol allows client/server applications to
communicate across a network in a way designed to prevent eavesdropping and tampering. TLS is supported by all major browser software.

Note: All discussion of TLS is also applicable to the predecessor protocol, SSL.

Operating Environment Information: Using the FILENAME statement requires information that is specific to your operating environment. The URL access method is fully documented here, but for more information about how to specify filenames, see the SAS documentation for your operating environment.

Examples:

Example 1: Accessing a File at a Website
This example accesses document test.dat at site www.a.com:

```sas
filename foo url 'http://www.a.com/test.dat'
    proxy='http://www.gt.sas.com';
```

Example 2:Specifying a User ID and a Password
This example accesses document file1.html at site www.b.com using the TLS protocol and requires a user ID and password:

```sas
filename foo url 'https://www.b.com/file1.html'
    user='jones' prompt;
```

Example 3: Reading Records from a URL File
This example reads records from lines 228 through 248 from a URL file and writes the records to the SAS log with a PUT statement:

```sas
filename foo url "http://support.sas.com/publishing/cert/sampdata.txt";

data _null_
    infile foo length=len;
    input record $varying200. len;
    if _n_>=228 and _n_<=248 then do;
        put record $varying200. len;
    end;
run;
```

See Also

- “Transport Layer Security (TLS)” in Encryption in SAS

Statements:

- “FILENAME Statement” on page 15
- “LOCKDOWN Statement” in SAS Intelligence Platform: Application Server Administration Guide
FILENAME Statement: WebDAV Access Method

Enables you to access remote files by using the WebDAV protocol.

Valid in: Anywhere
Category: Data Access
Restriction: Access to WebDAV servers is not supported on Open VMS.

Syntax

FILENAME fileref WEBDAV 'external-file' <webdav-options>;

Arguments

fileref
is a valid fileref.

Range 1 to 8 bytes

Tip The association between a fileref and an external file lasts only for the duration of the SAS session or until you change it or discontinue it with another FILENAME statement. You can change the fileref for a file as often as you want.

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

'external-file'
specifies the name of the file that you want to read from or write to a WebDAV server. The external file must be in one of these forms:

http://hostname/path-to-the-file
https://hostname/path-to-the-file
http://hostname:port/path-to-the-file
https://hostname:port/path-to-the-file

Requirement When using the HTTPS communication protocol, you must use the TLS or SSL protocol that provides secure network communications. For more information, see Encryption in SAS.

Operating environment For more information about specifying the physical names of external files, see the SAS documentation for your operating environment.
WebDAV Options

*webdav-options* can be any of these values:

**AUTHDOMAIN="auth-domain"**

specifies the name of an authentication domain metadata object in order to connect to the WebDAV server. The authentication domain references credentials (user ID and password) without your explicitly specifying the credentials.

An administrator creates authentication domain definitions while creating a user definition with the User Manager in SAS Management Console. The authentication domain is associated with one or more login metadata objects that provide access to the proxy or web server. The authentication domain is resolved by the BASE engine calling the SAS Metadata Server and returning the authentication credentials.

**Requirements**
The authentication domain and the associated login definition must be stored in a metadata repository, and the metadata server must be running in order to resolve the metadata object specification.

The *auth-domain* name is case sensitive, and it must be enclosed in double quotation marks.

**Interaction**
If you specify AUTHDOMAIN=, you do not need to specify USER= and PASS=.

**See**
For more information about creating and using authentication domains, see the section on credential management in SAS Intelligence Platform: Security Administration Guide.

**DEBUG**
writes debugging information to the SAS log.

**DEL_ALL**
enables you to delete a directory and all its members.

**Requirement**
The DIR option is required when you use the DEL_ALL option.

**Note**
The default behavior of the WebDAV access method is that only empty directories can be deleted. Use the DEL_ALL option to delete directories that are not empty.

**See**
"DIR" on page 104

**DIR**
enables you to access directory files. Specify the directory name in the external-file argument. You must use valid directory syntax for the specified host.

**Tip**
See FILEXT option on page 105 for information about specifying file extensions.

**ENCODING='encoding-value'**
specifies the encoding to use when SAS is reading from or writing to an 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.

Default SAS assumes that an external file is in the same encoding as the session encoding.


**FILEEXT**

specifies that a file extension is automatically appended to the filename when you use the DIR option.

Interaction The autocall macro facility always passes the extension .SAS to the file access method as the extension to use when opening files in the autocall library. The DATA step always passes the extension .DATA. If you define a fileref for an autocall macro library and the files in that library have a file extension of .SAS, use the FILEEXT option. If the files in that library do not have an extension, do not use the FILEEXT option. For example, if you define a fileref for an input file in the DATA step and the file X has an extension of .DATA, you would use the FILEEXT option to read the file X.DATA. If you use the INFILE or FILE statement, enclose the member name and extension in quotation marks to preserve case.

Tip The FILEEXT option is ignored if you specify a file extension in the FILE or INFILE statement.

See LOWCASE_MEMNAME option on page 105

**LOCALCACHE=”directory name”**

specifies a directory where a temporary subdirectory is created to hold local copies of the server files. Each fileref has its own unique subdirectory. If a directory is not specified, then the subdirectories are created in the SAS Work directory. SAS deletes the temporary files when the SAS program completes.

Default SAS Work directory

**LOCKDURATION=n**

specifies the number of minutes that the files that are written through the WebDAV fileref are locked. SAS unlocks the files when the SAS program successfully finishes executing. If the SAS program fails, then the locks expire after the time allotted.

Default 30 minutes

**LOWCASE_MEMNAME**

enables autocall macro retrieval of lowercase directory or member names from WebDAV servers.

Restriction SAS autocall macro retrieval always searches for uppercase directory member names. Mixed-case directory or member names are not supported.

See FILEEXT option on page 105

**LRECL=lrecl**

specifies the logical record length of the data.
Alternatively, you can specify a global logical record length by using the "LRECL= System Option" in SAS System Options: Reference. In SAS 9.4, the default value for the global LRECL system option is 32767. If you are using fixed-length records (RECFM=F), the default value for LRECL is 256.

**MKDIR=**`"new-directory-name"`  
specifies a new directory that is created from the parent directory that was specified in the **external-file** option.

**Requirements**  
You must use valid directory syntax for the specified host.

You must use the DIR option with the MKDIR option.

**Example**  
```
filename bankname webdav "http://webserver.com/parentdir/"
    dir mkdir="testdir1" user="myid" pass="xxxx";
```

**MOD**  
Places the file in Update mode and appends updates to the bottom of the file.

**PASS=**`password`  
where *password* is the password to use with the user name that is specified in the USER option. The password is case sensitive and it must be enclosed in single or double quotation marks.

**Alias**  
PASSWORD=, PW=, PWD=

**Tip**  
To use an encoded password, use the PWENCODE procedure in order to disguise the text string, and then enter the encoded password for the PASS= option. For more information, see “PWENCODE Procedure” in Base SAS Procedures Guide.

**PROMPT**  
specifies to prompt for the user logon password, if necessary.

**Interaction**  
The USER= and PASS= options override the PROMPT option if all three options are specified. If you specify the PROMPT option and do not specify the USER= or PASS= option, you are prompted for a user ID and password.

**PROXY=**`url`  
specifies the Uniform Resource Locator (URL) for the proxy server in one of these forms:

```
http://hostname/
http://hostname:port/
```

**RECFM=**`recfm`  
where *recfm* is one of two record formats:

**S**  
is a stream-record format. Data is transferred in image (binary) mode.

**Note**  
It is recommended that you specify RECFM=S for PDF or any other binary files, especially if ENCODING=UTF8 or any other Unicode encoding. Otherwise, a byte-order mark (BOM) is written at the beginning of the file and an incorrect content type is generated.
The amount of data that is read is controlled by the current LRECL value or the value of the NBYTE= variable in the INFILE statement. The NBYTE= option specifies a variable that is equal to the amount of data to be read. This amount must be less than or equal to the LRECL. To avoid problems when you transfer large binary files such as PDF or GIF, set NBYTE=1 to transfer one byte at a time.

See The NBYTE= option in the INFILE statement.

V is a variable-record format (the default). In this format, records have varying lengths, and they are transferred in text mode.

Tip Any record larger than LRECL is truncated.

Default V

USER='username'
where username is used to log on to the URL server. The user ID is case sensitive and it must be enclosed in single or double quotation marks.

Alias UID=

Details

The Basics
When you access a WebDAV server to update a file, the file is pulled from the WebDAV server to your local disk storage for processing. When this processing is complete, the file is pushed back to the WebDAV server for storage. The file is removed from the local disk storage when it is pushed back.

The Transport Layer Security (TLS) protocol is used when the URL begins with “https” instead of “http”. TLS and its predecessor, Secure Sockets Layer (SSL), are cryptographic protocols that are designed to provide communication security over the internet. TLS and SSL are protocols that provide network data privacy, data integrity, and authentication. In addition to providing encryption services, TLS performs client and server authentication, and it uses message authentication codes to ensure data integrity. The TLS protocol allows client/server applications to communicate across a network in a way designed to prevent eavesdropping and tampering. TLS is supported by all major browser software.

The name of the WebDAV server being accessed must match the TLS or SSL certificate name created for that server. For UNIX and z/OS operating environments, the TLS or SSL certificate must be stored in an ASCII file and referred to by the SSLCALISTLOC= system option. The SSLCALISTLOC= system option specifies the location of a single file that contains the public certificate or certificates for all of the trusted certification authorities (CA) in the trust chain. On Windows operating environments, the TLS or SSL certificate needs to be imported to the certificate store for the computer.

Note: All discussion of TLS is also applicable to the predecessor protocol, SSL.
Note: WebDAV servers have levels of permissions at both the directory and file level. The WebDAV access method honors those permissions. For example, if a file is available as read-only, the user cannot modify it.

Operating Environment Information: Using the FILENAME statement requires information that is specific to your operating environment. The WebDAV access method is fully documented here, but for more information about how to specify filenames, see the SAS documentation for your operating environment.

Examples:

Example 1: Accessing a File at a Website
This example accesses the file rawFile.txt at site www.mycompany.com.

```sas
filename foo webdav 'https://www.mycompany.com/production/files/rawFile.txt'
  user='wong' pass='jd751d';
data _null_; infile foo; input a $80.; run;
```

Example 2: Using a Proxy Server
This example accesses the file acctgfile.dat by using the proxy server otherwebsvr:80.

```sas
filename foo webdav 'https://webserver.com/webdav/acctgfile.dat'
  user='sanchez' pass='239sk349exz'
  proxy='http://otherwebsvr.com:80';
data _null_; infile foo; input a $80.; run;
```

Example 3: Writing to a New Member of a Directory
This example writes the file SHOES to the directory TESTING.

```sas
filename writeit webdav
  "https://webserver.com:8443/webdav/testing/"
  dir user="webuser" pass=XXXXXXXXX;
data _null_; file writeit(shoes);
  set sashelp.shoes;
  put region $25. product $14.; run;
```

Example 4: Reading from a Member of a Directory
This example reads the file SHOES from the directory TESTING1.

```sas
filename readit webdav
  "https://webserver.com:8443/webdav/testing1/"
```
Example 5: Using a WebDAV Location as an Autocall Macro Library

By default, the autocall macro facility expects uppercase filenames. This example accesses the file **MYTEST** in the autocall macro library **WRITEIT**.

```sas
filename writeit webdav
   "https://webserver.com/webdav/macrolib"
   dir fileext user="webuser" pass=XXXXXXXXX;
options SASAUTOS=(writeit);
/* expects a file called MYTEST.SAS */
%MYPTEST;
```

Example 6: Accessing a Lowercased Autocall Macro Member

This example accesses the file **testmem.sas** in the autocall macro library **LIST**. The **LOWCASE_MEMNAME** option is used to access the file, which is in lowercase.

```sas
filename list webdav "https://webserver.com:8443/accounting/"
   dir fileext user="xxxxx" pass="xxxxx" LOWCASE_MEMNAME;
options sasautos=(list);
%testmem;
```

Example 7: Using a %INCLUDE Statement and Macro Invocation to Access a Lowercased Autocall Macro Member

This example accesses the file **testmem.sas** in the autocall macro library **MYTEST**. Because the file is accessed by using the %INCLUDE statement, case sensitivity is preserved.

```sas
filename mytest webdav "https://webserver.com:8443/payroll/"
   dir user="xxxxxx" pass="xxxxx";
%include mytest(testmem.sas) /source2;
%testmem;
```

If the filename was in uppercase, the reference to the filename in the %INCLUDE statement and macro call needs to be uppercase.

```sas
%include mytest (TESTMEM.SAS) /source2;
%TESTMEM;
```

Example 8: Accessing a File with a Mixed-Case Name

This example accesses the file **fileNOext** from the **production** directory. Because the file is quoted in the INFILE statement, case sensitivity is preserved and the file extension is ignored.

```sas
filename test webdav "https://webserver.com:8443/production"
   dir user="xxxxxx" pass="xxxxx";
data _null_
   infile test('fileNOext');
```
Example 9: Using the FILEEXT Option to Automatically Attach a File Extension

This example accesses the file `testmem.sas` from the `sales` directory. The FILEEXT option automatically adds `.DATA` as the file extension. The member name that is read is `testmem.DATA`.

```sas
filename listing webdav "https://webserver.com:8443/sales"
   dir fileext user="xxxxxx" pass="xxxxx";
data _null_
   infile listing(testmem);
   input;
   list;
run;
```

Example 10: Deleting a Directory That Contains Members

In this example, the `newusers` directory contains members, and the deletion of the directory fails.

```sas
filename newusers webdav "https://webserver.com:8443/production"
   dir user="xxxxxx" pass="xxxxx";
   /**** cannot delete newusers because it has members ****/
   data _null_
      rc=fdelete("newusers");
      put rc=;
run;
   / **** can delete newusers because del_all in filename statement ****/

In this example, the FILENAME statement contains the DEL_ALL option, which enables the `newusers` directory to be deleted.

```sas
filename newusers webdav "https://webserver.com:8443/production"
   dir user="xxxxxx" pass="xxxxx" del_all;
   / **** can delete newusers because del_all option ****/
   data _null_
      rc=fdelete("newusers");
      put rc=;
run;
```

See Also

- “Transport Layer Security (TLS)” in Encryption in SAS
- “FILENAME Statement” on page 15
- “LIBNAME Statement: WebDAV Server Access” on page 167
FILENAME Statement: ZIP Access Method

Enables you to access ZIP files.

Valid in: Anywhere
Category: Data Access
Note: The ZIP access method reads and writes only files created with the WinZip file compression.

Syntax

FILENAME fileref ZIP 'external-file' <zip-options>;

Arguments

fileref
is a valid fileref.
Range 1 to 8 bytes
Tip The association between a fileref and an external file lasts only for the duration of the SAS session or until you change the fileref or discontinue it with another FILENAME statement. You can change the fileref for a file as often as you want.

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

'external-file'
specifies the name of the ZIP file that you want to read from or write to.

Operating environment
For information about specifying the physical names of external files, see the SAS documentation for your operating environment.

Notes
If you write multiple entries of the same ZIP file in a DATA step, an error occurs. Multiple entries overlay each other with unpredictable results.

All ZIP filenames and ZIP file entries are case sensitive.

Tip
Specify external-file when you assign a fileref to an external file. You can associate a fileref with a single file by using the MEMBER= syntax or with an aggregate file storage location that uses the fileref(member) syntax.
ZIP Options

`zip-options` can be any of these values:

**COMMENT=**"comment-string"
writes an informative comment in a ZIP file.

**COMPRESSION=**"compression-level"
specifies the compression level that is used to write to the ZIP file member. Valid values for the compression level are 0 through 9. A value of 0 stores the file with no compression. A value of 9 indicates maximum compression.

Default: 6

Restriction: `COMPRESSION=` is used only when opening a file for writing.

**DEBUG**
writes debugging information to the SAS log.

**ENCODING=**`encoding-value`
specifies the encoding to use when SAS is reading from or writing to an 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.

Default: SAS assumes that an external file is in the same encoding as the session encoding.


**FILEEXT**
specifies that a file extension is automatically appended to the filename member if the extension does not exist.

Interaction: The autocall macro facility always passes the extension .SAS to the file access method as the extension to use when opening files in the autocall library. The DATA step always passes the extension .DATA. If you define a fileref for an autocall macro library and the files in that library have a file extension of .SAS, use the FILEEXT option. If the files in that library do not have an extension, do not use the FILEEXT option. For example, if you define a fileref for an input file in the DATA step and the file X has an extension of .DATA, you would use the FILEEXT option to read the file X.DATA. If you use the INFILE or FILE statement, enclose the member name and extension in quotation marks to preserve the casing.

Tip: The FILEEXT option is ignored if you specify a file extension on the FILE or INFILE statement.

See: “LOWCASE_MEMNAME” on page 113

**GZIP**
specifies that the external file is a GZIP file.
The GZIP and MEMBER= options are mutually exclusive. If both options appear, GZIP takes precedence and the MEMBER= option is ignored.

Support for this option was added in SAS 9.4M5.

LOWCASE_MEMNAME
enables autocall macro retrieval of lowercase directory or member names from ZIP files.

SAS autocall macro retrieval always searches for uppercase directory member names. Mixed-case directory or member names are not supported.

See “FILEEXT” on page 112

LRECL=\\(lrecl\\)
specifies the logical record length of the data.

Default 32767

Alternatively, you can specify a global logical record length by using the “LRECL= System Option” in SAS System Options: Reference. In SAS 9.4, the default value for the global LRECL system option is 32767.

MEMBER="\\(member-file\\)"
associates the fileref with a single file found inside the ZIP file.

The MEMBER= and GZIP options are mutually exclusive. If both options appear, GZIP takes precedence and the MEMBER= option is ignored.

You can use a wildcard in the MEMBER= syntax. An asterisk (*) matches zero or more characters. A question mark (?) matches one character. Wildcards are supported when reading entries and for exist actions. Wildcards are not supported for write or delete actions. For example, writing entry “A*” creates an entry “A*”. Deleting an entry named “A*” deletes “A*” but not any entry that starts with “A”. Calling an exist function with “A*” returns True as long as one or more entries that start with “A” exist.

NAMEENCODING=\\(encoding-value\\)
specifies the encoding to use for ZIP file entry names and comments. The value for NAMEENCODING= indicates that the entry name and comment have a different encoding from the current session encoding.

Default Code Page 437

Example filename zs zip "yxz.zip" nameencoding=sjis member="s" termstr=lf;

RECFM=\\(recfm\\)
where recfm is one of four record formats:

F
is a fixed-record format. Each record has the same length.
N is a binary format. The file consists of stream bytes with no record boundaries.

S is a stream-record format.

Interaction
The amount of data that is read is controlled by the current LRECL value or by the value of the NBYTE= variable in the INFILE statement. The NBYTE= option specifies a variable that is equal to the amount of data to be read. This amount must be less than or equal to LRECL.

See The NBYTE= option in the INFILE statement.

V is a variable-record format (the default). In this format, records have varying lengths, the records are transferred in text mode.

Interaction Any record larger than LRECL is truncated.

Default V

TERMSTR='eol-termination-character'
specifies the terminating character, which is the line character for Read operations and the terminating character for Write operations. There are four valid values:

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CR</td>
<td>carriage return (CR).</td>
</tr>
<tr>
<td>CRLF</td>
<td>carriage return (CR) followed by line feed (LF).</td>
</tr>
<tr>
<td>LF</td>
<td>line feed only (the default).</td>
</tr>
<tr>
<td>NULL</td>
<td>NULL character (0x00).</td>
</tr>
</tbody>
</table>

Default CRLF for Windows. LF for all other operating environments.

Operating environment Using the FILENAME statement requires information that is specific to your operating environment. For more information about how to specify filenames, see the SAS documentation for your operating environment.

Examples:

Example 1: Reading a ZIP File Member from a Directory
This example reads the test1.txt ZIP file member from the testzip ZIP file.

```sas
filename foo ZIP 'U:\directory1\testzip.zip' member="test1.txt" ;

data _null_;
infile foo;
input a $80.;
run;
```
Example 2: Writing a ZIP File to a New Member of a Directory

This example writes the shoes file to the testzip ZIP file.

```
filename foo ZIP 'U:\directory1\testzip.zip';

data _null_;
  file foo(shoes);
  set sashelp.shoes;
  put region $25. product $14.;
run;
```

Example 3: Reading from a Member of a Directory

This example reads the file shoes from the testzip ZIP file.

```
filename foo ZIP 'U:\directory1\testzip.zip';

data shoes;
  length region $25  product $14;
  infile foo(shoes);
  input region $25. product $14.;
run;
```

See Also

Statements:
- “FILE Statement” in SAS DATA Step Statements: Reference
- “FILENAME Statement” on page 15
- “INFILE Statement” in SAS DATA Step Statements: Reference

FOOTNOTE Statement

Writes up to 10 lines of text at the bottom of the procedure or DATA step output.

Valid in: Anywhere
Category: Output Control
Restriction: The FOOTNOTE statement does not support Unicode.
Requirement: You must specify the FOOTNOTE option if you use a FILE statement.
See: FOOTNOTE Statement under Windows, UNIX, and z/OS

Syntax
```
FOOTNOTE<n > <ods-format-options> <'text' | "text">;
```
Without Arguments
Using FOOTNOTE without arguments cancels all existing footnotes.

Arguments

\[ n \]

specifies the relative line to be occupied by the footnote.

**Default**
If you omit \( n \), SAS assumes a value of 1.

**Range**
\( n \) can range from 1 to 10.

**Tip**
For footnotes, lines are pushed up from the bottom. The FOOTNOTE statement with the highest number appears on the bottom line.

**ods-format-options**
specifies formatting options for the ODS HTML, RTF, and PRINTER(PDF) destinations.

**BOLD**
specifies that the footnote text is bold font weight.

**COLOR=**color
specifies the footnote text color.

**BCOLOR=**color
specifies the background color of the footnote block.

**FONT=**font-face
specifies the font to use. If you supply multiple fonts, then the destination device uses the first one that is installed on your system.

**HEIGHT=**size
specifies the point size.

**ITALIC**
specifies that the footnote text is in italic style.
JUSTIFY= CENTER | LEFT | RIGHT
specifies justification.

CENTER
specifies center justification.

Alias C

LEFT
specifies left justification.

Alias L

RIGHT
specifies right justification.

Alias R

Example
“Example 3: Customizing Titles and Footnotes By Using the Output Delivery System” on page 198

LINK='url'
specifies a hyperlink.

TEMPERATURE destination HTML, RTF, PRINTER

Tip
The visual properties for LINK= always come from the current style.

UNDERLIn= 0 | 1 | 2 | 3
specifies whether the subsequent text is underlined. 0 indicates no underlining. 1, 2, and 3 indicates underlining.

Alias U

ODS destination HTML, RTF, PRINTER

Tip
ODS generates the same type of underline for values 1, 2, and 3. However, SAS/GRAPH uses values 1, 2, and 3 to generate increasingly thicker underlines.

Note
The defaults for how ODS renders the FOOTNOTE statement come from style elements that relate to system footnotes in the current style. The FOOTNOTE statement syntax with ods-format-options is a way to override the settings that are provided by the current style. The current style varies according to the ODS destination. For more information about how to determine the current style, see “Understanding Styles, Style Elements, and Style Attributes” in SAS Output Delivery System: Procedures Guide and “Concepts: TEMPLATE Procedure” in SAS Output Delivery System: Procedures Guide.
Tip You can specify these options by letter, word, or words by preceding each letter or word of the text by the option. For example, this code makes the footnote “Red, White, and Blue” appear in different colors.

footnote color=red "Red," color=white "White, and" color=blue "Blue";

'text' | “text”
specifies the text of the footnote in single or double quotation marks

Tips For compatibility with previous releases, SAS accepts some text without quotation marks. When you write new programs or update existing programs, always enclose text in quotation marks.

You can use macro variables and macros to change the information in FOOTNOTE statements. If the footnote is enclosed in double quotation marks (""), the text indicated is substituted into the footnote. If the footnote is enclosed in single quotation marks ("), the text is not substituted.

If you use single quotation marks (') or double quotation marks (""") together (with no space in between them) as the string of text, SAS writes a single quotation mark (') or double quotation mark (""), respectively.

Details

A FOOTNOTE statement takes effect when the step or RUN group with which it is associated executes. After you specify a footnote for a line, SAS repeats the same footnote on all pages until you cancel or redefine the footnote for that line. When a FOOTNOTE statement is specified for a given line, it cancels the previous FOOTNOTE statement for that line and for all footnote lines with higher numbers.

Operating Environment Information: The maximum footnote length that is allowed depends on the operating environment and the value of the LINESIZE= system option. For more information, see the SAS documentation for your operating environment.

Comparisons

You can also create footnotes with the FOOTNOTES window. For more information, refer to the online Help for the window.

You can modify footnotes with the Output Delivery System. See “Example 3: Customizing Titles and Footnotes By Using the Output Delivery System” on page 198.

Example: Using the FOOTNOTE Statement

These examples of a FOOTNOTE statement result in the same footnote:

footnote8 "Managers' Meeting";
footnote8 'Managers'' Meeting';

These are examples of FOOTNOTE statements that use some of the formatting options for the ODS HTML, RTF, and Printer(PDF) destinations. For the complete example, see “Example 3: Customizing Titles and Footnotes By Using the Output Delivery System” on page 198.

footnote j=left height=20pt
See Also

Statements:

- "TITLE Statement" on page 192

---

%INCLUDE Statement

Brings a SAS programming statement, data lines, or both, into a current SAS program.

Valid in: Anywhere
Category: Program Control
Alias: %INC
See: %INCLUDE Statement under Windows, UNIX, and z/OS

Syntax

```
%INCLUDE source(s)
</<SOURCE2> <S2=length> <operating-environment-options>> >;
```

Arguments

source(s)

describes the location of the information that you want to access with the
%INCLUDE statement. There are three possible sources:

<table>
<thead>
<tr>
<th>Source</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>file-specification</td>
<td>specifies an external file</td>
</tr>
<tr>
<td>internal-lines</td>
<td>specifies lines that are entered earlier in the same SAS job or session</td>
</tr>
<tr>
<td>keyboard-entry</td>
<td>specifies statements or data lines that you enter directly from the keyboard</td>
</tr>
</tbody>
</table>

file-specification

identifies an entire external file that you want to bring into your program.

File-specification can have these forms:
'external-file'
specifies the physical name of an external file that is enclosed in quotation marks. The physical name is the name by which the operating environment recognizes the file.

fileref
specifies a fileref that has previously been associated with an external file.

Range 1 to 8 bytes

Tip You can use a FILENAME statement or function or an operating environment command to make the association.

fileref (filename-1 <, "filename–2.xxx", ... filename-n>)
specifies a fileref that has previously been associated with an aggregate storage location. Follow the fileref with one or more filenames that reside in that location. Enclose the filenames in one set of parentheses, and separate each filename with a comma followed by a space.

This example instructs SAS to include the files testcode1.sas, testcode2.sas, and testcode3.txt. These files are located in the aggregate storage location mylib. You do not need to specify the file extension for testcode1 and testcode2 because they are the default .SAS extension. You must enclose testcode3.txt in quotation marks with the whole filename specified because it has an extension other than .SAS:

```
%include mylib(testcode1, testcode2, "testcode3.txt");
```

Operating environment
Different operating environments call an aggregate grouping of files by different names, such as a directory, a MACLIB, a text library, or a partitioned data set. For information about accessing files from a storage location that contains several files, see the SAS documentation for your operating environment.

Note A file that is located in an aggregate storage location and has a name that is not a valid SAS name must have its name enclosed in quotation marks.

Tip You can use a FILENAME statement or function or an operating environment command to make the association.

Restriction You cannot selectively include lines from an external file.

Operating environment The character length allowed for filenames is operating environment specific. For complete details about specifying the physical names of external files, see the SAS documentation for your operating environment.

Tips You can verify the existence of file-specification by using the SYSERR macro variable if the ERRORCHECK option is set to STRICT.

Including external sources is useful in all types of SAS processing: batch, windowing, interactive line, and noninteractive.
**internal-lines**

includes lines that were entered earlier in the same SAS job or session.

To include internal lines, use any of these values:

- **n** includes line **n**.
- **n-m** or **n:m** includes lines **n** through **m**.

**Note**  
The SPOOL system option controls internal access to previously submitted lines when you run SAS in interactive line mode, noninteractive mode, and batch mode. By default, the SPOOL system option is set to NOSPOOL. The SPOOL system option must be in effect in order to use %INCLUDE statements with internal line references. Use the OPTIONS procedure to determine the current setting of the SPOOL system option on your system.

**Tips**  
Including internal lines is most useful in interactive line mode processing.

Use a %LIST statement to determine the line numbers that you want to include.

Although you can use the %INCLUDE statement to access previously submitted lines when you run SAS in a windowing environment, it might be more practical to recall lines in the Program Editor with the RECALL command and then submit the lines with the SUBMIT command.

**keyboard-entry**

is a method for preparing a program so that you can interrupt the current program's execution, enter statements or data lines from the keyboard, and then resume program processing.

*  
prompts you to enter data from the keyboard. Place an asterisk (*) after the %INCLUDE statement in your code: To resume processing the original source program, enter a %RUN statement from the keyboard.

```sas
proc print;
  %include *;
run;
```

**Restriction**  
The asterisk (*) cannot be used to specify keyboard entry if you use the Enhanced Editor in the Microsoft Windows operating environment.

**Note**  
The fileref SASTERM must have been previously associated with an external file in a FILENAME statement or function or an operating environment command.

**Tips**  
Use this method when you run SAS in noninteractive or interactive line mode. SAS pauses during processing and prompts you to enter statements from the keyboard.

Use this argument to include source from the keyboard:

You can use a %INCLUDE * statement in a batch job by creating a file with the fileref SASTERM that contains the statements that you would otherwise enter from the keyboard. The %INCLUDE *
statement causes SAS to read from the file that is referenced by SASTERM. Insert a %RUN statement into the file that is referenced by SASTERM where you want SAS to resume reading from the original source.

**SOURCE2**
causes the SAS log to show the source statements that are being included in your SAS program.

**Tips**
- The SAS log also displays the fileref and the filename of the source and the level of nesting (1, 2, 3, and so on).
- The SOURCE2 system option produces the same results. When you specify SOURCE2 in a %INCLUDE statement, it overrides the setting of the SOURCE2 system option for the duration of the include operation.

**S2=length**
specifies the length of the record to be used for input. *Length* can have these values:

- **S** sets S2 equal to the current setting of the S= SAS system option.
- **0** tells SAS to use the setting of the SEQ= system option to determine whether the line contains a sequence field. If the line does contain a sequence field, SAS determines line length by excluding the sequence field from the total length.
- **n** specifies a number greater than zero that corresponds to the length of the line to be read, when the file contains fixed-length records. When the file contains variable-length records, *n* specifies the column in which to begin reading data.

**Interaction**
The S2= system option also specifies the length of secondary source statements that are accessed by the %INCLUDE statement, and it is effective for the duration of your SAS session. The S2= option in the %INCLUDE statement affects only the current include operation. If you use the S2= option in the %INCLUDE statement, it overrides the S2= system option setting for the duration of the include operation.

**Tips**
- Text input from the %INCLUDE statement can be either fixed or variable length.
- Fixed-length records are either unsequenced or sequenced at the end of each record. For fixed-length records, the value given in S2= is the ending column of the data.
- Variable-length records are either unsequenced or sequenced at the beginning of each record. For variable-length records, the value given in S2= is the starting column of the data.

**See**
For a detailed discussion of fixed-length and variable-length input records, see “S= System Option” in SAS System Options: Reference and “S2= System Option” in SAS System Options: Reference.

**operating-environment-options**

**Operating environment**
Operating environments can support various options for the %INCLUDE statement. See the documentation for your
Details

What %INCLUDE Does

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.

Operating Environment Information: Use of the %INCLUDE statement is dependent on your operating environment. Before you run the examples for this statement and for more information about additional software features and methods of referring to and accessing your files, see the documentation for your operating environment.

Three Sources of Data

The %INCLUDE statement accesses SAS statements and data lines from three possible sources:

- external files
- lines entered earlier in the same job or session
- lines entered from the keyboard

Uses of %INCLUDE

The %INCLUDE statement is most often used when running SAS in interactive line mode, noninteractive mode, or batch mode. Although you can use the %INCLUDE statement when you run 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.

Rules for Using %INCLUDE

- You can specify any number of sources in a %INCLUDE statement, and you can mix the types of included sources. However, although it is possible to include information from multiple sources in one %INCLUDE statement, it might be easier to understand a program that uses separately coded %INCLUDE statements for each source.

- The %INCLUDE statement must begin at a statement boundary. That is, it must be the first statement in a SAS job or must immediately follow a semicolon that ends another statement. A %INCLUDE statement cannot immediately follow a DATALINES, DATALINES4, CARDS, or CARDS4 statement (or PARMCARDS or PARMCARDS4 statement in procedures that use those statements). However, you can include data lines with the %INCLUDE statement using one of these methods:
  - Make the DATALINES, DATALINES4 statement or the CARDS, CARDS4 statement the first line in the file that contains the data.
  - Place the DATALINES, DATALINES4 statement or the CARDS, CARDS4 statement in one file, and the data lines in another file. Use both sources in a single %INCLUDE statement.
The `%INCLUDE` statement can be nested within a file that has been accessed with `%INCLUDE`. The maximum number of nested `%INCLUDE` statements that you can use depends on system-specific limitations of your operating environment (such as available memory or the number of files that you can have open concurrently).

- Because `%INCLUDE` is a global statement and global statements are not executable, the `%INCLUDE` statement cannot be used in conditional logic.
- The maximum line length is 32K bytes.

Comparisons

The `%INCLUDE` statement executes statements immediately. The `INCLUDE` command brings the included lines into the Program Editor window but does not execute them. You must issue the SUBMIT command to execute those lines.

Examples:

**Example 1: Including an External File**

- This example stores a portion of a program in a file named MYFILE. The file can be included in a program that is written later.

  ```sparql
  data monthly;
  input x y month $;
  datalines;
  1 1 January
  2 2 February
  3 3 March
  4 4 April
  
  This program includes an external file named MYFILE and submits the DATA step that it contains before the PROC PRINT step executes.
  
  `%include 'MYFILE';`
  proc print;
  run;
  
  To reference a file by using a fileref rather than the actual filename, you can use the FILENAME statement (or a command recognized by your operating environment) to assign a fileref.
  
  ```sparql
  filename in1 'MYFILE';
  
  Later, you can access MYFILE with the fileref IN1.
  
  `%inc in1;`
  
  If you want to use many files that are stored in a directory, PDS, or MACLIB (or whatever your operating environment calls an aggregate storage location), you can assign the fileref to the larger storage unit and then specify the filename. For example, this FILENAME statement assigns the fileref STORAGE to an aggregate storage location.
  
  ```sparql
  filename storage
    'aggregate-storage-location';
  
  Later, you can include a file using this statement.
You can also access several files or members from this storage location by listing them in parentheses after the fileref in a single `%INCLUDE` statement. Separate filenames with a comma or a blank space. This `%INCLUDE` statement demonstrates this method.

```
%inc storage(file-1,file-2,file-3);
```

When the file does not have the default .SAS extension, you can access it using quotation marks around the complete filename listed inside the parentheses.

```
%inc storage("file-1.txt","file-2.dat","file-3.cat");
```

### Example 2: Including Previously Submitted Lines

This `%INCLUDE` statement causes SAS to process lines 1, 5, 9 through 12, and 13 through 16 as if you had entered them again from your keyboard.

```
%include 1 5 9-12 13:16;
```

### Example 3: Including Input from the Keyboard

The method shown in this example is valid only when you run SAS in noninteractive mode or interactive line mode.

**Restriction:** The asterisk (*) cannot be used to specify keyboard entry if you use the Enhanced Editor in the Microsoft Windows operating environment.

This example uses `%INCLUDE` to add a customized TITLE statement when PROC PRINT executes.

```
data report;
   infile file-specification;
   input month $ salesamt $;
run;
proc print;
   %include *;
run;
```

When this DATA step executes, `%INCLUDE` with the asterisk causes SAS to issue a prompt for statements that are entered at the keyboard. For example:

```
where month= 'January';
title 'Data for month of January';
```

After you enter statements, you can use `%RUN` to resume processing by entering `%run;`.

The `%RUN` statement signals to SAS to leave keyboard-entry mode and resume reading and executing the remaining SAS statements from the original program.

### Example 4: Using `%INCLUDE` with Several Entries in a Single Catalog

This example submits the source code from three entries in the catalog MYLIB.INCLUDE. When no entry type is specified, the default is CATAMS.

```
filename dir catalog 'mylib.include';
%include dir(mem1);
```
LIBNAME Statement

Associates or disassociates a SAS library with a libref (a shortcut name), clears one or all librefs, lists the characteristics of a SAS library, concatenates SAS libraries, or concatenates SAS catalogs.

Valid in: Anywhere
Category: Data Access
Restriction: When SAS is in a locked-down state, the LIBNAME statement is not available for files that are not in the lockdown path list. For more information, see “SAS Processing Restrictions for Servers in a Locked-Down State” in SAS Language Reference: Concepts.

See: LIBNAME Statement under Windows, UNIX, and z/OS

Syntax

Form 1: LIBNAME libref <engine> 'SAS-library' <libname-options> <engine-host-options>;

Form 2: LIBNAME libref CLEAR | _ALL_ CLEAR ;

Form 3: LIBNAME libref LIST | _ALL_ LIST;

Form 4: LIBNAME libref <engine> (library-specification-1 <…library-specification-n>) <libname-options>;

Required Arguments

libref

is a shortcut name or a “nickname” for the aggregate storage location where your SAS files are stored. It is any SAS name when you are assigning a new libref. When you are disassociating a libref from a SAS library or when you are listing attributes, specify a libref that was previously assigned.

Range 1 to 8 bytes

Tip The association between a libref and a SAS library lasts only for the duration of the SAS session or until you change it or discontinue it with another LIBNAME statement.
A libref follows the same rules of syntax as any SAS name. For more information about SAS naming conventions, see “Names in the SAS Language” in SAS Language Reference: Concepts.

'SAS-library'
must be the physical name for the SAS library. The physical name is the name that is recognized by the operating environment. Enclose the physical name in single or double quotation marks.

Operating environment
For more information about specifying the physical names of files, see the SAS documentation for your operating environment.

library-specification
is two or more SAS libraries that are specified by physical names, previously assigned librefs, or a combination of the two. Separate each specification with either a blank or a comma and enclose the entire list in parentheses.

'SAS-library'
is the physical name of a SAS library, enclosed in quotation marks.

libref
is the name of a previously assigned libref.

Restriction
When concatenating libraries, you cannot specify options that are specific to an engine or an operating environment.

See
“Rules for Library Concatenation” on page 139

Example
“Example 2: Logically Concatenating SAS Libraries” on page 141

CLEAR
disassociates one or more currently assigned librefs.

Tip
Specify libref to disassociate a single libref. Specify _ALL_ to disassociate all currently assigned librefs.

_ALL_
specifies that the CLEAR or LIST argument applies to all currently assigned librefs.

LIST
writes the attributes of one or more SAS libraries to the SAS log.

Tip
Specify libref to list the attributes of a single SAS library. Specify _ALL_ to list the attributes of all SAS libraries that have librefs in your current session.

Optional Arguments

libname-options can be any of these values:

ACCESS=READONLY | TEMP

READONLY
assigns a read-only attribute to an entire SAS library. SAS does not allow you to open a data set in the library in order to update information or write new information.
TEMP
specifies that the SAS library be treated as a scratch library. That is, the
system does not consume CPU cycles to ensure that the files in a Temp
library do not become corrupted.

Tip Use ACCESS=TEMP to save resources only when the data is
recoverable.

AUTHADMIN= YES | NO
specifies whether an administrator can access a metadata-bound library for
which corresponding metadata is corrupted, misconfigured, or missing.

Default NO

Restriction This LIBNAME option can be used only by administrators of
metadata-bound libraries.

Interactions If the administrator specifies AUTHADMIN=YES in a LIBNAME
statement and knows the password (or passwords) for the target
data, the administrator can access that data by explicitly supplying
the password (or passwords).

An administrator can choose to specify the AUTHPW= option in the
LIBNAME statement as an additional method for making the
metadata-bound library password available to later requests.

Note The use of AUTHADMIN=YES is intended for the administrator to
correct misaligned location and metadata information. To ensure
that the user who is issuing the LIBNAME statement has
administrator rights to correct the misalignments, the user must
have the same permissions that are needed to run the AUTHLIB
procedure statements and must supply the metadata-bound data
passwords when accessing the data sets.

Tip The AUTHLIB REPAIR statement is preproduction. It is
recommended that you use AUTHADMIN=YES when performing
any AUTHLIB REPAIR action. As a best practice, do not use
AUTHADMIN=YES in any other circumstance.

See "AUTHPW=password"
"Metadata-Bound Libraries" on page 140
SAS Guide to Metadata-Bound Libraries
PROC AUTHLIB in Base SAS Procedures Guide

AUTHALTER=alter-password
Specifies an ALTER password to use only in data access requests where both of
these conditions exist:

- AUTHADMIN=YES is specified in the LIBNAME statement that is referenced
  in the request.
The correct password for the target metadata-bound data set or library is not otherwise available or is invalid.

**Requirement**  
The **AUTHADMIN** option must be set to YES for this option to have an effect.

**Interaction**  
You can use the AUTHALTER= option in the same way as the AUTHPW= option if all three of the passwords (ALTER, READ, and WRITE) are the same.

**See**  
*SAS Guide to Metadata-Bound Libraries*

**AUTHPW=password**

Specifies a password to use only in data access requests where both of these conditions exist:

- AUTHADMIN=YES is specified in the LIBNAME statement that is referenced in the request or is invalid.
- The correct password for the target metadata-bound library is not otherwise available.

**Requirement**  
The **AUTHADMIN** option must be set to YES for this option to have an effect. However, the use of AUTHADMIN=YES does not require that you use AUTHPW. You are not required to specify metadata-bound library passwords in a LIBNAME statement.

**Interactions**  
If the metadata-bound library has two or three distinct passwords, you must specify each individual password with the AUTHALTER=, AUTHREAD=, and AUTHWRITE= options as appropriate instead of using the AUTHPW= option on its own.

You can use the AUTHALTER= option in the same way as the AUTHPW= option if all three of the passwords (ALTER, READ, and WRITE) are the same and you are in a SAS language context where ALTER= can be used.

**Tip**  
An error occurs if the AUTHPW password does not match the password that is within the referenced secured library object.

**See**  
*SAS Guide to Metadata-Bound Libraries*

**AUTHREAD=read-password**

Specifies a READ password to use only in data access requests where both of these conditions exist:

- AUTHADMIN=YES is specified in the LIBNAME statement that is referenced in the request.
- The correct password for the target metadata-bound library is not otherwise available or is invalid.

**Requirement**  
The **AUTHADMIN** option must be set to YES for this option to have an effect.

**See**  
*SAS Guide to Metadata-Bound Libraries*

**AUTHWRITE=write-password**

Assigns a WRITE password to a metadata-bound library that prevents users from writing to a library, unless they enter the password.
Requirement  The AUTHADMIN option must be set to YES for this option to have an effect.

See  SAS Guide to Metadata-Bound Libraries

COMPRESS=NO | YES | CHAR | BINARY
controls the compression of observations in output SAS data sets for a SAS library.

NO
specifies that the observations in a newly created SAS data set be uncompressed (fixed-length records).

YES CHAR
specifies that the observations in a newly created SAS data set be compressed (variable-length records) by SAS using RLE (Run Length Encoding). RLE compresses observations by reducing repeated consecutive characters (including blanks) to two-byte or three-byte representations.

Tip  Use this compression algorithm for character data.

BINARY
specifies that the observations in a newly created SAS data set be compressed (variable-length records) by SAS using RDC (Ross Data Compression). RDC combines run-length encoding and sliding-window compression to compress the file.

Tip  This method is highly effective for compressing medium to large (several hundred bytes or larger) blocks of binary data (numeric variables). Because the compression function operates on a single record at a time, the record length needs to be several hundred bytes or larger for effective compression.

Interaction  For the COPY procedure, the default value CLONE uses the compression attribute from the input data set for the output data set instead of the value specified in the COMPRESS= option. For more information about CLONE and NOCLONE, see COPY Statement in the DATASETS procedure. This interaction does not apply when using SAS/SHARE or SAS/CONNECT.

CVPBYTES=bytes
specifies the number of bytes by which to expand character variable lengths when processing a SAS data file that requires transcoding. The CVP engine expands the lengths so that character data truncation does not occur. The lengths for character variables are increased by adding the specified value to the current length. You can specify a value from 0 to 32,766.

For example, the following LIBNAME statement implicitly assigns the CVP engine by specifying the CVPBYTES= option:

libname expand 'SAS data-library' cvpbytes=5;

Character variable lengths are increased by adding 5 bytes. A character variable with a length of 10 is increased to 15, and a character variable with a length of 100 is increased to 105.

Default  If you specify CVPBYTES=, SAS automatically uses the CVP engine to expand the character variable lengths according to your
specification. If you explicitly assign the CVP engine but do not specify either CVPBYTES= or CVPMULTIPLIER=, then SAS uses CVPMULTIPLIER=1.5 to increase the lengths of the character variables.

**Restrictions**
The CVP engine supports SAS data files, no SAS views, catalogs, item stores, and so on.

The CVP engine is available for input (read) processing only.

For library concatenation with mixed engines that include the CVP engine, only SAS data files are processed. For example, if you execute the COPY procedure, only SAS data files are copied.

**Requirement**
The number of bytes that you specify must be large enough to accommodate any expansion. Otherwise, truncation occurs, which results in an error message in the SAS log.

**Interaction**
You cannot specify both the CVPBYTES= option and the CVPMULTIPLIER= option. Specify only one of these options.

**See**
"Avoiding Character Data Truncation By Using the CVP Engine" in SAS National Language Support (NLS): Reference Guide

---

**CVPENGINE=engine**
specifies the engine to use to process a SAS data file that requires transcoding. The CVP engine expands the character variable lengths to transcoding so that character data truncation does not occur. Then the specified engine processes the actual file.

**Alias**
CVPENG

**Default**
SAS uses the default SAS engine.

**See**
"Avoiding Character Data Truncation By Using the CVP Engine" in SAS National Language Support (NLS): Reference Guide

---

**CVPFORMATWIDTH=YES | NO**
specifies whether to expand the character format width.

If CVPVARCHAR= is not specified, the new format width is determined by the CVPMULTIPLIER= and CVPBYTES= options.

If CVPVARCHAR= is specified, the CVP engine automatically adjusts the format width to meet the maximum-byte length of a converted character variable. For example, in a UTF-8 session, the format width is multiplied by 4.

**Alias**
CVPFMTW

**Default**
YES

---

**CVPMULTIPLIER=multiplier**
specifies a multiplier value that expands character variable lengths when you are processing a SAS data file that requires transcoding. The CVP engine expands the lengths so that character data truncation does not occur. The lengths for character variables are increased by multiplying the current length by the specified value. You can specify a multiplier value from 1 to 5 or you can specify 0 and then the CVP engine determines the multiplier automatically.
For example, the following LIBNAME statement implicitly assigns the CVP engine by specifying the CVPMULTIPLIER= option:

```
libname expand 'SAS data-library' cvpmultiplier=2.5;
```

Character variable lengths are increased by multiplying the lengths by 2.5. A character variable with a length of 10 is increased to 25, and a character variable with a length of 100 is increased to 250.

**Alias**

CVPMULT

**Default**

If you specify the CVPMULTIPLIER= option, SAS automatically uses the CVP engine to expand the character variable lengths according to your specification. If you explicitly specify the CVP engine but do not specify either the CVPMULTIPLIER= option or the CVPBYTES= option, then SAS uses CVPMULTIPLIER=AUTO(0) to increase the lengths. AUTO(0) sets the value of the CVP engine based on the encoding of the SAS session and input data set.

**Restrictions**

The CVP engine supports SAS data files, no SAS views, catalogs, item stores, and so on.

The CVP engine is available for input (read) processing only.

For library concatenation with mixed engines that include the CVP engine, only SAS data files are processed. For example, if you execute the COPY procedure, only SAS data files are copied.

**Requirement**

The number of bytes that you specify must be large enough to accommodate any expansion. Otherwise, truncation occurs, which results in an error in the SAS log.

**Interaction**

You cannot specify both the CVPMULTIPLIER= option and the CVPBYTES= option. Specify only one of these options.

**See**

“Avoiding Character Data Truncation By Using the CVP Engine” in SAS National Language Support (NLS): Reference Guide

**CVPVARCHAR=**YES | NO

specifies whether to convert fixed-width character variables to variable-width characters during input file processing. The byte length of the new-width character variable is the maximum number of bytes per character from the SAS session encoding multiplied by the specified fixed-width character length.

**Default**

No

**Interaction**

If you specify CVPVARCHAR=YES, the CVPMULTIPLIER= and CVPBYTES= options are ignored.

**Notes**

Trailing blanks are removed from string data that is under CHAR columns.

Fixed-width character variables with a format of TRANSCODE=NO are excluded during conversion.

**EXTENDOBS=**YES | NO

specifies whether to extend the maximum observation count in output SAS data files for a SAS library.
YES

specifies to use the default maximum observation count of $2^{63} - 1$ or approximately 9.2 quintillion observations in a newly created SAS data file.

Restriction

A SAS data file that has the extended observation count attribute cannot be used by releases prior to SAS 9.3. To remove the extended observation count attribute, the file must be re-created. If you plan to use the file in SAS 9.2 or earlier releases, then set EXTENDOBSCOUNTER=NO when you create the file.

Interaction

EXTENDOBSCOUNTER=YES is ignored if the data representation is a 64-bit UNIX operating environment.

NO

is a compatibility setting for a newly created SAS data file, to enable its use in releases prior to SAS 9.3.

- Under UNIX, if you specify OUTREP= and plan to use the file in SAS 9.2 or earlier releases, specify EXTENDOBSCOUNTER=NO. If you do not specify OUTREP=, then you do not need to specify EXTENDOBSCOUNTER=NO.

- Under Windows or z/OS, if you plan to use the file in SAS 9.2 or earlier releases, specify EXTENDOBSCOUNTER=NO.

Alias

EOC=

Defaults

Under UNIX environments, by default the EXTENDOBSCOUNTER= option is not set. The extended observation count feature is not necessary under 64-bit UNIX. However, if you specify the OUTREP= option, and the data representation is not a 64-bit UNIX operating environment, then SAS automatically sets EXTENDOBSCOUNTER=YES. SAS adds the extended observation count feature for compatibility with environments other than UNIX where it might be necessary.

Under Windows and z/OS, by default EXTENDOBSCOUNTER=YES. Files are created with the enhanced file format and the extended observation count attribute.

Restrictions

Use with output data files only.

Use with the BASE engine only.

If you copy a file, the extended observation count attribute is not inherited.

See

“Understanding the Observation Count in a SAS Data File” in SAS Language Reference: Concepts

INENCODING=ANY | ASCIIANY | EBCDICANY | encoding-value

overrides the encoding when you are reading (input processing) SAS data sets in the SAS library.

See

LIBRARYDEFINITION=source-definition-URI
retrieves pre-defined engine LIBNAME information from the Data Sources
microservice and performs a LIBNAME assignment using that information.

Here is an example:

```sql
libname x
  LIBDEF="/dataSources/providers/Compute/
    sourceDefinitions/a22d983d-c324-442c-a605-06758af9aa6d"
  access=readonly;
```

Note: The SERVICESBASEURL= system option must be set during the
invocation of your SAS session. This option specifies the host and port for file
service requests. The access method fails at assignment time if the
SERVICESBASEURL= option is not specified. For more information, see
"SERVICESBASEURL= System Option" in SAS System Options: Reference.

Note: The SAS_VIYA_TOKEN environment variable must be defined.
For more
information about defining this variable, see "SAS_VIYA_TOKEN Environment
Variable" in Encryption in SAS.

Alias LIBDEF=

Restriction This is option is available only in SAS Viya 3.4.

Requirement LIBDEF= must be the first option specified after the libref.

OUTENCODING=

OUTENCODING=ANY | ASCIIANY | EBCDICANY | encoding-value

overrides the encoding when you are creating (output processing) SAS data sets
in the SAS library.

See "INENCODING=, OUTENCODING= Options Statements" in SAS National
Language Support (NLS): Reference Guide

OUTREP=format

specifies the data representation for the SAS library, which is the form in which
data is stored in a particular operating environment. Different operating
environments use different standards or conventions for storing floating-point
numbers (for example, IEEE or IBM mainframe); for character encoding (for
example, ASCII or EBCDIC); for the ordering of bytes in memory (for example,
big Endian or little Endian); for word alignment (for example, 4-byte boundaries
or 8-byte boundaries); for integer data-type length (for example, 16-bit, 32-bit, or
64-bit); and for doubles (for example, byte-swapped or not).

By default, SAS creates a new SAS data set by using the data representation of
the CPU that is running SAS. Specifying the OUTREP= option enables you to
create a SAS data set with a different data representation. For example, in a
UNIX environment, you can create a SAS data set that uses a Windows data
representation. For more information about compatibility and data
representation, see "Processing Data Using Cross-Environment Data Access

Values for OUTREP= are listed in this table.
### Table 2.3  Data Representation Values for OUTREP= Option

<table>
<thead>
<tr>
<th>OUTREP= Value</th>
<th>Alias(^1)</th>
<th>Environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALPHA_TRU64</td>
<td>ALPHA_OSF</td>
<td>Tru64 UNIX</td>
</tr>
<tr>
<td>ALPHA_VMS_32</td>
<td>ALPHA_VMS</td>
<td>OpenVMS Alpha</td>
</tr>
<tr>
<td>ALPHA_VMS_64</td>
<td></td>
<td>OpenVMS Alpha</td>
</tr>
<tr>
<td>HP_IA64</td>
<td>HP_ITANIUM</td>
<td>HP-UX for the Itanium Processor Family Architecture</td>
</tr>
<tr>
<td>HP_UX_32</td>
<td>HP_UX</td>
<td>HP-UX for PA-RISC</td>
</tr>
<tr>
<td>HP_UX_64</td>
<td></td>
<td>HP-UX for PA-RISC, 64-bit</td>
</tr>
<tr>
<td>INTEL_ABI</td>
<td></td>
<td>ABI for Intel architecture</td>
</tr>
<tr>
<td>LINUX_32</td>
<td>LINUX</td>
<td>Linux for Intel architecture</td>
</tr>
<tr>
<td>LINUX_IA64</td>
<td></td>
<td>Linux for Itanium-based systems</td>
</tr>
<tr>
<td>LINUX_X86_64</td>
<td></td>
<td>Linux for x64</td>
</tr>
<tr>
<td>LINUX_POWER_64</td>
<td></td>
<td>Linux on the Power Architecture(^2)</td>
</tr>
<tr>
<td>MIPS_ABI</td>
<td></td>
<td>MIPS ABI</td>
</tr>
<tr>
<td>MVS_32</td>
<td>MVS</td>
<td>31-bit SAS on z/OS</td>
</tr>
<tr>
<td>MVS_64_BFP</td>
<td></td>
<td>64-bit SAS on z/OS</td>
</tr>
<tr>
<td>OS2</td>
<td></td>
<td>OS/2 for Intel</td>
</tr>
<tr>
<td>RS_6000_AIX_32</td>
<td>RS_6000_AIX</td>
<td>AIX</td>
</tr>
<tr>
<td>RS_6000_AIX_64</td>
<td></td>
<td>AIX</td>
</tr>
<tr>
<td>SOLARIS_32</td>
<td>SOLARIS</td>
<td>Solaris for SPARC</td>
</tr>
<tr>
<td>SOLARIS_64</td>
<td></td>
<td>Solaris for SPARC</td>
</tr>
<tr>
<td>SOLARIS_X86_64</td>
<td></td>
<td>Solaris for x64</td>
</tr>
<tr>
<td>VAX_VMS</td>
<td></td>
<td>OpenVMS VAX</td>
</tr>
<tr>
<td>VMS_IA64</td>
<td></td>
<td>OpenVMS on HP Integrity</td>
</tr>
<tr>
<td>WINDOWS_32</td>
<td>WINDOWS</td>
<td>32-bit SAS on Microsoft Windows</td>
</tr>
</tbody>
</table>
OUTREP= Value | Alias\(^1\) | Environment
--- | --- | ---
WINDOWS_64 | 64-bit SAS on Microsoft Windows (for both Itanium-based systems and x64)

\(^1\) It is recommended that you use the current values. The aliases are available for compatibility only.

\(^2\) LINUX_POWER_64 is added in SAS Viya 3.5. It is not supported in SAS 9.

Interactions
By default, PROC COPY uses the data representation of the file from the source library. If, instead, you want to use the data representation of the current SAS session, specify the NOCLONE option. If you want to use a different data representation, specify the NOCLONE option and the OUTREP= option. When you use PROC COPY with SAS/SHARE or SAS/CONNECT, the default behavior is to use the data representation of the current SAS session. For more information about CLONE and NOCLONE, see COPY Statement in the Base SAS Procedures Guide.

The COPY procedure (with NOCLONE) and the MIGRATE procedure can use the LIBNAME option OUTREP= for DATA, VIEW, ACCESS, MDDB, and DMDB member types. Otherwise, only DATA member types are affected by the OUTREP= LIBNAME option.

When you use the OUTREP= LIBNAME statement option, the default encoding is based on the operating environment that is represented by the OUTREP= value and the locale of the current SAS session. To assign a nondefault encoding such as UTF-8, you must also specify the OUTENCODING= LIBNAME statement option. For more information about locale and encoding, see SAS National Language Support (NLS): Reference Guide.

Transcoding could result in character data loss when encodings are incompatible. For more information, see SAS National Language Support (NLS): Reference Guide.

If you specify the OUTREP= option, and you plan to use the file in an earlier release of SAS, you might also want to specify the EXTENDOBSCOUNTER= option. See “EXTENDOBSCOUNTER=YES | NO” on page 132.

POINTOBS=YES | NO
specifies whether SAS creates compressed data sets whose observations can be randomly accessed or sequentially accessed.

YES
causes SAS software to produce a compressed data set that might be randomly accessed by observation number.

Note For an individual data set, the POINTOBS= data set option overrides the setting of the POINTOBS= option in the LIBNAME statement.

Tip Specifying POINTOBS=YES does not affect the efficiency of retrieving information from a data set. It does increase CPU usage by...
approximately 10% when creating a compressed data set and when updating or adding information to it.

**NO**

suppresses the ability to randomly access observations in a compressed data set by observation number.

**Tip** Specifying POINTOBS=NO is desirable for applications where the ability to point directly to an observation by number within a compressed data set is not important. If you do not need to access data by observation number, then you can improve performance by approximately 10% by specifying POINTOBS=NO when creating a compressed data set or when updating or adding observations to it.

**Default** YES

**REPEMPTY=** YES | NO

controls replacement of SAS data sets when the new one is empty.

**YES**

specifies that a new empty data set replaces an existing data set. This is the default.

**Interaction** If REPEMPTY=YES and REPLACE=NO, then the data set is not replaced.

**NO**

specifies that a new empty data set does not replace an existing data set.

Here is an example where setting REPEMPTY=NO prevents the empty data set B from replacing the data set MYLIB.A:

```
libname mylib 'c:\mydata' repempty=no;
data mylib.a;
  i=1;
run;

data b; /* create an empty data set B */
run;

data mylib.a;
  set b;
run;
```

Here is the log:

WARNING: Data set MYLIB.A was not replaced because REPEMPTY=NO and the replacement file is empty.

**Tip** For both the convenience of replacing existing data sets with new ones that contain data and the protection of not overwriting existing data sets with new empty ones that are created by mistake, set REPLACE=YES and REPEMPTY=NO.

**Note** For an individual data set, the REPEMPTY= data set option overrides the setting of the REPEMPTY= option in the LIBNAME statement.

**See** "REPEMPTY= Data Set Option" in *SAS Data Set Options: Reference*
Engines

*engine* is an engine name.

**Tip** Usually, 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, then you can override the automatic selection.

*See* LIBNAME Statement under Windows, UNIX, and z/OS

For more information, see “SAS Engines” in SAS Language Reference: Concepts.

Engine Host Options

*engine-host-options* are one or more options that are listed in the general form `keyword=value`. For a list of engines, see the SAS documentation for your operating system.

**Restriction** When concatenating libraries, you cannot specify options that are specific to an engine or an operating environment.

*See* LIBNAME Statement under Windows, UNIX, and z/OS

Details

Associating a Libref with a SAS Library (*Form 1*)

The association between a libref and a SAS library lasts only for the duration of the SAS session or until you change the libref or discontinue it with another LIBNAME statement. The simplest form of the LIBNAME statement specifies only a libref and the physical name of a SAS library:

```
LIBNAME libref 'SAS-library';
```

*See* “Example 1: Assigning and Using a Libref” on page 141.

An engine specification is usually not necessary. If the situation is ambiguous, SAS uses the setting of the `ENGINE=` system option to determine the default engine. If all data sets in the library are associated with a single engine, then SAS uses that engine as the default. In either situation, you can override the default by specifying another engine with the `ENGINE=` system option:

```
LIBNAME libref engine 'SAS-library' <options> <engine/host-options>;
```

**Operating Environment Information:** Using the LIBNAME statement requires host-specific information. See the SAS documentation for your operating environment before using this statement.

Disassociating a Libref from a SAS Library (*Form 2*)

To disassociate a libref from a SAS library, use a LIBNAME statement by specifying the libref and the `CLEAR` option. You can clear a single, specified libref or all current librefs.

```
LIBNAME libref CLEAR | _ALL_ CLEAR;
```
Writing SAS Library Attributes to the SAS Log (Form 3)

Use a LIBNAME statement to write the attributes of one or more SAS libraries to the SAS log. Specify libref to list the attributes of one SAS library; use _ALL_ to list the attributes of all SAS libraries that have been assigned librefs in your current SAS session.

LIBNAME libref LIST | _ALL_ LIST;

Concatenating SAS Libraries (Form 4)

When you logically concatenate two or more SAS libraries, you can reference them all with one libref. You can specify a library with its physical filename or its previously assigned libref.

LIBNAME libref <engine> (library–specification-1 <...library–specification-n>) <options>;

In the same LIBNAME statement, you can use any combination of specifications: librefs, physical filenames, or a combination of librefs and physical filenames. See “Example 2: Logically Concatenating SAS Libraries” on page 141.

Concatenating SAS Catalogs (Form 4)

When you logically concatenate two or more SAS libraries, you also concatenate the SAS catalogs that have the same name. For example, if three SAS libraries each contain a catalog named CATALOG1, then when you concatenate them, you create a catalog concatenation for the catalogs that have the same name. See “Example 3: Concatenating SAS Catalogs” on page 141.

LIBNAME libref <engine> (library–specification-1 <...library–specification-n>) <options>;

Rules for Library Concatenation

After you create a library concatenation, you can specify the libref in any context that accepts a simple (non-concatenated) libref. These rules determine how SAS files (that is, members of SAS libraries) are located among the concatenated libraries:

- When a SAS file is opened for input or update, the concatenated libraries are searched and the first occurrence of the specified file is used.
- When a SAS file is opened for output, it is created in the first library that is listed in the concatenation.
- When you delete or rename a SAS file, only the first occurrence of the file is affected.
- Anytime a list of SAS files is displayed, only one occurrence of a filename is shown.

Note: Even if the name occurs multiple times in the concatenation, only the first occurrence is shown.
A SAS file that is logically connected to another file (such as an index to a data set) is listed only if the parent file resides in that same library. For example, if library One contains A.DATA, and library Two contains A.DATA and A.INDEX, only A.DATA from library One is listed. (See the previous rule.)

If any library in the concatenation is sequential, then all of the libraries are treated as sequential.

The attributes of the first library that is specified determine the attributes of the concatenation. For example, if the first SAS library that is listed is “read only,” then the entire concatenated library is “read only.”

If you specify any options or engines, they apply only to the libraries that you specified with the complete physical name, not to any library that you specified with a libref.

If you alter a libref after it has been assigned in a concatenation, it does not affect the concatenation.

Automatically Creating the Library Directory

You can set the DLCREATEDIR system option to create the directory for the SAS library that is specified in the LIBNAME statement if that directory does not exist. For more information, see “DLCREATEDIR System Option” in SAS System Options: Reference.

z/OS Specifics: For more information, see “DLCREATEDIR System Option: z/OS” in SAS Companion for z/OS.

Metadata-Bound Libraries

The Base SAS LIBNAME engine can enforce permissions on a user and group basis to SAS data sets that are bound to secured table objects in the metadata server. Metadata-bound libraries provide enhanced protection for Base SAS data (SAS data sets and SAS views). A connection to the metadata server is required in order to access metadata-bound data.

For more information, see SAS Guide to Metadata-Bound Libraries and the AUTHLIB procedure in Base SAS Procedures Guide.

If you have questions or need assistance accessing your data, contact your local SAS Administrator.

Comparisons

- Use the LIBNAME statement to reference a SAS library. Use the FILENAME statement to reference an external file. Use the LIBNAME, SAS/ACCESS statement to access DBMS tables.

- Use the CATNAME statement to concatenate SAS catalogs. Use the LIBNAME statement to concatenate SAS catalogs. The CATNAME statement enables you to specify the names of the catalogs that you want to concatenate. The LIBNAME statement concatenates all like-named catalogs in the specified SAS libraries.
Examples:

Example 1: Assigning and Using a Libref

This example assigns the libref SALES to an aggregate storage location that is specified in quotation marks as a physical filename. The DATA step creates SALES.QUARTER1 and stores it in that location. The PROC PRINT step references it by its two-level name, SALES.QUARTER1.

```
libname sales 'SAS-library';
data sales.quarter1;
infile 'your-input-file';
input salesrep $20. +6 jansales febsales marsales;
run;
proc print data=sales.quarter1;
run;
```

Example 2: Logically Concatenating SAS Libraries

- This example concatenates three SAS libraries by specifying the physical filename of each:
  
  ```
  libname allmine ("file-1" "file-2" "file-3");
  ```

- This example assigns librefs to two SAS libraries, one that contains SAS 6 files and one that contains SAS 9 files. This technique is useful for updating your files and applications from SAS 6 to SAS 9 and enables you to have convenient access to both sets of files:
  
  ```
  libname v6 'v6-SAS-library';
  libname v9 'v9-SAS-library';
  libname allmine (v9 v6);
  ```

- This example shows that you can specify both librefs and physical filenames in the same concatenation specification:
  
  ```
  libname allmine (v9 v6 'some-filename');
  ```

Example 3: Concatenating SAS Catalogs

This example concatenates three SAS libraries by specifying the physical filename of each and assigns the libref ALLMINE to the concatenated libraries:

```
libname allmine ("file-1" "file-2" "file-3");
```

If each library contains a SAS catalog named MYCAT, then using ALLMINE.MYCAT as a libref.catref provides access to the catalog entries that are stored in all three catalogs named MYCAT. To logically concatenate SAS catalogs with different names, see “CATNAME Statement” on page 7.

Example 4: Permanently Storing Data Sets with One-Level Names

If you want the convenience of specifying only a one-level name for permanent, not temporary, SAS files, then use the USER= system option. This example stores the
data set QUARTER1 permanently without using a LIBNAME statement first to assign a libref to a storage location:

```
options user='SAS-library';
data quarter1;
infile 'your-input-file';
input salesrep $20. +6 jansales febsales marsales;
run;
proc print data=quarter1;
run;
```

See Also


Data Set Options:


Statements:

- “CATNAME Statement” on page 7 for a discussion of concatenating SAS catalogs
- “FILENAME Statement” on page 15
- LIBNAME option character variable attributes used to transcode SAS files
- LIBNAME Statement for SAS metadata
- LIBNAME Statement for Scalable Performance Data (SPD)
- LIBNAME statement for XML documents
- LIBNAME Statement for SAS/ACCESS
- LIBNAME Statement for SAS/CONNECT
- LIBNAME Statement for SAS/SHARE
- “LOCKDOWN Statement” in SAS Intelligence Platform: Application Server Administration Guide

System Options:

- “DLCREATEDIR System Option” in SAS System Options: Reference
- “LOCKDOWN System Option in SAS Intelligence Platform: Application Server Administration Guide
- “USER= System Option” in SAS System Options: Reference
LIBNAME Statement: CVP Engine

Associates a libref for the character variable padding (CVP) engine to expand character variable lengths so that character data truncation does not occur when a file requires transcoding.

Valid in: Anywhere
Category: Data Access
Restrictions: The CVP engine is available for input (read) processing only.
The CVP engine supports SAS data files, but the engine does not support SAS views, catalogs, or item stores.
The number of bytes that you specify must be large enough to accommodate any expansion. Otherwise, truncation occurs, which results in an error message in the SAS log.
For library concatenation with mixed engines that include the CVP engine, only SAS data files are processed. For example, if you execute the COPY procedure, only SAS data files are copied.

Tip: The CVP engine expands character variable lengths but not character format widths. A character format that is not wide enough can prevent an observation from printing correctly.

Syntax

LIBNAME libref CVP 'SAS-library' <libname-options>;

Required Arguments

libref
is a character constant, variable, or expression that specifies the libref that is assigned to a SAS library.

Range 1 to 8 bytes

SAS-library
is the physical name for the SAS library. The physical name is recognized by the operating environment. Enclose the physical name in single or double quotation marks.

Optional Argument

libname-options
libname-options can be any of these values:

CVPBYTES=bytes
specifies the number of bytes by which to expand character variable lengths when processing a SAS data file that requires transcoding. The CVP engine expands the lengths so that character data truncation does not occur. The lengths for character variables are increased by adding the specified value to the current length. You can specify a value from 0 to 32,766.

For example, the following LIBNAME statement implicitly assigns the CVP engine by specifying the CVPBYTES= option:
libname expand 'SAS data-library' cvpbytes=5;

Character variable lengths are increased by adding 5 bytes. A character variable with a length of 10 is increased to 15, and a character variable with a length of 100 is increased to 105.

Default
If you specify CVPBYTES=, SAS automatically uses the CVP engine to expand the character variable lengths according to your specification. If you explicitly assign the CVP engine but do not specify either CVPBYTES= or CVPMULTIPLIER=, then SAS uses CVPMULTIPLIER=1.5 to increase the lengths of the character variables.

Restrictions
The CVP engine supports SAS data files, no SAS views, catalogs, item stores, and so on.

The CVP engine is available for input (read) processing only.

For library concatenation with mixed engines that include the CVP engine, only SAS data files are processed. For example, if you execute the COPY procedure, only SAS data files are copied.

Requirement
The number of bytes that you specify must be large enough to accommodate any expansion. Otherwise, truncation occurs, which results in an error message in the SAS log.

Interaction
You cannot specify both the CVPBYTES= option and the CVPMULTIPLIER= option. Specify only one of these options.

See
“Avoiding Character Data Truncation By Using the CVP Engine” in SAS National Language Support (NLS): Reference Guide

CVPENGINE=engine
specifies the engine to use to process a SAS data file that requires transcoding. The CVP engine expands the character variable lengths to transcoding so that character data truncation does not occur. Then the specified engine processes the actual file.

Alias CVPENG

Default SAS uses the default SAS engine.

See “Avoiding Character Data Truncation By Using the CVP Engine” in SAS National Language Support (NLS): Reference Guide

CVPFORMATWIDTH=YES | NO
specifics whether to expand the character format width.

If CVPVARCHAR= is not specified, the new format width is determined by the CVPMULTIPLIER= and CVPBYTES= options.

If CVPVARCHAR= is specified, the CVP engine automatically adjusts the format width to meet the maximum-byte length of a converted character variable. For example, in a UTF-8 session, the format width is multiplied by 4.

Alias CVPFMTW

Default YES
CVPMULTIPLIER=multiplier

specifies a multiplier value that expands character variable lengths when you are processing a SAS data file that requires transcoding. The CVP engine expands the lengths so that character data truncation does not occur. The lengths for character variables are increased by multiplying the current length by the specified value. You can specify a multiplier value from 1 to 5 or you can specify 0 and then the CVP engine determines the multiplier automatically.

For example, the following LIBNAME statement implicitly assigns the CVP engine by specifying the CVPMULTIPLIER= option:

```sas
libname expand 'SAS data-library' cvpmultiplier=2.5;
```

Character variable lengths are increased by multiplying the lengths by 2.5. A character variable with a length of 10 is increased to 25, and a character variable with a length of 100 is increased to 250.

Alias CVMULT

Default If you specify the CVPMULTIPLIER= option, SAS automatically uses the CVP engine to expand the character variable lengths according to your specification. If you explicitly specify the CVP engine but do not specify either the CVPMULTIPLIER= option or the CVPBYTES= option, then SAS uses CVPMULTIPLIER=AUTO(0) to increase the lengths. AUTO(0) sets the value of the CVP engine based on the encoding of the SAS session and input data set.

Restrictions The CVP engine supports SAS data files, no SAS views, catalogs, item stores, and so on.

The CVP engine is available for input (read) processing only.

For library concatenation with mixed engines that include the CVP engine, only SAS data files are processed. For example, if you execute the COPY procedure, only SAS data files are copied.

Requirement The number of bytes that you specify must be large enough to accommodate any expansion. Otherwise, truncation occurs, which results in an error in the SAS log.

Interaction You cannot specify both the CVPMULTIPLIER= option and the CVPBYTES= option. Specify only one of these options.

See “Avoiding Character Data Truncation By Using the CVP Engine” in SAS National Language Support (NLS): Reference Guide

CVVARCHAR=YES | NO

specifies whether to convert fixed-width character variables to variable-width characters during input file processing. The byte length of the new-width character variable is the maximum number of bytes per character from the SAS session encoding multiplied by the specified fixed-width character length.

Default No
If you specify CVPVARCHAR=YES, the CVPMULTIPLIER= and CVPPBYTES= options are ignored.

Trailing blanks are removed from string data that is under CHAR columns.

Fixed-width character variables with a format of TRANSCODE=NO are excluded during conversion.

The character variable padding (CVP) engine expands character variable lengths so that character data truncation does not occur when a file requires transcoding. Character data truncation can occur when the number of bytes for a character in one encoding is different from the number of bytes for the same character in another encoding. An example is a single-byte character set (SBCS) such as Wlatin1 or a double-byte character set (DBCS) such as Shift-jis that is transcoded to a multi-byte character set (MBCS) such as UTF-8.

By explicitly specifying the CVP engine with the LIBNAME statement, the default character expansion is 1.5 times the character variable lengths. To specify a different expansion amount, use the CVPPBYTES= or CVPMULTIPLIER= option.

Note: The expansion amount must be large enough to accommodate any expansion. Otherwise, truncation still occurs.

The CVP engine might affect performance for processing that conditionally selects a subset of observations using a WHERE expression. Processing the file without using the CVP engine might be faster than processing the file using the CVP engine. For example, if you use the CVP engine with a data set that has indexes, the indexes are not used to optimize the WHERE expression.

Example 1

This LIBNAME statement explicitly assigns the CVP engine. Character variable lengths are increased using the default expansion, which multiples the lengths by 1.5. For example, a character variable with a length of 10 has a new length of 15. A character variable with a length of 100 has a new length of 150.

    libname expand cvp 'SAS-library';

Example 2

In this example, the CVP engine is used to expand character variable lengths by adding two bytes to each length.

    libname expand cvp 'SAS-library' cvppbytes=2;
LIBNAME Statement: JMP Engine

 Associates a libref with a JMP data table and enables you to read and write JMP data tables.

 Valid in: Anywhere
 Category: Data Access
 See: Base SAS LIBNAME Statement

Syntax

```
LIBNAME libref JMP 'path' <FMTLIB=libref.format-catalog>;
```

Arguments

- `libref` is a character constant, variable, or expression that specifies the libref that is assigned to a SAS library.
  
  Range 1 to 8 bytes

- `path` is the physical name for the SAS library. The physical name is the name that is recognized by the operating environment. Enclose the physical name in single or double quotation marks.

- `FMTLIB=` specifies where the formats are stored when a JMP data table is read and where the formats come from when a JMP data table is created.

Requirement The library that is specified in the FMTLIB argument must be a SAS data set LIBNAME statement.

Example

```
libname inv jmp '.' fmtlib=seform.formats;
libname seform '.';
data work.mine;
set inv.suri2011;
run;
```
Details

A JMP file is a file format that the JMP software program creates. JMP is an interactive statistics package that is available for Microsoft Windows and Macintosh. For more information, see the JMP documentation that is packaged with your system.

A JMP file contains data that is organized in a tabular format of fields and records. Each field can contain one type of data, and each record can hold one data value for each field.

SAS supports access to JMP files. You can access JMP files by either of these two methods:

- the IMPORT and EXPORT procedures and the Import and Export Wizard without a license for SAS/ACCESS Interface to PC Files. SAS imports data from JMP files that are saved with version 7 or later formats, and it exports data to JMP files with version 7 or later formats. SAS no longer supports JMP files with versions 3 through 6 formats.
  For more information, see *SAS/ACCESS Interface to PC Files: Reference*.
- the LIBNAME statement for the JMP engine

Note: The JMP LIBNAME engine does not support extended attributes. If you want extended attributes, either use the IMPORT procedure or use the EXPORT procedure with `DBMS=JMP`.

Examples:

Example 1: Using the LIBNAME Statement to Read a JMP Data Table

This example reads and prints five observations from the `bank` JMP data table.

```sas
libname b jmp 'c:/temp/national';
proc contents data=b.bank(drop=edlevel id age);
run;
proc print data=b.bank(obs=5 drop=edlevel id age);
run;
```

Example 2: Reading and Sorting a JMP Data Table

This example reads a JMP data table, sorts it, and stores it in a SAS data set. The formats stored on the JMP data set are put in `a.formats`.

```sas
libname a 'c:/temp/field';
libname b jmp '.' fmtlib=a.formats;
proc sort data=b.cars out=a.sorted;
  by category_ic;
run;
```
LIBNAME Statement: JSON Engine

Provides read-only sequential access to JSON data.

Valid in: Anywhere
Category: Data Access
Notes: The JSON file is read only once, when the JSON engine LIBNAME statement is assigned. To read the JSON file again, you must reassign the JSON libref. Map files generated by the JSON engine are created with the SAS session encoding by default. To create the map files with a different session encoding, see "Example 3: Re-Create an Existing JSON Map File in a Different Encoding" on page 167. To read JSON that is not in your session encoding, see "Example 4: Read JSON Created in a Different Encoding" on page 167.
Tip: If you want to create a JSON file from a SAS data set, SAS provides the JSON procedure. For more information, see Base SAS Procedures Guide.

Syntax

LIBNAME libref JSON < 'JSON-document-path' > <options>;

Arguments

libref
specifies a logical name, or libref, to associate with the SAS library.

Range 1 to 8 bytes

JSON-document-path
is the physical location of the JSON document. Enclose the physical location in single or double quotation marks.

Note: If the physical location is not supplied, the JSON engine tries to access a fileref with the same name as the libref that is supplied. The fileref can be a disk file, a URL access method fileref, an FTP access method fileref, or other valid fileref.

LIBNAME Options

ALLDATA= "name"
renames the ALLDATA data set to the specified name. A data set named ALLDATA is created by default when the JSON engine runs. The ALLDATA data set contains all of the information in the JSON file. This option creates the data set with the specified name instead. The new name must meet the conventions for SAS names.

Note This option is available beginning with SAS 9.4M5 and SAS Viya 3.4.

AUTOMAP= REUSE | CREATE
specifies the action to take. AUTOMAP can have one of these values:
REUSE
uses the MAP fileref if the file exists. Otherwise, generates a JSON map and writes it to the MAP fileref.

CREATE
generates a JSON map and writes it to the MAP fileref.

Note: Using REPLACE or CREATE overwrites an existing file.

Alias   REPLACE

Requirement
If a JSON map file is specified but does not exist, the AUTOMAP option is required.

Interaction
If a JSON map file is not specified, it is automatically created in memory. The AUTOMAP option is not required.

FILEREFFileref
specifies a fileref that points to the location for the JSON input. The fileref cannot exceed eight bytes.

JSONCOMPRESS | JSONNOCOMPRESS
specifies whether to compress internal JSON information.

TIP   Compression saves memory and disk space when caching information, at the expense of CPU time.

Default   JSONNOCOMPRESS

MAPFileref | 'map physical name'
specifies a fileref that points to a physical location for the JSON map, or the quoted physical name of the JSON map file.

MEMLEAVE=n | nK | nM | nG | ALL
specifies the amount of memory to leave available when processing JSON. Once the memory limit is met, JSON information is cached to disk using an internally generated TEMP fileref.

n
amount of memory.

nK
specifies the amount of memory in Kilobytes.

nM
specifies the amount of memory in Megabytes.

nG
specifies the amount of memory in Gigabytes.

ALL
specifies that no memory is used to store JSON information. All JSON information is cached to disk.

Default   0.5G

NOALLDATA
Suppresses creation of the ALLDATA data set.
LIBNAME Statement: JSON Engine

**NO_REOPEN_MSG | NRM**
Suppresses the message, JSON data is only read once. To read the JSON again, reassign the JSON LIBNAME.

**ORDINALCOUNT= ALL | NONE | n**
specifies the maximum number of ordinal variables to generate for each data set. The maximum number of possible ordinal variables for a data set depends on the position of the data in the JSON, and can be less than the number that you specify. In that case, only the maximum number of possible ordinal variables is generated. ORDINALCOUNT can have one of these values:

- **ALL**
  creates all possible ordinal variables for the data set.

- **NONE**
  suppresses creation of ordinal variables for the data set.

- **n**
  is an integer that is greater than or equal to 0 (zero).

**Default** 2

**RETAIN**
retains values in the observation buffer between observations.

Details

**The Basics**

A JavaScript Object Notation (JSON) file is a file that contains a human-readable collection of data.

The JSON LIBNAME statement enables you to read a JSON file using the JSON engine.

The JSON engine uses a JSON map file to describe the data sets in the specified JSON file. The JSON engine can generate a JSON map file for you when you assign the LIBNAME statement, or you can supply your own JSON map file in the MAP= option.

The JSON automapper generates a data set for each object in the JSON. It also generates a data set named ALLDATA, which contains all JSON information in a single data set. After the JSON engine library is assigned, you can list the data sets in the library by using PROC DATASETS. You can get information about the data sets with PROC CONTENTS. You can view the data in each data set by using PROC PRINT.

If the data sets created by the automapper do not sufficiently describe the data, you can modify the generated map file. Before using the output data sets in SAS, you might want to merge the output data sets. You can also manipulate the data in the ALLDATA data set to create a new SAS data set.
JSON MAP Details

A JSON map is a file that describes the data sets in a JSON engine library. If specified, the JSON automapper can automatically generate a map of your JSON data.

A JSON map consists of a DATASETS array.

Each object in the DATASETS array describes a data set in the library.

Each data set object requires a DSNAME string and a TABLEPATH string and usually contains an optional VARIABLES array.

Each object in the VARIABLES array describes a variable in that data set.

Required items for each VARIABLES object are a NAME string, a TYPE string, and a PATH string.

For character TYPE variables, a LENGTH item is optional.

**DSNAME**

The DSNAME provides a name for the data set. The automapper generates a default name. When modifying your map file, you can provide any name that conforms to the SAS data set naming standard.

**TABLEPATH**

A TABLEPATH path tells the engine how to delimit data set observations, given this JSON:

```json
{
    "data" : [
        { "a" : 1 , "b" : 2, "c" : "taxes" },
        { "a" : 2 , "b" : 4, "c" : "sport" },
        { "a" : 3 , "b" : 6, "c" : "vacation" }
    ]
}
```

If you want an observation every time you encounter an object in the data array, set the TABLEPATH to "/root/data". The JSON mapper automatically generates this JSON map:

```json
{
    "DATASETS": [ {
        "DSNAME": "data",
        "TABLEPATH": "/root/data",
        "VARIABLES": [ {
            "NAME": "ordinal_root",
            "TYPE": "ORDINAL",
            "PATH": "/root"
        }, {
            "NAME": "ordinal_data",
            "TYPE": "ORDINAL",
            "PATH": "/root/data"
        }, {
            "NAME": "a",
            "TYPE": "NUMERIC",
            "PATH": "/root/data/a"
        ]
    }
]
}
```
NAME
 The NAME gives a name for the variable that conforms to the SAS naming standard.

TYPE
 TYPE is ORDINAL, NUMERIC, or CHARACTER.

PATH
 PATH is the path in the JSON map file for this variable.

LENGTH
 The LENGTH setting is the optional length of this character variable. If no length is specified, the JSON LIBNAME engine sets this length to the maximum length of all values that it has seen for this variable.

Note When reusing maps with different JSON input, particularly JSON input with longer strings, the map LENGTH remains in effect and might result in truncation.

Tip When the JSON LIBNAME engine generates an automap, it generates a CURRENT_LENGTH: n value, set to the maximum length of the variable in the current JSON data. This is for documentation only. When reading maps, the JSON LIBNAME engine ignores the CURRENT_LENGTH setting.

FORMAT
 You can provide a FORMAT for a variable in a map. FORMAT is an array where the first element of the array is the format name, the second element is the width, and the third element is the decimal specification. The FORMAT variable is optional.

"FORMAT" : [ "FormatName", "width", "decimal-specification" ]

Note The JSON LIBNAME engine automapper does not currently generate FORMATs.

Example This map specifies a format BEST that contains a total of 12 digits with 3 decimal places.

```json
{
  "NAME": "c",
  "TYPE": "NUMERIC",
  "PATH": "/root/nums/c",
  "FORMAT" : [ "BEST", 12, 3 ]
}
```
INFORMAT

You can provide an INFORMAT for a variable in a map. INFORMAT is an array where the first element of the array is the informat name, the second element is the width, and the third element is the decimal specification. The INFORMAT variable is optional.

"INFORMAT" : [ "InformatName", "width", "decimal-specification" ]

Note The JSON LIBNAME engine automapper does not currently generate INFORMATs. This map specifies the informat IS8601DT that contains 19 digits and no decimal places.

```json
{
    "NAME": "d",
    "TYPE": "NUMERIC",
    "PATH": "/root/nums/d",
    "INFORMAT" : [ "IS8601DT", 19, 0 ]
}
```

Tip You can suppress "invalid data" messages printed in the log by adding a preceding "?" to the informat name.

"INFORMAT" : [ "?IS8601DT", 19, 0 ]

LABEL

You can provide a LABEL for a variable in a map. The LABEL variable is optional.

"LABEL" : [ "text" ]

Note The JSON LIBNAME engine automapper does not currently generate LABELS.

Example This map specifies a label for the variable d.

```json
{
    "NAME": "d",
    "LABEL": "This is the d variable.",
    "TYPE": "NUMERIC",
    "PATH": "/root/nums/d"
}
```

OPTIONS

You can turn RETAIN on or off for an individual variable. The OPTIONS variable is optional. For more information, see "RETAIN" on page 151.

"OPTIONS" : [ "RETAIN" | "NORETAIN"]

Note Setting NORETAIN on ORDINAL variables has no effect and produces a NOTE during map validation. ORDINAL variables are always retained.

Tip Setting RETAIN on a variable in a map takes precedence over the RETAIN option in the LIBNAME statement. For example, with RETAIN set in the LIBNAME statement, and NORETAIN set on JSON variable Status, all variables are retained except for Status.

Example This example shows turning RETAIN on for the variable Status.
Creating and Editing a JSON MAP

This example shows how to get a list of employee phone numbers, as well as type of phone, first name of the employee, and his age using a JSON file named example.json. This is the content of example.json:

```json
{
  "type": "Full",
  "info": [
    {
      "name": "Eric", "age": 21, "phone": [
        {
          "type": "cell", "number": "540-555-2377"
        },
        {
          "type": "home", "number": "540-555-0120"
        }
      ]
    },
    {
      "name": "John", "age": 22, "phone": [
        {
          "type": "cell", "number": "919-555-6665"
        },
        {
          "type": "home", "number": "336-555-0140"
        }
      ]
    }
  ],
  "type": "Part",
  "info": [
    {
      "name": "Bjorn", "age": 27, "phone": [
        {
          "type": "cell", "number": "720-555-8377"
        },
        {
          "type": "burner", "number": "720-555-2877"
        },
        {
          "type": "home", "number": "720-555-0194"
        }
      ]
    }
  ]
}
```

The first step is to create a JSON map from the JSON file. This LIBNAME statement produces the JSON map file, user.map:

```
libname in json 'example.json' map='user.map' automap=create;
```

You can use PROC DATASETS to view the content of library IN. For these examples, we have changed the SAS output to list format to conserve space.
Three data sets are produced by the JSON: INFO, INFO_PHONE, and ROOT. You can use PROC PRINT to print the contents of the three data sets.

```
5   proc print data=in.root; run;
    ordinal_
    OBS root type
    1  1 Full
    2  2 Part
6   proc print data=in.info; run;
    ordinal_ ordinal_
    OBS root info name age
    1  1  1 Eric 21
    2  1  2 John 22
    3  2  3 Bjorn 27
7   proc print data=in.info_phone; run;
    ordinal_ ordinal_
    OBS info phone type number
    1  1  1 cell 540-555-2377
    2  1  2 home 540-555-0120
    3  2  3 cell 919-555-6665
    4  2  4 home 336-555-0140
    5  3  5 cell 720-555-8377
    6  3  6 burner 720-555-2877
    7  3  7 home 720-555-0194
```

Use a file editor to view the content of generated map file user.map.

```
{
  "DATASETS": [
    {
      "DSNAME": "root",
      "TABLEPATH": "/root",
      "VARIABLES": [
        {
          "NAME": "ordinal_root",
```
"TYPE": "ORDINAL",
"PATH": "/root"
],
[
  "NAME": "type",
  "TYPE": "CHARACTER",
  "PATH": "/root/type",
  "CURRENT_LENGTH": 4
]
],

"DSNAME": "info",
"TABLEPATH": "/root/info",
"VARIABLES": [
  
  
  
  "NAME": "ordinal_root",
  "TYPE": "ORDINAL",
  "PATH": "/root"
],
[
  "NAME": "ordinal_info",
  "TYPE": "ORDINAL",
  "PATH": "/root/info"
],
[
  "NAME": "name",
  "TYPE": "CHARACTER",
  "PATH": "/root/info/name",
  "CURRENT_LENGTH": 5
],
[
  "NAME": "age",
  "TYPE": "NUMERIC",
  "PATH": "/root/info/age"
]
],

"DSNAME": "info_phone",
"TABLEPATH": "/root/info/phone",
"VARIABLES": [
  
  "NAME": "ordinal_info",
  "TYPE": "ORDINAL",
  "PATH": "/root/info"
],
[
  "NAME": "ordinal_phone",
  "TYPE": "ORDINAL",
  "PATH": "/root/info/phone"
],
[
  "NAME": "type",
  "TYPE": "CHARACTER",
  "PATH": "/root/info/phone/type",
  "CURRENT_LENGTH": 3
]
Using the file editor, copy the user.map file to create a new file: user.map.all.

Modify user.map.all as follows:

- Change the DSNAME of the first data set to ALL.
- Remove the ORDINAL variables from the ALL data set.
- Copy the variable descriptions of the variables that you want from the other data sets into the ALL data set. Ensure there is a comma after each variable object except the last one.
- Change the name of the type variable from the INFO_PHONE data set to PHONETYPE.
- Add a LABEL to the PHONETYPE variable.
- Set the TABLEPATH to /root/info/phone to get an observation after a phone object is encountered.
- Remove CURRENT_LENGTH from each variable.

Here is the modified map:

```json
{
   "DATASETS": [
      {
         "DSNAME": "all",
         "TABLEPATH": "/root/info/phone",
         "VARIABLES": [
            {
               "NAME": "type",
               "TYPE": "CHARACTER",
               "PATH": "/root/type"
            },
            {
               "NAME": "name",
               "TYPE": "CHARACTER",
               "PATH": "/root/info/name"
            },
            {
               "NAME": "age",
               "TYPE": "NUMERIC",
               "PATH": "/root/info/age"
            },
            {
               "NAME": "phonetype",
               "TYPE": "CHARACTER",
               "LABEL": "This is the type of phone",
               "PATH": "/root/info/phone/number",
               "CURRENT_LENGTH": 12
            }
         ]
      }
   ]
}
```
These results are displayed using PROC PRINT with the modified map.

```
8         filename allmap 'user.map.all';
9         libname in json 'example.json' map=allmap;
10        proc print data=in.all label; run;
```

<table>
<thead>
<tr>
<th>OBS</th>
<th>type</th>
<th>name</th>
<th>age</th>
<th>of phone</th>
<th>number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Full</td>
<td>Eric</td>
<td>21</td>
<td>cell</td>
<td>540-555-2377</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td>home</td>
<td>540-555-0120</td>
</tr>
<tr>
<td>3</td>
<td>John</td>
<td>22</td>
<td></td>
<td>cell</td>
<td>919-555-6665</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td>home</td>
<td>336-555-0140</td>
</tr>
<tr>
<td>5</td>
<td>Part</td>
<td>Bjorn</td>
<td>27</td>
<td>cell</td>
<td>720-555-8377</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td>burner</td>
<td>720-555-2877</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
<td></td>
<td>home</td>
<td>720-555-0194</td>
</tr>
</tbody>
</table>

Notice that the observation buffer is cleared between Eric's cell phone and Eric's home phone. You can use the RETAIN option to keep the observation buffer from being cleared.

```
11        libname in json 'example.json' map=allmap RETAIN;
12        proc print data=in.all label; run;
```

```
<table>
<thead>
<tr>
<th>OBS</th>
<th>type</th>
<th>name</th>
<th>age</th>
<th>of phone</th>
<th>number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Full</td>
<td>Eric</td>
<td>21</td>
<td>cell</td>
<td>540-555-2377</td>
</tr>
<tr>
<td>2</td>
<td>Full</td>
<td>Eric</td>
<td>21</td>
<td>home</td>
<td>540-555-0120</td>
</tr>
<tr>
<td>3</td>
<td>Full</td>
<td>John</td>
<td>22</td>
<td>cell</td>
<td>919-555-6665</td>
</tr>
<tr>
<td>4</td>
<td>Full</td>
<td>John</td>
<td>22</td>
<td>home</td>
<td>336-555-0140</td>
</tr>
<tr>
<td>5</td>
<td>Part</td>
<td>Bjorn</td>
<td>27</td>
<td>cell</td>
<td>720-555-8377</td>
</tr>
<tr>
<td>6</td>
<td>Part</td>
<td>Bjorn</td>
<td>27</td>
<td>burner</td>
<td>720-555-2877</td>
</tr>
<tr>
<td>7</td>
<td>Part</td>
<td>Bjorn</td>
<td>27</td>
<td>home</td>
<td>720-555-0194</td>
</tr>
</tbody>
</table>
```

Merging Data Sets

This example describes how to read JSON code into four SAS data sets and then use ordered values to merge the data sets into a single data set.

In this JSON code, there are two types (Work and Holding) and three statuses (complete, in the middle, and not started). There is also name and address information. The code exists in a file named example2.json.

```
[
  
    "Type" : "Work",
    "info" : [{ "Status" : "complete",
        "name" : { "name" : "Eric", "Date" : "28sep15", "age" : 21 },
```
Use this SAS code to assign the JSON LIBNAME engine to read the input JSON document. Use PROC DATASETS to show the name and member type of the four SAS data sets that were created.

```
filename in 'example2.json';
filename map 'example.map';
libname in json map=map automap=replace;

proc datasets library=in; run; quit;
```

You can use PROC PRINT to print the contents of the data sets.
The four data sets contain ordinal variables, which are key variables that provide a relationship between two data sets.

The second data set, INFO_NAME, has an observation with John's name and it has an ORDINAL_INFO value of 2. In the fourth data set, INFO_ADD, the address associated with the ORDINAL_INFO value of 2 is 268 Hydrangea. This is the address associated with John.

To merge the four data sets based on ordinal values, merge the ROOT and INFO data sets by ORDINAL_ROOT.

```plaintext
data a;
  merge in.root in.info;
  by ORDINAL_root;
run;
```

NOTE: There were 2 observations read from the data set IN.ROOT.
NOTE: There were 3 observations read from the data set IN.INFO.
NOTE: The data set WORK.A has 3 observations and 4 variables.

```plaintext
proc print data=a; run;
```
Next, to complete the creation of a single data set that contains all of the JSON information, merge Name and Address and drop the ORDINAL variables.

```sas
data b;
  merge a in.info_name in.info_add;
  by ORDINAL_info;
  drop ORDINAL_info ORDINAL_name ORDINAL_add ORDINAL_root;
run;
```

NOTE: There were 3 observations read from the data set WORK.A.
NOTE: There were 3 observations read from the data set IN.INFO_NAME.
NOTE: There were 3 observations read from the data set IN.INFO_ADD.
NOTE: The data set WORK.B has 3 observations and 7 variables.

```sas
proc print data=b; run;
```

<table>
<thead>
<tr>
<th>Obs</th>
<th>Type</th>
<th>Status</th>
<th>name</th>
<th>Date</th>
<th>age</th>
<th>Address</th>
<th>zip</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Work</td>
<td>complete</td>
<td>Eric</td>
<td>28sep15</td>
<td>21</td>
<td>55 Pelican Avenue</td>
<td>44442</td>
</tr>
<tr>
<td>2</td>
<td>Work</td>
<td>in the middle</td>
<td>John</td>
<td>02oct15</td>
<td>22</td>
<td>268 Hydrangea</td>
<td>40207</td>
</tr>
<tr>
<td>3</td>
<td>Holding</td>
<td>not started</td>
<td>Bjorn</td>
<td>01dec15</td>
<td>27</td>
<td>1217 Onslow</td>
<td>22801</td>
</tr>
</tbody>
</table>

The **ALLDATA Data Set**

The **ALLDATA** data set gives you access to all of the JSON data in one data set. For example:

```sas
proc print data=in.ALLDATA(obs=24); run;
```

<table>
<thead>
<tr>
<th>OBS</th>
<th>P</th>
<th>P1</th>
<th>P2</th>
<th>P3</th>
<th>P4</th>
<th>V</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>stores</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>stores</td>
<td>Name</td>
<td></td>
<td></td>
<td>1</td>
<td>Bob's Mart</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>stores</td>
<td>opened</td>
<td></td>
<td></td>
<td>1</td>
<td>06-01-2001</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
<td>stores</td>
<td>sales</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>3</td>
<td>stores</td>
<td>sales</td>
<td>Hot_Dogs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>4</td>
<td>stores</td>
<td>sales</td>
<td>Hot_Dogs</td>
<td>count</td>
<td>1</td>
<td>39</td>
</tr>
<tr>
<td>7</td>
<td>4</td>
<td>stores</td>
<td>sales</td>
<td>Hot_Dogs</td>
<td>price</td>
<td>1</td>
<td>1.09</td>
</tr>
<tr>
<td>8</td>
<td>3</td>
<td>stores</td>
<td>sales</td>
<td>Salami</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>4</td>
<td>stores</td>
<td>sales</td>
<td>Salami</td>
<td>count</td>
<td>1</td>
<td>20</td>
</tr>
<tr>
<td>10</td>
<td>4</td>
<td>stores</td>
<td>sales</td>
<td>Salami</td>
<td>price</td>
<td>1</td>
<td>5.99</td>
</tr>
<tr>
<td>11</td>
<td>3</td>
<td>stores</td>
<td>sales</td>
<td>Canteloupes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>4</td>
<td>stores</td>
<td>sales</td>
<td>Canteloupes</td>
<td>count</td>
<td>1</td>
<td>26</td>
</tr>
<tr>
<td>13</td>
<td>4</td>
<td>stores</td>
<td>sales</td>
<td>Canteloupes</td>
<td>price</td>
<td>1</td>
<td>1.39</td>
</tr>
<tr>
<td>14</td>
<td>3</td>
<td>stores</td>
<td>sales</td>
<td>Mustard</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>4</td>
<td>stores</td>
<td>sales</td>
<td>Mustard</td>
<td>count</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>16</td>
<td>4</td>
<td>stores</td>
<td>sales</td>
<td>Mustard</td>
<td>price</td>
<td>1</td>
<td>2.19</td>
</tr>
<tr>
<td>17</td>
<td>2</td>
<td>stores</td>
<td>Code</td>
<td></td>
<td></td>
<td>1</td>
<td>12BMx2</td>
</tr>
<tr>
<td>18</td>
<td>1</td>
<td>stores</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>2</td>
<td>stores</td>
<td>Name</td>
<td></td>
<td></td>
<td>1</td>
<td>Grab 'n' Git</td>
</tr>
<tr>
<td>20</td>
<td>2</td>
<td>stores</td>
<td>opened</td>
<td></td>
<td></td>
<td>1</td>
<td>06-03-2012</td>
</tr>
<tr>
<td>21</td>
<td>2</td>
<td>stores</td>
<td>sales</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>3</td>
<td>stores</td>
<td>sales</td>
<td>Hot_Dogs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>4</td>
<td>stores</td>
<td>sales</td>
<td>Hot_Dogs</td>
<td>count</td>
<td>1</td>
<td>18</td>
</tr>
<tr>
<td>24</td>
<td>4</td>
<td>stores</td>
<td>sales</td>
<td>Hot_Dogs</td>
<td>price</td>
<td>1</td>
<td>1.19</td>
</tr>
</tbody>
</table>

The **ALLDATA** data set example contains these variables:
P is a NUMERIC data type that shows how many of the P1-P4 variables contain information for this observation.

P1–P4 are CHARACTER data types.

V is a NUMERIC data type showing whether a Value is available.

Value is a CHARACTER data type and is the JSON value.

In observation 1, P=1 indicates that P1 contains information and the P2–P4 variables are blank. Also, in observation 1, V=0 indicates that Value is blank. In observation 6, P=4 indicates that the P1–P4 variables contain information and V=1 indicates that Value contains a value.

Observations where V=0 indicate the beginning of a new JSON object. For example, in observations 1 and 18, where P=1 and V=1 indicate that a new Stores object begins. Observation 5 indicates that a new stores/sales/Hot_Dogs object begins. The V=0 observations are helpful for keeping track of the JSON objects.

The JSON LIBNAME engine also creates macro symbols describing lengths of the ALLDATA data set.

Here are the macro variables and values for the JSON example. The JSON LIBNAME is IN.

```
IN_JADENUM=4
IN_JADVLEN=20
IN_JADP1LEN=6
IN_JADP2LEN=6
IN_JADP3LEN=11
IN_JADP4LEN=5
```

Using the ALLDATA Data Set

Create a data set where each observation has these variables:

- item
- item price and the count
- store name and code

Note that when you look at the ALLDATA data set, you see the Store Name, and then observations that contain the item name, the count and price. You create two data sets from the ALLDATA data set. One data set named StoreInfo contains the store Name and Code. The other data set named ItemInfo contains the Item, Count, and Price. Each time you find a Price, an observation is written to the ItemInfo data set. Each time you find a Code, an observation is written to the StoreInfo data set. In order to merge the two data sets, each data set contains a key that indicates which store the observation data came from. Here is the code for the example:

```plaintext
data storeinfo (keep = Key StoreName Code)  
iteminfo  (keep = Key Item Price Count)  
;
/-----------------------------------------------------------------------*/
/* bring in ALLDATA                                                      */
/-----------------------------------------------------------------------*/
set in.ALLDATA;

/-----------------------------------------------------------------------*/
/* Since StoreName and Code are found in the Value variable of ALLDATA   */
/-----------------------------------------------------------------------*/
/* the length of StoreName and Code should be &IN_JADVLEN Similarly,   */
```
/* Item comes from P3, so its length is &IN_JADP3LEN. */
/*-----------------------------------------------------------------------*/
length StoreName $ &IN_JADVLEN  Code $ &IN_JADVLEN Item $ &IN_JADP3LEN ;

/*-----------------------------------------------------------------------*/
/* Both StoreName and Count are picked up in observations before the */
/* observations which tell us to write and output observation. So we */
/* need to retain StoreName and Count */
/*-----------------------------------------------------------------------*/
retain StoreName Count;

/*-----------------------------------------------------------------------*/
/* We want a Key which we'll increment each time we see a store object */
/* (v=0 p=1 and P1="stores" */
/*-----------------------------------------------------------------------*/
retain Key 0;

/*-----------------------------------------------------------------------*/
/* increment our key each time we see a new store object */
/**/
/**/
/* OBS  P  P1  P2  P3  P4  V  Value */
/* 1  1  stores  0  */

/*-----------------------------------------------------------------------*/
if v=0 and p=1 and p1="stores" then key+1;

 /*-------------------------------------------------------------------------*/
/* get StoreName, as in observation 2 */
/**/
/**/
/* OBS  P  P1  P2  P3  P4  V  Value */
/* 2  2  stores  Name  1  Bob's Mart */

 /*-------------------------------------------------------------------------*/
if P=2 and p2 = "Name" then StoreName = value;

 /*-------------------------------------------------------------------------*/
/* get Code and write a storeinfo observation */
/**/
/**/
/* OBS  P  P1  P2  P3  P4  V  Value */
/* 17  2  stores  Code  1 12BMx2 */

 /*-------------------------------------------------------------------------*/
if p=2 and p2 = "Code" then do;
    Code = Value;
    output storeinfo;
end;

 /*-------------------------------------------------------------------------*/
/* get Count, example observations below */
/**/
/**/
/* OBS  P  P1  P2  P3  P4  V  Value */
/* 6  4  stores  sales  Hot_Dogs  count  1  39 */
/* 9  4  stores  sales  Salami  count  1  20 */
/* 12 4  stores  sales  Canteloupes  count  1  26 */

 /*-------------------------------------------------------------------------*/
if P=4 and p4 = "count" then Count = input(value, 5.);

 /*-------------------------------------------------------------------------*/
/* get Price, and from that same observation, p3 is the Item. And each time */
/* we see price, we want to output an observation. */
Here are the two data sets:

```bash
proc print data=storeinfo; run;
```

<table>
<thead>
<tr>
<th>OBS</th>
<th>StoreName</th>
<th>Code</th>
<th>Key</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Bob's Mart</td>
<td>12BMx2</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Grab 'n' Git</td>
<td>10GNx9</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>Larry's Quick Shoppe</td>
<td>17LQx2</td>
<td>3</td>
</tr>
</tbody>
</table>

```bash
proc print data=iteminfo; run;
```

<table>
<thead>
<tr>
<th>OBS</th>
<th>Item</th>
<th>Count</th>
<th>Key</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Hot_Dogs</td>
<td>39</td>
<td>1</td>
<td>1.09</td>
</tr>
<tr>
<td>2</td>
<td>Salami</td>
<td>20</td>
<td>1</td>
<td>5.99</td>
</tr>
<tr>
<td>3</td>
<td>Canteloupes</td>
<td>26</td>
<td>1</td>
<td>1.39</td>
</tr>
<tr>
<td>4</td>
<td>Mustard</td>
<td>6</td>
<td>1</td>
<td>2.19</td>
</tr>
<tr>
<td>5</td>
<td>Hot_Dogs</td>
<td>18</td>
<td>2</td>
<td>1.19</td>
</tr>
<tr>
<td>6</td>
<td>Salami</td>
<td>3</td>
<td>2</td>
<td>7.99</td>
</tr>
<tr>
<td>7</td>
<td>Mustard</td>
<td>6</td>
<td>2</td>
<td>2.19</td>
</tr>
<tr>
<td>8</td>
<td>Beer</td>
<td>20</td>
<td>2</td>
<td>8.99</td>
</tr>
<tr>
<td>9</td>
<td>Hot_Dogs</td>
<td>39</td>
<td>3</td>
<td>1.09</td>
</tr>
<tr>
<td>10</td>
<td>Salami</td>
<td>20</td>
<td>3</td>
<td>5.99</td>
</tr>
<tr>
<td>11</td>
<td>Mustard</td>
<td>6</td>
<td>3</td>
<td>2.19</td>
</tr>
<tr>
<td>12</td>
<td>Beer</td>
<td>7</td>
<td>3</td>
<td>8.99</td>
</tr>
<tr>
<td>13</td>
<td>Wine</td>
<td>15</td>
<td>3</td>
<td>12.99</td>
</tr>
</tbody>
</table>

This code merges the two data sets:

```bash
data a;
    merge storeinfo iteminfo;
    by key;
run;
```

This code is the merged data sets:
Using the JSON Pretty Print DATA Step Function

The JSON Pretty Print DATA step function creates a readable copy of input JSON. Here is the syntax:

```sas
data _null_;  
rc = jsonpp("input file","output file");  
run;
```

**input file**

The input JSON. This can be a physical name or a fileref.

**output file**

The output JSON. This can be a physical name or a fileref. If the output file is 'LOG', then the output is written to the SAS log.

This example reads the disk file test.json and creates a disk file test.json.pp

```sas
data _null_;  
rc = jsonpp('test.json', 'test.json.pp');  
run;
```

/* read json from a url fileref and pretty print to disk fileref */

```sas
filename in url "http://example.com/~username/snip.json";  
filename out 'pp.txt';  
data _null_;  
rc = jsonpp('in','out');  
run;
```

**Examples:**

**Example 1: Use the LIBNAME Statement to Create or Reuse a JSON Map**

This example reads JSON data from a file called my.json and creates a JSON map in the file my.map. The engine creates a map if it does not exist. Otherwise, it uses the existing map.

```sas
filename in 'my.json';
```
This example shows how to access a JSON document using the physical location of the document:

```sas
filename map 'my.map';
libname in json map=map automap=reuse;
```

Example 2: Use JSON from a URL Access Method Fileref

This example shows how to access JSON from a URL fileref.

```sas
filename in url "http://example.com/~username/snip.json" debug;
filename map 'snap.map';
libname in json map=map automap=replace;
proc contents data=in._all_; run;
```

When you want to call a RESTful API a second time, reassign the LIBNAME libref.

```sas
libname in json ... ;
```

Example 3: Re-Create an Existing JSON Map File in a Different Encoding

This example shows the settings necessary to use an existing map file that was created in the local SAS session encoding and create a map file in a different encoding. In this example, the new encoding is UTF-8.

This map is created with the session encoding:

```sas
filename m1 "mapexample.map";
libname in json map=m1 automap=create;
```

This map is created with an encoding value of UTF-8:

```sas
filename m2 "mapexample.map.utf8" encoding=utf8;
libname in json map=m2 automap=create;
```

Example 4: Read JSON Created in a Different Encoding

This example shows the settings necessary to read JSON created with a SAS session encoding that is different from your SAS session encoding. The engine reads the file myjson as UTF-8, regardless of the session encoding. To read JSON created with a UTF encoding other than UTF-8, such as UTF-16LE, you must specify the appropriate UTF encoding.

```sas
filename in "myjson.utf8" encoding=utf8;
libname in json;
```

---

**LIBNAME Statement: WebDAV Server Access**

Associates a libref with a SAS library and enables access to a WebDAV (Web-based Distributed Authoring And Versioning) server.

- **Valid in:** Anywhere
- **Category:** Data Access
- **Restriction:** Access to WebDAV servers is not supported on OpenVMS or z/OS.
Syntax

LIBNAME libref <engine> 'SAS-library' < options > WEBDAV USER="user-ID" PASSWORD="user-password" WEBDAV options;

LIBNAME libref CLEAR | _ALL_ CLEAR ;

LIBNAME libref LIST | _ALL_ LIST ;

Arguments

libref
  specifies a shortcut name for the aggregate storage location where your SAS files are stored.
  Range 1 to 8 bytes
  Tip The association between a libref and a SAS library lasts only for the duration of the SAS session or until you change it or discontinue it with another LIBNAME statement.

engine
  specifies the name of a valid SAS engine.
  Restriction REMOTE engines are not supported with the WebDAV options.
  See For a list of valid engines, see the SAS documentation for your operating environment.

'SAS-library'
  specifies the URL location (path) on a WebDAV server. The URL specifies either HTTP or HTTPS communication protocols.
  Restriction Only one data library is supported when using the WebDAV extension to the LIBNAME statement.
  Requirement When using the HTTPS communication protocol, you must use the Transport Layer Security (TLS) protocol that provides secure network communications. For more information, see Encryption in SAS.

CLEAR
  disassociates one or more currently assigned librefs. When a libref using a WebDAV server is cleared, the cached files stored locally are deleted also.
  Tip Specify libref to disassociate a single libref. Specify _ALL_ to disassociate all currently assigned librefs.

LIST
  writes the attributes of one or more SAS libraries to the SAS log.
  Tip Specify libref to list the attributes of a single SAS library. Specify _ALL_ to list the attributes of all SAS libraries that have librefs in your current session.
_ALL_
specifies that the CLEAR or LIST argument applies to all currently assigned librefs.

LIBNAME Options

For valid LIBNAME statement options, see "LIBNAME Statement" on page 126.

WebDAV Specific Options

**AUTHDOMAIN="auth-domain"**
specifies the name of an authentication domain metadata object in order to connect to the WebDAV server. The authentication domain references credentials (user ID and password) without your having to explicitly specify the credentials. The *auth-domain* name is case sensitive, and it must be enclosed in double quotation marks.

An administrator creates authentication domain definitions while creating a user definition with the User Manager in SAS Management Console. The authentication domain is associated with one or more login metadata objects that provide access to the WebDAV server and is resolved by the BASE engine calling the SAS Metadata Server and returning the authentication credentials.

**Requirement**
The authentication domain and the associated login definition must be stored in a metadata repository, and the metadata server must be running in order to resolve the metadata object specification.

**Interaction**
If you specify AUTHDOMAIN=, you do not need to specify USER= and PASSWORD=.

**See**
For complete information about creating and using authentication domains, see the discussion on credential management in *SAS Intelligence Platform: Security Administration Guide*.

**LOCALCACHE="directory name"**
specifies a directory where a temporary subdirectory is created to hold local copies of the server files. Each libref has its own unique subdirectory. If a directory is not specified, then the subdirectories are created in the SAS WORK directory. SAS deletes the temporary files when the SAS program completes.

**Default**
SAS WORK directory

**LOCKDURATION=n**
specifies the number of minutes that the files written through the WebDAV libref are locked. SAS unlocks the files when the SAS program successfully completes. If the SAS program fails, then the locks expire after the time allotted.

**Default**
30

**PASSWORD="user-password"**
specifies a password for the user to access the WebDAV server. The password is case sensitive and it must be enclosed in single or double quotation marks.

**Alias**
PWD=, PW=, PASS=

**Tip**
You can specify the PROMPT option instead of the PASSWORD= option.
PROMPT
specifies to prompt for the user login password, if necessary.

Interaction If PROMPT is specified without USER=, then the user is prompted for an ID, as well as a password.

Tip If you specify the PROMPT option, you do not need to specify the PASSWORD= option.

PROXY=url
specifies the Uniform Resource Locator (URL) for the proxy server in one of these forms:
- "http://hostname"
- "http://hostname:port"

USER="user-ID"
specifies the user name for access to the WebDAV server. The user ID is case sensitive and it must be enclosed in single or double quotation marks.

Alias UID

Tip If PROMPT is specified, but USER= is not, then the user is prompted for an ID as well as a password.

WEBDAV
specifies that the libref access a WebDAV server.

Details

Data Set Options That Function Differently with a WebDAV Server

This table lists the data set options that have different functionality when using a WebDAV server. All other data set options function as described in the SAS Data Set Options: Reference.

Table 2.4 Data Set Option Functionality with a WebDAV Server

<table>
<thead>
<tr>
<th>Data Set Option</th>
<th>WebDAV Storage Functionality</th>
</tr>
</thead>
<tbody>
<tr>
<td>CNTLLEV=</td>
<td>LIB locks all data sets in the library before writing the data into the local cache. All members are unlocked after the DATA step has completed and the data set has been written back to the WebDAV server. MEM locks the member before writing the data into the local cache. Member is unlocked after the DATA step has completed and the data has been written back to the WebDAV server. REC is not supported. WebDAV allows updates to the entire data set only.</td>
</tr>
<tr>
<td>FILECLOSE</td>
<td>The VxTAPE engine is not supported. Therefore, this option is ignored.</td>
</tr>
</tbody>
</table>
### Data Set Option

<table>
<thead>
<tr>
<th>Data Set Option</th>
<th>WebDAV Storage Functionality</th>
</tr>
</thead>
<tbody>
<tr>
<td>GENMAX=</td>
<td>This functionality is not supported because the maximum number of revisions to keep cannot be specified in the WebDAV server.</td>
</tr>
<tr>
<td>GENNUM=</td>
<td>This functionality is not supported in WebDAV.</td>
</tr>
<tr>
<td>IDXNAME=</td>
<td>Users can specify an index to use if one exists.</td>
</tr>
<tr>
<td>INDEX=</td>
<td>Indexes can be created in the local cache and saved on the WebDAV server.</td>
</tr>
<tr>
<td>TOBSNO=</td>
<td>Remote engines are not supported. Therefore, this option is ignored.</td>
</tr>
</tbody>
</table>

### WebDAV File Processing

When accessing a WebDAV server, the file is pulled from the WebDAV server to your local disk storage for processing. When you complete the updating, the file is pushed back to the WebDAV server for storage. The file is removed from the local disk storage when it is pushed back.

### Multiple Librefs to a WebDAV Library

When you assign a libref to a file on a WebDAV server, the path (URL location), user ID, and password are associated with that libref. After the first libref has been assigned, the user ID and password is validated on subsequent attempts to assign another libref to the same library.

**Note:** Lock errors that you typically would not see might occur if either a different user ID or the password, or both, are used in the subsequent attempt to assign a libref to the same library.

### Locked Files on a WebDAV Server

In local libraries, SAS locks a file when you open it to prevent other users from altering the file while it is being read. WebDAV locks require Write access to a library, and there is no concept of a read lock. In addition, WebDAV servers can go down, come back up, or go offline at any time. Consequently, SAS honors a lock request on a file on a WebDAV server only if the file is already locked by another user.

### Example: Associating a Libref with a WebDAV Directory

This example associates the libref `davdata` with the WebDAV directory `/users/mydir/datadir` on the WebDAV server `www.webserver.com`:

```sql
libname davdata v9 *https://www.webserver.com/users/mydir/datadir";
webdav user="mydir" pw="12345";
```
See Also

Statements:
- “FILENAME Statement: WebDAV Access Method” on page 103
- “LIBNAME Statement” on page 126

%LIST Statement
Displays lines that are entered in the current session.

Valid in: Anywhere
Category: Program Control

Syntax
%LIST<n | − m>; 

Without Arguments
In interactive line mode processing, if you use the %LIST statement without arguments, it displays all previously entered program lines.

Arguments

\( n \)
- displays line \( n \).

\( n - m \)
- displays lines \( n \) through \( m \).

Alias \( n:m \)

Details

Where and When to Use
The %LIST statement can be used anywhere in a SAS job except between a DATALINES or DATALINES4 statement and the matching semicolon (;) or semicolons (;;;;). This statement is useful mainly in interactive line mode sessions to display SAS program code on the monitor. It is also useful to determine lines to include when you use the %INCLUDE statement.

Interactions

CAUTION
In all modes of execution, the SPOOL system option controls whether SAS statements are saved. When the SPOOL system option is in effect in interactive line mode, all SAS statements and data lines are saved automatically when they are
submitted. You can display them by using the %LIST statement. When NOSPOOL is in effect, %LIST cannot display previous lines.

Example: Displaying Lines That Are Entered in the Current Session

This %LIST statement displays lines 10 through 20:

%list 10-20;

See Also

Statements:
- "%INCLUDE Statement" on page 119

System Options:
- "SPOOL System Option" in SAS System Options: Reference

LOCK Statement

Acquires, lists, or releases an exclusive lock on an existing SAS file.

Valid in: Anywhere
Category: Program Control
Restrictions: The SAS file must exist before you can request a lock.
You cannot lock a SAS file that another SAS session is currently accessing (either from an exclusive lock or because the file is open).
The LOCK statement syntax is the same whether you issue the statement in a single-user environment or in a client/server environment. However, some LOCK statement functionality applies only to a client/server environment.

Syntax

```
LOCK libref.<member-name.<member-type | .entry-name.entry-type>>
<LIST | QUERY | SHOW | CLEAR | NOMSG>;
```

Arguments

`libref`

is a name that is associated with a SAS library. The libref (library reference) must be a valid SAS name. If the libref is Sasuser or Work, you must specify it.

Range 1 to 8 bytes

Tip Typically, in a single-user environment, you would not issue the LOCK statement to exclusively lock a library. To lock a library that is accessed
via a multiuser SAS/SHARE server, see the LOCK statement in SAS/SHARE User’s Guide.

**member-name**

is a valid SAS name that specifies a member of the SAS library that is associated with the libref.

**member-type**

is the type of SAS file to be locked. For example, valid values are DATA, VIEW, CATALOG, MDDB, and so on. The default is DATA.

**entry-name**

is the name of the catalog entry to be locked.

**Tip**  
In a single-user environment, if you issue the LOCK statement to lock an individual catalog entry, the entire catalog is locked. Typically, you would not issue the LOCK statement to exclusively lock a catalog entry. To lock a catalog entry in a library that is accessed via a multiuser SAS/SHARE server, see the LOCK statement in SAS/SHARE User’s Guide.

**entry-type**

is the type of catalog entry to be locked.

**Tip**  
In a single-user environment, if you issue the LOCK statement to lock an individual catalog entry, the entire catalog is locked. Typically, you would not issue the LOCK statement to exclusively lock a catalog entry. To lock a catalog entry in a library that is accessed via a multiuser SAS/SHARE server, see the LOCK statement in SAS/SHARE User’s Guide.

**LIST | QUERY | SHOW**

writes to the SAS log whether you have an exclusive lock on the specified SAS file.

**Tip**  
This option provides more information in a client/server environment. To use this option in a client/server environment, see the LOCK statement in SAS/SHARE User’s Guide.

**CLEAR**

releases a lock on the specified SAS file that was acquired using the LOCK statement in your SAS session.

**NOMSG**

specifies that warnings and error messages are not written to the SAS log. NOMSG does not suppress notes that tell you that a lock is successful or that a lock is cleared.

**Interactions**  
To suppress warnings and error messages, you must specify NOMSG for each execution of the LOCK statement.

The SAS macro variable SYSLCKRC return code is not affected if NOMSG is specified.

**Tip**  
NOMSG is useful if you want a LOCK statement resubmitted in a code loop until a lock is available, but you do not want error messages displayed in the SAS log each time that an exclusive lock is not available.
Details

General Information

The LOCK statement enables you to acquire, list, or release an exclusive lock on an existing SAS file. With an exclusive lock, no other operation in the current SAS session can read, write, or lock the file until the lock is released. In addition, with an exclusive lock, when the file is open, the lock ensures that another SAS session cannot access the file.

The primary use of the LOCK statement is to retain exclusive control of a SAS file across SAS statement boundaries. There are times when it is desirable to perform several operations on a file, one right after the other, without losing exclusive control of the file. However, when a DATA or PROC step finishes executing and control flows from it to the next operation, the file is closed and becomes available for processing by another SAS session that has access to the same data storage location. To ensure that an exclusive lock is guaranteed across multiple SAS sessions, you must use SAS/SHARE.

To release an exclusive lock, use the CLEAR option. In addition, an exclusive lock on a data set is released when you use the DATASETS procedure DELETE statement to delete the data set.

Return Codes for the LOCK Statement

The SAS macro variable SYSLCKRC contains the return code from the LOCK statement. These actions result in a nonzero value in SYSLCKRC:

- You try to lock a file but cannot obtain the lock (for example, the file was in use or is locked by another SAS session).
- You use a LOCK statement with the LIST option to list a lock.
- You use a LOCK statement with the CLEAR option to release a lock that you do not have.

For more information about the SYSLCKRC SAS macro variable, see SAS Macro Language: Reference.

Comparisons

- With SAS/SHARE software, you can also use the LOCK statement. Some LOCK statement functionality applies only to a client/server environment.
- The CNTLLEV= data set option specifies the level at which shared Update access to a SAS data set is denied.

Example: Locking a SAS File

This SAS program illustrates the process of locking a SAS data set. Including the LOCK statement provides protection for the multistep program by acquiring exclusive access to the file.

```
libname mydata 'SAS-library';
lock mydata.census;  1
data mydata.census;  2
    modify mydata.census;
    /* statements to remove obsolete observations */
run;  3
proc sort force data=mydata.census;  4
```
by CrimeRate;
run;
proc datasets library=mydata;  \[5\]
    modify census;
    index create CrimeRate;
    quit;
lock mydata.census clear;  \[6\]

1 Acquires exclusive access to the SAS data set MyData.Census.
2 Opens MyData.Census to remove observations. During the update, no other operation in the current SAS session and no other SAS session can access the file.
3 At the end of the DATA step, the file is closed. No other operation in the current SAS session can access the file. However, until the file is reopened, it can be accessed by another SAS session.
4 Opens MyData.Census to sort the file. During the sort, no other operation in the current SAS session and no other SAS session can access the file. At the end of the procedure, the file is closed, which means that no other operation in the current SAS session can access the file, but the file can be accessed by another SAS session.
5 Opens MyData.Census to rebuild the file’s index. No other operation in the current SAS session and no other SAS session can access the file. At the end of the procedure, the file is closed.
6 Releases the exclusive lock on MyData.Census.

See Also

For information about locking a data object in a library that is accessed via a multiuser SAS/SHARE server, see “LOCK Statement” in SAS/SHARE User’s Guide.

Data Set Options:

- “CNTLLEV= Data Set Option” in SAS Data Set Options: Reference

MISSING Statement

Assigns characters in your input data to represent special missing values for numeric data.

Valid in: Anywhere
Category: Information

Syntax

MISSING character(s);
 Arguments

**character**

is the value in your input data that represents a special missing value.

**Range**

Special missing values can be any of the 26 letters of the alphabet (uppercase or lowercase) or the underscore (_).

**Tip**

You can specify more than one character.

Details

The MISSING statement usually appears within a DATA step, but it is global in scope.

Comparisons

The MISSING= system option enables you to specify a character to be printed when numeric variables contain ordinary missing values (.). If your data contains characters that represent special missing values, such as a or z, do not use the MISSING= option to define them; simply define these values in a MISSING statement.

Example: Identifying Certain Types of Missing Data

With survey data, you might want to identify certain types of missing data. For example, in the data, an A can mean that the respondent is not at home at the time of the survey; an R can mean that the respondent refused to answer. Use the MISSING statement to identify to SAS that the values A and R in the input data lines are to be considered special missing values rather than invalid numeric data values:

```sas
data survey;
  missing a r;
  input id answer;
datalines;
  001 2
  002 R
  003 1
  004 A
  005 2
;```

The resulting data set SURVEY contains exactly the values that are coded in the input data.

See Also

**Statements:**

- “UPDATE Statement” in SAS DATA Step Statements: Reference

**System Options:**

- “MISSING= System Option” in SAS System Options: Reference
Null Statement
Signals the end of data lines or acts as a placeholder.
Valid in: Anywhere
Category: Action
Type: Executable

Syntax
;
or
;;;;

Without Arguments
The Null statement signals the end of the data lines that occur in your program.

Details
The primary use of the Null statement is to signal the end of data lines that follow a DATALINES or CARDS statement. In this case, the Null statement functions as a step boundary. When your data lines contain semicolons, use the DATALINES4 or CARDS4 statement and a Null statement of four semicolons.
Although the Null statement performs no action, it is an executable statement. Therefore, a label can precede the Null statement, or you can use it in conditional processing.

Example: Marking the End of Data Lines
- The Null statement in this program marks the end of data lines and functions as a step boundary.
  ```sas
data test;
  input score1 score2 score3;
datalines;
55 135 177
44 132 169
;
```
- The input data records in this example contain semicolons. Use the Null statement following the DATALINES4 statement to signal the end of the data lines.
  ```sas
data test2;
  input code1 $ code2 $ code3 $;
datalines4;
55;39;1 135;32;4 177;27;3
78;29;1 149;22;4 179;37;3
;;;;
```
The Null statement is useful while you are developing a program. For example, use it after a statement label to test your program before you code the statements that follow the label.

```plaintext
data _null_;  
set dsn;  
file print header=header;  
put 'report text';  
...more statements...  
return;  
header:;  
run;
```

See Also

**Statements:**
- “DATALINES Statement” in SAS DATA Step Statements: Reference
- “DATALINES4 Statement” in SAS DATA Step Statements: Reference
- “GO TO Statement” in SAS DATA Step Statements: Reference
- “LABEL Statement” in SAS DATA Step Statements: Reference

---

**OPTIONS Statement**

Specifies or changes the value of one or more SAS system options.

**Valid in:** Anywhere  
**Category:** Program Control  
**See:** OPTIONS Statement under z/OS

**Syntax**

```plaintext
OPTIONS options;
```

**Arguments**

- `option` specifies one or more SAS system options to be changed.

**See** SAS System Options: Reference  
**System Options Syntax** in SAS Help Center

**Details**

The change that is made by the OPTIONS statement remains in effect for the rest of the job, session, SAS process, or until you issue another OPTIONS statement to change the options again. You can specify SAS system options through the
OPTIONS statement, through the OPTIONS window, at SAS invocation, and at the initiation of a SAS process.

If you attempt to set an option that is restricted by your site administrator, SAS issues a note that the option is restricted and cannot be changed. For more information, see “Restricted Options” in SAS System Options: Reference.

Note: If you want a particular group of options to be in effect for all your SAS jobs or sessions, store an OPTIONS statement in an autoexec file or list the system options in a configuration file or custom_option_set.

Note: For a system option with a null value, the GETOPTION function returns a value of ‘ ’ (single quotation marks with a blank space between them), for example, EMAILID=' '. This GETOPTION value can then be used in the OPTIONS statement.

An OPTIONS statement can appear at any place in a SAS program, except within data lines.

Operating Environment Information: The system options that are available depend on your operating environment. Also, the syntax that is used to specify a system option in the OPTIONS statement might be different from the syntax that is used at SAS invocation. For more information, see the SAS documentation for your operating environment.

Comparisons

The OPTIONS statement requires you to enter the complete statement including system option name and value, if necessary. The SAS OPTIONS window displays the options’ names and settings in columns. To change a setting, type over the value that is displayed and press Enter or Return.

Example: Changing the Value of a System Option

This example suppresses the date that is normally written to SAS LISTING output and sets a line size of 72:

options nodate linesize=72;

See Also

“Definition of System Options” in SAS System Options: Reference

---

PAGE Statement

Skips to a new page in the SAS log.

Valid in: Anywhere

Category: Log Control
Syntax
PAGE;

Without Arguments
The PAGE statement skips to a new page in the SAS log.

Details
You can use the PAGE statement when you run SAS in a windowing environment, batch, or noninteractive mode. The PAGE statement itself does not appear in the log. When you run SAS in interactive line mode, PAGE might print blank lines to the display monitor (or to the alternate log file).

See Also
Statements:
  ● “LIST Statement” in SAS DATA Step Statements: Reference

System Options:
  ● “LINESIZE= System Option” in SAS System Options: Reference
  ● “PAGESIZE= System Option” in SAS System Options: Reference

RESETLINE Statement
Restarts the program line numbers in the SAS log to 1.
Valid in:  Anywhere
Category:  Log Control
Type:  Executable

Syntax
RESETLINE;

Without Arguments
Use the RESETLINE statement to reset the program line numbers in the SAS log to 1.

Details
Program statements are identified by line numbers in the SAS log. The line numbers start with 1 and continue with the sequence of line numbering until the end of the SAS session or batch program.
You use the RESETLINE statement in your program to restart the program line numbering at 1.

---

Note: If you use the SPOOL system option, you can use only the %INCLUDE statement to resubmit lines of code that were submitted after the most recent RESETLINE statement.

---

Example: Resetting Line Numbers in the SAS Log

This example resets the program line numbers between DATA steps.

```sas
data a;
a=1;
run;
resetline;
data b;
b=2;
run;
```

The program writes these lines to the SAS log:

```
1    data a;
2       a=1;
3    run;
4    resetline;
1
2    data b;
3       b=2;
4    run;
```

---

RUN Statement

Executes the previously entered SAS statements.

Valid in: Anywhere
Category: Program Control

Syntax

```
RUN <CANCEL>;
```
Without Arguments

Without arguments, the RUN statement executes the previously entered SAS statements.

Arguments

CANCEL
terminates the current step without executing it. SAS prints a message that indicates that the step was not executed.

CAUTION
The CANCEL option does not prevent execution of a DATA step that contains a DATALINES or DATALINES4 statement.

CAUTION
The CANCEL option has no effect when you use the KILL option with PROC DATASETS.

Details

Although the RUN statement is not required between steps in a SAS program, using it creates a step boundary and can make the SAS log easier to read.

Examples:

Example 1: Executing SAS Statements

This RUN statement marks a step boundary and executes this PROC PRINT step:

```sas
proc print data=report;
title 'Status Report';
run;
```

Example 2: Using the CANCEL Option

This example shows the usefulness of the CANCEL option in a line prompt mode session. The fourth statement in the DATA step contains an invalid value for PI (4.13 instead of 3.14). RUN with CANCEL ends the DATA step and prevents it from executing.

```sas
data circle;
  infile file-specification;
  input radius;
  c=2*4.13*radius;
run cancel;
```

This message is written to the SAS log:

WARNING: DATA step not executed at user's request.
%RUN Statement

Ends source statements following a %INCLUDE * statement.

Valid in: Anywhere
Category: Program Control

Syntax

%RUN;

Without Arguments

The %RUN statement causes SAS to stop reading input from the keyboard (including subsequent SAS statements on the same line as %RUN) and resume reading from the previous input source.

Details

Using the %INCLUDE statement with an asterisk specifies that you enter source lines from the keyboard.

Note: The asterisk (*) cannot be used to specify keyboard entry if you use the Enhanced Editor in the Microsoft Windows operating environment.

Comparisons

The RUN statement executes previously entered DATA or PROC steps. The %RUN statement ends the prompting for source statements and returns program control to the original source program, when you use the %INCLUDE statement to allow data to be entered from the keyboard.

The type of prompt that you use depends on how you run the SAS session. The include operation is most useful in interactive line and noninteractive modes, but it can also be used in windowing and batch mode. When you are running SAS in batch mode, include the %RUN statement in the external file that is referenced by the SASTERM fileref.

Example: Entering Source Lines from the Keyboard

To request keyboard-entry source in a %INCLUDE statement, follow the statement with an asterisk:

%include *;

Note: The asterisk (*) cannot be used to specify keyboard entry if you use the Enhanced Editor in the Microsoft Windows operating environment.
When it executes this statement, SAS prompts you to enter source lines from the keyboard. When you finish entering code from the keyboard, enter this statement to return processing to the program that contains the %INCLUDE statement.

%run;

See Also

Statements:
- “%INCLUDE Statement” on page 119
- “RUN Statement” on page 182

SASFILE Statement

Opens a SAS data set and allocates enough buffers to hold the entire file in memory.

Valid in: Anywhere

Category: Program Control

Restriction: A SAS data set opened by the SASFILE statement can be used for subsequent input (read) or update processing but not for output or utility processing.

See: “SASFILE Statement: z/OS” in SAS Companion for z/OS in SAS Companion for z/OS

Syntax

SASFILE <libref>. member-name<.member-type> <(password-options)>
OPEN | LOAD | CLOSE;

Arguments

libref
- a name that is associated with a SAS library. The libref (library reference) must be a valid SAS name. The default libref is either User (if assigned) or Work (if User is not assigned).
  - Range 1 to 8 bytes
  - Restriction The libref cannot represent a concatenation of SAS libraries that contain a library in sequential format.

member-name
- a valid SAS name that is a SAS data file. The data file is a member of the SAS library associated with the libref.
  - Restriction The SAS data set must have been created with the V7, V8, or V9 Base SAS engine.

member-type
- the type of SAS file to be opened. A valid value is DATA, which is the default.
**password-options**

specifies one or more of these password options:

**ENCRIPTKEY=key-value**

enables the SASFILE statement to open an AES-encrypted SAS data file. If a SAS data file is encrypted with the AES (Advanced Encryption Standard) algorithm, a key value is assigned to the file and must be specified in order to access the file. The key value can be up to 64 bytes long.

**Interaction**  
If you do not specify the ENCRYPTKEY= option for an AES-encrypted SAS data file, a dialog box prompts you to specify the key value.

**See**  
"AES Encryption" in SAS Language Reference: Concepts

**READ=password**

enables the SASFILE statement to open a read-protected file. The password must be a valid SAS name.

**WRITE=password**

enables the SASFILE statement to use the WRITE password to open a file that is both read-protected and write-protected. The password must be a valid SAS name.

**ALTER=password**

enables the SASFILE statement to use the ALTER password to open a file that is both read-protected and alter-protected. The password must be a valid SAS name.

**PW=password**

enables the SASFILE statement to use the password to open a file that is assigned for all levels of protection. The password must be a valid SAS name.

**Tip**  
When SASFILE is executed, SAS checks whether the file is read-protected. Therefore, if the file is read-protected, you must include the READ= password in the SASFILE statement. If the file is either write-protected or alter-protected, you can use a WRITE=, ALTER=, or PW= password. However, the file is opened only in input (read) mode. For subsequent processing, you must specify the necessary password or passwords. See “Example 2: Specifying Passwords with the SASFILE Statement” on page 190.

**OPEN**

opens the file, allocates the buffers, but defers reading the data into memory until a procedure, statement, or application is executed.

**LOAD**

opens the file, allocates the buffers, and reads the data into memory.

**CLOSE**

frees the buffers and closes the file.

---

**Note:** If the total number of allowed buffers is less than the number of buffers required for the file based on the number of data set pages and index file pages, SAS issues a warning about how many pages are read into memory.
Details

General Information

The SASFILE statement opens a SAS data set and allocates enough buffers to hold the entire file in memory. After the file is read, data is held in memory, available to subsequent DATA and PROC steps or applications, until either a second SASFILE statement closes the file and frees the buffers or the program ends. Ending the program automatically closes the file and frees the buffers.

Using the SASFILE statement can improve performance by reducing these tasks:
- multiple open or close operations (including allocation and freeing of memory for buffers) to process a SAS data set to one open or close operation
- I/O processing by holding the data in memory

If your SAS program consists of steps that read a SAS data set multiple times and you have an adequate amount of memory so that the entire file can be held in real memory, the program should benefit from using the SASFILE statement. Also, SASFILE is especially useful as part of a program that starts a SAS server such as a SAS/SHARE server. However, it is recommended that you set up a test in your environment to measure performance with and without the SASFILE statement.

Processing a SAS Data Set Opened with SASFILE

When the SASFILE statement executes, SAS opens the specified file. When subsequent DATA and PROC steps execute, SAS does not open the file for each request; the file remains open until a second SASFILE statement closes it or the program or session ends.

When a SAS data set is opened by the SASFILE statement, the file is opened for input processing and can be used for subsequent input or update processing. However, the file cannot be used for subsequent utility or output processing, because utility and output processing requires exclusive access to the file (member-level locking). For example, you cannot replace the file or rename its variables.

This table provides a list of several SAS procedures and statements and specifies whether they are allowed if the file is opened by the SASFILE statement.

<table>
<thead>
<tr>
<th>Processing Request</th>
<th>Open Mode</th>
<th>Allowed</th>
</tr>
</thead>
<tbody>
<tr>
<td>APPEND procedure</td>
<td>update</td>
<td>Yes</td>
</tr>
<tr>
<td>DATA step that creates or replaces the file</td>
<td>output</td>
<td>No</td>
</tr>
<tr>
<td>DATASETS procedure to rename or add a variable, add or change a label, or add or remove integrity constraints or indexes</td>
<td>utility</td>
<td>No</td>
</tr>
<tr>
<td>DATASETS procedure with AGE, CHANGE, or DELETE statements</td>
<td>does not open the file but requires exclusive access</td>
<td>No</td>
</tr>
</tbody>
</table>
### Table of Processing Requests

<table>
<thead>
<tr>
<th>Processing Request</th>
<th>Open Mode</th>
<th>Allowed</th>
</tr>
</thead>
<tbody>
<tr>
<td>FSEDIT procedure</td>
<td>update</td>
<td>Yes</td>
</tr>
<tr>
<td>PRINT procedure</td>
<td>input</td>
<td>Yes</td>
</tr>
<tr>
<td>SORT procedure that replaces the original data set with a sorted one</td>
<td>output</td>
<td>No</td>
</tr>
<tr>
<td>SQL procedure to modify, add, or delete observations</td>
<td>update</td>
<td>Yes</td>
</tr>
<tr>
<td>SQL procedure with the CREATE TABLE or CREATE VIEW statement</td>
<td>output</td>
<td>No</td>
</tr>
<tr>
<td>SQL procedure to create or remove integrity constraints or indexes</td>
<td>utility</td>
<td>No</td>
</tr>
</tbody>
</table>

### Buffer Allocation

A buffer is a reserved area of memory that holds a segment of data while it is processed. The number of allocated buffers determines how much data can be held in memory at one time.

The number of buffers is not a permanent attribute of a SAS file. That is, it is valid only for the current SAS session or job. When a SAS file is opened, a default number of buffers for processing the file is set. The default depends on the operating environment but is typically a small number. To specify a different number of buffers, use the BUFNO= data set option or system option.

When the SASFILE statement is executed, SAS automatically allocates the number of buffers based on the number of data set pages and index file pages (if an index file exists). For example:

- If the number of data set pages is five and there is no index file, SAS allocates five buffers.
- If the number of data set pages is 500 and the number of index file pages is 200, SAS allocates 700 buffers.

If a file that is held in memory increases in size during processing, the number of allocated buffers increases to accommodate the file. If SASFILE is executed for a SAS data set, the BUFNO= option is ignored.

### I/O Processing

An I/O (input/output) request reads a segment of data from a storage device (such as a disk) and transfers the data to memory, or conversely transfers the data from memory and writes it to the storage device. When a SAS data set is opened by the SASFILE statement, data is read once and held in memory, which should reduce the number of I/O requests.
CAUTION

I/O processing can be reduced only if there is sufficient real memory. If the SAS data set is very large, you might not have sufficient real memory to hold the entire file. If insufficient memory exists, your operating environment can simulate more memory than actually exists, which is virtual memory. If virtual memory occurs, data access I/O requests are replaced with swapping I/O requests, which could result in no performance improvement. In addition, both SAS and your operating environment have a maximum amount of memory that can be allocated, which could be exceeded by the needs of your program. If your program needs exceed the memory that is available, the number of allocated buffers might be decreased to the default allocation in order to free memory.

TIP  To determine how much memory a SAS data set requires, execute the CONTENTS procedure for the file to list its page size, the number of data set pages, the index file size, and the number of index file pages.

Using the SASFILE Statement in a SAS/SHARE Environment

Here are considerations for using the SASFILE statement with SAS/SHARE software:

- You must execute the SASFILE statement before you execute the PROC SERVER statement.
- If the client (the computer on which you use a SAS session to access a SAS/SHARE server) executes the SASFILE statement, it is rejected.
- After the SASFILE statement is executed, all users who subsequently open the file access the data held in memory instead of data that is stored on the disk.
- After the SASFILE statement is executed, you cannot close the file and free the buffers until the SAS/SHARE server is terminated.
- You can use the ALLOCATE SASFILE command for the PROC SERVER statement as an alternative that brings part of the file into memory (controlled by the BUFNO= option).
- If the SASFILE statement is executed and you execute ALLOCATE SASFILE by specifying a value for BUFNO= that is a larger number of buffers than allocated by SASFILE, performance is not improved.

Comparisons

- Use the BUFNO= system option or data set option to specify a specific number of buffers.
- With SAS/SHARE software, you can use the ALLOCATE SASFILE command for the PROC SERVER statement to bring part of the file into memory (controlled by the BUFNO= option).
Examples:

Example 1: Using SASFILE in a Program with Multiple Steps

This SAS program illustrates the process of opening a SAS data set, transferring its data to memory, and reading that data held in memory for multiple tasks. The program consists of steps that read the file multiple times.

```
libname mydata 'SAS-library';
sasfile mydata.census.data open;  1
  data test1;
    set mydata.census;  2
  run;
  data test2;
    set mydata.census;  3
  run;
  proc summary data=mydata.census print;  4
  run;
  data mydata.census;  5
    modify mydata.census;
      .
      . (statements to modify data)
    .
  run;
sasfile mydata.census close;  6
```

1 Opens SAS data set MyData.Census and allocates the number of buffers based on the number of data set pages and index file pages.
2 Reads all pages of MyData.Census and transfers all data from disk to memory.
3 Reads MyData.Census a second time, but this time from memory without additional I/O requests.
4 Reads MyData.Census a third time, again from memory without additional I/O requests.
5 Reads MyData.Census a fourth time, again from memory without additional I/O requests. If the MODIFY statement successfully changes data in memory, the changed data is transferred from memory to disk at the end of the DATA step.
6 Closes MyData.Census and frees allocated buffers.

Example 2: Specifying Passwords with the SASFILE Statement

This SAS program illustrates using the SASFILE statement and specifying passwords for a SAS data set that is both read-protected and alter-protected.

```
libname mydata 'SAS-library';
sasfile mydata.census (read=gizmo) open;  1
  proc print data=mydata.census (read=gizmo);  2
  run;
  data mydata.census;
    modify mydata.census (alter=luke);  3
    .
    . (statements to modify data)
    .
  run;
```

1 Specifies read-protected password GIZMO for MyData.Census.
2 Reads the data set with the specified password.
1 The SASFILE statement specifies the READ password, which is sufficient to open the file.
2 In the PRINT procedure, the READ password must be specified again.
3 The ALTER password is used in the MODIFY statement, because the data set is being updated.

Note: It is acceptable to use the higher-level ALTER password instead of the READ password in the preceding example.

See Also
- For information about using the SASFILE statement in a SAS/SHARE environment, see “SERVER Procedure” in SAS/SHARE User’s Guide.

Data Set Options:
- “BUFNO= Data Set Option” in SAS Data Set Options: Reference

System Options:
- “BUFNO= System Option” in SAS System Options: Reference

---

**SKIP Statement**

Creates a blank line in the SAS log.

Valid in: Anywhere
Category: Log Control

**Syntax**

```
SKIP <n>;
```

Without Arguments

Using SKIP without arguments causes SAS to create one blank line in the log.

**Arguments**

\( n \)

specifies the number of blank lines that you want to create in the log.

**Tip** If the number specified is greater than the number of lines that remain on the page, SAS goes to the top of the next page.

**Details**

The SKIP statement itself does not appear in the log. You can use this statement in all methods of operation.
SYSECHO Statement

Sends a global statement complete event and passes a text string back to the IOM client.

Valid in: Anywhere
Category: Program Control
Restriction: Has an effect only in objectserver mode

Syntax

SYSECHO <"text"> ;

Without Arguments

Using SYSECHO without arguments sends a global statement complete event to the IOM client.

Arguments

"text"

specifies a text string that is passed back to the IOM client.

<table>
<thead>
<tr>
<th>Range</th>
<th>1–64 characters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Requirement</td>
<td>The text string must be enclosed in double quotation marks.</td>
</tr>
</tbody>
</table>

Details

The SYSECHO statement enables IOM clients to manually track the progress of a segment of a submitted SAS program.

When the SYSECHO statement is executed, a global statement complete event is generated and, if specified, the text string is passed back to the IOM client.

TITLE Statement

Specifies title lines for SAS output.
Valid in: Anywhere
Category: Output Control
Restriction: The TITLE statement does not support Unicode.
See: TITLE Statement under Windows, UNIX, or z/OS

Syntax

```
TITLE <n> <ods-format-options> <text | "text">;
```

Without Arguments

Using TITLE without arguments cancels all existing titles.

Arguments

- **n**
  - specifies the relative line that contains the title line.
  - Range: 1–10
  - Tips: The title line with the highest number appears on the bottom line. If you omit n, SAS assumes a value of 1. Therefore, you can specify TITLE or TITLE1 for the first title line.
  - You can create titles that contain blank lines between the lines of text. For example, if you specify text with a TITLE statement and a TITLE3 statement, there is a blank line between the two lines of text.

- **ods-format-options**
  - specifies formatting options for the ODS HTML, RTF, and PRINTER destinations.
    - **BOLD**
      - specifies that the title text is bold font weight.
      - **ODS destination** HTML, RTF, PRINTER
    - **COLOR=color**
      - specifies the title text color.
      - **Alias** C
      - **ODS destination** HTML, RTF, PRINTER
      - **Example** “Example 3: Customizing Titles and Footnotes By Using the Output Delivery System” on page 198
    - **BCOLOR=color**
      - specifies the background color of the title block.
      - **ODS destination** HTML, RTF, PRINTER
    - **FONT=font-face**
      - specifies the font to use. If you supply multiple fonts, then the destination device uses the first one that is installed on your system.
HEIGHT=dimension | size
specifies the size of the font for titles.

dimension
is a nonnegative number.

Units of Measure for Dimension

<table>
<thead>
<tr>
<th>Unit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>cm</td>
<td>Centimeters</td>
</tr>
<tr>
<td>em</td>
<td>Standard typesetting measurement unit for width</td>
</tr>
<tr>
<td>ex</td>
<td>Standard typesetting measurement unit for height</td>
</tr>
<tr>
<td>in</td>
<td>Inches</td>
</tr>
<tr>
<td>mm</td>
<td>Millimeters</td>
</tr>
<tr>
<td>pt</td>
<td>A printer’s point</td>
</tr>
</tbody>
</table>

Restriction: If you specify dimension, then specify a unit of measure. Without a unit of measure, the number becomes a relative size.

size
The value of size is relative to all other font sizes in the HTML document.

Range: 1 to 7

ITALIC
specifies that the title text is in italics.

JUSTIFY= CENTER | LEFT | RIGHT
specifies justification.

CENTER
specifies center justification.

LEFT
specifies left justification.

RIGHT
specifies right justification.
Alias \textbf{R} \\

Alias \textbf{J} \\

ODS destination HTML, RTF, PRINTER \\

Example "Example 3: Customizing Titles and Footnotes By Using the Output Delivery System" on page 198 \\

\textbf{LINK=\textit{url}} \\
specifies a hyperlink. \\

ODS destination HTML, RTF, PRINTER \\

Tip The visual properties for LINK= always come from the current style. \\

\textbf{UNDERLIN= 0 | 1 | 2 | 3} \\
specifies whether the subsequent text is underlined. Value 0 indicates no underlining. Values 1, 2, and 3 indicate underlining. \\

Alias \textbf{U} \\

ODS destination HTML, RTF, PRINTER \\

Tip ODS generates the same type of underline for values 1, 2, and 3. However, SAS/GRAPH uses values 1, 2, and 3 to generate increasingly thicker underlines. \\

\textbf{Note} The defaults for how ODS renders the TITLE statement come from style elements relating to system titles in the current style. The TITLE statement syntax with \texttt{ods-format-options} is a way to override the settings provided by the current style. The current style varies according to the ODS destination. For more information about how to determine the current style, see "Understanding Styles, Style Elements, and Style Attributes" in \textit{SAS Output Delivery System: Procedures Guide}. Also see "TEMPLATE Procedure: Creating a Style Template" in \textit{SAS Output Delivery System: Procedures Guide}. \\

\textbf{Tips} You can specify these options by letter, word, or words by preceding each letter or word of \textit{text} by the option. \\

For example, this code makes the title “Red, White, and Blue” appear in different colors. \\
\begin{verbatim}
title color=red "Red," color=white "White, and" color=blue "Blue";
\end{verbatim} \\

\textbf{\textit{text} | \texttt{\textit{text}}} \\
specifies text that is enclosed in single or double quotation marks. \\

You can customize titles by inserting BY variable values (#BYVALn), BY variable names (#BYVARn), or BY lines (#BYLINE) in titles that are specified in PROC steps. Embed the items in the specified title text string at the position where you want the substitution text to appear.
#BYVALn
#BYVAL(variable-name)
substitutes the current value of the specified BY variable for #BYVAL in the
text string and displays the value in the title.

Follow these rules when you use #BYVAL in the TITLE statement of a PROC
step:

- Specify the variable that is used by #BYVAL in the BY statement.
- Insert #BYVAL in the specified title text string at the position where you
  want the substitution text to appear.
- Follow #BYVAL with a delimiting character, either a space or other non-
alphanumeric character (for example, a quotation mark) that ends the text
string.
- If you want the #BYVAL substitution to be followed immediately by other
text, with no delimiter, use a trailing dot (as with macro variables).

Specify the variable with one of these values:

- \( n \)
  specifies which variable in the BY statement #BYVAL should use. The
  value of \( n \) indicates the position of the variable in the BY statement.

  Example  \#BYVAL2 specifies the second variable in the BY statement.

variable-name
names the BY variable.

Tip  Variable-name is not case sensitive.

Example  \#BYVAL(YEAR) specifies the BY variable, YEAR.

#BYVARn
#BYVAR(variable-name)
substitutes the name of the BY variable or label that is associated with the
variable (whatever the BY line would normally display) for #BYVAR in the text
string and displays the name or label in the title.

Follow these rules when you use #BYVAR in the TITLE statement of a PROC
step:

- Specify the variable that is used by #BYVAR in the BY statement.
- Insert #BYVAR in the specified title text string at the position where you
  want the substitution text to appear.
- Follow #BYVAR with a delimiting character, either a space or other non-
alphanumeric character (for example, a quotation mark) that ends the text
string.
- If you want the #BYVAR substitution to be followed immediately by other
text, with no delimiter, use a trailing dot (as with macro variables).

Specify the variable with one of these values:

- \( n \)
  specifies which variable in the BY statement #BYVAR should use. The
  value of \( n \) indicates the position of the variable in the BY statement.

  Example  \#BYVAR2 specifies the second variable in the BY statement.
variable-name
names the BY variable.

Tip variable-name is not case-sensitive.

Example #BYVAR(SITES) specifies the BY variable SITES.

#BYLINE
substitutes the entire BY line without leading or trailing blanks for #BYLINE in the text string and displays the BY line in the title.

Tip #BYLINE produces output that contains a BY line at the top of the page unless you suppress the BY line by using NOBYLINE in an OPTIONS statement.

See For more information about NOBYLINE, see the “BYLINE System Option” in SAS System Options: Reference.

Tips For compatibility with previous releases, SAS accepts some text without quotation marks. When writing new programs or updating existing programs, always enclose text in quotation marks.

You can use macro variables and macros to change the information in TITLE statements. If the title is enclosed in double quotation marks (""), the text indicated is substituted into the title. If the title is enclosed in single quotation marks ("), the text is not substituted.

You can use macro variables and macros to change the information in TITLE statements. The SAS macro facility resolves the macro variable.

See For more information about including quotation marks as part of the title, see “Expressions” in SAS Language Reference: Concepts.

Details
A TITLE statement takes effect when the step or RUN group with which it is associated executes. After you specify a title for a line, it is used for all subsequent output until you cancel the title or define another title for that line. A TITLE statement for a given line cancels the previous TITLE statement for that line and for all lines with larger n numbers.

Operating Environment Information: The maximum title length that is allowed depends on your operating environment and the value of the LINESIZE= system option. For more information, see the SAS documentation for your operating environment.

Comparisons
You can also create titles with the TITLES window.

Examples:

Example 1: Using the TITLE Statement
These examples show how you can use the TITLE statement.
This statement suppresses a title on line \textit{n} and all lines after it:
\begin{verbatim}
  titlen;
\end{verbatim}

These code lines are examples of TITLE statements:
\begin{itemize}
  \item title 'First Draft';
  \item title2 "Year's End Report";
  \item title2 'Year''s End Report';
\end{itemize}

Example 2: Customizing Titles By Using BY Variable Values
You can customize titles by inserting BY variable values in the titles that you specify in PROC steps. These examples show how to use \texttt{#BYVALn}, \texttt{#BYVARn}, and \texttt{#BYLINE}:
\begin{itemize}
  \item title 'Quarterly Sales for \#byval(site)';
  \item title 'Annual Costs for \#byvar2';
  \item title 'Data Group \#byline';
\end{itemize}

Example 3: Customizing Titles and Footnotes By Using the Output Delivery System
You can customize titles and footnotes with ODS. This example shows you how to change the color, justification, and size of the text for the title and footnote:
\begin{verbatim}
ods html path='c:\temp' file='test.html';

  title j=left
  font= 'Times New Roman' color=blue bcolor=red "Student Data "
  c=green bold italic "Growth Measurements";
  title2 j=center color=red underlin=1
  height=28pt "2"
  height=24pt "0"
  height=20pt "1"
  height=16pt "8";
  footnote j=left height=20pt
  color=red "Prepared 
  c='#FF9900' "on";
  footnote2 j=center color=blue
  height=24pt "&sysdate9";
  footnote3 link='http://support.sas.com/documentation' "SAS Documentation";

proc print data=sashelp.class noobs;
run;

ods html close;
\end{verbatim}
Example 3: Customizing Titles and Footnotes By Using the Output Delivery System

Output 2.1  Output with Customized Titles and Footnotes

Student Data: Growth Measurements

<table>
<thead>
<tr>
<th>Name</th>
<th>Sex</th>
<th>Age</th>
<th>Height</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alfred</td>
<td>M</td>
<td>14</td>
<td>69.0</td>
<td>112.5</td>
</tr>
<tr>
<td>Alice</td>
<td>F</td>
<td>13</td>
<td>56.5</td>
<td>84.0</td>
</tr>
<tr>
<td>Barbara</td>
<td>F</td>
<td>13</td>
<td>65.3</td>
<td>98.0</td>
</tr>
<tr>
<td>Carol</td>
<td>F</td>
<td>14</td>
<td>62.5</td>
<td>102.5</td>
</tr>
<tr>
<td>Henry</td>
<td>M</td>
<td>14</td>
<td>63.5</td>
<td>102.5</td>
</tr>
<tr>
<td>James</td>
<td>M</td>
<td>12</td>
<td>57.3</td>
<td>83.0</td>
</tr>
<tr>
<td>Jane</td>
<td>F</td>
<td>12</td>
<td>59.8</td>
<td>84.5</td>
</tr>
<tr>
<td>Janet</td>
<td>F</td>
<td>15</td>
<td>62.5</td>
<td>112.5</td>
</tr>
<tr>
<td>Jeffrey</td>
<td>M</td>
<td>13</td>
<td>62.5</td>
<td>84.0</td>
</tr>
<tr>
<td>John</td>
<td>M</td>
<td>12</td>
<td>59.0</td>
<td>99.5</td>
</tr>
<tr>
<td>Joyce</td>
<td>F</td>
<td>11</td>
<td>51.3</td>
<td>50.5</td>
</tr>
<tr>
<td>Judy</td>
<td>F</td>
<td>14</td>
<td>64.3</td>
<td>90.0</td>
</tr>
<tr>
<td>Louise</td>
<td>F</td>
<td>12</td>
<td>56.3</td>
<td>77.0</td>
</tr>
<tr>
<td>Mary</td>
<td>F</td>
<td>15</td>
<td>66.5</td>
<td>112.0</td>
</tr>
<tr>
<td>Philip</td>
<td>M</td>
<td>16</td>
<td>72.0</td>
<td>150.0</td>
</tr>
<tr>
<td>Robert</td>
<td>M</td>
<td>12</td>
<td>64.8</td>
<td>128.0</td>
</tr>
<tr>
<td>Ronald</td>
<td>M</td>
<td>15</td>
<td>67.0</td>
<td>133.0</td>
</tr>
<tr>
<td>Thomas</td>
<td>M</td>
<td>11</td>
<td>57.5</td>
<td>85.0</td>
</tr>
<tr>
<td>William</td>
<td>M</td>
<td>15</td>
<td>66.5</td>
<td>112.0</td>
</tr>
</tbody>
</table>

Prepared on 06APR2018

See Also

Statements:
- “FOOTNOTE Statement” on page 115

System Options:
- “LINESIZE= System Option” in SAS System Options: Reference
**X Statement**

Issues an operating-environment command from within a SAS session.

**Valid in:** Anywhere

**Category:** Operating Environment

**See:** X Statement under Windows, UNIX, or z/OS

### Syntax

```
X <"operating-environment-command">
```

### Without Arguments

Using X without arguments places you in your operating environment, where you can issue commands that are specific to your environment.

### Arguments

`"operating-environment-command"`

- specifies an operating environment command that is enclosed in quotation marks.

### Details

In all operating environments, you can use the X statement when you run SAS in windowing or interactive line mode. In some operating environments, you can use the X statement when you run SAS in batch or noninteractive mode.

**Operating Environment Information:** The X statement is dependent on your operating environment. See the SAS documentation for your operating environment to determine whether it is a valid statement on your system. Keep in mind that the way you return from operating environment mode to the SAS session is dependent on your operating environment and the commands that you use with the X statement are specific to your operating environment.

You can use the X statement with SAS macros to write a SAS program that can run in multiple operating environments. For more information, see *SAS Macro Language: Reference*.

### Comparisons

In a windowing session, the X command works exactly like the X statement except that you issue the command from a command line. You submit the X statement from the Program Editor window.

The X statement is similar to the SYSTEM function, the X command, and the CALL SYSTEM routine. In most cases, the X statement, X command or %SYSEEXEC macro statement are preferable because they require less overhead. However, the SYSTEM function can be executed conditionally. The X statement is a global statement and executes as a DATA step is being compiled.
See Also

CALL Routines:
- “CALL SYSTEM Routine” in SAS Functions and CALL Routines: Reference

Functions:
- “SYSTEM Function” in SAS Functions and CALL Routines: Reference
Dictionary of SAS Global Statement Environment Variables

SAS_FTP_AUTHTLS Environment Variable

Enables Transport Layer Security (TLS) authentication.

Valid in: SAS configuration file, SAS invocation, OPTIONS statement, SAS System Options window

Used by: SAS FILENAME statement, FTP Access Method

Syntax

```
SAS_FTP_AUTHTLS 0 | 1 | 2 | 3
```

Required Arguments

- **0**: Uses the FILENAME statement, FTP Access Method option to determine TLS security. This is the default setting.
- **1**: Enforces TLS authentication. If security authorization fails, an error is returned.
- **2**: Enforces TLS authentication if the AUTHTLS, PROT=, or PBSZ= option is specified in the FILENAME statement, FTP Access Method.

**Note**: If you do not specify the AUTHTLS, PROT=, or PBSZ= option in the FILENAME statement, FTP Access Method, TLS authentication is attempted. If the FTP server does not accept TLS authentication, then basic FTP authentication is used.
Enforces TLS authentication and a note is written to the SAS log. If security authorization fails, an error is returned.

Details

Transport Layer Security (TLS) and its predecessor, Secure Sockets Layer (SSL), are cryptographic protocols that are designed to provide communication security over the internet. TLS and SSL are protocols that provide network data privacy, data integrity, and authentication.

The SAS_FTP_AUTHTLS environment variable can be used instead of adding the AUTHTLS, PROT=, or PBSZ= option to your FILENAME FTP access method statement to enforce TLS authentication. If the SAS_FTP_AUTHTLS environment variable is used, the default values of PROT=P and PBSZ=0 are used in conjunction with AUTHTLS.

How you define the SAS environment variables depends on your operating environment. For most operating environments, you can define the environment variables either locally (for use only in your SAS session) or globally. For example, you can define the SAS environment variables with the SET system option in a SAS configuration file, at SAS invocation, with the OPTIONS statement, or in the SAS System Options window. In addition, you can use your operating system to define the environment variables.

This table includes examples of defining the SAS_FTP_AUTHTLS environment variable.

<table>
<thead>
<tr>
<th>Method</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAS configuration file</td>
<td>-set SAS_FTP_AUTHTLS 1</td>
</tr>
<tr>
<td>SAS invocation</td>
<td>-set SAS_FTP_AUTHTLS 1</td>
</tr>
<tr>
<td>OPTIONS statement</td>
<td>options set=SAS_FTP_AUTHTLS 1;</td>
</tr>
</tbody>
</table>

For more information about TLS, see *Encryption in SAS*

See Also

Statements:

- “FILENAME Statement: FTP Access Method” on page 58