THE POWER TO KNOW.

SAS® 9.2 Foundation
System Requirements
for OpenVMS™ on HP Integrity

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Some software included in SAS Foundation may display a release number other than 9.2.

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Overview

This document provides requirements for installing and running SAS 9.2 Foundation under OpenVMS for HP Integrity. You must update your system to meet the minimum requirements before installing SAS 9.2 Foundation. The major requirements listed in the document are:

- ❑ Operating System and User Requirements

- ❑ System Performance and Configuration

- ❑ Hardware Requirements

- ❑ Space Requirements

- ❑ Specific Product Requirements

- ❑ Graphics Hardware and Software Compatibility

Operating System and User Requirements

SAS 9.2 Foundation has been tested and approved for the following operating system:

- OpenVMS for HP Integrity Servers, Version 8.3 or above

The following patches are required:

- VMS831_UPDATE-V0400

Note: *The patch levels listed were correct at the time this document was printed. However, patches required for OpenVMS for HP Integrity are subject to unexpected change as development continues. To ensure you have the latest patch requirements, go to the Install Center Web page (http://support.sas.com/installcenter) to find the most recent updates to this System Requirements document.*

- DecWindows Motif 1.6 (required for use of the interactive SAS windowing environment)
- HP TCP/IP Services, Version 5.6 – ECO1 or higher
- File Systems:
  - o ODS-2 (Files 11)
  - o ODS-5 (extended file specifications)

System Performance and Configuration

SAS 9.2 Foundation is a heavy user of system resources. This includes physical and virtual memory and the I/O subsystem. Typical SAS sessions execute many distinct images and process large amounts of data. This requires ample physical memory and address space, as well as heavy use of the I/O subsystem for spooling and SAS data set operations.

There are several areas in which you can make system changes to provide better performance or to ensure that larger SAS jobs will be able to successfully execute. Primarily, control over system resources is accomplished by means of altering SYSGEN (system generation) parameters that control

resources affecting all users, and AUTHORIZE quotas that are established on a per user (or per process) basis.

In order to provide an optimal I/O environment for SAS 9.2 Foundation, it is important to spread your disk accesses across different disks. It is a good idea to have SAS 9.2 Foundation images on a separate disk from SAS 9.2 Foundation data. If you can spread your applications and data across more disk drives, there will be less contention at the drive level.

Images that are used by multiple users should be installed with the option `/SHARED/OPEN/HEADER` to reduce the amount of image loading overhead needed to activate the images. Use of the OpenVMS `INSTALL` utility to make an image available in this fashion is documented in the OpenVMS operating system documentation. For more information on which images to install, refer to the `LOADLIST` option documented in the *SAS Companion for the OpenVMS Environment*.

Classifying SAS Job Size

Even though the size and type of SAS jobs vary from site to site, you can use the following set of guidelines to determine settings for SYSGEN parameters and AUTHORIZE quotas for small, medium, and large SAS jobs.

The amount of address space consumed and how much memory your job needs are the most important things to consider when quantifying small, medium, and large SAS jobs. Address space is required for both code and data. Therefore, if you have a lot of observations, you are going to need more address space and your job will be considered larger. More important, however, are the number of procedures and the types of applications you run. Executing a large number of procedures over a small data set also produces a large job.

Large jobs can include:

- a lot of data
- a lot of code running over a little data
- a little data run over a lot of procedures without unloading
- running large applications

Small jobs can include:

- a few thousand observations being run by a couple of procedures
- data entry jobs

The following are estimates for quantifying small, medium, and large jobs by observation size:

- SMALL   under 5,000 observations
- MEDIUM   under 50,000 observations
- LARGE   over 50,000 observations.

You will be able to better gauge the size of your SAS jobs if you are familiar with the following facets of the jobs:

- your data
- the type of application you are running
- the number of procedures your job uses
- buffer size settings

Once this type of information has been determined, it will be easier to set the recommended SYSGEN parameters and AUTHORIZE quotas to the appropriate values.

Minimum and Recommended SYSGEN Parameters

For the most part, modifying SYSGEN parameters will not actually have any impact on SAS System performance. Where this is not the case, it is explicitly noted below. SYSGEN parameters will, instead, determine the size of the jobs that may be run. SYSGEN parameters impose a limit on the amount of particular resources that a process can use. When a process has exhausted the resource allotted by the operating system, SAS 9.2 Foundation has to either attempt to free up resources of a like nature that are not in use, or, in the event that SAS 9.2 Foundation cannot free up sufficient resource, your SAS session will abort.

Any parameters not mentioned below are assumed to be set at their default values.

SYSGEN Parameters		
	Minimum	**Recommended**
CHANNELCNT	512	4096
CTLPAGES	1056	1200
CTLIMGLIM	35	60
GBLSECTIONS	See the appropriate section	
GBLPAGES	See the appropriate section	
PROCSECTCNT	1024	2048
WSMAX	See the appropriate section	

CHANNELCNT parameter (channels)

Minimum   512*

Recommended   4096

Note: *Certain applications may require this to be higher.

CHANNELCNT controls the number of I/O channels a process is able to have open at once. This value should be at least 50 larger than the largest value of the process quota FILLM (see "Minimum and Recommended AUTHORIZE Quotas" later in this section). If you run out of channels, you receive the following system message:

```
%SYSTEM-F-NOIOCHAN, no I/O channel available
```

When running a SAS program, the number of files opened, the number of steps, procedures, formats, informats, functions, and device drivers used, and the number of full screen operations used by the program will all require I/O channels. CHANNELCNT must be set to a value sufficient to accommodate SAS usage requirements.

CTLPAGES and CTLIMGLIM parameters (pagelets)

CTLPAGES and CTLIMGLIM specify the number of pagelets in the process dynamic memory pool. OpenVMS uses the process pool to store image control structures, process logical names, and other data structures. CTLPAGES determines the size of the pool and CTLIMGLIM limits the amount of the

pool that can be used for the image control structures. If you run out of space for image control structures, you receive the following OpenVMS system message:

```
%SYSTEM-F-INSFMEM, insufficient dynamic memory
```

You should then raise `CTLPAGES` and `CTLIMGLIM` by equal amounts. If you run out of space for logical names, first try increasing the `AUTHORIZE` quota, `JTQUOTA`. If that does not work, raise `CTLPAGES`.

For `CTLPAGES` and `CTLIMGLIM`, the size of the SAS program is determined by the number of steps, procedures, formats, informats, functions, and device drivers used by the program. The following values for `CTLPAGES` and `CTLIMGLIM` are recommended, based on the size of your SAS job:

`CTLPAGES`=1200 `CTLIMGLIM`=35 for small to large jobs

`CTLPAGES`=1200 `CTLIMGLIM`=60 is sufficient for the largest possible SAS program

Note: *Always maintain or increase the difference of 15 between* `CTLPAGES` *and* `CTLIMGLIM`.

GBLSECTIONS and GBLPAGES parameters

`GBLSECTIONS` and `GBLPAGES` are used when installing images as shareable to improve performance.

Installing Known Images

You have the option of installing certain SAS images, such as the Base SAS image, `SAS$ROOT:[SASEXE]SAS.EXE`, as known images. Doing so may improve performance, but requires that you dedicate more system resources to SAS 9.2 Foundation.

If you choose to install the Base SAS image as a known image, the following resources are required:

```
SAS$ROOT:[SASEXE]SAS.EXE:
  GBLSECTIONS     5
  GBLPAGES        9824
```

To improve SAS performance, you may also choose to install the following SAS images as known images:

```
SAS$ROOT:[SASEXE]TKMK.EXE:
  GBLSECTIONS     6
  GBLPAGES        1480

SAS$ROOT:[SASEXE]SASMOTIF.EXE:
  GBLSECTIONS     4
  GBLPAGES        23727
```

To check the parameters and their current usage, use the following commands:

```
$ INSTALL LIST/GLOBAL/SUMMARY
Summary of Local Memory Global Sections
174 Global Sections Used,   21706/44294 Global Pages Used/Unused
```

Run `SYSGEN` to find out the maximum available global sections:

```
$ RUN SYS$SYSTEM:SYSGEN

SYSGEN> SHOW GBLSECTIONS

Parameter-name  Current     Default     Minimum     Maximum     Units
Dynamic

----------------------------------------------------------------------

GBLSECTIONS     190         128         20          4095        Sections

SYSGEN> EXIT
```

In the above example, the number of available `GBLSECTIONS` is 190 - 174 = 16. The number of free `GBLPAGES` is 44294. Both values exceed the minimum required, so you could install the SAS image as a known image without modifying the system parameters.

If the values do not meet the minimum requirement, increase the parameter values by the appropriate amount. For example, assume your need one additional GBLSECTION and 816 additional GBLPAGES. Increase the parameter values by adding the following lines to the `SYS$SYSTEM:MODPARAMS.DAT` file:

```
ADD_GBLSECTIONS=1
ADD_GBLPAGES=816
```

Then run the AUTOGEN with the following command:

```
$ @SAS$UPDATE:AUTOGEN SAVPARAMS REBOOT
```

Note that this will cause your system to reboot.

To ensure that the Base SAS image is installed as a known image and is available to users each time the system is booted, you should place these commands in the system start-up file:

```
$ @SASdisk:[SAS.SASFOUNDATION.9^.2.UTILITIES.BIN]SAS92.COM
$ INSTALL :== $SYS$SYSTEM:INSTALL/COMMAND
$ INSTALL ADD SAS$ROOT:[SASEXE]SAS.EXE/OPEN/SHARED/HEADER
```

where `SASdisk` is the disk containing SAS 9.2.

PROCSECTCNT parameter (sections)

Minimum   1024

Recommended 2048

`PROCSECTCNT` controls the amount of process header memory used in the loading and running of images. Each image loaded uses one or more process sections. If you run out of process sections, you receive the following OpenVMS system message:

```
%SYSTEM-F-SECTTBLFUL, section table (process/global) is full
```

For `PROCSECTCNT`, the size of a SAS program is determined by the number of procedures, formats, informats, and functions used by the program.

WSMAX parameter

This parameter limits the maximum amount of physical memory that any one process can allocate. In order to minimize page faulting, you need to be sure that a process can allocate as much memory as possible without impacting other processes. However, `WSMAX` sets an upper limit to the amount of

memory that any one process can allocate, regardless of the individual process parameters. `WSMAX` should be at least 262144.

Note: *You should set* `WSMAX` *based on the maximum concurrent users and the system memory size. Normally, autogen will set this appropriately for the system.*

Minimum and Recommended AUTHORIZE Quotas

AUTHORIZE Quotas		
	Minimum	**Recommended**
BYTLM	150,000	400,000
FILLM	512	4096
WSDEF		8,192
WSQUO		32,768
WSEXTENT		same as WSMAX
JTQUOTA	4,096	4,096
PGFLQUOTA	2,097,152	3,500,000

Below is a list of several `AUTHORIZE` quotas that should result in a good level of system performance for the user.

BYTLM (bytes)

Minimum   150,000

Recommended   400,000

The amount of system memory that can be consumed by a process for I/O related overhead is controlled by the `BYTLM` quota. The file system (RMS) consumes this quota for some data structures associated with open files. We recommend that you set this value reasonably high. If necessary, you may have to increase the `SYSGEN` parameter `NPAGEDYN` to accommodate extra nonpaged system memory.

FILLM (files)

Minimum   512

Recommended   4096

The maximum number of files a process can have open simultaneously is controlled by the `FILLM` quota. This should always be as large as possible, because, depending on the complexity of the job, SAS may open a very large number of files. Files are opened for input, output, and format; utility files are opened for various products; dynamically loaded modules are opened; and mailboxes and sockets are opened. Setting `FILLM` to the recommended value will use a nominal amount of memory, but will allow the user to open a large number of files, and will consume added resources only when a particular file is open.

Note: *The* `SYSGEN` *parameter,* `CHANNELCNT`, *also limits the number of open files. See the previous section on "Minimum and Recommended SYSGEN Parameters".*

WSDEF

Recommended   8192

WSDEF specifies the default working set limit. This represents the initial limit to the number of physical pages the process can use. The value cannot be greater than the SYSGEN parameter WSMAX.

WSQUO

Recommended   32768

WSQUO specifies the working set quota. This is the maximum amount of physical memory a user process can lock into its working set. It also represents the maximum amount of swap space that the system reserves for this process and the maximum amount of physical memory that the system allows the process to consume if the system-wide memory demand is significant. The value cannot be greater than the value of WSMAX and cannot exceed 64K pages.

WSEXTENT

Recommended   same as WSMAX

WSEXTENT specifies the working set maximum. This represents the maximum amount of physical memory allowed to the process. The system provides memory to a process beyond its working set quota only when it has excess free pages. The additional memory is recalled by the system if needed. The value is an integer equal to or greater than WSQUOTA. WSEXTENT is used in conjunction with the SYSGEN parameter WSMAX and cannot be greater than it.

JTQUOTA (bytes)

Recommended   4096

The JTQUOTA quota affects the size of the job-wide logical name table. The number of SYSTEM, PROCESS, GROUP, and JOB level logical names that you define on your system affects this quota.

PGFLQUOTA (pages)

Minimum   2,097,152

Recommended   3,500,000

For best results, set PGFLQUOTA to the recommended level for installation and lower it to the minimum level as needed once installation is complete. Be sure there is adequate space in your page file(s) to contain PGFLQUOTA pages for all active processes. A site may consider creating alternate page files on a separate disk from the system disk for better paging performance. If SAS generates an out of memory message, then try increasing this quota by 50,000.

Note: *If the SAS job is using PROC SORT, then* PGFLQUOTA *should be at least three times greater than* WSEXTENT.

Web Browser

SAS 9.2 Foundation uses a new system, Remote Browsing, for displaying Web-based information. Instead of running a browser on the OpenVMS workstation, SAS 9.2 Foundation sends the URL to your desktop computer for display in a Web browser. This removes the browser overhead from the OpenVMS server. A small software agent named the Remote Browser Server is installed on your desktop computer to enable SAS to communicate with your browser. The process is illustrated below.

SAS creates a URL that references the information to be displayed (usually program help or ODS output), then sends the URL to the SAS Remote Browser Server on your desktop computer (step 1). The Remote Browser Server then sends a request to the browser to display a page (step 2). The browser then reconnects to SAS to retrieve the information to be displayed and displays it in the browser (step 3).

SAS 9.2 Foundation

SAS Remote
Browser Server

Browser
(IE shown)

**Desktop Computer
(Linux/Windows 32bit)**
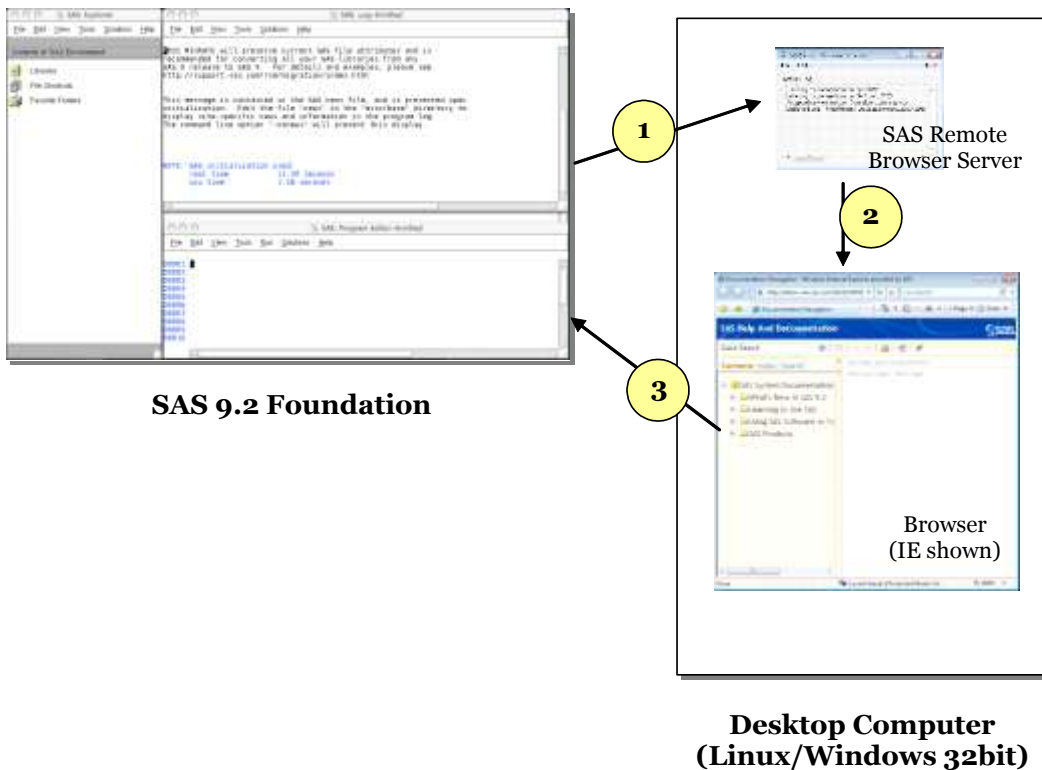
To use remote browsing, your desktop computer must be one of the following platforms, and have installed one of the supported browsers.

Platform	Supported Browser
Windows XP/Vista 32-bit	Firefox 3.0.6
	Internet Explorer 6 with SP2 or Internet Explorer 7
Linux	Firefox 3.0.6

The Remote Browser Server must be installed and running for SAS to display web information. The installer for the Remote Browser Server can be found on support.sas.com (`http://support.sas.com/documentation/configuration/thirdpartysupport/v92/thirdparty92.html`), or directly downloaded from a SAS session.

For SAS to be able to use your Web browser, the browser must be configured to allow pop-up windows. In addition, elements of SAS require access to the SAS Web site and third-party Web sites. Contact your sys admin to ensure that your browser is configured to access external sites.

Hardware Requirements

Machines Supported

- All HP Integrity systems supported by Hewlett-Packard Company that run the OpenVMS versions listed above in the Software Requirements section

Memory Requirements

- Recommended 4 GB per CPU

Distribution Media

- Electronic software delivery
- Single- or dual-layer DVD

Terminals Supported

- Workstations running Motif or any X Windows-based terminal or a server with graphics support that has a minimum of 256 colors

Space Requirements

The following list contains space requirements in blocks (512 bytes) for all of the products available with this release of SAS 9.2 Foundation for OpenVMS on HP Integrity. Use this information to help you determine how much free disk space you must have available before you can install SAS 9.2 Foundation.

Software Product	Required Disk Space (MB)	Additional Space for Samples (MB)
Base SAS Software	1063.0	7.9
Based SAS Virtual Java Repository	173.0	0.0
ODS Templates Software	6.6	0.0
Report Fonts for Servers Software	368.6	0.0
SAS High Performance Forecasting Software	39.7	0.2
SAS Installation Qualification Tool Software	0.1	0.0
SAS Integration Technologies Software	17.5	0.3
SAS Integration Technologies Virtual Java Repository	67.1	0.0
SAS OLAP Server Software	13.0	0.0
SAS/ACCESS Interface to Oracle Software	3.0	0.1
SAS/AF Software	13.6	0.0
SAS/ASSIST Software	23.2	0.0
SAS/CONNECT Software	7.5	0.2
SAS/EIS Software	21.1	10.4
SAS/ETS Software	140.1	2.1
SAS/FSP Software	4.8	0.0
SAS/Genetics Software	27.4	0.2
SAS/GIS Software	77.3	0.3
SAS/GRAPH Software	337.1	2.0
SAS/GRAPH Virtual Java Repository	135.3	0.0
SAS/IML Software	38.8	0.6
SAS/INSIGHT Software	30.7	0.4
SAS/IntrNet Software	5.1	1.2
SAS/LAB Software	23.7	0.0
SAS/OR Software	101.5	2.0
SAS/OR Math Program Common Software	12.6	0.0
SAS/QC Software	99.4	2.9
SAS/QC Virtual Java Repository	80.2	0.0
SAS/SECURE SSL Software	5.7	0.0
SAS/SHARE Software	2.1	0.2
SAS/STAT Software	330.6	3.7

SAS/GRAPH Map Data Sets

Data Set	Required Disk Space (blocks)
Countries in Africa and Middle East Maps	6.1
Countries in Asia and Pacific Maps	44.2
Countries in Europe Maps	26.0
Countries in North America	5.8
Countries in Latin America and Caribbean Maps	5.9
Canada Maps	1.7
Continents Maps	36.5
World Map	6.9
Very Large US County Map, Unprojected	10.9
Large US County Map, Unprojected and Reduced	1.8
Large US Mainland County Map, Projected and Reduced	1.7
Large US State Outline Map, Unprojected	1.8

Specific Product Requirements

Base SAS Software

PROC SORT

If SAS is sorting large data sets, then the larger values recommended for the `SYSGEN` parameters and `AUTHORIZE` quotas should be used.

Requirements for SPD Engine on OpenVMS on HP Integrity

- An SMP (symmetric multiprocessing) computer with at least two CPUs; four are preferred
- At least one I/O channel per two CPUs
- Enough disk drives to have at least one mount point per CPU isolated on its own disk; two mount points per CPU are better

ODS Graphics

The use of ODS Graphics in Base SAS software requires a SAS/GRAPH license.

SAS/ACCESS Interface to Oracle Software

Products Required

- Base SAS software
- SAS/ACCESS Interface to Oracle software

DBMS Products Required

SAS/ACCESS Interface to Oracle software can be installed on either a full Oracle RDBMS server node or on an Oracle client node. The minimum required Oracle **Client** release is:

- Oracle, Release 10g

Note: *In order to use the Bulk Load feature of this SAS product, you must have Oracle's SQL*Loader data-loading utility installed. This utility can be obtained by running the Oracle installer and selecting the Oracle Utilities product. Please refer to your Oracle documentation for information on SQL*Loader.*

SAS/AF Software

Products Required for Build Mode

- Base SAS software
- SAS/AF software
- SAS/GRAPH software (to create and display some graphics objects)
- Other products may be required depending on the application

Products Required for Run Mode

- Base SAS software
- SAS/GRAPH software (to display some graphics objects)
- Other products may be required depending on the application

Printers

- A color or gray scale printer is required for printing graphics-based objects.
- Certain non-graphic objects may require SAS/GRAPH to print depending on the object.

SAS/CONNECT Software

TCP/IP Access Method:

The following product is supported:

- Compaq TCP/IP Services, Version 5.6 – ECO1 or higher

SAS/EIS Software

Products Required for Build Mode

- Base SAS software
- SAS/AF software
- SAS/EIS software
- SAS/FSP software
- SAS/GRAPH software
- Other products may be required depending on the application

Products Required for Run Mode

- Base SAS software
- SAS/GRAPH software
- SAS/EIS software
- Other products may be required depending on the application

SAS/ETS Software

The use of ODS Graphics in SAS/ETS software requires a SAS/GRAPH license.

SAS/Genetics Software

Products Required:

- Base SAS software
- SAS/Genetics software
- SAS/GRAPH software

SAS/GIS Software

Products Required for Build Mode

- Base SAS software
- SAS/AF software (recommended)
- SAS/GIS software
- SAS/GRAPH software
- Other products may be required depending on the application

Products Required for Run Mode

- Base SAS software
- SAS/FSP software (recommended)
- SAS/GIS software
- SAS/GRAPH software
- Other products may be required depending on the application

Printers

A color or gray scale printer is required. The list of possible printers can be found in the Graphics Hardware and Software Compatibility section.

SAS/IntrNet Software

SAS/IntrNet software consists of several components that may be installed independently. SAS/IntrNet Server software is installed on an existing SAS System and is included on SAS 9.2 media.

CGI Tools and Applications

Note: *SAS/IntrNet's CGI Tools do not support operation on an OpenVMS Web server. CGI components (Application Broker and htmSQL) must be installed on a Windows, UNIX, or z/OS Web server.*

Application Dispatcher

Requires Base SAS software and SAS/IntrNet Server software. The Application Broker component of the Application Dispatcher must be installed on a Web server.

htmSQL

Requires Base SAS software, SAS/SHARE software, and a SAS/IntrNet software license (SETINIT). The htmSQL component must be installed on a Web server.

MDDB Report Viewer Application

Requires Base SAS software, SAS/GRAPH software, SAS/IntrNet software, and SAS/EIS software or SAS OLAP Server software. The Application Dispatcher component must be installed and configured.

Xplore Sample Web Application

Requires Base SAS software and SAS/IntrNet Server software. The Application Dispatcher component must be installed and configured.

Java Tools and Applications

SAS/CONNECT Driver for Java

Requires Base SAS software, SAS/CONNECT software, and SAS/IntrNet Server software. SAS/SHARE software must also be installed if data services are used. The Java Tools package must be installed on a Web server or client system.

Tunnel Feature

Must be installed on a Web server running on a UNIX or Windows system.

SAS/LAB Software

Products Required

- Base SAS software
- SAS/FSP software (required for interactive data entry)
- SAS/GRAPH software
- SAS/LAB software

SAS/OR Software

The use of traditional graphics in SAS/OR software requires a SAS/GRAPH license.

SAS/QC Software

The use of ODS Graphics and traditional graphics in SAS/QC software requires a SAS/GRAPH license.

SAS/SHARE Software

Products Required

- Base SAS software

TCP/IP Access Method

The following products are supported:

- HP TCP/IP Services, Version 5.6 – ECO1 or higher

SAS/STAT Software

The use of ODS Graphics in SAS/STAT software requires a SAS/GRAPH license.

Graphics Hardware and Software Compatibility

Printers

SAS/GRAPH software provides device drivers for all Hewlett-Packard printers (and compatibles), and printers that support PostScript, HP-GL, HP PCL, and other printer languages. Here is a partial list of printers that SAS/GRAPH software supports:

- CalComp ColorMaster, ColorMaster Plus, PlotMaster
- Canon Bubble Jet, Laser Shot
- Digital printers which support either SIXEL, HP PCL, Tektronix, or PostScript emulation modes
- Epson FX and LQ series printers (and all printers running in Epson emulation mode)
- Hewlett-Packard LaserJet, DeskJet, PaintJet, and DesignJet printers (and compatibles)
- IBM Graphics, Proprinter, and ColorJet printers
- PostScript printers (including color and gray-scale PostScript printers)
- QMS Colorgrafix with CGM interpreter
- QMS 800, 1200, 1500, 2200, and 2400 using QUIC or Tektronix emulation modes
- Talaris 800, 802, 1200, 1500, and 2400 using QUIC or Tektronix emulation modes
- Talaris printers using the EXCL language
- Tektronix Phaser printers (all models)
- Tektronix 4693 printers with Tektronix 4510 rasterizer
- Xerox 2700 and 4045 printers with a GRAPHX cartridge
- Xerox 3700 (with imaging board and at least 1M of memory)
- Xerox 4030 (contact Technical Support), 4213, 4235, and 4700
- Xerox 4700 printer
- Xerox 5775 color copier with an EFI Fiery attachment

SAS/GRAPH device drivers may also be available for additional printers not listed above and that do not support PostScript, HP-GL, or HP PCL. Contact SAS Institute Technical Support for additional information on these drivers.

Terminals and Displays

SAS/GRAPH software supports graphics display on graphics terminals from DEC, Tektronix, HP, and on X Windows terminals. SAS/GRAPH software also supports graphics emulators that emulate any of the above terminals. Note the use of the SAS/GRAPH graphics editor requires an X Windows display or X Windows emulation software.

Plotters

SAS/GRAPH software provides device drivers for all HP plotters supporting HP-GL or HP-GL/2, and plotters from other manufacturers that support the HP-GL or HP-GL/2 language. SAS/GRAPH software also supports Houston Instruments plotters using the DMPL language and ZETA plotters that support the GML language.

Film Recorders

SAS/GRAPH software provides device drivers that support the following film recorders:

- Genigraphics Masterpiece Camera System with SCODL interface
- Lasergraphics MPS 2000 film recorder with a Lasergraphics UI-100 or RASCOL rasterizer
- Matrix QCR and PCR cameras with Matrix QVP, MVP, or Lasergraphics rasterizers
- Polaroid Palette CI-3000 and CI-5000
- Presentation Technologies Montage film recorder

Support may be available for other film recorders not listed here. Contact SAS Institute Technical Support for details.

Interfaces to Other Graphics Software

Included with SAS/GRAPH software is a series of drivers that can produce Computer Graphics Metafiles (CGM) in binary, character, and clear-text formats. These drivers can be used to transfer SAS/GRAPH output to other products that support CGM input, such as Word for Windows, WordPerfect for Windows, Harvard Graphics, and Lotus Freelance, or to devices that can process CGM input.

SAS/GRAPH software can also generate encapsulated PostScript vector files, which can be exported to word processing packages such as Microsoft Word, WordPerfect, and several others.

Many other graphics and word processing applications can process files in Hewlett-Packard (HP-GL) format. The HPGL driver can be used to produce files that can be transferred to most applications that can process HP-GL files. In addition, there are drivers for PDF, PBM, PPM, GIF, JPEG, EMF, WMF, PNG, TIFF, EPSI, and PaintBrush image formats. To view a complete list of all SAS/GRAPH device drivers, submit the following SAS program:

```
proc gdevice c=sashelp.devices nofs;
   list _all_;
run; quit;
```

- SAS/GRAPH software can also export graphics in the following formats:
- BMP - Microsoft Windows Bitmap
- EPS - Encapsulated PostScript
- GIF - Graphics Interchange Format
- PNG - Portable Network Graphics
- PPM - Portable Pixmap
- PS - PostScript Bitmap
- TIF - Tagged Image File Format
- XPM - X11 Pixmap
- JPG - JPEG Files
- XBM - X11 Bitmap

In addition, SAS/GRAPH software can import graphics in the following formats:

- BMP - Microsoft Windows Bitmap
- EPS - Encapsulated PostScript
- GIF - Graphics Interchange Format

- PBM - Portable Bitmap
- PCX - PC PaintBrush
- PGM - Portable Graymap
- PNG - Portable Network Graphics
- PNM - Portable Anymap
- PPM - Portable Pixmap
- TGA - Targa format
- TIF - Tagged Image File Format
- XBM - X11 Bitmap
- XPM - X11 Pixmap
- XWD - X Window Dump
- JPG - JPEG Files

Viewing HTML Pages Created with the ActiveX and Java Device Drivers

The ActiveX and Java device drivers allow you to create HTML pages from within SAS 9.2 Foundation.

Refer to the "Web Browser" section in this document for an overview of Remote Browsing. This is used to view HTML pages.

To view the Java applets, the Java plug-in must be installed on your desktop computer where the Remote Browser Server is running. On Windows systems, the user can install the plug-in when prompted if it is not already installed.