Device Specifics Reference Manual for DEC GKS and DEC PHIGS

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This manual provides information on all DEC GKS™ and DEC PHIGS™ devices.

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Preface

This manual provides information about all devices supported by DEC GKS and DEC PHIGS.

Intended Audience

This document is intended for experienced programmers who are knowledgeable in programming languages and graphics.

Structure of This Document

This manual is divided into 17 chapters and 7 appendixes as follows:

- Chapter 1 provides introductory information on the devices supported by DEC GKS and DEC PHIGS, including how to access online help and a complete list of supported devices.
- The balance of this manual is organized into one chapter for each supported device, arranged in alphabetical order.
- Appendix A provides information about the fonts that can be accessed from the DEC GKS and DEC PHIGS software in stroke precision text.
- Appendix B describes the DEC GKS and DEC PHIGS escapes.
- Appendix C describes the DEC GKS supported generalized drawing primitives (GDPs).
- Appendix D provides information on dial and button support for DEC PHIGS.
- Appendix E provides input information that is applicable to all DEC GKS and DEC PHIGS workstations of category OUTIN.
- Appendix F provides the equations used for lighting of primitives and depth cueing for DEC PHIGS.
- Appendix G presents techniques for improving DEC PHIGS performance.

Associated Documents

The following manuals are also part of the DEC GKS documentation set:

- *DEC GKS User's Guide*
- *DEC GKS C Binding Reference Manual*
- *DEC GKS FORTRAN Binding Reference Manual*
- *DEC GKS GKS$ Binding Reference Manual*
- *DEC GKS GKS3D$ Binding Reference Manual*

The following manuals are also part of the DEC PHIGS documentation set:

- *DEC PHIGS Ada Binding Reference Manual*
- *DEC PHIGS C Binding Reference Manual*
- *DEC PHIGS ISO C Binding Reference Manual*
- *DEC PHIGS ISO Fortran Binding Reference Manual*
- *DEC PHIGS PHIGS$ Binding Reference Manual*
- *DEC PHIGS Developer's Guide*
- *Getting Started with DEC PHIGS*

For future releases of DEC PHIGS and DEC GKS, the configuration of the documentation set may change.

Conventions Used in This Document

The following conventions are used throughout this manual:

Convention	Meaning
Return	The symbol Return represents a single stroke of the Return key on a terminal.
INTEGER X . . .	A vertical ellipsis indicates that not all the text of a program or program output is illustrated. Only relevant material is shown in the example.
option, . . .	A horizontal ellipsis indicates that additional arguments, options, or values can be entered. A comma that precedes the ellipsis indicates that successive items must be separated by commas. Horizontal ellipses in illustrations indicate that there is information not illustrated that either precedes or follows the information included in the illustration itself.
bold	Boldface text represents the introduction of a new term. Boldface text in code examples shows user input.
italic	Italic text is used when referencing a DEC GKS or DEC PHIGS argument name, or to show variable names.
%	In this manual, the percent sign (%) in a command line represents the default user prompt under UNIX.
$	In this manual, the dollar sign ($) in a command line represents the default user prompt under OpenVMS.
UNIX systems	In this manual, references to UNIX® systems refers to operating systems based on UNIX software (ULTRIX™ and Digital UNIX [formerly DEC OSF/1] systems).

Throughout this manual, when code examples are used to illustrate the use of constant values, you can often substitute *GKS* in place of *PHIGS* to achieve the same program effects for both products. For example, GKS$K_CONID_DEFAULT can be substituted for an occurrence of PHIGS$K_CONID_DEFAULT within a code example to create a similar GKS code example.

Introduction

1
Introduction

DEC GKS is an implementation of the Graphical Kernel System defined by the ISO 7942:1985(E) standard and the Graphical Kernel System for Three Dimensions defined by the ISO 8805:1988(E) standard. The GKS standard defines levels of GKS implementations that address the most common classes of graphics devices and application needs. The levels are determined primarily by input and output capabilities. The output level values are represented by the characters m, 0, 1, and 2. The input level values are represented by the characters a, b, and c.

The DEC GKS software is a level 2c implementation, incorporating all the GKS output capabilities (level 2) and all the input capabilities (level c). This manual uses the term DEC GKS when describing the level 2c GKS product.

DEC PHIGS is an implementation of the Programmer's Hierarchical Interactive Graphics System. PHIGS is defined by the ISO 9592:1988(E) standard. These products each provide a set of graphics functions that can be used by numerous types of graphics applications to produce three-dimensional pictures on graphics output devices.

1.1 Capabilities of Supported Devices

In many applications, you may wish to write completely device-independent programs. In this way, you can run your programs using different devices without having to rewrite your programs. The DEC GKS and DEC PHIGS language binding manuals outline the procedure for device-independent programming using DEC GKS and DEC PHIGS.

Instead of writing device-independent programs, you may wish to review the range of capabilities of the DEC GKS and DEC PHIGS supported devices, or write device-dependent subroutines within your application. In either case, it is helpful to review relevant chapters in this manual before you begin coding your application.

The device-dependent chapters contain the following information:

- Workstation type modifiers
- Programming considerations
- Color capabilities
- Initial input values
- Other pertinent information about the device

1.2 Using Workstation Type Modifiers

The workstation type value for DEC GKS and DEC PHIGS is actually the value of a data structure that fits inside a 32-bit integer. The least significant 16 bits contain the workstation type. The most significant 16 bits are workstation-specific. It is helpful to examine workstation type values in hexadecimal form, as the bit boundaries are shown more clearly than in decimal form.

For example, a PostScript® printer is specified by the workstation type 61. For this device, the least significant byte of the second word specifies the paper size. The value 1 specifies legal size paper. In hexadecimal form, this would be represented as %x0001003D.

1.3 Using Constant Names for Workstation Types and Connection Identifiers

DEC GKS and DEC PHIGS define a series of constants to specify the workstation types and their modifiers within programs. By performing a bitwise OR operation on certain constants, you can control device-dependent features such as paper size. To use these constants, you must include the definitions file for your programming language.

To take advantage of device-dependent features, Digital recommends that you assign default values to the workstation type and connection identifier constants within your programs, and specify dependent bit mask definitions at command level. By using default constants, you eliminate having to recompile and relink your programs each time you change the bit mask definition.

On OpenVMS™ systems, define workstation type logical names as GKS$WSTYPE (for DEC GKS) and PHIGS$WSTYPE (for DEC PHIGS). Define connection identifier logical names as GKS$CONID (for DEC GKS) and PHIGS$CONID (for DEC PHIGS).

On UNIX systems, set workstation type environment variables to GKSwstype (for DEC GKS) and PHIGSwstype (for DEC PHIGS). Set connection identifier environment variables to GKSconid (for DEC GKS) and PHIGSconid (for DEC PHIGS).

For more information about the supported bit masks for any given device, see the specific chapter in this manual.

1.4 Supported Workstations

This section lists the devices that DEC GKS and DEC PHIGS support and the defined workstation type of each device. Use the workstation type constants in calls to the function OPEN WORKSTATION. You can also compare the workstation type constant with the values returned by the INQUIRE WORKSTATION CONNECTION AND TYPE function. To determine the corresponding workstation-type constant names for a specific language binding, see the language definitions file.

Table 1–1 lists the supported workstation types. The use of FILE in the **Output** column refers to whether the output of the workstation is a file. Unless otherwise indicated, all devices are supported on both OpenVMS VAX and ULTRIX systems. For detailed information about any device, refer to the chapter describing this device.

Table 1–1 Supported Devices

Device	Value	Type	Output
Default workstation type	0	Default	
CGM Metafile[1]	7	Output	FILE
Digital VT125™[1]	10	Output	FILE
Digital VT125 (color)[1]	11	I/O	Terminal display
Digital VT125 (monochrome)[1]	12	I/O	Terminal display
Digital VT240™ (color)[1]	13	I/O	Terminal display
Digital VT240 (monochrome)[1]	14	I/O	Terminal display
Digital LCG01 printer	15	Output	FILE
Digital VT330™ (monochrome)[1]	16	I/O	Terminal display
Digital VT340™ (color)[1]	17	I/O	Terminal display
LA34™ printer (graphics)	31	Output	FILE
LA100™ printer [1]	31	Output	FILE
LA50™ printer [1]	32	Output	FILE
LA210™ printer [1]	34	Output	FILE
LA75™ printer [1]	35	Output	FILE
LN03 PLUS™ printer [1]	38	Output	FILE
DEClaser™ 2100, 2200 printer [1]	39	Output	FILE
VWS workstation	41	I/O	VWS workstation display
Digital LVP16™ [1] (A-sized paper)	51	Output	FILE
Hewlett-Packard HP7475®[1]	51	Output	FILE
Digital LVP16[1] (B-sized paper)	52	Output	FILE
Hewlett-Packard HP7550®[1]	53	Output	FILE
Hewlett-Packard HP7580®[1]	54	Output	FILE
LaserGraphics MPS–2000™[1]	55	Output	FILE
Hewlett-Packard HP7585®[1]	56	Output	FILE
PostScript[1]	61	Output	FILE
PostScript (color)[1]	62	Output	FILE
Encapsulated PostScript[1]	65	Output	FILE
Encapsulated PostScript (color)[1]	66	Output	FILE
Tektronix® 4014	70	Output	Terminal display
Tektronix 4014	72	I/O	Terminal display
Tektronix 4107	80	Output	Terminal display
Tektronix 4107	82	I/O	Terminal display
Tektronix 4207	83	Output	Terminal display
Tektronix 4207	84	I/O	Terminal display
Tektronix 4128	85	Output	Terminal display
Tektronix 4128	86	I/O	Terminal display

[1]Also supported on OpenVMS Alpha and Digital UNIX systems.

(continued on next page)

Table 1–1 (Cont.) Supported Devices

Device	Value	Type	Output
Tektronix 4129	87	Output	Terminal display
Tektronix 4129	88	I/O	Terminal display
VAXstation 500	87	Output	Terminal display
VAXstation 500	88	I/O	Terminal display
LJ250™ ink jet printer	91	Output	FILE
LJ250 180 dpi	92	Output	FILE
LA324™ printer	93	Output	FILE
Digital VT284™ and VT286™[2]	110	Output	FILE
Digital VT286[2]	113	I/O	Terminal display (color)
Digital VT284[2]	114	I/O	Terminal display (monochrome)
LA84™ printer[1]	131	Output	FILE
LA86™ printer[1]	131	Output	FILE
LA280™ printer[1]	131	Output	FILE
LA380™ printer[1]	131	Output	FILE
Japanese LN03 PLUS printer[1]	138	Output	FILE
Japanese DEClaser 2300[1] printer	139	Output	FILE
Japanese VWS workstation	141	I/O	Japanese VWS workstation display
Japanese PostScript[1]	161	Output	FILE
Japanese PostScript[1] (color)	162	Output	FILE
Japanese Encapsulated PostScript[1]	165	Output	FILE
Japanese Encapsulated PostScript (color)[1]	166	Output	FILE
DECwindows™ output	210	Output	DECwindows workstation display
DECwindows	211	I/O	DECwindows workstation display
DECwindows Drawable	212	Output	DECwindows workstation display
DECwindows Widget	213	I/O	DECwindows workstation display
PEX output device	220	Output	PEX workstation display
PEX device using the DECwindows Toolkit	221	I/O	PEX workstation display
PEX device as an application window	222	Output	PEX workstation display
PEX device as a device within an application widget	223	I/O	PEX workstation display
OSF/Motif® output[1]	230	Output	Motif workstation display
OSF/Motif[1]	231	I/O	Motif workstation display
OSF/Motif Drawable[1]	232	Output	Motif workstation display
OSF/Motif Widget[1]	233	I/O	Motif workstation display
OSF/Motif PEX output[1]	240	Output	Motif/PEX workstation display

[1]Also supported on OpenVMS Alpha and Digital UNIX systems.

[2]Supported only on OpenVMS VAX and OpenVMS Alpha systems.

(continued on next page)

Table 1–1 (Cont.) Supported Devices

Device	Value	Type	Output
OSF/Motif PEX[1]	241	I/O	Motif/PEX workstation display
OSF/Motif PEX Drawable[1]	242	Output	Motif/PEX workstation display
OSF/Motif PEX Widget[1]	243	I/O	Motif/PEX workstation display
DDIF™[1]	250	Output	FILE
Hewlett-Packard LaserJet II (300 dpi)[1]	261	Output	FILE
OpenGL® output[3]	270	Output	OpenGL workstation display
OpenGL input/output[3]	271	I/O	OpenGL workstation display
OpenGL Drawable[3]	272	Output	OpenGL workstation display
OpenGL Widget[3]	273	I/O	OpenGL workstation display
Japanese DECwindows output	310	Output	Japanese DECwindows workstation display
Japanese DECwindows	311	I/O	Japanese DECwindows workstation display
Japanese DECwindows Drawable	312	Output	Japanese DECwindows workstation display
Japanese DECwindows Widget	313	I/O	Japanese DECwindows workstation display
Japanese PEX output device	320	Output	Japanese PEX workstation display
Japanese PEX device using the DECwindows Toolkit	321	I/O	Japanese PEX workstation display
Japanese PEX device as an application window	322	Output	Japanese PEX workstation display
Japanese PEX device as a device within an application window	323	I/O	Japanese PEX workstation display
Japanese OSF/Motif output[1]	330	Output	Japanese Motif workstation display
Japanese OSF/Motif[1]	331	I/O	Japanese Motif workstation display
Japanese OSF/Motif Drawable[1]	332	Output	Japanese Motif workstation display
Japanese OSF/Motif Widget[1]	333	I/O	Japanese Motif workstation display
Japanese OSF/Motif PEX[1]	340	Output	Japanese Motif/PEX workstation display
Japanese OSF/Motif PEX[1]	341	I/O	Japanese Motif/PEX workstation display
Japanese OSF/Motif PEX Drawable [1]	342	Output	Japanese Motif/PEX workstation display
Japanese Motif PEX Widget[1]	343	I/O	Japanese Motif/PEX workstation display
Japanese DDIF[1]	350	Output	FILE

[1]Also supported on OpenVMS Alpha and Digital UNIX systems.

[3]Supported only on Digital UNIX and OpenVMS Alpha systems.

1.5 Supported Fonts

All the devices support the following device-independent fonts. Simplex means that the characters are made up of one line. Duplex means that the characters are made up of two lines. Complex means that the characters are made up of more than two lines. Each of these device-independent fonts is illustrated in stroke precision in Appendix A.

Table 1–2 lists the device-independent fonts.

Table 1–2 Device-independent Fonts

Number	Descriptive Name
1	ISO Standard Character Set
–1	ISO Standard Character Set
–2	Small Simplex Roman and Greek
–3	Large Simplex Appendix A illustrates Roman
–4	Large Simplex Greek
–5	Large Simplex Script
–6	Medium Duplex Roman
–7	Medium Duplex Greek
–8	Medium Duplex Italic
–9	Large Complex Roman
–10	Large Complex Greek
–11	Large Complex Italic
–12	Large Simplex Roman
–13	Large Complex Script
–14	Large Complex Cyrillic
–15	Large Complex Roman
–16	Large Complex Italic
–17	Large Gothic German
–18	Large Gothic English
–19	Large Gothic Italian
–20	Medium Complex Special Characters
–21	Music, Astronomy, and Business
–22	Large Special Characters
–23	Large Special Characters
–24	Small Simple Roman
–10001	Japanese Character Set

1.6 Predefined Bundle Table Indexes for DEC GKS

The program GKS_PREDEF is included with the DEC GKS development kit. It displays information on the following predefined bundle tables and supported escapes:

- Color bundle table
- Marker bundle table

- Line bundle table
- Fill bundle table
- Pattern bundle table
- Edge bundle table
- Text bundle table
- View bundle table
- Highlight bundle table
- HLHSR bundle table
- Available escapes
- Connection identifier
- Workstation type

On OpenVMS systems, GKS_PREDEF is located in the directory SYS$COMMON:[SYSHLP.EXAMPLES.GKS]. The logical name GKS$EXAMPLES points to this directory. On UNIX systems, GKS_PREDEF is located in the directory /usr/lib/GKS/examples.

Example 1–1 provides an example of using this program on a OpenVMS system to list predefined color indexes for the Digital LCP01 printer device.

Example 1–1 GKS_PREDEF Program Example

```
$ PREDEF :== $GKS$EXAMPLES:GKS_PREDEF Return
$ PREDEF  Return

DEC GKS predefined bundle table program

Parameters:
    all:          list all information below
    color:        list predefined color bundle table
    marker:       list predefined marker bundle table
    line:         list predefined line bundle table
    fill:         list predefined fill bundle table
    pattern:      list predefined pattern bundle table
    edge:         list predefined edge bundle table
    text:         list predefined text bundle table
    view:         list predefined view bundle table

    highlight:    list predefined highlight bundle table
    hlhsr:        list available hlhsr modes/identifiers
    escapes:      list available escapes

    connid:       connection id [defaults to CONID_DEFAULT]
    wstype:       workstation type [defaults to WSTYPE_DEFAULT]

$ PREDEF COLOR WSTYPE 15 Return
```

(continued on next page)

Example 1–1 (Cont.) GKS_PREDEF Program Example

```
Color Information for Digital LCP01 or LCG01 printer (15) devices

    Default color model: RGB (1)
    Number of color models: 4
    Color models:
       RGB (1)
       CIE (2)
       HSV (3)
       HLS (4)
    Number of colors: 8
    Color availability: Color
    Number of predefined colors: 8

    Index    Red    Green   Blue
    =====   =====   =====   =====
       0    1.000   1.000   1.000
       1    0.000   1.000   0.000
       2    1.000   0.000   0.000
       3    0.000   0.000   1.000
       4    0.000   1.000   1.000
       5    1.000   0.000   1.000
       6    1.000   1.000   0.000
       7    0.000   0.000   0.000

    Number of colors: 8
```

1.7 Predefined Bundle Table Indexes for DEC PHIGS

The program PHIGS_PREDEF is included with the DEC PHIGS development kit. It displays information on the following predefined bundle tables and supported escapes:

- Color bundle table
- Marker bundle table
- Line bundle table
- Interior bundle table
- Edge bundle table
- Text bundle table
- View bundle table
- Depth cue bundle table
- Light bundle table
- Highlight bundle table
- HLHSR bundle table
- Curve and surface information
- Available escapes
- Connection identifier
- Workstation type

On OpenVMS systems, PHIGS_PREDEF is located in the directory SYS$COMMON:[SYSHLP.EXAMPLES.PHIGS]. The logical name PHIGS$EXAMPLES points to this directory. On UNIX systems, PHIGS_PREDEF is located in the directory /usr/lib/PHIGS/examples.

Example 1–2 provides an example of using this program on a OpenVMS system to list predefined color indexes for the Digital LCP01 printer device.

Example 1–2 PHIGS_PREDEF Program Example

```
$ PREDEF :== $PHIGS$EXAMPLES:PHIGS_PREDEF Return
$ PREDEF  Return

DEC PHIGS predefined bundle table program

Parameters:
    all:           list all information below
    color:         list predefined color bundle table
    marker:        list predefined marker bundle table
    line:          list predefined line bundle table
    interior:      list predefined interior bundle table
    edge:          list predefined edge bundle table
    text:          list predefined text bundle table
    view:          list predefined view bundle table
    depth:         list predefined depth cue bundle table
    light:         list predefined light bundle table

    highlight:     list predefined highlight bundle table
    hlhsr:         list available hlhsr modes/identifiers
    curve_surface: list curve and surface information
    escapes:       list available escapes

    connid:        connection id [defaults to PPCONID_DEFAULT]
    wstype:        workstation type [defaults to PPWSTYPE_DEFAULT]

$ PREDEF COLOR WSTYPE 15 Return
```

(continued on next page)

Example 1–2 (Cont.) PHIGS_PREDEF Program Example

```
Color Information for Digital LCP01 printer (15) devices

    Default color model: RGB (1)
    Number of color models: 1
    Color models:
       RGB (1)
    Number of direct color models: 2
    Direct color models:
       RGB (1)
       HLS (4)
    Number of rendering color models: 1
    Rendering color models:
       RGB (1)
    Number of colors in palette: 8
    Color availability: Color
    Number of predefined colors: 8

    Index    Red    Green   Blue
    =====   =====   =====   =====
       0    1.000   1.000   1.000
       1    0.000   1.000   0.000
       2    1.000   0.000   0.000
       3    0.000   0.000   1.000
       4    0.000   1.000   1.000
       5    1.000   0.000   1.000
       6    1.000   1.000   0.000
       7    0.000   0.000   0.000
```

1.8 Color and Bundle Indexes

DEC GKS and DEC PHIGS predefine color and bundle indexes for you to use within applications. When you use predefined color and bundle indexes in your programs, consider the following:

- You can change the representations of predefined bundle indexes using the SET . . . REPRESENTATION functions. For more information, see the chapter on attribute functions in the DEC GKS or DEC PHIGS binding manuals.
- The number of predefined color and bundle indexes may not be the maximum number allowed for a given workstation. For instance, DEC GKS and DEC PHIGS may predefine 10 bundles but allow a total of 15 bundle representations, leaving 5 additional undefined bundle indexes. All bundle representations can be changed.

  To determine the maximum number of bundle indexes allowed for your workstation, call the inquiry function INQUIRE WORKSTATION STATE TABLE LENGTHS for DEC PHIGS, or INQUIRE MAXIMUM LENGTH OF WORKSTATION STATE TABLES for DEC GKS. These functions return the maximum number of bundle indexes for the various kinds of bundle tables.
- If you change the representation of a color index, all output primitive bundle indexes using that color index change also. The bundles use the newly defined representation of the color index.

- Color and bundle index changes either occur dynamically or require an implicit regeneration. Implicit regenerations cause the loss of all output primitives not contained in structures or segments. For complete information on these changes, see the chapter on control functions in the DEC GKS or DEC PHIGS binding manuals.

1.9 Device-Independent HLHSR Mechanisms Support

All the graphics handlers except PEX and OSF/Motif PEX support the hidden line hidden surface removal (HLHSR) modes and identifiers listed in Table 1–3 and Table 1–4.

Table 1–3 HLHSR Mechanisms for DEC GKS

Mechanism	Description
Mode	0 (No HLHSR identifier)
	1 (Use the HLHSR identifier)
Identifier	0 (None)
	1 (Painter's algorithm)
	6 (Average Z)

Table 1–4 HLHSR Mechanisms for DEC PHIGS

Mechanism	Description
Mode	0 (None) Use the HLHSR identifier
	5 (IGNORE_ID) No HLHSR identifier
Identifier	0 (None)
	1 (Painter's algorithm)
	6 (Average Z)

An HLHSR mode removes lines or surfaces hidden by other objects from the drawing, or does not draw these lines or surfaces at all. The HLHSR identifier is set as a structure element. For information about HLHSR identifiers, see the SET HLHSR IDENTIFIER and SET HLHSR MODE functions in the DEC GKS or DEC PHIGS binding manuals.

Note

The current implementation of the Painter's HLHSR algorithm generates incorrect results on vector type devices such as the Tektronix 4014, the LVP16, and the HP–GL® plotters. These devices cannot delete lines that have already been drawn; therefore, not displaying hidden lines in a graphics output requires some effort. Using the Painter's algorithm (value 1) without a solution for removing hidden lines requires more CPU processing time and has no visible effect on the output.

1.10 Lighting Support for DEC PHIGS

All of the graphics handlers support the following light source types:

- Ambient
- Infinite (directional)
- Positional
- Spot

Use the INQUIRE LIGHT SOURCE FACILITIES function described in the DEC PHIGS binding manuals to list the maximum number of light source indexes, the maximum number of simultaneous active lights, and the number of available light source types.

On PEX devices using the PXG option, the maximum number of light source indexes is 32, while the maximum number of simultaneous active lights is 12. On PEX devices using the ZLX option, the maximum number of light source indexes is 32, and the maximum number of simultaneous active lights is 32.

To obtain reasonable results on an 8-plane system, DEC PHIGS ignores light source colors with the DECwindows and OSF/Motif device types, and on a PEX 8-plane workstation. DEC PHIGS converts light source color to hue, lightness, and saturation (HLS), and then uses only the lightness (L) component of the light source to compute the lightness component in an object's color. Note that there are no hue shifts due to the effects of lighting.

See Appendix F for DEC PHIGS lighting equations.

1.11 Depth Cueing Support for DEC PHIGS

All of the graphics handlers support allowed and suppressed depth cueing modes. Use the INQUIRE DEPTH CUE FACILITIES function described in the DEC PHIGS binding manuals to list the maximum number of depth cue table entries and the number of predefined depth cue indexes. See Appendix F for DEC PHIGS depth cueing equations.

1.12 Pattern Support for DEC GKS

Almost none of the graphics handlers support the SET PATTERN REPRESENTATION, SET PATTERN REFERENCE POINT, and SET PATTERN SIZE functions. DEC GKS accepts calls to these functions, but the pattern representation, size, and reference point used by the graphics handlers remain unaltered.

The exception to this rule is the graphics handler supporting the Tektronix 4100, Tektronix 4200, and Digital VS500 devices. This handler supports the function SET PATTERN REPRESENTATION, but not the SET PATTERN REFERENCE POINT and SET PATTERN SIZE functions. DEC GKS accepts calls to these functions, but the pattern size and reference point used by this graphics handler remain unaltered.

DEC GKS also supports user-settable patterns on the PostScript device.

Note

DEC PHIGS does not support patterns in Version 3.2.

1.13 Generalized Structure Elements

DEC PHIGS does not support generalized structure elements (GSEs).

1.14 Pixel Inquiries for DEC GKS

The pixel inquiry functions INQUIRE PIXEL and INQUIRE PIXEL ARRAY are supported on the following graphics handlers:

- DECwindows
- DECwindows PEX
- OSF/Motif
- OSF/Motif PEX
- Tektronix 4100 and 4200, and Digital VS500
- VWS

The pixel inquiry functions INQUIRE PIXEL and INQUIRE PIXEL ARRAY are not supported on the following graphics handlers:

- HPPCL
- LCG01
- LJ250 and LA324
- LVP16 and HP–GL
- PostScript
- ReGIS
- Sixel
- Tektronix 4014

1.15 Device Coordinate Information for DEC GKS and DEC PHIGS

DEC GKS and DEC PHIGS return device coordinates in meters for the following devices:

- DECwindows devices
- LVP16 and HP–GL plotters and recorders
- OSF/Motif devices
- PEX devices
- PostScript devices
- VWS devices

DEC GKS and DEC PHIGS return device coordinates in units other than meters for the following devices:

- HPPCL ink jet printers
- LCG01 ink jet printers
- LJ250 and LA324 printers
- PEX devices
- ReGIS devices

- Sixel printers
- Tektronix 4014 terminals
- Tektronix 4128, 4129, and Digital VS500 devices

The exact values depend on the screen size and workstation type. Use the INQUIRE DISPLAY SPACE SIZE function to determine the exact value for your device.

1.16 Environment Options

Environment options that are supported for each device are listed at the beginning of each chapter. For example, Table 1–5 lists two of the environment options supported by a PostScript device.

Table 1–5 PostScript Environment Options

Syntax	Description
Connection Identifier	
GKS$CONID GKSconid PHIGS$CONID PHIGSconid	Specifies the default workstation connection information. On OpenVMS systems, the startup procedure, GKSTARTUP.COM or PHIGS$STARTUP.COM, sets the default value. For example, on OpenVMS systems, you define the DEC PHIGS logical name for the connection identifier for a PostScript device as follows: $ **DEFINE PHIGS$CONID FILE.PS** Return On UNIX systems, you define the DEC GKS environment variable for the connection identifier for a PostScript device as follows: % **setenv GKSconid file.ps** Return
Workstation Type	
GKS$WSTYPE GKSwstype PHIGS$WSTYPE PHIGSwstype	Specifies the workstation type. On OpenVMS systems, the startup procedure, GKSTARTUP.COM or PHIGS$STARTUP, sets the default value. For example, on OpenVMS systems, you define the DEC PHIGS logical name for the monochrome PostScript printer workstation type as follows: $ **DEFINE PHIGS$WSTYPE 61** Return On UNIX systems, you define the DEC GKS environment variable for the color PostScript printer workstation type as follows: % **setenv GKSwstype 62** Return

See Chapter 12 for a complete list of the environment options supported by PostScript devices.

All the DEC GKS and DEC PHIGS OpenVMS logical names begin with GKS$ and PHIGS$, respectively. All the DEC GKS and DEC PHIGS UNIX environment variables begin with GKS and PHIGS, respectively, followed by the name of the environment variable in lowercase letters.

CGM Output

2
CGM Output

This chapter provides a brief overview of the internal format of Computer Graphics Metafiles (CGM). DEC GKS and DEC PHIGS define the workstation category CGM_OUTPUT to use when creating metafiles. Note that DEC GKS and DEC PHIGS can create, but cannot interpret, metafiles.

If you need to understand the CGM encoding formats in depth, see the CGM standard ANSI X3.122-1986. All references to the CGM standard in this chapter use this standard document.

2.1 Computer Graphics Metafiles

DEC GKS and DEC PHIGS support the CGM encoding format for use in creating metafiles. To create a file formatted for CGM, open and activate a workstation of category CGM_OUTPUT. (Note that DEC GKS and DEC PHIGS cannot interpret files formatted for CGM.)

The CGM standard defines a metafile as a mechanism for retaining and transporting graphical data and control information. This device-independent information contains one or more pictures. Because the CGM standard provides functionality for many types of graphics applications (not just DEC GKS and DEC PHIGS), certain DEC GKS and DEC PHIGS functionality may not be supported by the CGM format, and certain CGM capabilities cannot be used within a DEC GKS or DEC PHIGS program. When you create a CGM using DEC GKS or DEC PHIGS, CGM records only those features supported by the CGM format.

2.2 Environment Options

Table 2–1 summarizes the environment options you can use with CGM structures.

Table 2–1 CGM Environment Options

Syntax	Description
Connection Identifier	
GKS$CONID GKSconid PHIGS$CONID PHIGSconid	Specifies the default workstation connection information. On OpenVMS systems, the startup procedure, GKSTARTUP.COM or PHIGS$STARTUP.COM, sets the default value. For example, on OpenVMS systems, you define the DEC PHIGS logical name for the connection identifier for the device as follows: $ **DEFINE PHIGS$CONID *FILE.CGM*** Return On UNIX systems, you define the DEC GKS environment variable for the connection identifier for the device as follows: % **setenv GKSconid *file.cgm*** Return
Font Element List	
GKS$CGM_FONTS GKScgm_fonts PHIGS$CGM_FONTS PHIGScgm_fonts	Defines a list of font indexes. You can specify Hershey fonts (the default value), PostScript fonts, or both. For example, on OpenVMS systems, you define the DEC PHIGS logical name for the PostScript fonts as follows: $ **DEFINE PHIGS$CGM_FONTS "POSTSCRIPT"** Return On UNIX systems, you define the DEC GKS environment variable for both the Hershey and PostScript fonts as follows: % **setenv GKScgm_fonts "all"** Return See Section 2.12 for more information on selecting fonts.
Workstation Type	
GKS$WSTYPE GKSwstype PHIGS$WSTYPE PHIGSwstype	Specifies the workstation type. On OpenVMS systems, the startup procedure, GKSTARTUP.COM or PHIGS$STARTUP.COM, sets the default value. On OpenVMS systems, you define the DEC PHIGS logical name for the CGM output workstation type as follows: $ **DEFINE PHIGS$WSTYPE 7** Return On UNIX systems, you define the DEC GKS environment variable for the CGM output workstation type as follows: % **setenv GKSwstype 7** Return

2.3 Valid Bit Mask Values

The CGM standard defines three encodings. Encodings are formats used to store data within the metafile. The data types and values used to store information within the metafile varies depending on the encoding you use to create the metafile. The following list presents the three CGM encodings:

- Character encoding—A format whose physical file takes a minimal amount of storage
- Binary encoding—A format easily stored and read by many types of machine architectures and applications

- Clear text encoding—A format that can easily be read or edited by application programmers who wish to use the metafile

DEC GKS and DEC PHIGS support all three formats. The following bit mask is valid for use with the CGM output workstation:

Workstation Type	Hexadecimal Value	Description
7	%x000*n*0007	CGM output (using integer virtual display coordinates (VDC))

The value in the first part (000*n*) specifies the desired encoding. The value in the second part is the hexadecimal value of the CGM output workstation type (7 decimal).

The possible values for *n* include the following:

Value	Encoding
2	Character encoding
3	Binary encoding
4	Clear text encoding

The remaining sections describe the following topics in detail:

- Differences between CGM, and DEC GKS and DEC PHIGS graphics facilities
- CGM structure
- Supported encodings
- Element descriptions
- CGM physical file organization
- CGM encoding examples

2.4 Differences Between DEC GKS and DEC PHIGS, and CGM

Because CGM is designed to format files for many types of graphics applications, there is no unique relationship between CGM, and DEC GKS and DEC PHIGS. If CGM does not support a graphics facility of DEC GKS and DEC PHIGS, the metafile does not attempt to simulate such a facility. If the metafile structure supports a graphic facility unsupported by DEC GKS and DEC PHIGS, a DEC GKS or DEC PHIGS program will not generate those unsupported CGM elements.

DEC GKS and DEC PHIGS do not define graphics output in terms of pictures, as does CGM. Consequently, the CGM interpreter must determine what constitutes a new CGM picture definition.

The following list presents the DEC GKS and DEC PHIGS graphics facilities that are not supported by CGM:

- CGM does not support the changing of workstation transformations. Workstation transformations cause the CGM interpreter to start a new picture definition.

- A call to CLEAR WORKSTATION causes the CGM interpreter to start a new picture definition. For example, if at least one meaningful element call, such as POLYLINE, appears before the CLEAR WORKSTATION call, CGM produces a file with only one page.
- CGM has no elements that correspond to the DEC GKS and DEC PHIGS SET *primitive* REPRESENTATION functions.
- CGM does not support the DEC GKS segment and DEC PHIGS structure storage.

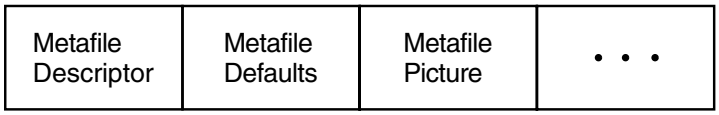
The following list presents the CGM facilities that are not supported by DEC GKS or DEC PHIGS:

- DEC GKS and DEC PHIGS do not support the extended text processing facilities of CGM (such as changing character sets and appended text).
- DEC GKS and DEC PHIGS do not support auxiliary color and direct color specification CGM facilities.

2.5 CGM Structure

The CGM standard defines three components within a metafile, as shown in Figure 2–1.

Figure 2–1 CGM Components



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The metafile descriptor component contains data relevant to the functional capabilities required to interpret that metafile. For example, this component can contain data such as a metafile descriptive string or title, the version number of the CGM standard used by the implemented CGM interpreter, the date of the metafile creation, and so forth. (Note that the format of this data depends on the encoding you choose.)

The metafile defaults component contains data relevant to all the picture definitions contained in the metafile. For example, this component can contain data such as the virtual display coordinate boundary (this corresponds to the DEC GKS and DEC PHIGS normalized device coordinate plane), attribute settings, and so forth.

Each metafile picture component contains data relevant to pictures created by a DEC GKS or DEC PHIGS program. Because the DEC GKS and DEC PHIGS standards do not define graphics output in terms of pictures, the CGM interpreter must use the *display surface empty* and *new frame necessary at update* entries in the DEC GKS or DEC PHIGS state list to determine when a picture ends and when a new picture begins.

CGM files contain components called elements. Each element serves a distinct purpose, and depending on its functionality, includes applicable data. CGM specifies an element by providing the encoding-dependent opcode and argument data. The opcode is a character or series of characters that specify the beginning of a distinct element.

The following list describes the types of elements in a metafile:

Category	Description
Delimiter elements	Separate components within the metafile
Metafile descriptor elements	Describe the functional content and unique characteristics of the metafile
Picture descriptor elements	Define the limits of the VDC points, and the parameter modes for the attribute elements
Control elements	Specify size and precision of the VDC points, and format descriptions of the CGM elements
Graphical primitive elements	Describe the geometric objects in the picture
Attribute elements	Describe the various appearances of the graphics elements
Escape elements	Describe device- and system-specific functionality
External elements	Pass information not needed for the creation of a picture (for example, a message sent to the user of the metafile)

Although CGM defines many data types that correspond to graphics data (for example, an index data type for bundle index specifications), there are a few data types from which all others are derived. The following list presents all the basic data types of information contained in a metafile:

Data Type	Description
Integer	Integer values such as bundle indexes, integer data, and so forth
Real	Real values such as VDC distance values; red, green, and blue color intensities; coordinate points; and so forth
String	Character strings such as metafile description titles and string data
Point list	Lists of points such as polyline points, polymarker points, and so forth

The characters used to specify an opcode and its data are encoding-specific. The following sections provide a brief overview of the supported encodings.

2.6 Character Encoding

The CGM character encoding provides a character code for each of the element opcodes, and provides storage-saving methods for storing argument data. This is the most storage-efficient encoding.

The CGM character encoding specifies either one or two 7-bit ASCII characters that correspond to each element opcode. For example, for the BEGIN METAFILE opcode, CGM places the two ASCII characters 3/0 and 2/0 into the metafile. (Table 2–2 in Section 2.8 lists the ASCII notations that correspond to each of the element opcodes.)

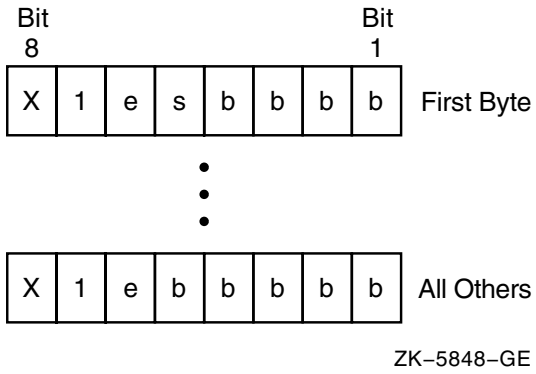
To translate the opcode notation into an ASCII value that corresponds to a character, multiply the first number by the value 16, and add the product to the number after the slash character (/). The notation 3/0 corresponds to ASCII value 48. For many 7-bit ASCII charts, the first number specifies the chart column and the number following the slash indicates the chart row. To find the ASCII character that corresponds to 3/0, look in column 3, row 0.

To encode data, the CGM character encoding uses a basic format. The basic format applies to the following CGM data types:

- Enumerated types
- Color indexes
- Indexes other than color indexes
- Integers
- Real numbers

Figure 2–2 presents the CGM character encoding basic format.

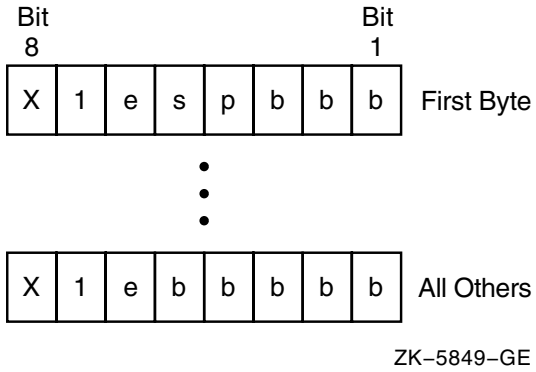
Figure 2–2 CGM Basic Data Encoding Format



CGM encodes each type of data in one or more bytes. Each byte contains bits that specify data values. In Figure 2–2, bit X is the value 0. Bit e (the sixth bit) is the extension flag. This flag contains the value 1 in all bytes except the last byte in the data specification. In the last byte, the flag contains the value 0. Bit s (the fifth bit of the first byte) is the sign bit (the value 0 for nonnegative numbers; the value 1 for negative numbers). Bits labeled b specify the numeric value in binary. The most significant bits are in the first byte and the least significant bits are in the last byte.

CGM encodes each real number as an integer mantissa followed by an exponent. The exponent is the power of 2 by which the integer mantissa is to be multiplied. Figure 2–3 illustrates how CGM uses the basic format to encode real numbers.

Figure 2–3 CGM Basic Encoding Format for Real Numbers



In Figure 2–3 bit e is the extension bit, and bit s is the sign bit. Bit p is the "exponent follows" bit, which is always the value 1. The last three bits in the first byte contain the exponent; the remaining bits are the mantissa.

The DEC GKS and DEC PHIGS CGM character encoding scheme uses the displacement mode to encode point list data. Displacement mode specifies pairs of VDC values that are the X and Y delta values relative to the last specified point.

CGM codes character strings as sequences of bytes starting with the designated OPEN CHARACTER STRING character and ending with the STRING TERMINATOR character.

The CGM encoding scheme defines many ways to encode data. For complete information concerning character encoding, see the CGM standard.

2.7 Clear Text Encoding

The CGM clear text encoding provides a character string for each of the element opcodes, and numbers and delimiters to specify argument data. Using this type of encoding, you can easily type or edit the metafile.

For example, this encoding represents the BEGIN METAFILE opcode as the character string BEGMF. DEC GKS and DEC PHIGS use the semicolon (;) to separate element opcodes. (Table 2–2 in Section 2.8 lists the character strings that correspond to each of the element opcodes.)

DEC GKS and DEC PHIGS specify integers as numbers, and separate the decimal portion of real numbers using a period (.). If you edit a clear text encoded metafile, you can insert comments delimited by percent signs (%). DEC GKS and DEC PHIGS use the single quote character to delimit strings (').
The DEC GKS and DEC PHIGS CGM clear text encoding mechanism for point lists is as follows:

- DEC GKS and DEC PHIGS enclose each pair of points in parentheses (( )).
- DEC GKS and DEC PHIGS separate each point specification, within a pair, using a comma (,).
- DEC GKS and DEC PHIGS separate the parenthetical point groupings using spaces.

For more information concerning clear text encoding, see the CGM standard.

2.8 Element Descriptions

Table 2–2 lists the opcodes required for each of the CGM elements. The first opcode listed is the 7-bit ASCII notation of the character or characters used by the character encoding, and the second opcode listed is the character string used by the clear text encoding.

Table 2–2 CGM Element Descriptions

Element Name	Opcode	Argument Data Description
BEGIN METAFILE	3/0 2/0 BEGMF	A string value specifying the metafile identifier.
END METAFILE	3/0 2/1 ENDMF	No data required.
BEGIN PICTURE	3/0 2/2 BEGPIC	A string value specifying the picture identifier.
BEGIN PICTURE BODY	3/0 2/3 BEGPICBODY	No data required.
END PICTURE	3/0 2/4 ENDPIC	No data required.
METAFILE VERSION	3/1 2/0 MFVERSION	An integer value corresponding to the version of the CGM standard being used.
METAFILE DESCRIPTION	3/1 2/1 MFDESC	A string value that describes the metafile contents.
VDC TYPE	3/1 2/2 VDCTYPE	An enumerated type specifying the virtual display coordinate type, which corresponds to the DEC GKS normalized device coordinate plane (INTEGER, REAL).
INTEGER PRECISION	3/1 2/3 INTEGERPREC	A value (of an encoding-dependent data type) that specifies the integer precision.
REAL PRECISION	3/1 2/4 REALPREC	A value or values (of an encoding-dependent data type) that specify the subfields of the real number precision.
INDEX PRECISION	3/1 2/5 INDEXPREC	A value (of an encoding-dependent data type) that specifies the precision of an index into a bundle table.
COLOR PRECISION	3/1 2/6 COLRPREC	A value (of an encoding-dependent data type) that specifies the subfields of the precision of red, green, and blue color intensity values.
COLOR INDEX PRECISION	3/1 2/7 COLRINDEXPREC	A value (of an encoding-dependent data type) that specifies the precision of an index into a color table.
MAX COLOR INDEX	3/1 2/8 MAXCOLRINDEX	A positive nonzero integer that is the maximum color index value.
COLOR VALUE EXTENT	3/1 2/9 COLRVALUEEXT	Two sets of red, green, and blue intensity real values that are the minimum and maximum color values.
METAFILE ELEMENT LIST	3/1 2/10 MFELEMLIST	A value (of an encoding-dependent data type) containing a list of all application-specific elements contained in this metafile.
BEGIN DEFAULTS REPLACEMENT	3/1 2/11 BEGMFDEFAULTS	Control, picture descriptor, and attribute element list of the same format as described for the corresponding elements.

(continued on next page)

Table 2–2 (Cont.) CGM Element Descriptions

Element Name	Opcode	Argument Data Description
END DEFAULTS REPLACEMENT	3/1 2/12 ENDMFDEFAULTS	No data required.
FONT LIST	3/1 2/13 FONTLIST	A list of strings that assigns a font index value, beginning with the value 1, to each font in the list.
CHARACTER SET LIST	3/1 2/14 CHARSETLIST	A list of information that specifies up to five of the supported character sets (from ISO 2022). Each pair consists of an enumerated value (such as <94-character>) followed by a short string describing the "tail end" of designating escape sequences for that set (such as 4/1).
CHARACTER CODING ANNOUNCER	3/1 2/15 CHARCODING	An enumerated type specifying the code extension technique assumed by the metafile creator (BASIC 7-BIT, BASIC 8-BIT, EXTENDED 7-BIT, EXTENDED 8-BIT).
SCALING MODE	3/2 2/0 SCALEMODE	An enumerated type value and a real value. The enumerated value specifies either ABSTRACT or METRIC. If ABSTRACT, the VDC space is correctly displayed at any size. If METRIC, the real value is the workstation surface distance in millimeters that corresponds to a single VDC point.
COLOR SELECT MODE	3/2 2/1 COLRMODE	An enumerated type that specifies color selection support (INDEXED, DIRECT); DIRECT specifies that color selections are by red, green, and blue intensity value.
LINE WIDTH SPEC MODE	3/2 2/2 LINEWIDTHMODE	An enumerated type specifying line width. ABSOLUTE specifies a measurement in VDC points; SCALED specifies a scale factor to be applied to a workstation-dependent nominal width.
MARKER SIZE SPEC MODE	3/2 2/3 MARKERSIZEMODE	An enumerated type specifying marker size. ABSOLUTE specifies a measurement in VDC points; SCALED specifies a scale factor to be applied to a workstation-dependent nominal size.
EDGE WIDTH SPEC MODE	3/2 2/4 EDGEWIDTHMODE	An enumerated type specifying edge width. ABSOLUTE specifies a measurement in VDC points; SCALED specifies a scale factor to be applied to a workstation-dependent nominal width.
VDC EXTENT	3/2 2/5 VDCEXT	Two sets of points that define opposite corners of a rectangular area of the VDC plane. This establishes the positive and negative directions for the VDC plane.
BACKGROUND COLOR	3/2 2/6 BACKCOLR	A set of red, green, and blue intensity values for the background color.
VDC INTEGER PREC	3/3 2/0 VDCINTEGERPREC	A value (of an encoding-dependent data type) containing the precision for integers used to designate VDC points.
VDC REAL PREC	3/3 2/1 VDCREALPREC	A value (of an encoding-dependent data type) containing the precision for real numbers used to designate VDC points.
AUXILIARY COLOR	3/3 2/2 AUXCOLR	An integer auxiliary color index used to color a primitive in transparency mode.

(continued on next page)

Table 2–2 (Cont.) CGM Element Descriptions

Element Name	Opcode	Argument Data Description
TRANSPARENCY	3/3 2/3 TRANSPARENCY	An enumerated type that specifies whether the transparency color is used to draw subsequent primitives (OFF, ON).
CLIP RECTANGLE	3/3 2/4 CLIPRECT	Two VDC point values specifying the clipping rectangle range.
CLIP INDICATOR	3/3 2/5 CLIP	An enumerated type specifying the clipping status (OFF, ON).
POLYLINE	2/0 INCRLINE	A set of points, each consecutive point connected to the last by a line.
DISJOINT POLYLINE	2/1 INCRDISJTLINE	A set of points, the first connected to the second, the third connected to the fourth, and so on, leaving spaces in the line.
POLYMARKER	2/2 INCRMARKER	A set of points, a special character drawn at each point.
TEXT	2/3 TEXT	A VDC starting point, an enumerated flag, and a string. If the flag is NOT FINAL, you can specify elements to change the text attributes between this element and the APPEND TEXT element. If the flag is FINAL, the string is the entire string to be displayed.
RESTRICTED TEXT	2/4 RESTRTEXT	Two VDC values that are the height and width vectors, a VDC starting point, an enumerated flag (as described in TEXT), and a string. The text must be contained within the parallelogram created using the starting point, and height and width vectors.
APPEND TEXT	2/5 APNDTEXT	An enumerated flag value (as described in TEXT) and a string. The flag value determines whether you can specify other elements between this element and a subsequent APPEND element.
POLYGON	2/6 INCRPOLYGON	A series of VDC points specifying a polygon.
POLYGON SET	2/7 INCRPOLYGONSET	A flagged point list, each list item containing a point and an enumerated flag. Each point is connected to the subsequent point or to the current closure point, but not to both. The flag can be one of the edge values INVISIBLE, VISIBLE, CLOSE INVISIBLE, CLOSE VISIBLE.
CELL ARRAY	2/8 CELLARRAY	Two diagonal VDC corner points, a third corner point clockwise between the starting point and diagonal points, a two-dimensional list of either color indexes or intensity values, and local color precision (format determined by the encoding).
GDP	2/9 GENERALIZED DRAWING PRIMITIVE	An integer generalized drawing primitive (GDP) identifier, a point list, and a data record (used in an interpreter-dependent manner).
RECTANGLE	2/10 RECT	Two VDC points specifying the starting point and the diagonal point of the rectangle.
CIRCLE	3/4 2/0 CIRCLE	A VDC center point and a VDC distance vector used as the radius.

(continued on next page)

Table 2–2 (Cont.) CGM Element Descriptions

Element Name	Opcode	Argument Data Description
CIRCLE ARC 3 POINT	3/4 2/1 ARC3PT	A starting point, an intermediate point, and an end point.
CIRCLE ARC 3 POINT CLOSE	3/4 2/2 ARC3PTCLOSE	A starting point, an intermediate point, an end point, and an enumerated close flag (PIE, CHORD).
CIRCULAR ARC CENTER	3/4 2/3 ARCCTR	A center point, a distance *x* and *y* vector for the starting point, a distance *x* and *y* vector for the end point, and a VDC radius distance vector.
CIRCULAR ARC CENTER CLOSE	3/4 2/4 ARCCTRCLOSE	A center point, a distance *x* and *y* vector for the starting point, a distance *x* and *y* vector for the end point, a VDC radius distance vector, and an enumerated close flag (PIE, CHORD).
ELLIPSE	3/4 2/5 ELLIPSE	A center point and an endpoint for each conjugate diameter.
ELLIPTICAL ARC	3/4 2/6 ELLIPARC	A center point, two endpoints on each conjugate diameter, a distance *x* and *y* vector for the starting point, and a distance *x* and *y* vector for the end point.
ELLIPTICAL ARC CLOSE	3/4 2/7 ELLIPARCCLOSE	A center point, two endpoints on each conjugate diameter, a distance *x* and *y* vector for the starting point, a distance *x* and *y* vector for the end point, and an enumerated close flag (PIE, CHORD).
LINE BUNDLE INDEX	3/5 2/0 LINEINDEX	Integer index value into the line bundle table.
LINE TYPE	3/5 2/1 LINETYPE	Integer line type value.
LINE WIDTH	3/5 2/2 LINEWIDTH	Either a VDC absolute value or a real scale specification.
LINE COLOR	3/5 2/3 LINECOLR	Either an integer index value or a set of red, green, and blue real values.
MARKER BUNDLE INDEX	3/5 2/4 MARKERINDEX	An integer index value into the polymarker bundle table.
MARKER TYPE	3/5 2/5 MARKERTYPE	An integer value specifying a marker type.
MARKER SIZE	3/5 2/6 MARKERSIZE	Either a VDC absolute value or a real scale specification.
MARKER COLOR	3/5 2/7 MARKERCOLR	Either an integer index value or a set of red, green, and blue real values.
TEXT BUNDLE INDEX	3/5 3/0 TEXTINDEX	An integer value that is a pointer into the text bundle table.
TEXT FONT INDEX	3/5 3/1 TEXTFONTINDEX	An integer index value associated with a previously specified font.
TEXT PRECISION	3/5 3/2 TEXTPREC	An enumerated type (STRING, CHARACTER, STROKE).
CHARACTER EXPANSION FACTOR	3/5 3/3 CHAREXPAN	A nonnegative real number specifying the height-to-width ratio.
CHARACTER SPACING	3/5 3/4 CHARSPACE	A real value specifying character spacing.

(continued on next page)

Table 2–2 (Cont.) CGM Element Descriptions

Element Name	Opcode	Argument Data Description
TEXT COLOR	3/5 3/5 TEXTCOLR	Either a color index integer or a set of red, green, and blue intensity values.
CHARACTER HEIGHT	3/5 3/6 CHARHEIGHT	A VDC value specifying character height.
CHARACTER ORIENTATION	3/5 3/7 CHARORI	A pair of *x* and *y* directional vector values (VDC points) that define which way is up, and a pair of *x* and *y* directional vector values (VDC points) that define the text base.
TEXT PATH	3/5 3/8 TEXTPATH	An enumerated type value that determines the text path (RIGHT, LEFT, UP, DOWN).
TEXT ALIGNMENT	3/5 3/9 TEXTALIGN	An enumerated type specifying horizontal alignment (NORMAL HORIZONTAL, LEFT, CENTRE, RIGHT, CONTINUOUS HORIZONTAL), an enumerated type specifying vertical alignment (NORMAL VERTICAL, TOP, CAP, HALF, BASE, BOTTOM, CONTINUOUS VERTICAL), and two real values specifying continuous horizontal and vertical alignments that align the string with a coordinate outside its text extent.
CHARACTER SET INDEX	3/5 3/10 CHARSETINDEX	An integer index value that chooses a previously specified character set.
ALTERNATE CHARACTER SET INDEX	3/5 3/11 ALTCHARSETINDEX	An integer index value that chooses a previously specified character set.
FILL BUNDLE INDEX	3/6 2/0 FILLINDEX	An integer value that points into the fill area bundle table.
INTERIOR STYLE	3/6 2/1 INTSTYLE	An enumerated type that specifies interior fill area style (HOLLOW, SOLID, PATTERN, HATCH, EMPTY).
FILL COLOR	3/6 2/2 FILLCOLR	Either an integer color index value or a set of red, green, and blue intensity values.
HATCH INDEX	3/6 2/3 HATCHINDEX	An integer value that specifies a hatch style.
PATTERN INDEX	3/6 2/4 PATINDEX	An integer value that specifies a pattern type.
EDGE BUNDLE INDEX	3/6 2/5 EDGEINDEX	An integer value that points into the edge bundle table.
EDGE TYPE	3/6 2/6 EDGETYPE	An integer value that specifies the edge type.
EDGE WIDTH	3/6 2/7 EDGEWIDTH	Either an absolute edge width specified in a VDC value, or an edge width scale factor.
EDGE COLOR	3/6 2/8 EDGECOLR	Either an integer color index value or a set of red, green, and blue intensity values.
EDGE VISIBILITY	3/6 2/9 EDGEVIS	An enumerated value specifying edge visibility (OFF, ON).
FILL REFERENCE POINT	3/6 2/10 FILLREFPT	A real value specifying the fill area reference point.

(continued on next page)

Table 2–2 (Cont.) CGM Element Descriptions

Element Name	Opcode	Argument Data Description
PATTERN TABLE	3/6 2/11 PATTABLE	An integer value specifying the placement of this pattern in the pattern table, a two-dimensional list of either color indexes or intensity values, and local color precision (format determined by the encoding).
PATTERN SIZE	3/6 2/12 PATSIZE	Two VDC values that specify the *x* and *y* components of the height distance vector, and two VDC values that specify the *x* and *y* components of the width distance vector.
COLOR TABLE	3/6 3/0 COLRTABLE	An integer that specifies a pointer into the bundle table where the first color value is placed, and a list of sets of red, green, and blue intensity values used to fill the table.
ASPECT SOURCE FLAGS	3/6 3/1 ASF	A list of pairs of enumerated ASF type values and ASF values (INDIVIDUAL, BUNDLED).
ESCAPE	3/7 2/0 ESCAPE	An integer function identifier, and a data record (implementation-dependent use).
MESSAGE	3/9 2/1 MESSAGE	An enumerated type specifying the action flag that determines whether the application requires some action by the user before resuming application execution (NO ACTION, ACTION), and the text string containing the message.
APPLICATION DATA	3/7 2/1 APPLDATA	An integer identifier, and a data record, both to be used in an application-dependent manner that does not affect the picture being generated.
OPEN CHARACTER STRING	1/11 5/8 '	A character that signifies the beginning of a character string. NOTE: This character is not an opcode. It usually follows an opcode that requires string data.
STRING TERMINATOR	1/11 5/12 '	A character that signifies the end of a character string. NOTE: This character is not an opcode. It usually follows an opcode that requires string data.

2.9 Physical File Organization

The DEC GKS and DEC PHIGS metafile outputs 512-byte records. Using the clear text encoding, the DEC GKS and DEC PHIGS metafile separates element opcodes with a semicolon (;), a line-feed, and a carriage return character.

2.10 CALS and TOP Application Profiles

The CALS and MAP/TOP application communities define the application profiles of CGM. These two profiles are virtually identical. The application profile specifies constraints on generators and interpreters for technical details that are left undefined in the CGM standard. The application profile also specifies semantics that were left ambiguous in the CGM standard. For example, the CALS and TOP profiles limit primitives such as polylines to 1024 points. The CALS and TOP application profiles eliminate some of the uncertainty of using CGM by making the resource requirements known, rendering elements unambiguous, and prohibiting the use of private data in the metafile.

2.11 CALS and TOP Data Precision

CGM output is written in VDC points. VDC points are integer numbers in either low precision (16 bits) or high precision (32 bits). The default is low precision. Either precision can be selected along with normal or CALS and TOP mode using the workstation type bit mask as follows:

%x00mn0007

The value for n specifies the encoding method described in Section 2.6. The possible values for m include the following:

Value	Encoding
0	Low precision normal mode
1	Low precision CALS and TOP mode
2	High precision normal mode
3	High precision CALS and TOP mode

2.12 Font Selection

CGM contains the element font list that associates a text string with a font index in the picture portion of the CGM file. This information is used by a CGM interpreter in an attempt to use the original font that the generating application intended.

The contents of the font list are selected through a logical name on OpenVMS systems or through an environment variable on UNIX systems. See Table 2–1 for the logical name and environment variable.

For DEC GKS and DEC PHIGS, the values for the environment options are as follows:

Value	Description
PostScript	Use the PostScript font list only.
Hershey	Use the Hershey font list only.
All	Use both the PostScript and Hershey font lists.

If no environment option is provided, the default value is Hershey. The CGM font list for Hershey contains the following elements:

- DEC:ISO_LATIN_SIMPLEX
- DEC:ISO_LATIN_SIMPLEX
- HERSHEY:CARTOGRAPHIC_ROMAN_GREEK
- HERSHEY:SIMPLEX_ROMAN
- HERSHEY:SIMPLEX_GREEK
- HERSHEY:SIMPLEX_SCRIPT
- HERSHEY:MEDIUM_COMPLEX_ROMAN
- HERSHEY:MEDIUM_COMPLEX_GREEK
- HERSHEY:MEDIUM_COMPLEX_ITALIC

- HERSHEY:COMPLEX_ROMAN
- HERSHEY:COMPLEX_GREEK
- HERSHEY:COMPLEX_ITALIC
- HERSHEY:DUPLEX_ROMAN
- HERSHEY:COMPLEX_SCRIPT
- HERSHEY:COMPLEX_CYRILLIC
- HERSHEY:TRIPLEX_ROMAN
- HERSHEY:TRIPLEX_ITALIC
- HERSHEY:GOTHIC_GERMAN
- HERSHEY:GOTHIC_ENGLISH
- HERSHEY:GOTHIC_ITALIAN
- HERSHEY:SYMBOL_SET_1
- HERSHEY:SYMBOL_SET_2
- HERSHEY:SYMBOL_SET_3
- HERSHEY:MATH_SYMBOLS

The CGM font list for PostScript contains a list of PostScript fonts. For the complete list, see Chapter 12 in this manual.

In CALS or TOP mode, the OpenVMS logical name is ignored and the font list contains only the following fonts:

- HERSHEY:SIMPLEX_ROMAN
- HERSHEY:COMPLEX_ROMAN
- HERSHEY:COMPLEX_ITALIC
- HERSHEY:COMPLEX_GREEK

The remaining fonts are either mapped into the list of fonts where the logical name is ignored, or the fonts are simulated using the DEC GKS and DEC PHIGS device-independent stroke fonts. This means that line elements are put into the CGM file instead of text elements when the text is simulated.

2.13 Encoding Examples

Example 2–1 presents a simple DEC GKS program that illustrates how to create a metafile.

Example 2–1 Metafile Creation

```
      IMPLICIT NONE
      INTEGER WS_ID, VT240, CONID_DEFAULT
      REAL X_ARRAY(2), Y_ARRAY(2)
      DATA X_ARRAY /0.0, 1.0/
      DATA Y_ARRAY /0.5, 0.5/
      DATA WS_ID / 1 /, VT240 / 13 /,
     * CONID_DEFAULT / 0 /

      CALL GKS$OPEN_GKS ('SYS$ERROR:')
      CALL GKS$OPEN_WS (WS_ID, CONID_DEFAULT, VT240)
      CALL GKS$ACTIVATE_WS (WS_ID)

      CALL GKS$POLYLINE (2, X_ARRAY, Y_ARRAY)

      CALL GKS$DEACTIVATE_WS (WS_ID)
      CALL GKS$CLOSE_WS (WS_ID)
      CALL GKS$CLOSE_GKS ()
      END
```

Example 2–2 presents the clear text encoded metafile produced by Example 2–1. Define the logical name GKS$WSTYPE to be %x00040007 to specify the clear text encoding.

Example 2–2 Clear Text Encoded Metafile

```
BegMF "";
MFVersion 1;
MFDesc "DEC GKS CGM Generator V1.0/V3.24 ";
MFElemList"DRAWINGSET  BegMFDefaults  EndMFDefaults  ColrIndexPrecMaxColrIndex
  IntegerPrec  RealPrec  IndexPrec  ColrPrec  ColrValueExt  FontList
CharSetList  CharCoding  ScaleMode  ColrMode  LineWidthMode  MarkerSizeMode
EdgeWidthMode";
VDCType integer;
IntegerPrec -32767 32767;
RealPrec -32767.0 32767.0 4;
IndexPrec -32767 32767;
ColrPrec 255;
ColrIndexPrec 255;
ColrValueExt 0 0 0 255 255 255;
MaxColrIndex 255;
BegMFDefaults;
VDCIntegerPrec -32767 32767;
VDCExt 0 0 4095 4095;
EndMFDefaults;
```

(continued on next page)

Example 2–2 (Cont.) Clear Text Encoded Metafile

```
FontList "DEC:ISO_LATIN_SIMPLEX" "DEC:ISO_LATIN_SIMPLEX"" HERSHEY:CARTOGRAPHIC_R
OMAN_GREEK" "HERSHEY:SIMPLEX_ROMAN" "HERSHEY:SIMPLEX_GREEK" "HERSHEY:SIMPLEX_SCR
IPT" "HERSHEY:MEDIUM_COMPLEX_ROMAN" "HERSHEY:MEDIUM_COMPLEX_GREEK" "HERSHEY:MEDI
UM_COMPLEX_ITALIC" "HERSHEY:COMPLEX_ROMAN" "HERSHEY:COMPLEX_GREEK" "HERSHEY:COMP
LEX_ITALIC" "HERSHEY:DUPLEX_ROMAN" "HERSHEY:COMPLEX_SCRIPT" "HERSHEY:COMPLEX_CYR
ILLIC" "HERSHEY:TRIPLEX_ROMAN" "HERSHEY:TRIPLEX_ITALIC" "HERSHEY:GOTHIC_GERMAN"
"HERSHEY:GOTHIC_ENGLISH" "HERSHEY:GOTHIC_ITALIAN" "HERSHEY:SYMBOL_SET_1" "HERSHE
Y:SYMBOL_SET_2" "HERSHEY:SYMBOL_SET_3" "HERSHEY:MATH_SYMBOLS";
CharCoding basic7bit;
BegPic "";
ScaleMode abstract 1.0;
ColrMode indexed;
LineWidthMode scaled;
MarkerSizeMode scaled;
EdgeWidthMode scaled;
BegPicBody;
ClipRect 0 0 4094 4094;
Line 0 2047 4094 2047;
EndPic;
EndMF;
```

DDIF Output Workstation

3
DDIF Output Workstation

DIGITAL Document Interchange Format (DDIF) is the format for the interchange of revisable compound documents (including illustrations) with Digital document processing systems. This chapter provides the information needed to use DEC GKS and DEC PHIGS to produce DDIF output that can be incorporated into other DDIF documents. It provides the predefined color and bundle indexes for the DDIF output facility. DEC GKS and DEC PHIGS predefine these indexes for you to use within your applications.

3.1 Copying DDIF Files from UNIX Systems to OpenVMS Systems

On OpenVMS systems, files containing DDIF information are expected to have the DDIF semantic attribute set, or they are ignored by DDIF tools.

After copying a DDIF file from a UNIX system to an OpenVMS system, check the semantic attribute using the following DCL command:

```
$ DIR/FULL Return
```

If the file semantic is *not* DDIF, set it with the following DCL command:

```
$ SET FILE/SEMANTIC=DDIF filename.doc Return
```

3.2 DDIF Output

DDIF output is written to a file. The file name is specified from the DEC GKS or DEC PHIGS connection identifier.

If you choose the default font (Font 1), the text is preserved as DDIF text and can be edited with a DDIF editor. DEC GKS and DEC PHIGS display other fonts as a simulation; DDIF does not store them as text objects.

3.3 Environment Options

Table 3–1 summarizes the environment options you can use with the DDIF output device.

Table 3–1 DDIF Environment Options

Syntax	Description
Connection Identifier	
GKS$CONID GKSconid PHIGS$CONID PHIGSconid	Specifies the default workstation connection information. On OpenVMS systems, the startup procedure, GKSTARTUP.COM or PHIGS$STARTUP.COM, sets the default value. For example, on OpenVMS systems, you define the DEC PHIGS logical name for the connection identifier for the device as follows: $ **DEFINE PHIGS$CONID *FILE.DDIF*** Return On UNIX systems, you define the DEC GKS environment variable for the connection identifier for the device as follows: % **setenv GKSconid *file.ddif*** Return
Language	
GKS$LANGUAGE GKSlanguage PHIGS$LANGUAGE PHIGSlanguage	Specifies whether to use the English language (value 0) or Japanese language (value 22). The default value is 0. See Section 3.8 for more information on Japanese fonts. For example, on OpenVMS systems, you define the DEC PHIGS logical name for the English language as follows: $ **DEFINE PHIGS$LANGUAGE 0** Return On UNIX systems, you define the DEC GKS environment variable for the Japanese language as follows: % **setenv GKSlanguage 22** Return
Workstation Type	
GKS$WSTYPE GKSwstype PHIGS$WSTYPE PHIGSwstype	Specifies the workstation type. On OpenVMS systems, the startup procedure, GKSTARTUP.COM or PHIGS$STARTUP.COM, sets the default value. For example, on OpenVMS systems, you define the DEC PHIGS logical name for the DDIF output workstation type as follows: $ **DEFINE PHIGS$WSTYPE 250** Return On UNIX systems, you define the DEC GKS environment variable for the DDIF output workstation type as follows: % **setenv GKSwstype 250** Return

3.4 Valid Bit Mask Values

The standard DDIF workstation type is defined as a constant DDIF in the binding-dependent header files for DEC PHIGS and DEC GKS.

You can specify hexadecimal bit mask values as workstation type values. Using DDIF output, you use the bit mask values to control color mapping.

The following bit mask is used for DDIF output:

Workstation Type	Hexadecimal Value	Description
250	%x*acbb*00FA	DDIF Output

The value in the first part (*acbb*) specifies the orientation and size of the output page. The possible values for *a* include the following:

Value	Paper Orientation
0	Portrait: The picture is taller than it is wide. This is the default setting.
1	Landscape: The picture is wider than it is tall.

Page size is specified by *bb*. The possible values include the following:

Value	Paper Size
00	Paper size is A (8.5 × 11 inches). This is the default setting.
01	Paper size is Legal (8.5 × 14 inches).
02	Paper size is B (11 × 17 inches).
03	Paper size is C (17 × 22 inches).
04	Paper size is D (22 × 34 inches).
05	Paper size is E (34 × 44 inches).
10	Paper size is A0 (84.1 × 118.9 centimeters).
20	Paper size is A1 (59.4 × 84.1 centimeters).
30	Paper size is A2 (42 × 59.4 centimeters).
40	Paper size is A3 (29.7 × 42 centimeters).
50	Paper size is A4 (21 × 29.7 centimeters).
60	Paper size is A5 (14.8 × 21 centimeters).
70	Paper size is B4 (25.7 × 36.4 centimeters).
80	Paper size is B5 (18.2 × 25.7 centimeters).

The number of requested colors is specified by *c*. This number is expressed as a power of 2; *c* can be any value from 0 (the default value) to 7. A value of 0 selects the maximum number of available colors.

The value in the second part (00FA) is the hexadecimal value of the DDIF workstation type (decimal 250).

3.5 Differences Between DEC GKS and DEC PHIGS, and DDIF

Because DDIF is designed to format files for many types of graphics applications, there is no unique relationship between DDIF, and DEC GKS and DEC PHIGS. If DDIF does not support a graphics facility of DEC GKS and DEC PHIGS, the metafile does not attempt to simulate such a facility. If the metafile structure supports a graphic facility unsupported by DEC GKS and DEC PHIGS, a DEC GKS or DEC PHIGS program will not generate those unsupported DDIF elements.

DEC GKS and DEC PHIGS do not define graphics output in terms of pictures, as does DDIF. Consequently, the DDIF interpreter must determine what constitutes a new DDIF picture definition.

The following list presents the DEC GKS and DEC PHIGS graphics facilities that are not supported by DDIF:

- DDIF does not support the changing of workstation transformations. Workstation transformations cause the DDIF interpreter to start a new picture definition.
- A call to CLEAR WORKSTATION causes the DDIF interpreter to start a new picture definition. For example, if at least one meaningful element call, such as POLYLINE, appears before the CLEAR WORKSTATION call, DDIF produces a file with only one page.
- DDIF has no elements that correspond to the DEC GKS and DEC PHIGS SET *primitive* REPRESENTATION functions.
- DDIF does not support the DEC GKS segment and DEC PHIGS structure storage.

The following list presents the DDIF facilities that are not supported by DEC GKS or DEC PHIGS:

- DEC GKS and DEC PHIGS do not support the extended text processing facilities of DDIF (such as changing character sets and appended text).
- DEC GKS and DEC PHIGS do not support auxiliary color and direct color specification DDIF facilities.

3.6 Color Capabilities

This section provides information on the number of reserved color indexes for the DDIF workstation. DEC GKS and DEC PHIGS predefine these indexes for your use within applications.

3.6.1 Color Reservation

The number of reserved color indexes affects the number of colors in the color table. In turn, the number of colors in the color table determines the size of each of the bundle tables. The number of predefined colors for the DDIF devices is in the range 2 to 248.

The DDIF handler replicates each entry in each primitive's bundle set by color table entries 1 to n. The value for n ranges from 1 to 7, depending on the number of reserved color indexes. If you reserve more than eight color indexes, the value of n is 7. (The default bundle tables never use the color index 0.)

The first eight default colors and their equivalent intensity values are as follows:

Index	Red	Green	Blue
0	1.000	1.000	1.000
1	0.000	0.000	0.000
2	1.000	0.000	0.000
3	0.000	1.000	0.000

Index	Red	Green	Blue
4	0.000	0.000	1.000
5	0.000	1.000	1.000
6	1.000	0.000	1.000
7	1.000	1.000	0.000

Color indexes 8 to 32 are random colors defined so that any two colors can be used side by side without causing difficulty in distinguishing between them. Indexes 33 to 248 are defined by incrementing the blue, green, and red intensity values in that order.

Table 3–2 lists the color table files that define these color values.

Table 3–2 Color Table Files

Operating System	File Name
OpenVMS	SYS$SHARE:VAXGFX$DDIF_COLOR_TABLE.DAT
UNIX	/lib/vaxgfx_ddif_color_table.dat

For example, on OpenVMS systems, define your own color table for DEC PHIGS as follows:

```
$ DEFINE PHIGS$DDIF_COLOR_TABLE TABLE_FILENAME Return
```

On UNIX systems, define your own color table for DEC GKS as follows:

```
% setenv GKS_ddif_color_table table_filename Return
```

The default table holds the definitions of 248 colors. You can add more colors to the table by defining more blue, green, and red combinations. Up to 32K colors can be requested.

If there is no color table file available, the DDIF device handler uses an internal color table that is the same as the VAXstation II/GPX color table.

The number of colors available is as follows:

- If you request more colors than are in the table, all the colors in the table are made available.
- If you request fewer colors than are in the table, the number requested is made available, starting with color 1.

For more information on workstation-type bit masks and color index reservation, see Section 3.4.

3.7 Pattern and Hatch Values

This section describes the available fill area pattern and hatch values for all DDIF output. The positive numeric style values are patterns (mixtures of colors) and the negative values are hatches (device-dependent designs, such as cross-hatches, dots, horizontal lines, and so forth). The style values are passed with the SET FILL AREA STYLE INDEX function.

If you change the default color representations, all patterns using that color index use the new color representation.

DEC PHIGS does not support patterns.

3.7.1 Available Fill Area Hatch Values

The following table identifies the predefined fill area hatch value indexes and describes the results.

Style Index	Appearance
–1	Cross-hatches
–2	Dark diagonal lines at 45 degrees
–3	Dark diagonal lines at –45 degrees
–4	Dark horizontal lines
–5	Dark vertical lines
–6	Light diagonal lines at 45 degrees—sparse
–7	Light diagonal lines at –45 degrees—sparse
–8	Light horizontal lines—sparse
–9	Light vertical lines—sparse
–10	Diagonal lines at 45 degrees
–11	Diagonal lines at –45 degrees
–12	Horizontal lines
–13	Vertical lines
–14	Very light diagonal lines at 45 degrees—sparse
–15	Very light diagonal lines at –45 degrees—sparse
–16	Very light horizontal lines—sparse
–17	Very light vertical lines—sparse
–18	Darkest diagonal lines at 45 degrees
–19	Darkest diagonal lines at –45 degrees
–20	Darkest horizontal lines
–21	Darkest vertical lines
–22	Dark diagonal lines at 45 degrees—sparse
–23	Dark diagonal lines at –45 degrees—sparse
–24	Dark horizontal lines—sparse
–25	Dark vertical lines—sparse
–26	Darkest diagonal lines at 45 degrees—sparse
–27	Darkest diagonal lines at –45 degrees—sparse
–28	Darkest horizontal lines—sparse
–29	Darkest vertical lines—sparse
–30	Dark horizontal lines—very fine
–31	Dark vertical lines—very fine
–32	Finely woven grid
–33	Sparsely woven grid

3.7.2 Predefined Fill Area Pattern Values for DEC GKS

The following table identifies the predefined fill area pattern value indexes and describes the results.

Style Index	Appearance
1	Light diagonally woven pattern (25%)
2	Light diagonally woven pattern (25%)
3	Light diagonally woven pattern (25%)
4	Light diagonally woven pattern (25%)
5	Light diagonally woven pattern (25%)
6	Light diagonally woven pattern (25%)
7	Light diagonally woven pattern (25%)
8	Darker diagonally woven pattern (50%)
9	Darker diagonally woven pattern (50%)
10	Darker diagonally woven pattern (50%)
11	Darker diagonally woven pattern (50%)
12	Darker diagonally woven pattern (50%)
13	Darker diagonally woven pattern (50%)
14	Darker diagonally woven pattern (50%)
15	Dark diagonally woven pattern (75%)
16	Dark diagonally woven pattern (75%)
17	Dark diagonally woven pattern (75%)
18	Blue dark diagonally woven pattern (75%)
19	Dark diagonally woven pattern (75%)
20	Dark diagonally woven pattern (75%)
21	Dark diagonally woven pattern (75%)
22	Horizontal brick pattern
23	Horizontal brick pattern
24	Horizontal brick pattern
25	Horizontal brick pattern
26	Horizontal brick pattern
27	Horizontal brick pattern
28	Horizontal brick pattern
29	Vertical brick pattern
30	Vertical brick pattern
31	Vertical brick pattern
32	Vertical brick pattern
33	Vertical brick pattern
34	Vertical brick pattern
35	Vertical brick pattern
36	Brick pattern at –45 degrees
37	Brick pattern at –45 degrees

Style Index	Appearance
38	Brick pattern at –45 degrees
39	Brick pattern at –45 degrees
40	Brick pattern at –45 degrees
41	Brick pattern at –45 degrees
42	Brick pattern at –45 degrees
43	Brick pattern at 45 degrees
44	Brick pattern at 45 degrees
45	Brick pattern at 45 degrees
46	Brick pattern at 45 degrees
47	Brick pattern at 45 degrees
48	Brick pattern at 45 degrees
49	Brick pattern at 45 degrees
50	Finely woven grid
51	Finely woven grid
52	Finely woven grid
53	Finely woven grid
54	Finely woven grid
55	Finely woven grid
56	Finely woven grid
57	Sparsely woven grid
58	Sparsely woven grid
59	Sparsely woven grid
60	Sparsely woven grid
61	Sparsely woven grid
62	Sparsely woven grid
63	Sparsely woven grid
64	Downward scales (fish-like)
65	Downward scales
66	Downward scales
67	Downward scales
68	Downward scales
69	Downward scales
70	Downward scales
71	Upward scales
72	Upward scales
73	Upward scales
74	Upward scales
75	Upward scales
76	Upward scales
77	Upward scales

Style Index	Appearance
78	Rightward scales
79	Rightward scales
80	Rightward scales
81	Rightward scales
82	Rightward scales
83	Rightward scales
84	Rightward scales
85	Leftward scales
86	Leftward scales
87	Leftward scales
88	Leftward scales
89	Leftward scales
90	Leftward scales
91	Leftward scales
92 to 196	Increasing densities, incrementing first by color, starting at 1/16 density, incrementing by 1/16, up to 15/16 density

3.8 Japanese Fonts

The DDIF device handler supports the following Japanese OSF/Motif fonts in string text precision. The fonts are saved as DDIF text and can be edited with a DDIF editor.

X Font Name	Font Index
–JDECW–Screen–*–JISX0201–RomanKana	–10001
–JDECW–Screen–*–JISX0208–Kanji11	–10001
–JDECW–Mincho–*–JISX0201.1976-0	–10101
–JDECW–Mincho–*–JISX0208.1983-1	–10101
–JDECW–Gothic–*–JISX0201.1976-0	–10102
–JDECW–Gothic–*–JISX0208.1983-1	–10102

To use the Japanese fonts with the English DDIF workstation type (value 250), you must set the language environment option to Japanese (value 22). If you use the Japanese DDIF workstation type (value 350), you do not need to set the language environment option. The bit mask values and many other characteristics of the Japanese DDIF workstation type are the same as the English DDIF workstation type.

DECwindows Workstation

4
DECwindows Workstation

This chapter describes the information you need to use DEC GKS and DEC PHIGS with the DECwindows workstation. All information applies to both DEC GKS and DEC PHIGS unless otherwise indicated.

To use DEC GKS or DEC PHIGS on a DECwindows workstation, the workstation must meet the following minimum requirements:

- Run X11® display.
- Have DECwindows software installed as a client where the application is actually being run.
- Have DECwindows software installed as a server on the display device.
- Run DECwindows XUI window manager on the display device.

Note

DECwindows devices are not supported on OpenVMS Alpha and Digital UNIX systems.

4.1 Environment Options

Table 4–1 summarizes the environment options you can use with the DECwindows workstation.

Table 4–1 DECwindows Environment Options

DEC GKS Syntax	DEC PHIGS Syntax
Border Size	
GKS$DECW_BORDER_SIZE GKSdecw_border_size PHIGS$DECW_BORDER_SIZE PHIGSdecw_border_size	When you run a DEC GKS or DEC PHIGS application on a DECwindows workstation, geometry management conflicts may arise with different window managers. If you get the error message "BORDER SIZE attribute incorrect," set this logical name to the value printed in the error message and run the application again. For example, on OpenVMS systems, you define the DEC PHIGS logical name for the border size as follows: $ **DEFINE PHIGS$DECW_BORDER_SIZE 20** Return On ULTRIX systems, you define the DEC GKS environment variable for the border size as follows: % **setenv GKSdecw_border_size 20** Return
Color Map Size	
GKS$DECW_COLORMAP_SIZE*mmm* GKSdecw_colormap_size*mmm* PHIGS$DECW_COLORMAP_SIZE*mmm* PHIGSdecw_colormap_size*mmm*	Used in conjunction with the *mm* field in the workstation type bit mask to specify the size of the color table allocated by the workstation. For example, if the bit mask is set to FF and you define this option to be 38, DEC GKS and DEC PHIGS will use 38 colors. If you do not define this option, DEC GKS or DEC PHIGS will use 255 colors (because the hexadecimal value FF is 255). You cannot allocate more than 255 colors. On OpenVMS systems, you define the DEC PHIGS logical name to use 36 colors in the color map as follows: $ **DEFINE PHIGS$DECW_COLORMAP_SIZE255 36** Return On ULTRIX systems, you define the DEC GKS environment variable to use 16 colors in the color map as follows: % **setenv GKSdecw_colormap_size255 16** Return
Connection Identifier	
GKS$CONID GKSconid PHIGS$CONID PHIGSconid	Specifies the default workstation connection information. On OpenVMS systems, the startup procedure, GKSTARTUP.COM or PHIGS$STARTUP.COM, sets the default value. For example, on OpenVMS systems, you define the DEC PHIGS logical name for the connection identifier of a workstation as follows: $ **DEFINE PHIGS$CONID *NODENAME::n.n*** Return On ULTRIX systems, you define the DEC GKS environment variable for the connection identifier of a workstation using the TCP/IP transport as follows: % **setenv GKSconid *nodename:n.n*** Return See Section 4.2 for more information on specifying the connection identifier.

(continued on next page)

Table 4–1 (Cont.) DECwindows Environment Options

DEC GKS Syntax	DEC PHIGS Syntax
Double Buffering Flag	
GKS$DOUBLE_BUFFERING GKSdouble_buffering PHIGS$DOUBLE_BUFFERING PHIGSdouble_buffering	Specifies that double buffering should be enabled. This option defaults to a value of 0 (FALSE) for DECwindows workstations. The only supported double buffering method for DECwindows workstations is pixmap double buffering. The value of the double buffering environment option is ignored for DECwindows workstations. Double buffering is enabled simply by the existence of the environment option. In other words, if the value of the double buffering logical name is 0, double buffering is still enabled. However, for PEX workstations, when the value of the double buffering logical name is 0, double buffering is disabled. For example, on OpenVMS systems, you define the DEC PHIGS logical name for pixmap double buffering as follows: $ **DEFINE PHIGS$DOUBLE_BUFFERING 1** Return On ULTRIX systems, you define the DEC GKS environment variable for pixmap double buffering as follows: % **setenv GKSdouble_buffering 1** Return
Font Index	
GKS$DECW_FONT_*nnn* GKSdecw_font_*nnn* PHIGS$DECW_FONT_*nnn* PHIGSdecw_font_*nnn*	Specifies the X font name string associated with the font index. For example, on OpenVMS systems, you define the DEC PHIGS logical name for the font index as follows: $ **DEFINE PHIGS$DECW_FONT_103 "X_font_name"** Return On ULTRIX systems, you define the DEC GKS environment variable for the font index as follows: % **setenv GKSdecw_font_105 "X_font_name"** Return
Font List	
GKS$DECW_FONT_LIST GKSdecw_font_list PHIGS$DECW_FONT_LIST PHIGSdecw_font_list	Defines a list of font indexes. The handler uses this list to compose the logical name that contains the X font name string. For example, on OpenVMS systems, you define the DEC PHIGS logical name for the font list as follows: $ **DEFINE PHIGS$DECW_FONT_LIST "-103, -105, -107"** Return On ULTRIX systems, you define the DEC GKS environment variable for the font list as follows: % **setenv GKSdecw_font_list "-110"** Return See Section 4.11 for more information on the fonts supported by the DECwindows workstation.

(continued on next page)

Table 4–1 (Cont.) DECwindows Environment Options

DEC GKS Syntax	DEC PHIGS Syntax
Font Mode	
GKS$DECW_FONT_MODE GKSdecw_font_mode PHIGS$DECW_FONT_MODE PHIGSdecw_font_mode	Specifies the mode that will replace the default behavior. Valid values include *no definition*, *check*, *default*, *default check*, *all*, *all check*, *all**, *all* check*. See Table 4–2 for more information on font modes. For example, on OpenVMS systems, you define the DEC PHIGS logical name for the font mode as follows: $ **DEFINE PHIGS$DECW_FONT_MODE "all"** Return On ULTRIX systems, you define the DEC GKS environment variable for the font mode as follows: % **setenv GKSdecw_font_mode "check"** Return
Font Path	
GKS$DECW_FONT_PATH GKSdecw_font_path PHIGS$DECW_FONT_PATH PHIGSdecw_font_path	Specifies the DECwindows font path. The font path is the full directory specification for the font path or a list of font paths separated by a comma. The default system directory is always searched before the user-supplied font path. For example, on OpenVMS systems, you define the DEC PHIGS logical name for the font path as follows: $ **DEFINE PHIGS$DECW_FONT_PATH -** Return _$ ***SYSTEM::DISK:[USER.FONTS]*** Return On ULTRIX systems, you define the DEC GKS environment variable for the font path as follows: % **setenv GKSdecw_font_path** ***/usr/users/lee/fonts*** Return Note that this option is not currently implemented.
Hardware Dials and Buttons	
PHIGS$USE_DIALS_AND_BUTTONS PHIGSuse_dials_and_buttons	Specifies whether the button and dial hardware is required to be available. If the value of this option is set to 0, DEC PHIGS emulates the button and dial boxes with on-screen widgets. If the value is set to 1, DEC PHIGS aborts if the button and dial boxes are not available. If no value is specified for this option, DEC PHIGS uses the button and dial hardware if it is available, or falls back to the on-screen emulation if it is not. For example, on OpenVMS systems, you define the DEC PHIGS logical name for the dials and buttons as follows: $ **DEFINE PHIGS$USE_DIALS_AND_BUTTONS 1** Return On ULTRIX systems, you define the DEC PHIGS environment variable for the dials and buttons as follows: % **setenv PHIGSuse_dials_and_buttons 1** Return For specific information on hardware dials and buttons support, see Appendix D.

(continued on next page)

Table 4–1 (Cont.) DECwindows Environment Options

DEC GKS Syntax	DEC PHIGS Syntax
Input Mode	
GKS$INPUT_FIXED GKSinput_fixed PHIGS$INPUT_FIXED PHIGSinput_fixed	Specifies whether the widgets used to display choice, string, and valuator input devices are fixed to the main output widget (value 1), or nonfixed to any widget (value 0). When input is not fixed, these widgets can be moved or minimized individually, or will be minimized with the main widget. The default value is 1, fixed input. For example, on OpenVMS systems, you define the DEC PHIGS logical name for fixed input mode as follows: $ **DEFINE PHIGS$INPUT_FIXED 1** Return On ULTRIX systems, you define the DEC GKS environment variable for nonfixed input mode as follows: % **setenv GKSinput_fixed 0** Return
Language	
GKS$LANGUAGE GKSlanguage PHIGS$LANGUAGE PHIGSlanguage	Specifies whether to use the English language (value 0), Hebrew language (value 21), or Japanese language (value 22). The default value is 0. See Section 4.14 for more information on internationalization. For example, on OpenVMS systems, you define the DEC PHIGS logical name for the Hebrew language as follows: $ **DEFINE PHIGS$LANGUAGE 21** Return On ULTRIX systems, you define the DEC GKS environment variable for the Japanese language as follows: % **setenv GKSlanguage 22** Return
Menu Bar Size	
GKS$DECW_MENU_BAR_SIZE GKSdecw_menu_bar_size PHIGS$DECW_MENU_BAR_SIZE PHIGSdecw_menu_bar_size	When you run a DEC GKS or DEC PHIGS application on a DECwindows workstation, geometry management conflicts may arise with different window managers. If you get the error message "MENU BAR SIZE attribute incorrect," set this logical name to the value printed in the error message and run the application again. If you specify the value 0, the menu bar will not be created and no screen space will be used. For example, on OpenVMS systems, you define the DEC PHIGS logical name for the menu bar size as follows: $ **DEFINE PHIGS$DECW_MENU_BAR_SIZE 10** Return On ULTRIX systems, you define the DEC GKS environment variable for no menu bar as follows: % **setenv GKSdecw_menu_bar_size 0** Return

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Table 4–1 (Cont.) DECwindows Environment Options

DEC GKS Syntax	DEC PHIGS Syntax
Resize Mode	
GKS$RESIZE_ZOOM GKSresize_zoom PHIGS$RESIZE_ZOOM PHIGSresize_zoom	Specifies the behavior of the output image when the main application widget is resized. The graphics can either be resized to match the new dimensions, or scrolling will be enabled. If the value is 0, the handler uses the scrolling resize mode of the output image. If the value is 1, the handler resizes the graphics of the output image. The default value is 0 (scrolling). For example, on OpenVMS systems, you define the DEC PHIGS logical name for the scrolling mode as follows: $ **DEFINE PHIGS$RESIZE_ZOOM 0** Return On ULTRIX systems, you define the DEC GKS environment variable for resizing as follows: % **setenv GKSresize_zoom 1** Return

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Table 4–1 (Cont.) DECwindows Environment Options

DEC GKS Syntax	DEC PHIGS Syntax
Standard Color Map	
GKS$USE_STANDARD_COLOR_MAP GKSuse_standard_color_map PHIGS$USE_STANDARD_COLOR_MAP PHIGSuse_standard_color_map	Allows several DEC GKS or DEC PHIGS 210 and 220 series workstations to share a single color map, so that separate workstations do not cause their neighboring workstations to display false colors. For example, if you want DEC PHIGS to use a standard color map (as for the true color portion of a 220 series workstation), define the logical name PHIGS$USE_STANDARD_COLOR_MAP to the X atom name of a valid standard color map. If the map is defined as RGB_BEST_MAP and the map does not exist, DEC PHIGS tries to create it. If the map is defined as any other color map and it does not exist, DEC PHIGS returns an error and does *not* open the workstation. Note that the contents of the *standard_color_map* environment option is sensitive to case and spelling. The string is taken as presented and used to ask the server for the X atom name. There is *no* default value for the *standard_color_map* environment option. If it is not defined, the handler uses a private or system color map. For example, on OpenVMS systems, you define the DEC PHIGS logical name for the standard color map as follows: `$ DEFINE PHIGS$USE_STANDARD_COLOR_MAP -` Return `_$ RGB_DEFAULT_MAP` Return On ULTRIX systems, you define the DEC GKS environment variable for the standard color map as follows: `% setenv GKSuse_standard_color_map RGB_DEFAULT_MAP` Return For more information on standard color maps, see the following books: Jones, Oliver. *Introduction to the X Window System*. Englewood Cliffs, New Jersey: Prentice Hall, 1989. Schiefler, Robert W. and Gettys, James. *X Window System, Third Edition*. Burlington, Massachusetts: Digital Press, 1992.

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Table 4–1 (Cont.) DECwindows Environment Options

DEC GKS Syntax	DEC PHIGS Syntax
Title Size	
GKS$DECW_TITLE_SIZE GKSdecw_title_size PHIGS$DECW_TITLE_SIZE PHIGSdecw_title_size	When you run a DEC GKS or DEC PHIGS application on a DECwindows workstation, geometry management conflicts may arise with different window managers. If you get the error message "TITLE SIZE attribute incorrect," set this logical name to the value printed in the error message and run the application again. For example, on OpenVMS systems, you define the DEC PHIGS logical name for the title size as follows: $ **DEFINE PHIGS$DECW_TITLE_SIZE 10** Return On ULTRIX systems, you define the DEC GKS environment variable for the title size as follows: % **setenv GKSdecw_title_size 20** Return
UID Search Path	
GKS$UID_PATH GKSuid_path PHIGS$UID_PATH PHIGSuid_path	Specifies the UID search path and overrides the standard UID file area. See Section 4.12 for more information on UIL files. For example, on OpenVMS systems, you define the DEC PHIGS logical name for the UID search path as follows: $ **DEFINE PHIGS$UID_PATH -** Return _$ **SYSTEM::DISK:[USERNAME.UID]** Return On ULTRIX systems, you define the DEC GKS environment variable for the UID search path as follows: % **setenv GKSuid_path *usr/users/smith/fonts*** Return
Workstation Type	
GKS$WSTYPE GKSwstype PHIGS$WSTYPE PHIGSwstype	Specifies the workstation type. On OpenVMS systems, the startup procedure, GKSTARTUP.COM or PHIGS$STARTUP.COM, sets the default value. For example, on OpenVMS systems, you define the DEC PHIGS logical name for a DECwindows workstation as follows: $ **DEFINE PHIGS$WSTYPE 211** Return On ULTRIX systems, you define the DEC GKS environment variable for a DECwindows workstation widget as follows: % **setenv GKSwstype 213** Return

4.2 Connection Identifier

A connection identifier must be defined for DEC GKS and DEC PHIGS to work with the DECwindows workstation. If you do not define the connection identifier, the OPEN WORKSTATION function returns an error. You can define the connection identifier in your code (or in a logical names table to which your program has access).

The definition depends on whether you are running under the OpenVMS or ULTRIX operating system and transport. For more information on local transports, see Section G.1.9.

The connection identifier also depends on which type of workstation you are using, as defined by the display identifier. The following sections are broken down by workstation type.

Workstation Types 210 and 211

For DECwindows workstations of type 210 and 211, the connection identifier must be defined using a valid DECwindows display identifier. The syntax depends on the transport mechanism.

Syntax	Transport Mechanism
nodename::n.n	Connect to display using DECnet™.
nodename:n.n	Connect to display using TCP/IP.
DECW$DISPLAY	OpenVMS—specified by the SET DISPLAY command.
local:0	ULTRIX shared memory.

In the previous table:

- The *nodename* is the name of the host machine to which the display is physically connected.
- The first *n* is required. It specifies the display on the host machine and is usually 0.
- The second *n* is optional. It is the screen identifier and defaults to 0.

Workstation Type 212

For workstations of type 212, the connection identifier is an ASCII string consisting of the X display identifier, followed by the X drawable identifier, separated by an exclamation point. Both values are expressed as decimal numbers. An example of a valid connection identifier is:

1234857!388291

Workstation Type 213

For workstations of type 213, the connection identifier is an ASCII string representing the decimal value of the widget identifier. An example of a valid connection identifier is:

396251

4.3 Valid Bit Mask Values

When using the DECwindows workstation, you can specify workstation types as hexadecimal bit masks. Use the bit mask values to control color mapping.

The DECwindows workstation contains a hardware color map that must be shared by all windows open on the workstation. The DECwindows workstation associates a virtual color map that maintains the color values for that window. If possible, the DECwindows workstation maps the virtual color maps onto the hardware color map so that the virtual maps do not overlap. (That is, all virtual color maps are resident.)

By default, DEC GKS and DEC PHIGS allocate a color map of 64 entries where available on the hardware. If you need a different size color map, then you can use a workstation-type modifier to specify the size of the color map.

By default, for DEC GKS, the DECwindows workstation color maps are shared among applications. This means that changes to DEC GKS color representations do not occur dynamically. You can use a workstation-type modifier to tell DEC GKS to use a dynamically changeable color map instead of the default color map so that color representation changes happen immediately.

The following bit masks are valid for use with the DECwindows workstation:

Workstation Type	Hexadecimal Value	Description
210	%x0*nmm*00D2	As an output-only device using DECwindows
211	%x0*nmm*00D3	As an input/output device using DECwindows
212	%x0*nmm*00D4	As an output-only device within an application drawable (window or pixmap)
213	%x0*nmm*00D5	As an input/output device within an application widget
220	%x0*nmm*00DC	As an output-only device using DECwindows PEX
221	%x0*nmm*00DD	As an input/output device using DECwindows PEX
222	%x0*nmm*00DE	As an output-only device within a PEX application drawable (window or pixmap)
223	%x0*nmm*00DF	As an input/output device within a PEX application widget

Color Table Size

Valid values for *mm* are 00 through FF, specified in hexadecimal notation. The value *mm* specifies the size of the color table used by DEC GKS and DEC PHIGS. If *mm* is 0, the workstation uses a color table of the default size. If *mm* value is nonzero, it determines the name of the color map size environment option to be translated. The size of the color table can also affect the size and content of the bundle tables. For more information concerning the effect of color table size on bundle tables, see Section 1.8.

Color Table Dynamics

Valid values for *n* are 0 (the default behavior) and 1 (dynamic color changes). The value *n* is not supported by DEC PHIGS. A value of 1 causes all SET COLOUR REPRESENTATION function calls to change the color representation immediately; the application does not have to update the workstation.

DECwindows Output Only, Value 210

Workstation type 210 is output-only. In all other respects, it behaves exactly like workstation type 211, which performs both input and output.

DECwindows Input and Output, Value 211

Workstation type 211 performs input and output, and uses the DECwindows Toolkit. Because of a restriction in the DECwindows Toolkit software, your application may not initialize the DECwindows Toolkit if it uses workstation types 210 or 211. In addition, you should not select events on any windows created by the DEC GKS or DEC PHIGS workstation.

You can create widgets that are children of certain widgets belonging to the DEC GKS or DEC PHIGS workstation. Escape functions are provided to obtain the identifiers of these widgets. The escapes are documented in Appendix B.

When the user or window manager resizes workstations of type 211, the picture may be clipped at the new window boundaries. A push button on the menu bar allows the user to restore the window to its default size and location. Scroll bars allow the user to pan the displayable region of a clipped picture.

DECwindows Drawable, Value 212

Workstation type 212 uses a preexisting window or pixmap, and is output-only. Your application must open the display and create the drawable before calling the OPEN WORKSTATION function, and it must not close the display or destroy the drawable until after it has called the CLOSE WORKSTATION function.

This workstation does not select any X events. Consequently, your application is free to select any X events on this or any other window. In addition, this workstation will *not* redraw itself when exposed or when an icon is expanded to a window. In such instances, your application should call the REDRAW ALL STRUCTURES function (for DEC PHIGS) or the REDRAW ALL SEGMENTS function (for DEC GKS) to force a redraw of the window. This workstation does not make use of the DECwindows Toolkit; your application has unrestricted use of the DECwindows Toolkit.

DECwindows Widget, Value 213

Workstation type 213 uses a preexisting DECwindows Toolkit widget. The widget must be an attached dialogue box and must be realized *before* calling the OPEN WORKSTATION function.

This type of workstation allows the use of either SAMPLE or EVENT mode for DEC GKS and DEC PHIGS input in addition to using the DECwindows Toolkit in your application. However, if you call the AWAIT EVENT function, you must set the timeout parameter to 0; otherwise, if there are no events in the queue, your application waits the full timeout amount.

Note

You cannot call REQUEST mode input with this workstation type. To do so results in an error.

Do not destroy the DECwindows workstation widget until after a call to the CLOSE WORKSTATION function.

DECwindows PEX, Values 220 to 223

Workstation types 220 to 223 have the same characteristics as workstation types 210 to 213. The information in this chapter applies to non-PEX use of DECwindows software. However, input information for DECwindows software on PEX workstations is identical. For more information on PEX workstation types, see Chapter 11.

4.4 Programming Considerations

You should review the following information before programming with DEC GKS and DEC PHIGS using the DECwindows workstation.

4.4.1 Display Size, Windows, and Echo Areas

The DECwindows workstation provides a banner that runs across the top of each window, and borders that line each side. DEC GKS and DEC PHIGS do not include borders and banners in specified window sizes or input echo area sizes. You need to adjust your window and echo area sizes for banners and borders. Use the INQUIRE DISPLAY SPACE SIZE (3) function to adjust the input echo areas so they do not overlap the output drawing area.

4.5 Cell Array Restriction for DEC GKS

DEC GKS uses the following criteria to determine whether to simulate a cell array:

- The projection type is PERSPECTIVE. You set the projection type by calling the function EVALUATE VIEW MAPPING MATRIX 3.
- The cell array is clipped.
- The borders of the cell array are not parallel to the *x*- and *y*-axes of the device.

For better performance, DEC GKS also simulates cell arrays if the size of the cells is big in relation to the number of cells.

4.6 General Information

This section provides general information, you should consider when programming with DEC GKS and DEC PHIGS using the DECwindows workstation.

- To open or query DECwindows workstation types 210, 211, 212, and 213 for DEC GKS and DEC PHIGS, your application must be running on a system that runs the DECwindows workstation client-side software. The client does *not* need a physical display device; nor does it need the DECwindows workstation server-side software.
- For DECwindows workstation types 210 and 211, the connection identifier specifies the DECwindows workstation display to use.
- If you resize the window, it may be erased and redrawn causing the loss of primitives.
- The resource identification of the window created for output can be fetched using the Inquire Window Identifiers (–304) escape function.
- The DECwindows workstation supports double buffering in two ways. For example, on OpenVMS systems, you can enable double buffering by defining the double buffering environment option name to be any value, or you can call the escape function SET DOUBLE BUFFERING. When double buffering is enabled, output is first written to a buffer and only displayed when you call UPDATE WORKSTATION or an equivalent “flush” operation.

4.7 Minimizing Color Traversal for DEC PHIGS

On DECwindows X11 devices, DEC PHIGS does a special traversal for colors to determine what colors are needed in the X color table. When regenerating the display in double buffer mode, the picture may change colors briefly as the picture is drawn into the backing buffer.

To minimize color traversal, you can create a structure with:

- POLYLINE SET WITH DATA element with a different vertex color corresponding to each fixed color needed. This element can be degenerate and should be clipped away.
- SET INTERIOR REFLECTANCE EQUATION element with the diffuse equation.
- TRIANGLE STRIP 3 WITH DATA element with a different vertex color corresponding to each lighted, shaded, and depth cued color. This element can be degenerate and should be clipped away.

When this structure is posted, DEC PHIGS allocates a cell in the X color map for each color in the POLYLINE SET WITH DATA element. DEC PHIGS allocates a constant hue gamut in the X color map for each color in the TRIANGLE STRIP WITH DATA element. If the rest of the application uses only these colors, no reallocation of color map pixels takes place; no double buffer color problems occur.

4.8 Bundle Indexes

Use the program PHIGS_PREDEF (included with the DEC PHIGS development kit) or GKS_PREDEF (included with the DEC GKS development kit) to display information on the predefined bundle tables and supported escapes for other DECwindows workstation types. (See Example 1–1 or Example 1–2.) Use the available inquiry function in the DEC GKS or DEC PHIGS binding manuals to return the specific values for these indexes.

4.9 Pattern and Hatch Values

This section describes the available fill area pattern and hatch values for the DECwindows workstation. The positive numeric style values are patterns (mixtures of colors) and the negative values are hatches (device-dependent designs, such as cross-hatches, dots, horizontal lines, and so forth). The style values are passed with the SET FILL AREA STYLE INDEX function.

If you change the default color representations, all patterns using that color index use the new color representation.

DEC PHIGS does not support patterns.

4.9.1 Available Fill Area Hatch Values

The following table identifies the available fill area hatch value indexes and describes the results.

Style Index	Appearance
–1	Cross-hatches
–2	Diagonal lines at 45 degrees

Style Index	Appearance
–3	Diagonal lines at –45 degrees
–4	Horizontal lines
–5	Vertical lines
–6	Diagonal lines at 45 degrees—sparse
–7	Diagonal lines at –45 degrees—sparse
–8	Horizontal lines—sparse
–9	Vertical lines—sparse

4.9.2 Predefined Fill Area Pattern Values (Monochrome) for DEC GKS

The following table identifies the predefined fill area pattern values for color index 1, and describes the results.

Style Index	Appearance
1	Light diagonally woven pattern (25%)
2	Darker diagonally woven pattern (50%)
3	Dark diagonally woven pattern (75%)
4	Horizontal brick pattern
5	Vertical brick pattern
6	Brick pattern at –45 degrees
7	Brick pattern at 45 degrees
8	Finely woven grid
9	Sparsely woven grid
10	Downward scales (fish-like)
11	Upward scales
12	Rightward scales
13	Leftward scales
14 to 28	Increasing densities of grey (no hatch style), starting at 1/16 density, incrementing by 1/16, up to 15/16 density

4.9.3 Predefined Fill Area Pattern Values (Color) for DEC GKS

The following table identifies the predefined fill area pattern values for color index 1, and describes the results.

Style Index	Appearance
1	Light diagonally woven pattern (25%)
2	Darker diagonally woven pattern (50%)
3	Dark diagonally woven pattern (75%)
4	Horizontal brick pattern
5	Vertical brick pattern
6	Brick pattern at –45 degrees

Style Index	Appearance
7	Brick pattern at 45 degrees
8	Finely woven grid
9	Sparsely woven grid
10	Downward scales (fish-like)
12	Rightward scales
13	Leftward scales
14 to 28	Increasing densities of grey (no hatch style), starting at 1/16 density, incrementing by 1/16, up to 15/16 density
29	Vertical lines—sparse (6.25%)
30	Vertical lines—sparse (12.5%)
31	Vertical lines—sparse (50%)
32	Vertical lines—sparse (75%)
33	Vertical lines—very fine (50%)
34	Vertical lines (25%)
35	Vertical lines (50%)
36	Vertical lines (75%)
37	Horizontal lines—sparse (6.25%)
38	Horizontal lines—sparse (12.5%)
39	Horizontal lines—sparse (50%)
40	Horizontal lines—sparse (75%)
41	Horizontal lines—very fine (50%)
42	Horizontal lines (25%)
43	Horizontal lines (50%)
44	Horizontal lines (75%)
45	Diagonal lines at 45 degrees—sparse (6.25%)
46	Diagonal lines at 45 degrees—sparse (12.5%)
47	Diagonal lines at 45 degrees—sparse (50%)
48	Diagonal lines at 45 degrees—sparse (75%)
49	Diagonal lines at 45 degrees (25%)
50	Diagonal lines at 45 degrees (50%)
51	Diagonal lines at 45 degrees (75%)
52	Diagonal lines at –45 degrees—sparse (6.25%)
53	Diagonal lines at –45 degrees—sparse (12.5%)

Style Index	Appearance
54	Diagonal lines at –45 degrees—sparse (50%)
55	Diagonal lines at –45 degrees—sparse (75%)
56	Diagonal lines at –45 degrees (25%)
57	Diagonal lines at –45 degrees (50%)
58	Diagonal lines at –45 degrees (75%)
59	Sparsely woven grid
60	Sparsely woven grid
61	Sparsely woven grid
62	Sparsely woven grid
63	Sparsely woven grid
64	Downward scales (fish-like)
65	Downward scales (fish-like)

4.10 Input Information

Each of the following input class sections lists the supported logical input device numbers, and supported prompt and echo type (PET) numbers. For a complete description of these numbers, see the chapter on input functions in the DEC GKS or DEC PHIGS binding manuals.

For all input classes, you specify the echo area in device coordinates. The DECwindows workstation device coordinate system origin is in the lower left corner of the workstation display surface.

When you request input, the DECwindows device handler places the workstation viewport at the top of any other overlapping viewports. Viewport appearance before and after the input request is unchanged.

4.10.1 Choice Input Class

Supported Logical Input Devices

The following table identifies the supported choice-class logical input devices for the DECwindows workstation.

Choice Device Types	Input Action
1, 6, 7, 8	Select with mouse. Trigger with mouse button 1. Break by selecting Cancel button when echoing is enabled or with mouse button 2 when echoing is disabled.
2	Keypad key is selection and trigger.
3	Function key is selection and trigger.
4	Mouse button down is selection and trigger.
5	Mouse button up is selection and trigger.
9	Select and trigger software button box with mouse button 1.
10	Select and trigger hardware button box by pressing button.

Supported PETs

The choice input class for the DECwindows workstation (excluding choice device types 9 and 10) supports PETs –1, 1, and 3. See the chapter on input functions in

the DEC GKS or DEC PHIGS binding reference manuals for more information on PETs.

The DECwindows workstation choice device types 9 and 10 support PETs –1, 1, 2, and 3. See Appendix D for more information on hardware dials and buttons support.

For DECwindows devices, key F1 through F6 are available and are returned as choice numbers 21 through 26. See Appendix E for more information on keypad functionality.

Default Input Values

The following table identifies the default input values for the DECwindows workstation choice-class logical input devices.

Input Construct	Default Value
PET	1
Initial choice	1
Initial status	STATUS_OK
Echo area	Varies by device
Data record	Varies by device—list of choice strings

4.10.2 Locator Input Class

Supported Logical Input Devices

The following table identifies the supported locator-class logical input devices for the DECwindows workstation.

Locator Device Types	Input Action
1, 2, 3, 4, 7	Select with mouse. Trigger with mouse button 1. Break with mouse button 2.
5	Select with mouse. Trigger with mouse button 2.
6	Select with mouse. Trigger with mouse button 3.
8	Movement is selection and trigger.

Supported PETs

The locator input class for the DECwindows workstation supports PETs –13 (DEC GKS only), –12, –11, –10, –9, –8, –7, –6, –5, –4, –3, –2, –1, 1, 2, 3, 4, 5, and 6. See the chapter on input functions in the DEC GKS or DEC PHIGS binding reference manuals for more information on PETs.

Default Input Values

The following table identifies the default input values for the DECwindows workstation locator-class logical input devices.

Input Construct	Default Value
PET	1
Initial position	Ignored
Initial view transformation	0
Echo area	Largest square
Data record	NULL

4.10.3 Pick Input Class

Supported Logical Input Devices

The following table identifies the supported pick-class logical input devices for the DECwindows workstation.

Pick Device Types	Input Action
1, 2, 3, 4	Select with mouse. Trigger with mouse button 1. Break with mouse button 2.
5	Select with mouse. Trigger with mouse button 2.
6	Select with mouse. Trigger with mouse button 3.

Supported PETs

The pick input class for the DECwindows workstation supports PETs 1, 2, and 3. See the chapter on input functions in the DEC GKS or DEC PHIGS binding reference manuals for more information on PETs.

Default Input Values

The following table identifies the default input values for the DECwindows workstation pick-class logical input devices.

Input Construct	Default Value
PET	1
Initial pick identifier	1
Initial pick path	NULL (no path) (for DEC PHIGS only)
Initial status	STATUS_OK
Echo area	Largest square
Data record	Aperture: 0.0027 in device coordinates

The size of the pick aperture is limited by the hardware cursor map.

4.10.4 String Input Class

Supported Logical Input Devices

The following table identifies the supported string-class logical input devices for the DECwindows workstation.

String Device Types	Input Action
1, 2, 4	Enter characters from keyboard. Trigger with Return key or Enter button. Break by selecting Cancel button when echoing is enabled, or by selecting Ctrl/U when echoing is disabled.
3	ASCII–encoded string. Keypress enters character and triggers device.

Supported PETs

The string input class for the DECwindows workstation supports PET 1. See the chapter on input functions in the DEC GKS or DEC PHIGS binding reference manuals for more information on PETs.

Default Input Values

The following table identifies the default input values for the DECwindows workstation string-class logical input devices.

Input Construct	Default Value
PET	1
Initial string	NULL
Echo area	Varies by device
Data record	Input buffer size: 20 ASCII characters
Initial position	1

4.10.5 Stroke Input Class

Supported Logical Input Devices

The following table identifies the supported stroke-class logical input devices for the DECwindows workstation.

Stroke Device Types	Input Action
1, 2, 3, 4	Points are entered with mouse motion. Trigger with mouse button 1. Break with mouse button 2.

Supported PETs

The stroke input class for the DECwindows workstation supports PETs 1, 3, and 4. See the chapter on input functions in the DEC GKS or DEC PHIGS binding reference manuals for more information on PETs.

Default Input Values

The following table identifies the default input values for the DECwindows workstation stroke-class logical input devices.

Input Construct	Default Value
PET	1
Initial number of points	0
Initial transformation	0
Echo area	Largest square

Input Construct	Default Value
Data record	Stroke buffer size: 80 points
	Editing position: 0
	x interval: 0.01 in world coordinate points
	y interval: 0.01 in world coordinate points
	Time interval: 0.0 seconds

4.10.6 Valuator Input Class

Supported Logical Input Devices

The following table identifies the supported valuator-class logical input devices for the DECwindows workstation.

Valuator Device Types	Input Action
1, 2, 3, 4	Select with mouse. Trigger with mouse button 1 or Enter button. Break by selecting Cancel button when echoing is enabled, or by selecting mouse button 2 when echoing is disabled.
5 to 12	Rotation of hardware dials is selection and trigger.

Supported PETs

The DECwindows workstation valuator device types 1, 2, 3, and 4 support PETs –4, –3, –2, –1, 1, 2, and 3. See the chapter on input functions in the DEC GKS or DEC PHIGS binding reference manuals for more information on PETs.

The DECwindows workstation valuator device types 5 to 12 support PETs –4, –3, –2, –1, 1, 2, and 3. See Appendix D for more information on hardware dials and buttons support.

Default Input Values

The following table identifies the default input values for the DECwindows workstation valuator-class logical input devices.

Input Construct	Default Value
PET	1
Initial value	0.5
Echo area	Varies by device
Data record	Minimum: 0.0, Maximum: 1.0

4.11 Font Support

The following sections describe how to manipulate the set of fonts supported by the DECwindows workstation. They describe the default set of fonts for each language type.

4.11.1 Default Fonts

The default set of fonts for each language is determined by defining the *language* logical name or environment variable. (See Section 4.14.)

4.11.1.1 English and ISO–Latin–1 Fonts

The following fonts are the default fonts for English and ISO–Latin–1. They are available in string precision only.

X Font Name	Font Index
–Courier–Medium–R	1
–Times–Medium–R	–101
–Times–Medium–I	–102
–Times–Bold–R	–103
–Times–Bold–I	–104
–Helvetica–Medium–R	–105
–Helvetica–Medium–O	–106
–Helvetica–Bold–R	–107
–Helvetica–Bold–O	–108
–Courier–Medium–R	–109
–Courier–Medium–O	–110
–Courier–Bold–R	–111
–Courier–Bold–O	–112
–Symbol	–113

If the font mode option is “all”, then all the fonts listed in Section 4.11.3 in the range –101 to –300 are included in the list of available fonts.

4.11.1.2 Japanese Fonts

The following fonts are the default fonts for Japanese. They are available in string precision only.

X Font Name	Font Index
–Courier–Medium–R	1
–Times–Medium–R	–101
–Times–Medium–I	–102
–Times–Bold–R	–103
–Times–Bold–I	–104
–Helvetica–Medium–R	–105
–Helvetica–Medium–O	–106
–Helvetica–Bold–R	–107
–Helvetica–Bold–O	–108
–Courier–Medium–R	–109
–Courier–Medium–O	–110
–Courier–Bold–R	–111
–Courier–Bold–O	–112
–Symbol	–113
–JDECW–Screen–*–JISX0201–RomanKana	–10001
–JDECW–Screen–*–JISX0208–Kanji11	–10001

X Font Name	Font Index
–JDECW–Mincho–*–JISX0201.1976–0	–10101
–JDECW–Mincho–*–JISX0208.1983–1	–10101
–JDECW–Gothic–*–JISX0201.1976–0	–10102
–JDECW–Gothic–*–JISX0208.1983–1	–10102

4.11.1.3 Hebrew and ISO–Latin–8 Fonts

The following fonts are the default fonts for Hebrew and ISO–Latin–8. They are available in string precision only.

X Font Name	Font Index	Comment
–DEC–Gam–Medium–R	1	Same as Courier
–Symbol	–113	
–DEC–David–Medium–R	–301	Same as Times
–DEC–David–Medium–O	–302	Same as Times Oblique
–DEC–David–Bold–R	–303	Same as Times Bold
–DEC–David–Bold–O	–304	Same as Times Bold Oblique
–DEC–Narkisstam–Medium–R	–305	Same as Helvetica
–DEC–Narkisstam–Medium–O	–306	Same as Helvetica Oblique
–DEC–Narkisstam–Bold–R	–307	Same as Helvetica Bold
–DEC–Narkisstam–Bold–O	–308	Same as Helvetica Bold Oblique
–DEC–Gam–Medium–R	–309	Same as Courier
–DEC–Gam–Medium–O	–310	Same as Courier Oblique
–DEC–Gam–Bold–R	–311	Same as Courier Bold
–DEC–Gam–Bold–O	–312	Same as Courier Bold Oblique

If the font mode option is “all”, all the fonts listed in Section 4.11.3 in the range –301 to –500 are included in the list of available fonts.

4.11.2 Font Mode Options

Table 4–2 lists the possible font mode values to use with the OpenVMS logical names GKS$DECW_FONT_MODE and PHIGS$DECW_FONT_MODE, and ULTRIX environment variables GKSdecw_font_mode and PHIGSdecw_font_mode.

Table 4–2 DECwindows Font Modes

Value	Meaning
No definition	Only the default set of fonts is available. The default set depends on the current language. The set of fonts on the X server is not checked for availability. The DECwindows device handler checks the value of the font list option. Any fonts listed in the font list option are added to the font list or redefined as existing fonts.

(continued on next page)

Table 4–2 (Cont.) DECwindows Font Modes

Value	Meaning
"**check**"	Only the default set of fonts is available. The default set depends on the current language. The set of fonts on the X server is checked for availability. The DECwindows device handler checks the value of the font list option.
"**default**"	Only the default set of fonts is available. The default set depends on the current language. The set of fonts on the X server is not checked for availability. This mode is the fastest mode. The DECwindows device handler does not check the value of the font list option.
"**default check**"	Only the default set of fonts is available, but the default set is checked to make sure the font exists on the DECwindows server. This is slightly slower than the previous option. The DECwindows device handler does not check the value of the font list option.
"**all**"	All known DECwindows fonts for the current language are made available in the font list. The set of fonts on the X server is not checked for availability. (See Section 4.11.3 for a complete list.) The DECwindows device handler checks the value of the font list option. Any fonts listed in the font list option are added to the font list or redefined as existing fonts.
"**all check**"	All known DECwindows fonts for the current language are made available in the font list. The set of fonts on the X server is checked for availability. (See Section 4.11.3 for a complete list.) The DECwindows device handler checks the value of the font list option. Any fonts listed in the font list option are added to the font list or redefined as existing fonts.
"**all***"	All known DECwindows fonts for all languages are made available in the font list. The set of fonts on the X server is not checked for availability. (See Section 4.11.3 for a complete list.) The DECwindows device handler checks the value of the font list option. Any fonts listed in the font list option are added to the font list or redefined as existing fonts.
"**all* check**"	All known DECwindows fonts for all languages are made available in the font list. The set of fonts on the X server is checked for availability. (See Section 4.11.3 for a complete list.) The DECwindows device handler checks the value of the font list option. Any fonts listed in the font list option are added to the font list or redefined as existing fonts.

4.11.3 Known Fonts

The following fonts are considered known to the DECwindows device handler.

X Font Name	Font Index
–Courier–Medium–R	1
–Times–Medium–R	–101
–Times–Medium–I	–102
–Times–Bold–R	–103
–Times–Bold–I	–104
–Helvetica–Medium–R	–105

X Font Name	Font Index
–Helvetica–Medium–O	–106
–Helvetica–Bold–R	–107
–Helvetica–Bold–O	–108
–Courier–Medium–R	–109
–Courier–Medium–O	–110
–Courier–Bold–R	–111
–Courier–Bold–O	–112
–Symbol	–113
–Terminal–Medium–R–Normal––ISO8859–1*	–114
–Terminal–Medium–R–DoubleWide––ISO8859–1*	–115
–Terminal–Medium–R–Narrow––ISO8859–1*	–116
–Terminal–Medium–R–Wide––ISO8859–1*	–117
–Terminal–Bold–R–Normal––ISO8859–1*	–118
–Terminal–Bold–R–DoubleWide––ISO8859–1*	–119
–Terminal–Bold–R–Narrow––ISO8859–1*	–120
–Terminal–Bold–R–Wide––ISO8859–1*	–121
–InterimDM–Medium–I–	–122
–BigelowHolmes–Menu–Medium–R	–123
–AvantGardeBook–R	–124
–AvantGardeBook–O	–125
–AvantGardeDemi–R	–126
–AvantGardeDemi–O	–127
–LubalinGraph–Book–R	–128
–LubalinGraph–Book–O	–129
–LubalinGraph–Demi–R	–130
–LubalinGraph–Demi–O	–131
–NewCenturySchoolbook–Medium–R	–132
–NewCenturySchoolbook–Medium–I	–133
–NewCenturySchoolbook–Bold–R	–134
–NewCenturySchoolbook–Bold–I	–135
–Souvenir–Demi–R	–136
–Souvenir–Demi–I	–137
–Souvenir–Light–R	–138
–Souvenir–Light–I	–139
–DEC–David–Medium–R*	–301
–DEC–David–Medium–O*	–302
–DEC–David–Bold–R*	–303
–DEC–David–Bold–O*	–304
–DEC–Narkisstam–Medium–R*	–305
–DEC–Narkisstam–Medium–O*	–306

X Font Name	Font Index
–DEC–Narkisstam–Bold–R*	–307
–DEC–Narkisstam–Bold–O*	–308
–DEC–Gam–Medium–R*	–309
–DEC–Gam–Medium–O*	–310
–DEC–Gam–Bold–R*	–311
–DEC–Gam–Bold–O*	–312
–DEC–Miriam–Medium–R*	–313
–DEC–Miriam–Medium–O*	–314
–DEC–Miriam–Bold*	–315
–DEC–Miriam–Bold–O*	–316
–DEC–MiriamFixed–Medium–R*	–317
–DEC–MiriamFixed–Medium–O*	–318
–DEC–MiriamFixed–Bold–R*	–319
–DEC–MiriamFixed–Bold–O*	–320
–DEC–FrankRuhl–Medium–R*	–321
–DEC–FrankRuhl–Medium–O*	–322
–DEC–FrankRuhl–Bold–R*	–323
–DEC–FrankRuhl–Bold–O*	–324
–DEC–Terminal–Medium–R–Normal––ISO8859–8*	–325
–DEC–Terminal–Medium–R–DoubleWide––ISO8859–8*	–326
–DEC–Terminal–Medium–R–Narrow––ISO8859–8*	–327
–DEC–Terminal–Medium–R–Wide––ISO8859–8*	–328
–DEC–Terminal–Bold–R–Normal––ISO8859–8*	–329
–DEC–Terminal–Bold–R–DoubleWide––ISO8859–8*	–330
–DEC–Terminal–Bold–R–Narrow––ISO8859–8*	–331
–DEC–Terminal–Bold–R–Wide––ISO8859–8*	–332
–JDECW–Screen–*–JISX0201–RomanKana	–10001
–JDECW–Screen–*–JISX0208–Kanji11	–10001
–JDECW–Mincho–*–JISX0201.1976–0	–10101
–JDECW–Mincho–*–JISX0208.1983–1	–10101
–JDECW–Gothic–*–JISX0201.1976–0	–10102
–JDECW–Gothic–*–JISX0208.1983–1	–10102

4.12 UIL Files

Much of the widget creation logic is written in User Interface Language (UIL). When the UIL files are compiled, a User Interface Database (UID) file is created. At startup, widgets are fetched out of the UID database. There are two UID files: one containing most of the widget definitions, and a language-specific file. The language-specific file contains text strings, font specification, and may contain text direction.

The UID files for DEC GKS are:

- gks*.uid

The UID files for DEC PHIGS are:

- gfx_decw.uid
- gfx_decw_en.uid (UID language-specific file for English)
- gfx_decw_jp.uid (UID language-specific file for Japanese)

To run the DECwindows device handler, the UID files must be in one of the following directories:

- The standard English language UID file area for OpenVMS systems:

  ```
  DECW$USER_DEFAULTS: -- defaults to SYS$LOGIN
  DECW$SYSTEM_DEFAULTS
  ```

- The standard English language UID file area for ULTRIX systems:

  ```
  /usr/lib/X11/uid
  ```

  On ULTRIX systems, DECwindows software searches the user's home directory before searching the standard UID file area.

You can place the UID file in any directory and set the environment option for the UID search path to that directory. Specify the full directory path name, but do not include the UID file names.

4.13 Customization

You can customize certain DECwindows attributes through the use of an Xdefaults file. Customization can also be done with the UIL files. For this capability, contact your Digital Customer Support Center.

4.13.1 Use of Xdefaults Files

Attributes modified in the Xdefaults files can either be the widget class or the actual instance of the widget. When using the widget class, prefix the class specification with the application resource. If this is not done, all widgets of that class that run from the user's session will adopt the resource change. To explicitly access the device widgets through the Xdefaults file, use the following prefix:

- Nonpopup mode: Different for each widget type
  - Choice: GFX*GFX$Pasteboard*choice_topwidget_dialog
  - Choice button box: GFX*GFX$Pasteboard*choiceb_topwidget_dialog
  - String: GFX*GFX$Pasteboard*string_topwidget_dialog
  - Valuator: GFX*GFX$Pasteboard*valuator_topwidget_dialog
- Popup mode: Different for each widget type
  - Choice: GFX*GFXChoicePopup
  - Choice button box: GFX*GFXChoiceBBoxPopup
  - String: GFX*GFXStringPopup
  - Valuator: GFX*GFXValuatorPopup
- Nonpopup or popup mode: Different for each widget type
  - Menu bar: GFX*GFXMenuBar
  - Message: GFX*message_errors_messagebox

At the end of each of these strings, place the class or instance of the attribute you want to change. See the DECwindows Toolkit documentation or widget definition include files to obtain the class names.

The following examples illustrate how to change colors on various devices.

To change the cancel button background in the valuator device to yellow, use the following syntax:

```
GFX*valuator_cancel_pushbutton.background:yellow
```

To change all widgets of the valuator to blue, use the following syntax:

```
GFX*valuator_topwidget_dialog*background:blue
```

To change all choice menu pushbuttons (in popup and nonpopup mode) to green, use the following syntax:

```
GFX*choice_menu.DwtPushButton.background:green
```

To change the menu pushbuttons only in popup mode to green, use the following syntax:

```
GFX*GFXChoicePopup*choice_menu.DwtPushButton.background:green
```

For further information on the syntax of Xdefaults file entries, see the Xdefaults file section in the worksystem documentation for the appropriate operating system. The widget class names are documented in the worksystem documentation, and are available in the widget definition include files.

4.13.2 Widget Hierarchies

Figure 4–1 through Figure 4–6 illustrate the widget hierarchy for each of the devices. These figures are provided to assist you in changing widget attributes.

When the DECwindows input mode is nonfixed, the top-level label widget is not used in the following widget hierarchies:

- Choice
- Choice Button Box
- Valuator
- String

Figure 4–1 Menu Bar

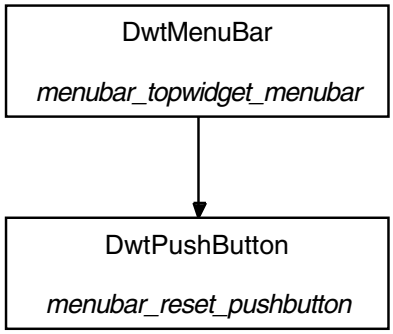

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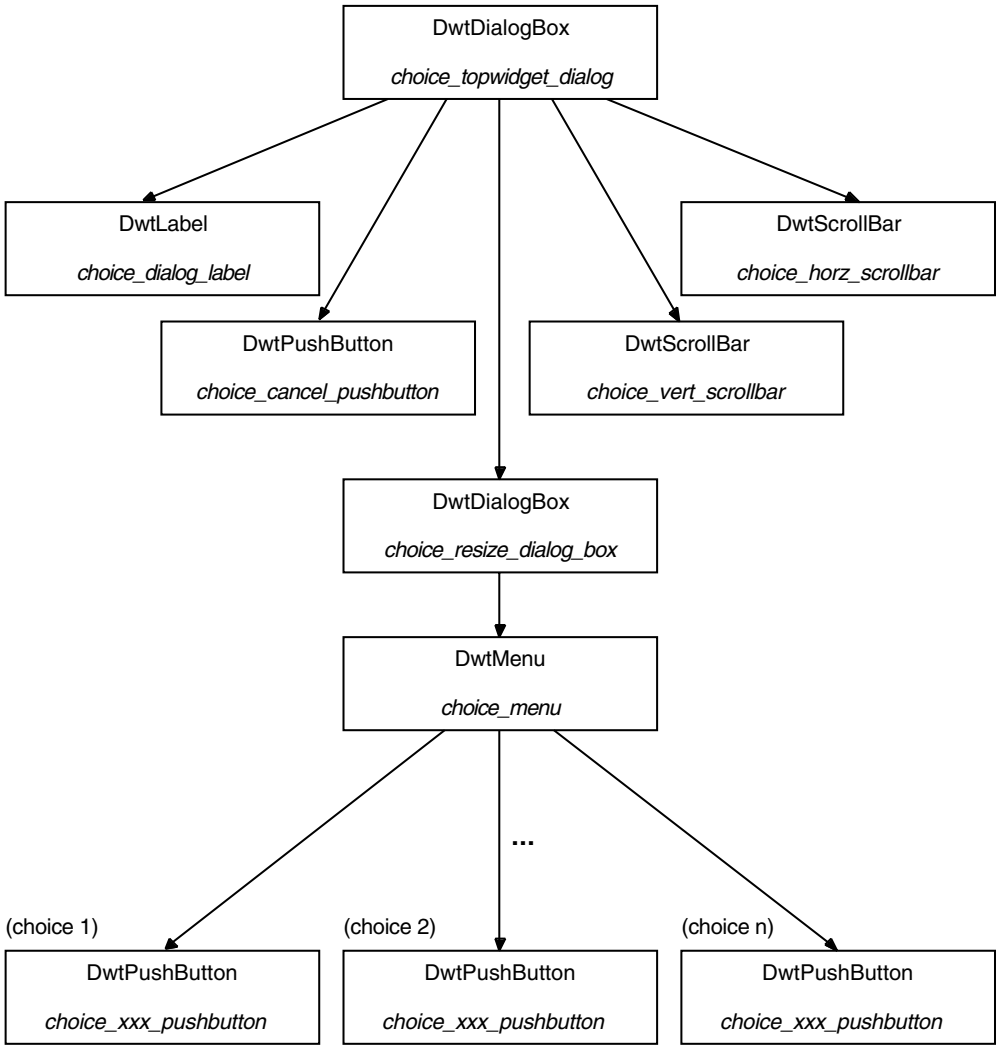
Figure 4–2 Choice Menu



xxx = default for choice PETs 2 to 5
xxx = trans for other choice PETs

ZK–9839–GE

Figure 4–3 Choice Button Box (Software)

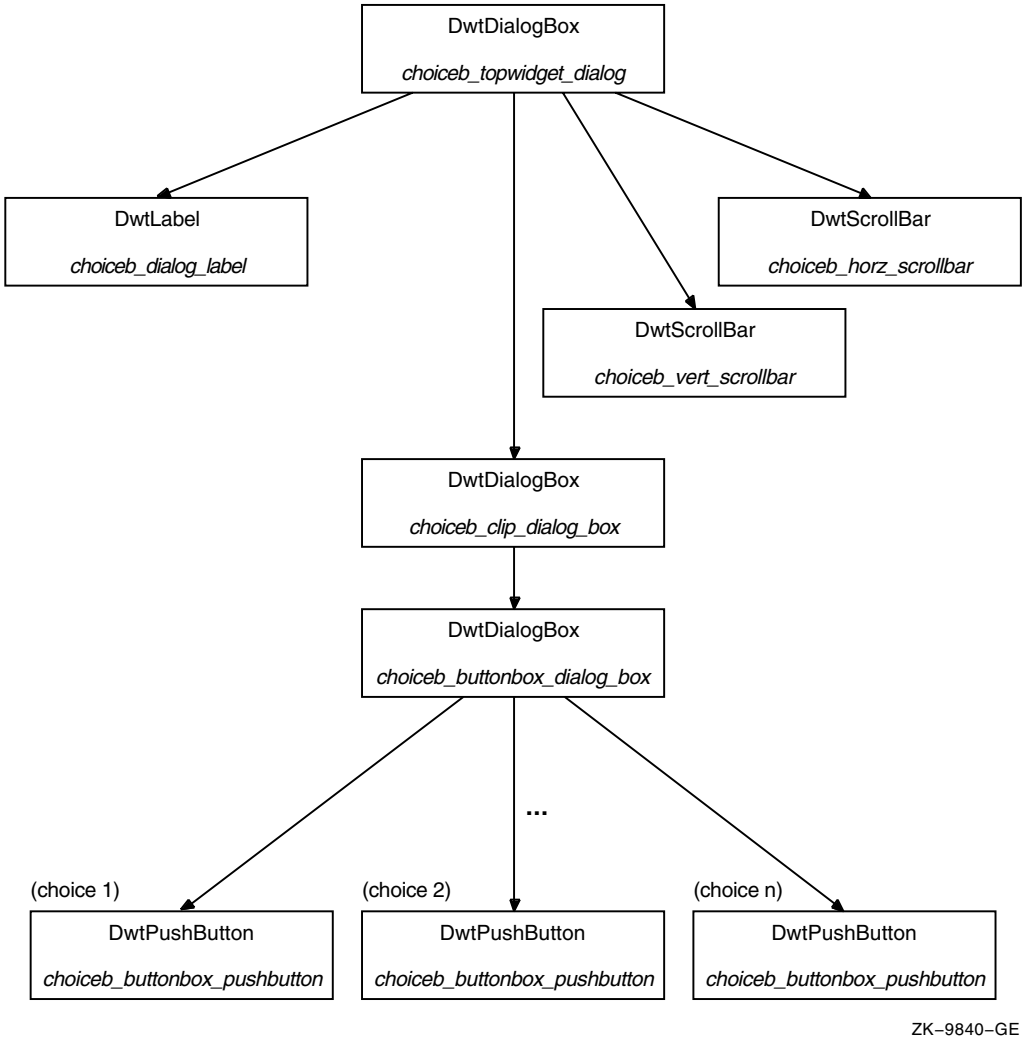


Figure 4–4 Valuator

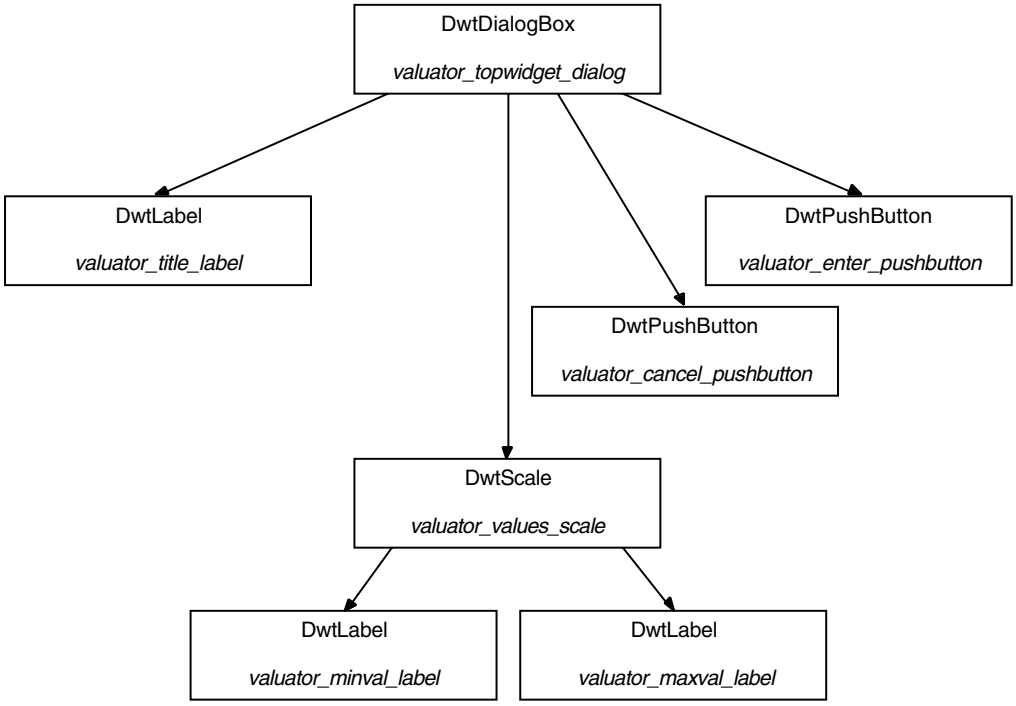


Figure 4–5 String

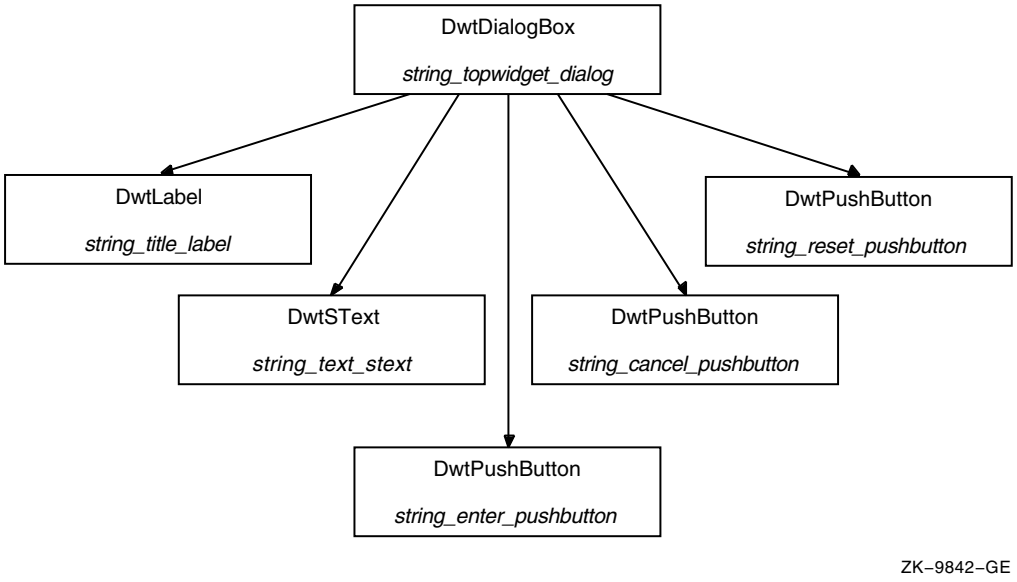


Figure 4–6 Message Box

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4.14 Internationalization

The DECwindows device handler provides the following internationalization features:

- Default font set for the specified language
- Translated text in output widgets
- Control over text direction in output widgets

Any text that is displayed outside of a widget is not translated.

Use environment options to dictate which language to use. (See Table 4–1.)

The language environment option can be set to any of the following integers:

- 0 = English
- 21 = Hebrew
- 22 = Japanese

If no language environment option is set, the default integer is 0 (English). By setting the language environment option, a language-specific UID file is read in at startup. In addition, the text direction field is set in accordance with the language type. To notify the toolkit of the current language in use, the language type can be set through the session manager. If a session manager is not available, the language type can be set through an environment option or with the Xdefaults file. See the DECwindows Toolkit documentation appropriate to your operating system.

To use the Japanese fonts with the English DECwindows workstation types, you must set the language environment option to Japanese (value 22). If you use the Japanese DECwindows workstation types (31*n*), you do not need to set the language environment option. The bit mask values and many other characteristics of the Japanese DECwindows workstation types are the same as the English DECwindows workstation types.

Note

Hebrew support is not included as part of the base DEC GKS or DEC PHIGS product, but is included as part of the localized versions.

4.15 DEC GKS Sample Application

For a DEC GKS sample program performing pick input using workstation type 213, see the DEC GKS development kit. The program GKS_PICK213 samples the pick input device, creates a simple detectable (pickable) segment, and puts the pick input device into sample mode.

HPPCL Workstation

5
HPPCL Workstation

This chapter provides the information you need to use DEC GKS and DEC PHIGS with the Hewlett-Packard LaserJet® II, which uses the PCL® Level 4 printer language. DEC GKS and DEC PHIGS support HPPCL printers as workstations of the category WSCAT_OUTPUT.

5.1 Environment Options

Table 5–1 summarizes the environment options you can use with the HPPCL printer.

Table 5–1 HPPCL Printer Environment Options

Syntax	Description
Connection Identifier	
GKS$CONID GKSconid PHIGS$CONID PHIGSconid	Specifies the default workstation connection information. On OpenVMS systems, the startup procedure, GKSTARTUP.COM or PHIGS$STARTUP.COM, sets the default value. For example, on OpenVMS systems, you define the DEC PHIGS logical name for the connection identifier of the device as follows: $ **DEFINE PHIGS$CONID *FILE.HPPCL*** Return On UNIX systems, you define the DEC GKS environment variable for the connection identifier of the device as follows: % **setenv GKSconid *file.hppcl*** Return
Workstation Type	
GKS$WSTYPE GKSwstype PHIGS$WSTYPE PHIGSwstype	Specifies the workstation type. On OpenVMS systems, the startup procedure, GKSTARTUP.COM or PHIGS$STARTUP.COM, sets the default value. For example, on OpenVMS systems, you define the DEC PHIGS logical name for the HPPCL workstation as follows: $ **DEFINE PHIGS$WSTYPE 261** Return On UNIX systems, you define the DEC GKS environment variable for the HPPCL workstation as follows: % **setenv GKSwstype 261** Return

5.2 Valid Bit Mask Values

For the HPPCL graphics handler, you can specify hexadecimal bit masks as workstation type values. Using this device, you use the bit mask values to specify the paper orientation.

The following bit masks are valid for use with the HPPCL printer:

Workstation Type	Hexadecimal Value	Description
261	%x*mynn*0105	HPPCL printer, 300 dpi. This is the default value.

The value in the first part (*mynn*) specifies the paper orientation. The value in the second part is the hexadecimal value (0105) of the workstation type. These hexadecimal values correspond to the decimal workstation type value equivalents (261 for the default 300-dpi HPPCL printer).

The possible values for *m* include the following:

Value	Paper Orientation
0	Landscape: The picture is wider than it is tall.
1	Portrait: The picture is taller than it is wide. This is the default setting.

The possible values for *y* include the following:

Value	Paper Size
0	300 dpi
1	75 dpi
2	150 dpi

The possible values for *nn* include the following:

Value	Paper Size
0	Paper size A letter (8.5 × 11 inches).
1	Legal paper size (8.5 × 14 inches).
5	Paper size A4 (21 × 29.7 centimeters).

5.2.1 Device Queues and Allocation

When using the HPPCL printer as either allocated or queued devices on OpenVMS systems, you need to set terminal characteristics by entering the following DCL command:

```
$ SET TERMINAL device_name /INTERACTIVE/NOECHO/NOTYPEAHEAD- Return
_$ /PASSTHRU/NOESCAPE/NOHOSTSYNC/TTSYNC/LOWERCASE/TAB/NOWRAP/HARDCOPY- Return
_$ /NOEIGHTBIT/NOBROADCAST/FORM/FULLDUP/SPEED=set_speed Return
```

Replace *device_name* with the name of the device to be allocated. Replace *set_speed* with a value equal to the baud rate as determined by the switches currently set on the printer.

For more information on device allocation, see the ALLOCATE command in the *OpenVMS DCL Dictionary*.

When using the HPPCL printer as either allocated or queued devices on UNIX systems, you need to set terminal characteristics by entering the following command:

```
% stty pass8 -echo new speed < /dev/ttynn Return
```

Replace *speed* with a value equal to the baud rate as determined by the switches currently set on the printer. Replace *nn* with the port number.

5.3 Printer Resolutions

This section describes the printer resolutions in dots per inch (dpi).

Printer	Horizontal	Vertical
HP LaserJet II	300	300

5.4 File Format

DEC GKS and DEC PHIGS generate an HPPCL raster graphics image bitmap.

5.5 Performance Notes

For best performance, Digital suggests using 75 dpi mode whenever possible. The 300 dpi mode takes significantly longer to process, and produces a much bigger file than does 75 dpi mode.

LCG01 Workstation

6
LCG01 Workstation

This chapter provides the information you need to use DEC GKS and DEC PHIGS with the Digital LCG01 ink jet printer. DEC GKS and DEC PHIGS support this device as a workstation of the category WSCAT_OUTPUT.

Note

The LCG01 ink jet printer is not supported on OpenVMS Alpha and Digital UNIX systems.

6.1 Environment Options

Table 6–1 summarizes the environment options you can use with an LCG01 device.

Table 6–1 LCG01 Environment Options

Syntax	Description
Connection Identifier	
GKS$CONID GKSconid PHIGS$CONID PHIGSconid	Specifies the default workstation connection information. On OpenVMS systems, the startup procedure, GKSTARTUP.COM or PHIGS$STARTUP.COM, sets the default value. For example, on OpenVMS systems, you define the DEC PHIGS logical name for the connection identifier of the device as follows: $ **DEFINE PHIGS$CONID *FILE.LCG01*** Return On ULTRIX systems, you define the DEC GKS environment variable for the connection identifier of the device as follows: % **setenv GKSconid *file.lcg01*** Return

(continued on next page)

Table 6–1 (Cont.) LCG01 Environment Options

Syntax	Description
Workstation Type	
GKS$WSTYPE GKSwstype PHIGS$WSTYPE PHIGSwstype	Specifies the workstation type. On OpenVMS systems, the startup procedure, GKSTARTUP.COM or PHIGS$STARTUP.COM, sets a default for this option. For example, on OpenVMS systems, you define the DEC PHIGS logical name for the Digital LCG01 printer workstation type as follows: $ **DEFINE PHIGS$WSTYPE 15** Return On ULTRIX systems, you define the DEC GKS environment variable for for the Digital LCG01 printer workstation type as follows: % **setenv GKSwstype 15** Return

6.2 Valid Bit Mask Values

To use the LCG01 graphics handler, you can specify hexadecimal bit masks as workstation type values. The following bit mask is valid for use with an LCG01 device:

Workstation Type	Hexadecimal Value	Description
15	%x*m*000000F	Digital LCG01 printer

The value in the first part (*m*000) specifies the paper orientation. The value in the second part is the hexadecimal value of the workstation type.

The possible values for *m* include the following:

Value	Paper Orientation
0	Landscape: The picture is wider than it is tall. This is the default setting.
1	Portrait: The picture is taller than it is wide.

If you use the workstation type constant within the DEC GKS and DEC PHIGS program, you can use a bitwise OR operation to specify either landscape or portrait orientation, by logically relating the mask constant with the workstation type constant, OR in a declaration.

6.3 Device Queues and Allocation

To use the LCG01 printer as either an allocated or queued device on a OpenVMS system, set terminal characteristics by entering the following DCL command:

```
$ SET TERMINAL device_name /NOBROADCAST/NOECHO/EIGHTBIT/NOWRAP- Return
_$ /SCOPE/NOTYPEAHEAD/LOWERCASE/FULLDUP/NOMODEM/INTERACTIVE- Return
_$ /TTSYNC/FORM/TAB/NOESCAPE /SPEED=set_speed/WIDTH=(132)- Return
_$ /PAGE=(0)/DEVICE_TYPE=(UNKNOWN) Return
```

Replace *device_name* with the name of the device to be allocated. Replace *set_speed* with a value equal to the baud rate as determined by the switches currently set on the printer.

For more information on device allocation, see the ALLOCATE command in the *OpenVMS DCL Dictionary*.

When using the LCG01 printer as either an allocated or a queued device on an ULTRIX system, you need to set terminal characteristics by entering the following command:

```
% stty pass8 -echo new cols 132 speed < /dev/ttynn Return
```

Replace *speed* with a value equal to the baud rate as determined by the switches currently set on the printer. Replace *nn* with the port number.

6.4 Pattern and Hatch Values

This section describes the available fill area pattern and hatch values for the LCG01 printer. The positive numeric style values are patterns (mixtures of colors) and the negative values are hatches (device-dependent designs, such as cross-hatches, dots, horizontal lines, and so forth). The style values are passed with the SET FILL AREA STYLE INDEX function.

If you change the default color representations, all patterns using that color index use the new color representation.

DEC PHIGS does not support patterns.

6.4.1 Available Fill Area Hatch Values

The following table identifies the available fill area hatch value indexes and describes the results.

Style Index	Appearance
–1	Cross-hatches
–2	Diagonal lines at 45 degrees
–3	Diagonal lines at –45 degrees
–4	Horizontal lines
–5	Vertical lines
–6	Diagonal lines at 45 degrees—sparse
–7	Diagonal lines at –45 degrees—sparse
–8	Horizontal lines—sparse
–9	Vertical lines—sparse
–10 to –19	Varying densities, each density in each color
–33 to –126	Hatching with the corresponding ASCII character

6.4.2 Predefined Fill Area Pattern Values for DEC GKS

The following table identifies the predefined fill area pattern value indexes and describes the results.

Style Index	Appearance
1	Mixes colors white and green
2	Mixes colors white and red
3	Mixes colors white and blue

Style Index	Appearance
4	Mixes colors white and cyan
5	Mixes colors white and magenta
6	Mixes colors white and yellow
7	Mixes colors white and black
8	Mixes colors green and red
9	Mixes colors green and blue
10	Mixes colors green and cyan
11	Mixes colors green and magenta
12	Mixes colors green and yellow
13	Mixes colors green and black
14	Mixes colors red and blue
15	Mixes colors red and cyan
16	Mixes colors red and magenta
17	Mixes colors red and yellow
18	Mixes colors red and black
19	Mixes colors blue and cyan
20	Mixes colors blue and magenta
21	Mixes colors blue and yellow
22	Mixes colors blue and black
23	Mixes colors cyan and magenta
24	Mixes colors cyan and yellow
25	Mixes colors cyan and black
26	Mixes colors magenta and yellow
27	Mixes colors magenta and black
28	Mixes colors yellow and black

LJ250 and LA324 Workstation

7

LJ250 and LA324 Workstation

This chapter provides the information you need to use DEC GKS and DEC PHIGS with the Digital LJ250 ink jet and LA324 printers. DEC GKS and DEC PHIGS support these devices as workstations of category WSCAT_OUTPUT.

Note

These devices are not supported on OpenVMS Alpha and Digital UNIX systems.

7.1 Environment Options

Table 7–1 summarizes the environment options you can use with the LJ250 and LA324 printers.

Table 7–1 LJ250 and LA324 Environment Options

Syntax	Description
Connection Identifier	
GKS$CONID GKSconid PHIGS$CONID PHIGSconid	Specifies the default workstation connection information. On OpenVMS systems, the startup procedure, GKSTARTUP.COM or PHIGS$STARTUP.COM, sets the default value. For example, on OpenVMS systems, you define the DEC PHIGS logical name for the connection identifier of the device as follows: $ **DEFINE PHIGS$CONID *FILE.LA324*** Return On ULTRIX systems, you define the DEC GKS environment variable for the connection identifier of the device as follows: % **setenv GKSconid *file.la324*** Return

(continued on next page)

Table 7–1 (Cont.) LJ250 and LA324 Environment Options

Syntax	Description
Workstation Type	
GKS$WSTYPE GKSwstype PHIGS$WSTYPE PHIGSwstype	Specifies the workstation type. On OpenVMS systems, the startup procedure, GKSTARTUP.COM or PHIGS$STARTUP.COM, sets the default value. For example, on OpenVMS systems, you define the DEC PHIGS logical name for the Digital LJ250 ink jet printer workstation type as follows: $ **DEFINE PHIGS$WSTYPE 91** Return On ULTRIX systems, you define the DEC GKS environment variable for the Digital LJ250 ink jet printer workstation type as follows: % **setenv GKSwstype 91** Return

7.2 Valid Bit Mask Values

The LJ250 and LA324 device handlers support several bit masks to control the format of output. These involve color support, print density, and paper orientation. The following bit masks are valid for use with an LJ250 printer:

Workstation Type	Hexadecimal Value	Description
91	%x*mDnn*005B	Digital LJ250 ink jet printer
92	%x*mDnn*005C	Digital LJ250 ink jet printer at 180 dpi

The value in the first part (*mDnn*) specifies the page orientation, the use of colors, and the density. The value in the second part is the hexadecimal value of the workstation type value 91 or 92.

The possible values for *m* include the following:

Value	Paper Orientation
0	Landscape: The picture is wider than it is tall.
1	Portrait: The picture is taller than it is wide.

The value *D* is a 4-bit (abcd) value determined by color allocation and print density. The possible values for *D* include the following:

True	Value of D	Description
ab	00XX	Use full 256 colors.
ab	01XX	Use 2 colors.
ab	10XX	Use 8 colors.
ab	11XX	Use 16 colors.
cd	XX00	Use 90 dpi.

True	Value of D	Description
cd	XX01	Use 72 dpi.
cd	XX10	Use 144 dpi.
cd	XX11	Use 180 dpi.

The default yields 90 dots per inch (dpi) printing with 256 possible simultaneous colors. Not all the previous combinations are supported for the LJ250 printer. The LJ250 printer supports 8 different colors in 180 dpi mode, and 256 colors in 90 dpi mode. The printer does not support 72 dpi or 144 dpi.

The following bit mask is valid for use with an LA324 printer:

Workstation Type	Hexadecimal Value	Description
93	%x*m*0*nn*005D	Digital LA324 printer

The value in the first part (*m*0*nn*) specifies the paper orientation and size. The value in the second part (005D) is the hexadecimal value of the workstation type value 93.

The possible values for *m* include the following:

Value	Paper Orientation
0	Landscape: The picture is wider than it is tall.
1	Portrait: The picture is taller than it is wide.

The possible values for *nn* include the following:

Value	Paper Size
00	Paper size A (8.5 × 11 inches)
01	Legal paper size (8.5 × 14 inches)
06	Tracker feed paper (11 × 14 inches)

Performance Considerations

The performance of the color sixel device driver is significantly affected by the density you select. For example, using 180 dpi instead of 90 dpi is two to four times slower because of the added size of the bitmap. Density is not selectable for workstation type 93.

7.3 Device Considerations

When using the LJ250 or LA324 printer as either an allocated or a queued device on an OpenVMS system, you need to set terminal characteristics by entering the following DCL commands:

```
$ SET TERMINAL device_name /NOBROADCAST/NOECHO/EIGHTBIT/NOWRAP- Return
_$ /SCOPE/NOTYPEAHEAD/LOWERCASE/FULLDUP/NOMODEM/INTERACTIVE- Return
_$ /TTSYNC/FORM/TAB/NOESCAPE/SPEED=set_speed /WIDTH=(132)- Return
_$ /PAGE=(0)/DEVICE_TYPE=(UNKNOWN) Return
```

Replace *device_name* with the name of the LJ250 or LA324 device. Replace *set_speed* with a value equal to the baud rate as determined by the switches currently set on the printer.

For more information on device allocation, see the ALLOCATE command in the *OpenVMS DCL Dictionary*. For more information on queued devices, see the *OpenVMS System Management Utilities Reference Manual*.

When using the LJ250 or LA324 printer as either an allocated or a queued device on ULTRIX systems, you need to set terminal characteristics by entering the following command:

```
% stty pass8 -echo new cols 132 speed < /dev/ttynn Return
```

Replace *speed* with a value equal to the baud rate as determined by the switches currently set on the printer. Replace *nn* with the port number.

7.4 Pattern and Hatch Values

This section describes the available fill area pattern and hatch values for the LJ250 and LA324 printers. The positive numeric style values are patterns (mixtures of colors) and the negative values are hatches (device-dependent designs, such as cross-hatches, dots, horizontal lines, and so forth). The style values are passed with the SET FILL AREA STYLE INDEX function.

If you change the default color representations, all patterns using that color index use the new color representation.

DEC PHIGS does not support patterns.

7.4.1 Available Fill Area Hatch Values

The following table identifies the available fill area hatch value indexes and describes the results.

Style Index	Appearance
–1	Cross-hatches
–2	Diagonal lines at 45 degrees
–3	Diagonal lines at –45 degrees
–4	Horizontal lines
–5	Vertical lines
–6	Diagonal lines at 45 degrees—sparse
–7	Diagonal lines at –45 degrees—sparse
–8	Horizontal lines—sparse
–9	Vertical lines—sparse

7.4.2 Predefined Fill Area Pattern Values for DEC GKS

The following table identifies the predefined fill area pattern value indexes and describes the results.

Style Index	Appearance
1	Light diagonally woven pattern (25%)
2	Darker diagonally woven pattern (50%)
3	Darkest diagonally woven pattern (75%)
4	Horizontal brick pattern
5	Vertical brick pattern
6	Brick pattern at –45 degrees
7	Brick pattern at 45 degrees
8	Finely woven grid
9	Sparsely woven grid
10	Downward scales (fish-like)
11	Upward scales
12	Rightward scales
13	Leftward scales
14 to 28	Increasing densities of grey (no hatch style), starting at 1/16 density, incrementing by 1/16, up to 15/16 density
29	Vertical lines—sparse (6.25%)
30	Vertical lines—sparse (12.5%)
31	Vertical lines—sparse (50%)
32	Vertical lines—sparse (75%)
33	Vertical lines—very fine (50%)
34	Vertical lines (25%)
35	Vertical lines (50%)
36	Vertical lines (75%)
37	Horizontal lines—sparse (6.25%)
38	Horizontal lines—sparse (12.5%)
39	Horizontal lines—sparse (50%)
40	Horizontal lines—sparse (75%)
41	Horizontal lines—very fine (50%)
42	Horizontal lines (25%)
43	Horizontal lines (50%)
44	Horizontal lines (75%)

Style Index	Appearance
45	Diagonal lines at 45 degrees—sparse (6.25%)
46	Diagonal lines at 45 degrees—sparse (12.5%)
47	Diagonal lines at 45 degrees—sparse (50%)
48	Diagonal lines at 45 degrees—sparse (75%)
49	Diagonal lines at 45 degrees (25%)
50	Diagonal lines at 45 degrees (50%)
51	Diagonal lines at 45 degrees (75%)
52	Diagonal lines at –45 degrees—sparse (6.25%)
53	Diagonal lines at –45 degrees—sparse (12.5%)
54	Diagonal lines at –45 degrees—sparse (50%)
55	Diagonal lines at –45 degrees—sparse (75%)
56	Diagonal lines at –45 degrees (25%)
57	Diagonal lines at –45 degrees (50%)
58	Diagonal lines at –45 degrees (75%)

LVP16 and HP–GL Graphics Protocol Workstation

8

LVP16 and HP–GL Graphics Protocol Workstation

This chapter describes the information on using DEC GKS and DEC PHIGS with the following devices:

- Digital LVP16 pen plotter
- HP7475 plotter
- HP7550 plotter
- HP7580 plotter
- HP7585 plotter
- MPS–2000 film recorder

DEC GKS and DEC PHIGS support these devices as workstations of category WSCAT_OUTPUT.

8.1 Environment Options

Table 8–1 summarizes the environment options you can use with the plotter and recorder devices.

Table 8–1 Plotter and Recorder Environment Options

Syntax	Description
Connection Identifier	
GKS$CONID GKSconid PHIGS$CONID PHIGSconid	Specifies the default workstation connection information. On OpenVMS systems, the startup procedure, GKSTARTUP.COM or PHIGS$STARTUP.COM, sets the default value. For example, on OpenVMS systems, you define the DEC PHIGS logical name for the connection identifier of the device as follows: $ **DEFINE PHIGS$CONID *FILE.HPGL*** Return On UNIX systems, you define the DEC GKS environment variable for the connection identifier of the device as follows: % **setenv GKSconid *file.hpgl*** Return

(continued on next page)

Table 8–1 (Cont.) Plotter and Recorder Environment Options

Syntax	Description
Threshold Value	
GKS$HPGL_THRESHOLD GKShpgl_threshold PHIGS$HPGL_THRESHOLD PHIGShpgl_threshold	If you have not defined this environment option, or if you define it to a nonnumeric value, the handler uses the default Xoff threshold level. If the environment option is defined as a negative value, or a value less than the maximum HP–GL threshold value (1023), the handler uses the default value. In all other cases, the handler sets the Xoff threshold level to the specified value. For example, on OpenVMS systems, you define the DEC PHIGS logical name for the maximum threshold value of 1023 as follows: $ **DEFINE PHIGS$HPGL_THRESHOLD 1023** Return On UNIX systems, you define the DEC GKS environment variable for a threshold value of 0 as follows: % **setenv GKShpgl_threshold 0** Return
Workstation Type	
GKS$WSTYPE GKSwstype PHIGS$WSTYPE PHIGSwstype	Specifies the workstation type. On OpenVMS systems, the startup procedure, GKSTARTUP.COM or PHIGS$STARTUP, sets the default value. For example, on OpenVMS systems, you define the DEC PHIGS logical name for a Digital LVP16 printer as follows: $ **DEFINE PHIGS$WSTYPE 52** Return On UNIX systems, you define the DEC GKS environment variable for a Hewlett-Packard HP7550 printer as follows: % **setenv GKSwstype 53** Return

8.2 Valid Bit Mask Values

For the LVP16, HP7475, HP7550, HP7580, and HP7585 graphics handlers, you can specify hexadecimal bit masks as workstation types. The following bit masks are valid for use with these devices:

Workstation Type	Hexadecimal Value	Description
51	%x*m*0*nn*0033	Digital LVP16 pen plotter (8.5 ×11)
51	%x*m*0*nn*0033	HP7475 pen plotter
52	%x*m*0*nn*0034	Digital LVP16 pen plotter (11 × 17)
53	%x*m*0*nn*0035	HP7550 pen plotter
54	%x*m*0*nn*0036	HP7580 pen plotter
55	%x*m*0*nn*0037	MPS–2000 film recorder
56	%x*m*0*nn*0038	HP7585 pen plotter

The value in the first part (*m*0*nn*) specifies the paper orientation and size. The value in the second part is the hexadecimal value of the workstation type; for example, 33 for the LVP16 (8.5×11) and HP7475 plotters.

The possible values for *m* include the following:

Value	Paper Orientation
0	Landscape: The picture is wider than it is tall.
1	Portrait: The picture is taller than it is wide.

The possible values for *nn* include the following:

Value	Paper Size
00	Paper size A (8.5 × 11 inches)
01	Legal paper size (8.5 × 14 inches)
02	Paper size B (11 × 17 inches)
03	Paper size C (17 × 22 inches)
04	Paper size D (22 × 34 inches)
05	Paper size E (34 × 44 inches)
10	Paper size A0 (84.1 × 118.9 centimeters)
20	Paper size A1 (59.4 × 84.1 centimeters)
30	Paper size A2 (42 × 59.4 centimeters)
40	Paper size A3 (29.7 × 42 centimeters)
50	Paper size A4 (21 × 29.7 centimeters)
60	Paper size A5 (14.8 × 21 centimeters)
70	Paper size B4 (25.7 × 36.4 centimeters)
80	Paper size B5 (18.2 × 25.7 centimeters)

The default setting for all handlers is landscape orientation using 8.5 × 11 inch paper. The LVP16, HP7475, and HP7550 devices support only sizes A, B, A3, and A4. The HP7580 plotter supports all sizes except E, A0, A5, B4, and B5. The HP7585 plotter supports all sizes except A5, B4, and B5.

The actual plot area on the paper reflected by the DEC GKS and DEC PHIGS device display size is smaller than the actual paper size, and depends on the paper size selected on the plotter.

The DEC GKS and DEC PHIGS display and raster values assume that the plotter is operated in the NORMAL mode. The EXPAND mode is not supported.

Note

Make sure the paper size selected on the plotter matches the one specified by DEC GKS or DEC PHIGS. Not all Hewlett-Packard plotters support all DEC GKS or DEC PHIGS paper sizes. For example, if you specify a DEC GKS paper size that is not supported for the plotter used, then DEC GKS uses the default paper size.

8.3 Device Considerations

The following sections provide information on LVP16 switch settings and device queues and allocation.

8.3.1 LVP16 Switch Settings

Table 8–2 compares the proper LVP16 plotter operation switch settings using paper sizes of 8.5×11 and 11×17.

Table 8–2 LVP16 Switch Settings

Switch	8.5×11 Setting	11×17 Setting
S2	OFF	OFF
S1	OFF	OFF
D/Y	OFF	OFF
US/Met	ON	ON
A4/A3	OFF	ON
B4	ON	ON
B3	OFF	OFF
B2	ON	ON
B1	OFF	OFF

8.3.2 Device Queues and Allocation

When using one of the plotters or recorders as an allocated device on an OpenVMS system, you need to set terminal characteristics by entering the following DCL command:

```
$ SET TERMINAL device_name /EIGHTBIT/NOBROADCAST/NOTYPEAHEAD- Return
_$ /NOWRAP/INTERACTIVE/HOSTSYNC/TTSYNC/FORM/TAB/NOECHO/NOESCAPE- Return
_$ /PASSTHRU/SPEED=set_speed/WIDTH=(132)/PAGE=(0)- Return
_$ /DEVICE_TYPE=(UNKNOWN) Return
```

Replace *device_name* with the name of the device to be allocated. Replace *set_speed* with a value equal to the baud rate as determined by the switches currently set on the plotter or recorder.

Note

If you use one of the plotters or recorders as a queued device, you must add /PERM to the list of qualifiers on the DCL command line.

For more information on device allocation, see the ALLOCATE command in the *OpenVMS DCL Dictionary*.

When using one of the plotters or recorders as an allocated device on UNIX systems, you need to set terminal characteristics by entering the following command:

```
% stty pass8 -echo new cols 132 speed < /dev/ttynn Return
```

Replace *speed* with a value equal to the baud rate as determined by the switches currently set on the plotter or recorder. Replace *nn* with the port number.

8.4 Pattern and Hatch Values

This section describes the available fill area pattern and hatch values for the plotters and recorders. The positive numeric style values are patterns (mixtures of colors) and the negative values are hatches (device-dependent designs, such as cross-hatches, dots, horizontal lines, and so forth). The style values are passed with the SET FILL AREA STYLE INDEX function.

If you change the default color representations, all patterns using that color index use the new color representation.

DEC PHIGS does not support patterns.

8.4.1 Available Fill Area Hatch Values

The following table identifies the available fill area hatch value indexes and describes the results.

Style Index	Appearance
–1	Cross-hatches
–2	Diagonal lines at 45 degrees
–3	Diagonal lines at –45 degrees
–4	Horizontal lines
–5	Vertical lines
–6	Diagonal lines at 45 degrees—sparse
–7	Diagonal lines at –45 degrees—sparse
–8	Horizontal lines—sparse
–9	Vertical lines—sparse

8.4.2 Predefined Fill Area Pattern Values for DEC GKS

The HP–GL device handler does not support patterns.

8.5 LVP16 Font Support and Font Samples

The LVP16 plotter supports 19 hardware fonts in string precision.

Figures 8–1 through 8–19 list the hexadecimal ASCII values of the supported LVP16 hardware fonts.

Figure 8–1 LVP16 Font Number –5000

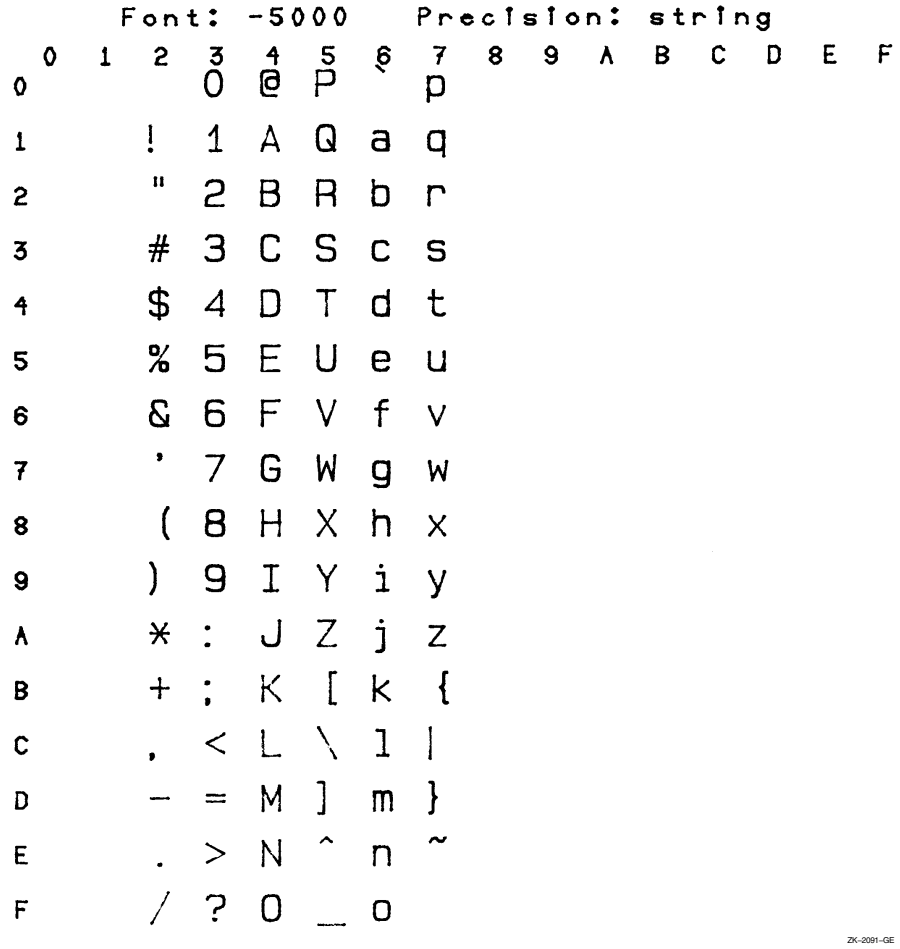


Figure 8–2 LVP16 Font Number –5001

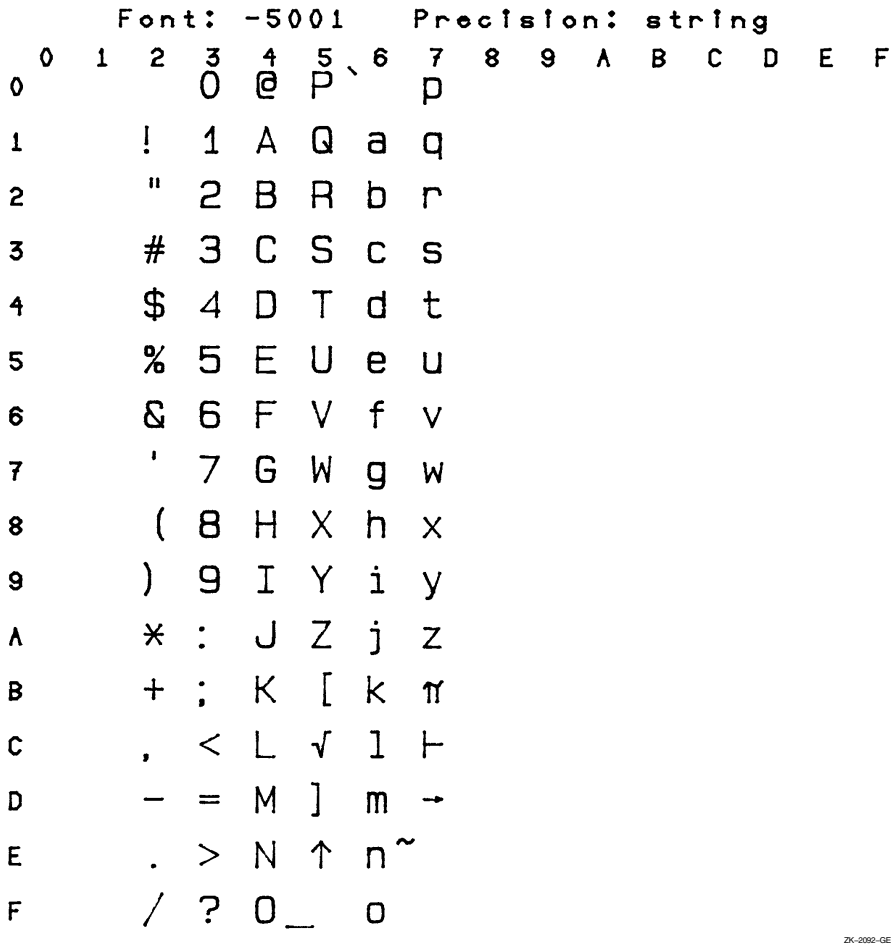


Figure 8–3 LVP16 Font Number –5002

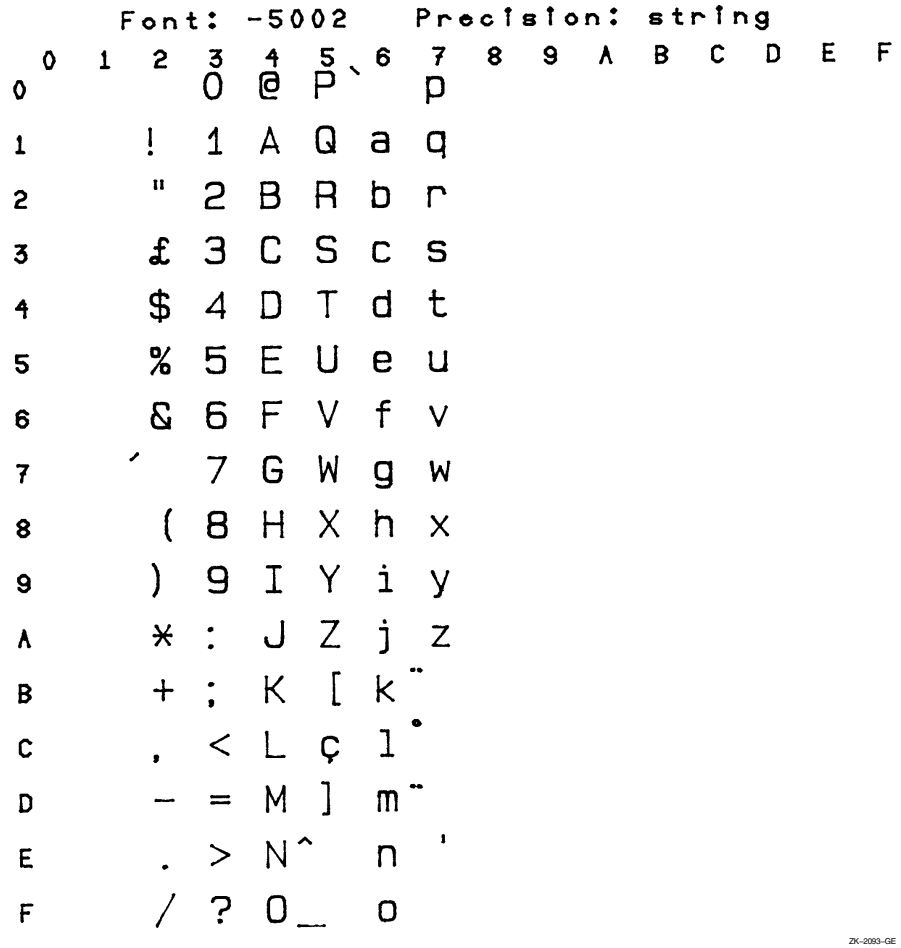


Figure 8–4 LVP16 Font Number –5003

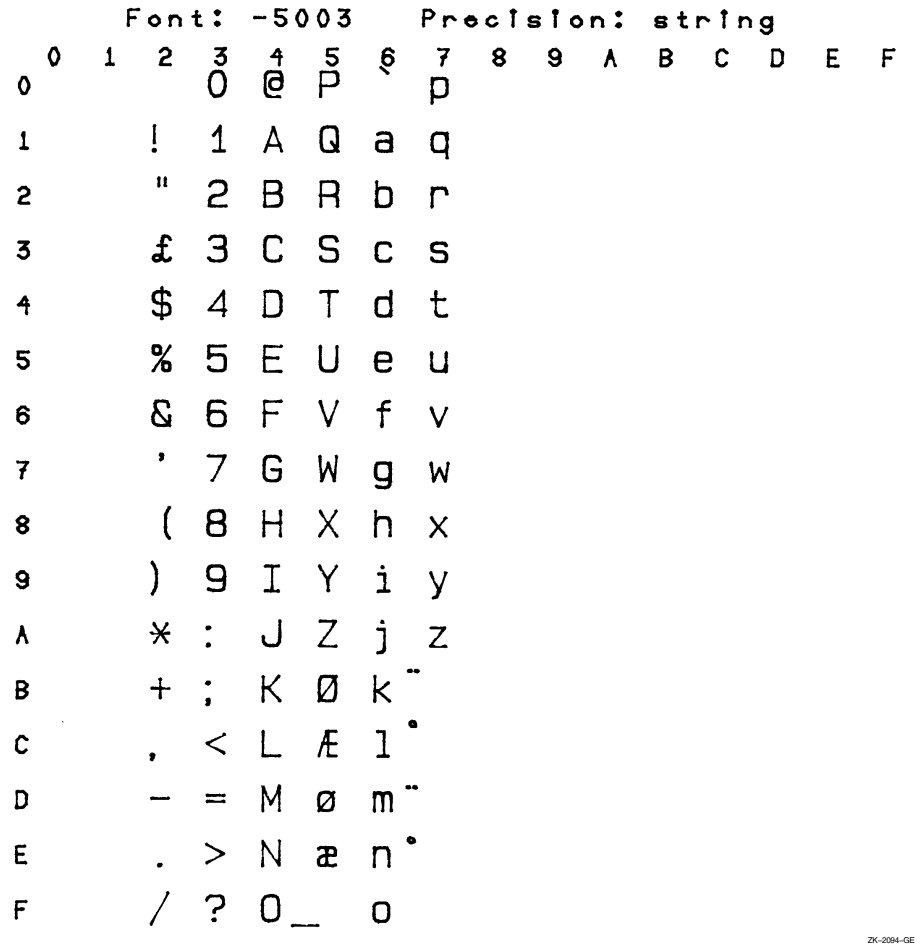


Figure 8–5 LVP16 Font Number –5004

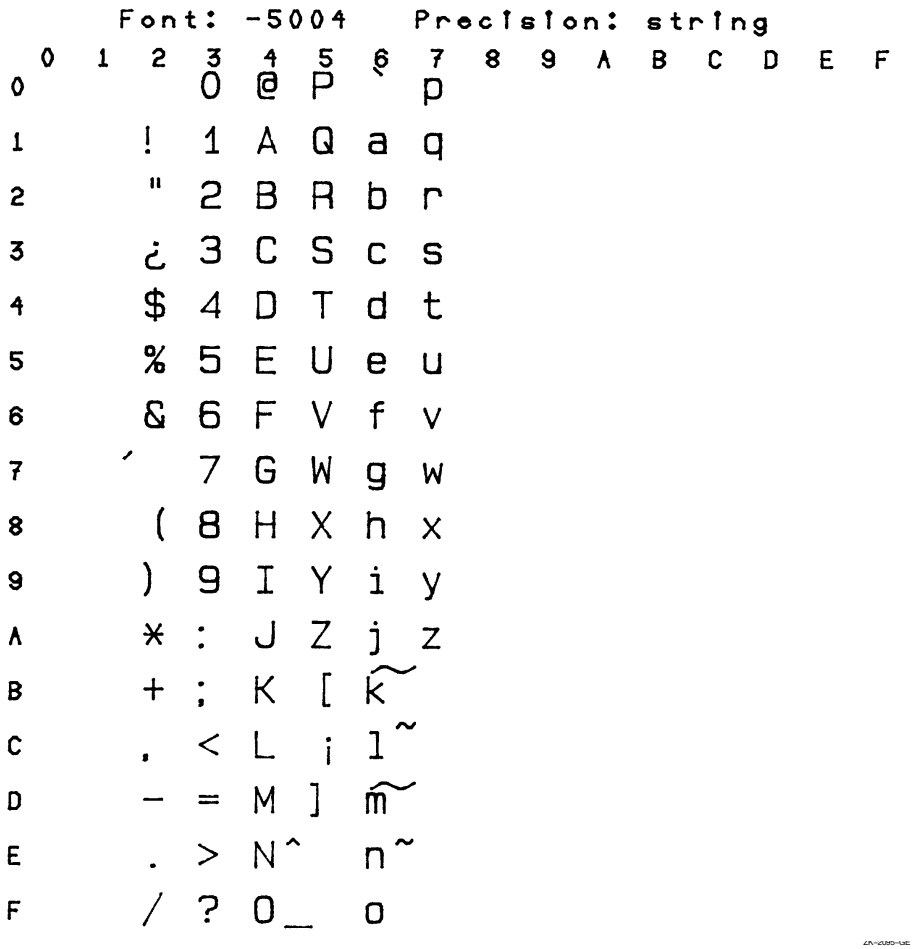


Figure 8–6 LVP16 Font Number –5006

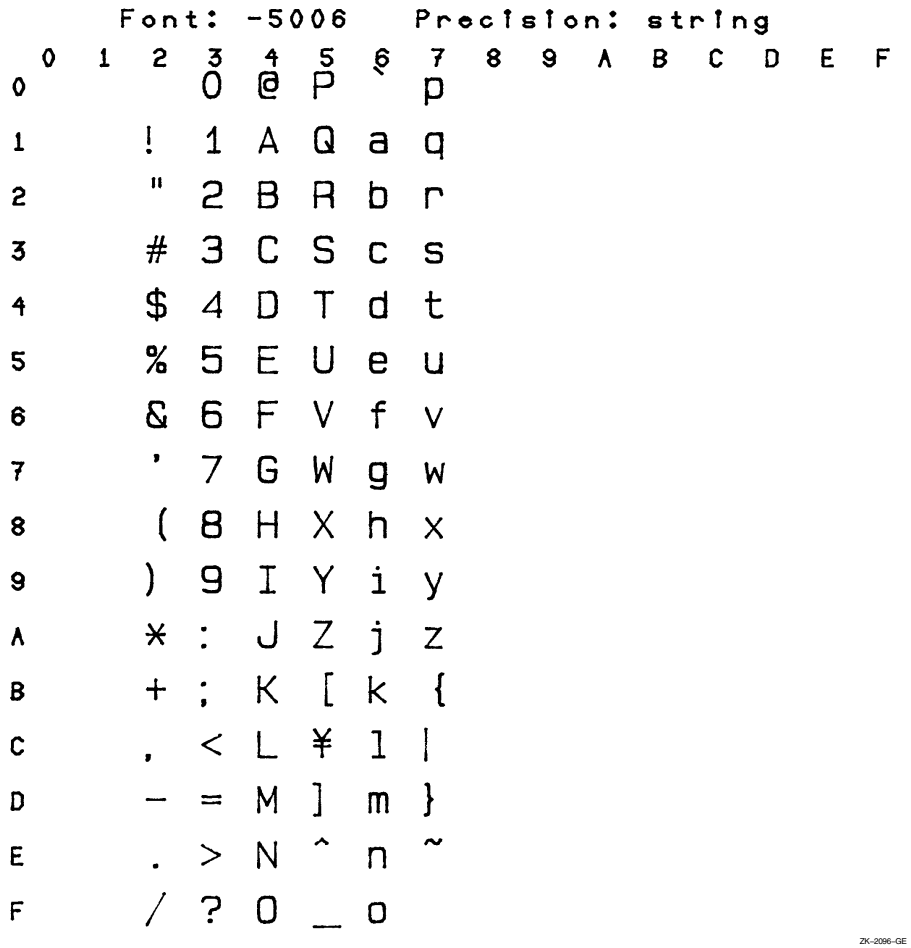


Figure 8–7 LVP16 Font Number –5007

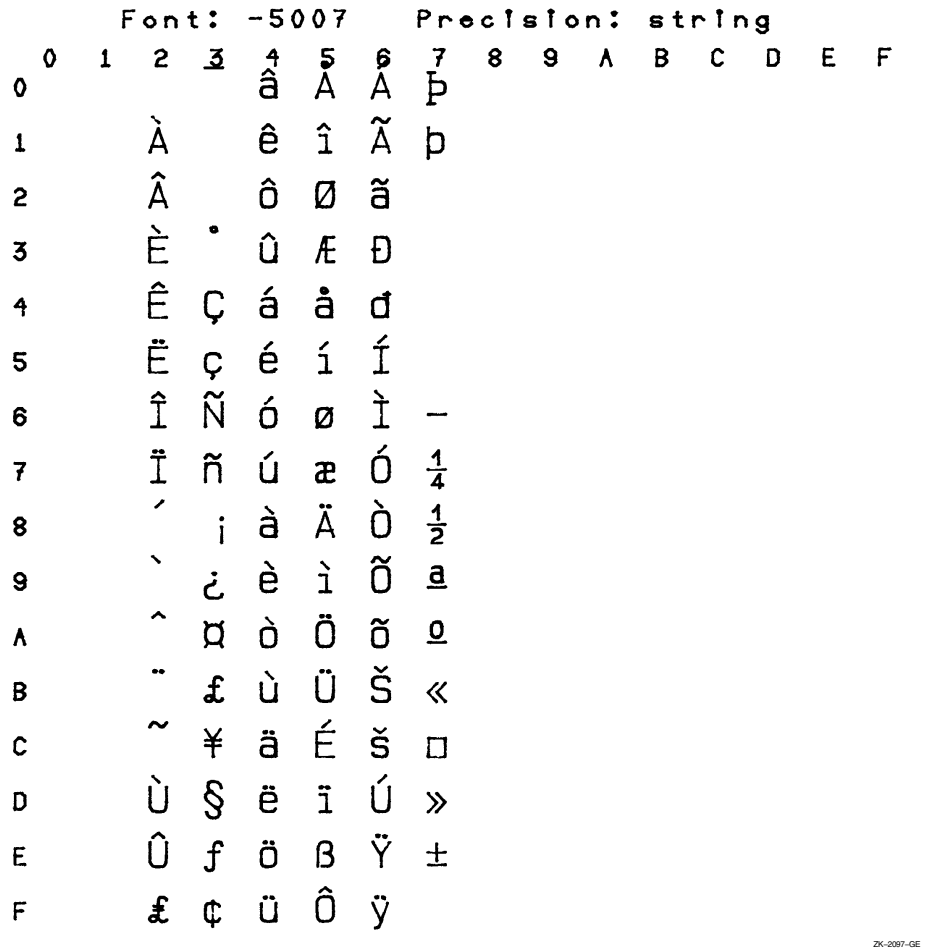


Figure 8–8 LVP16 Font Number –5008

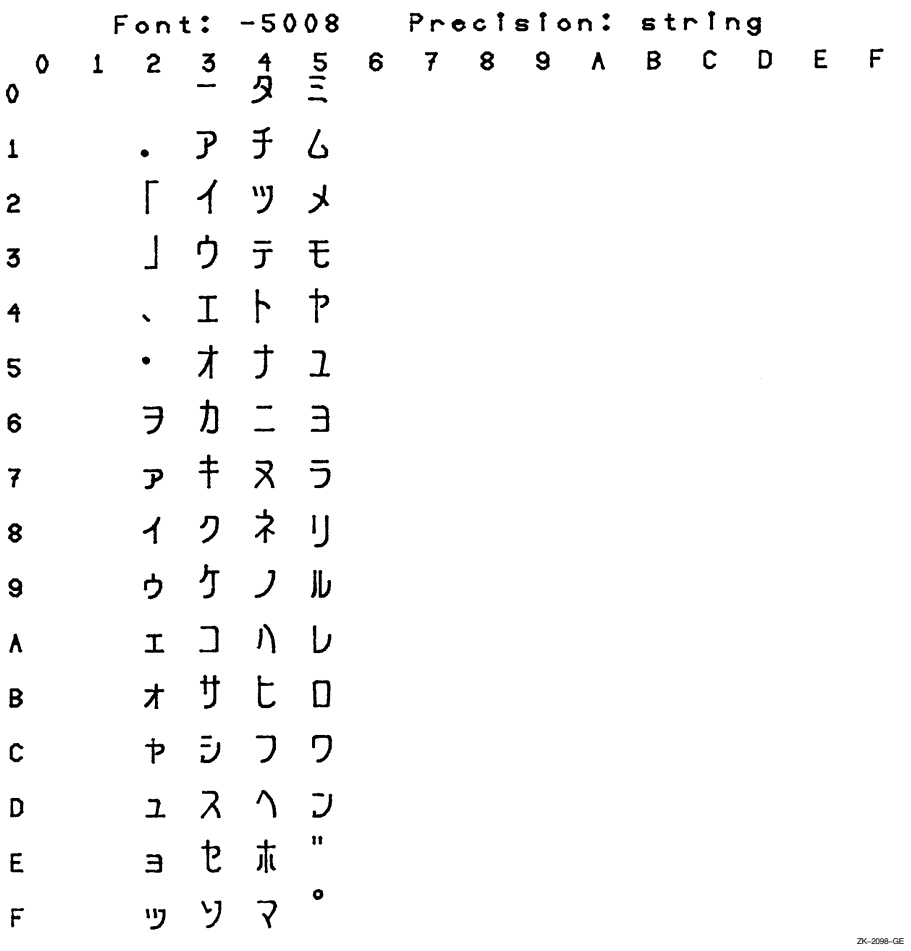


Figure 8–9 LVP16 Font Number –5009

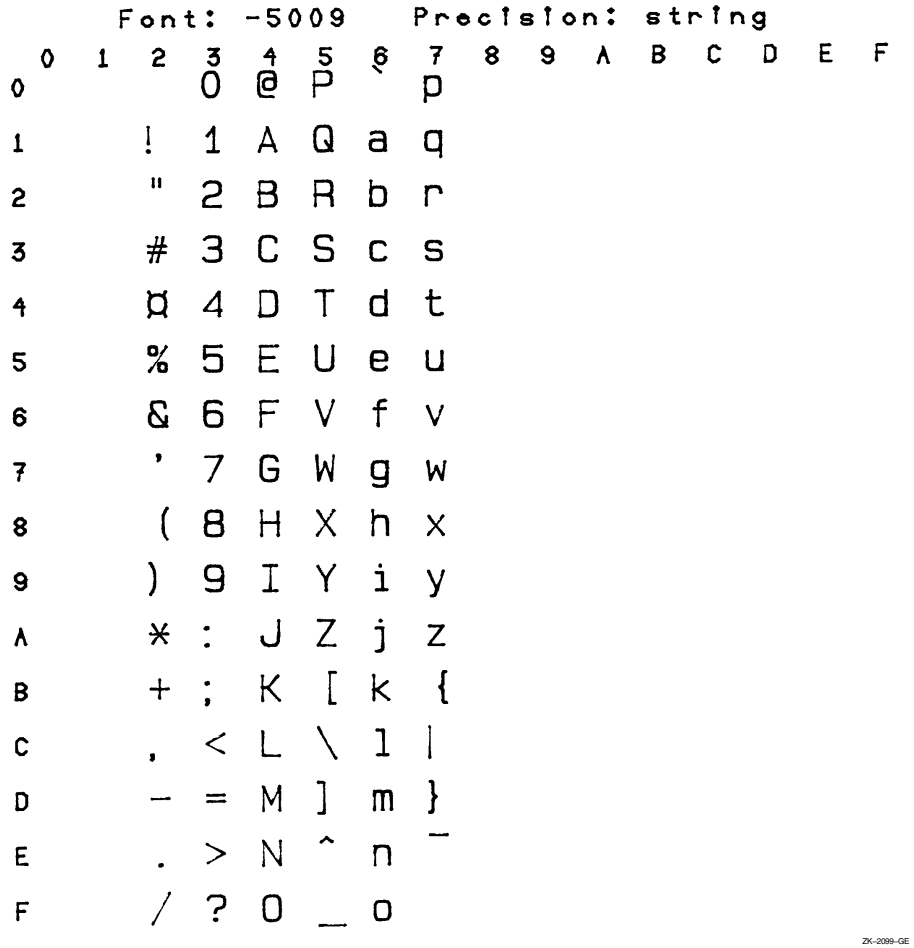


Figure 8–10 LVP16 Font Number –5030

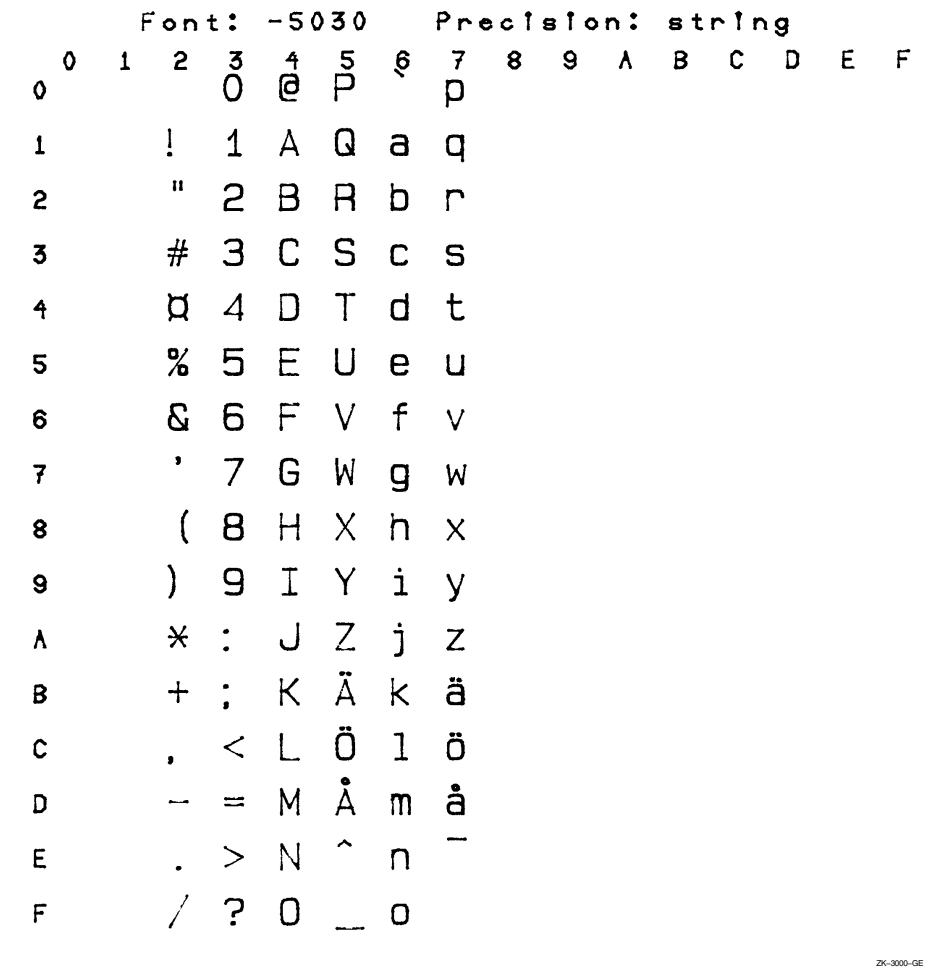


Figure 8–11 LVP16 Font Number –5031

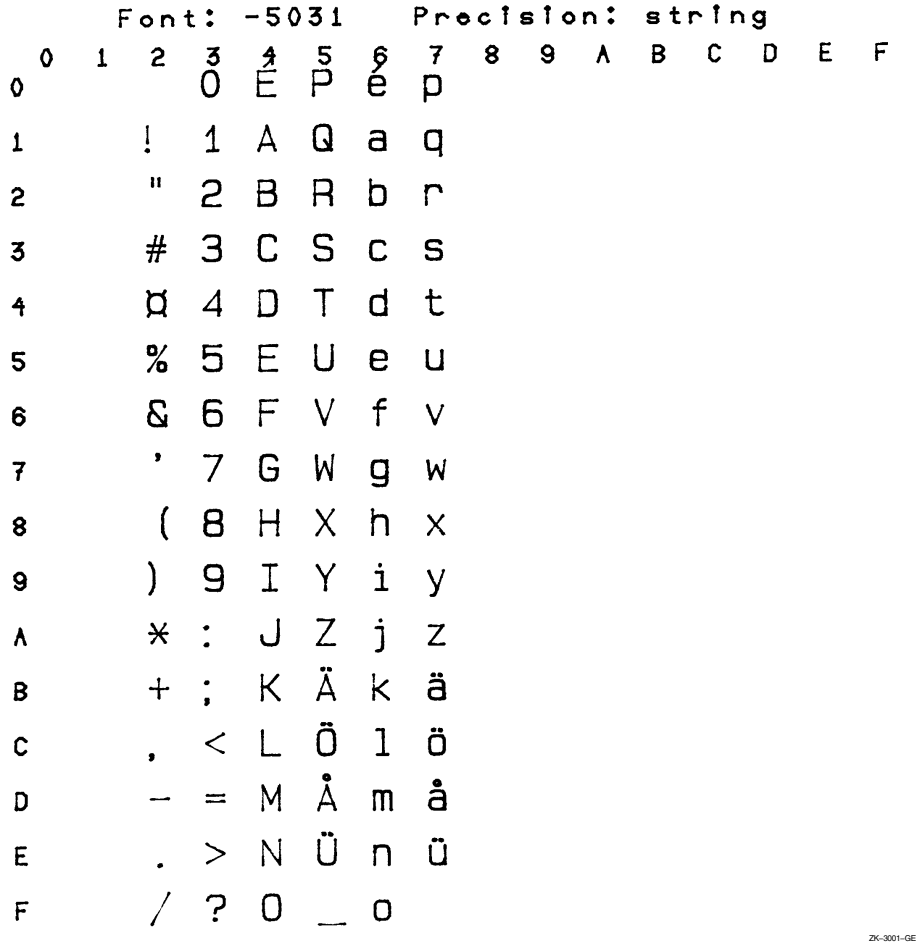


Figure 8–12 LVP16 Font Number –5032

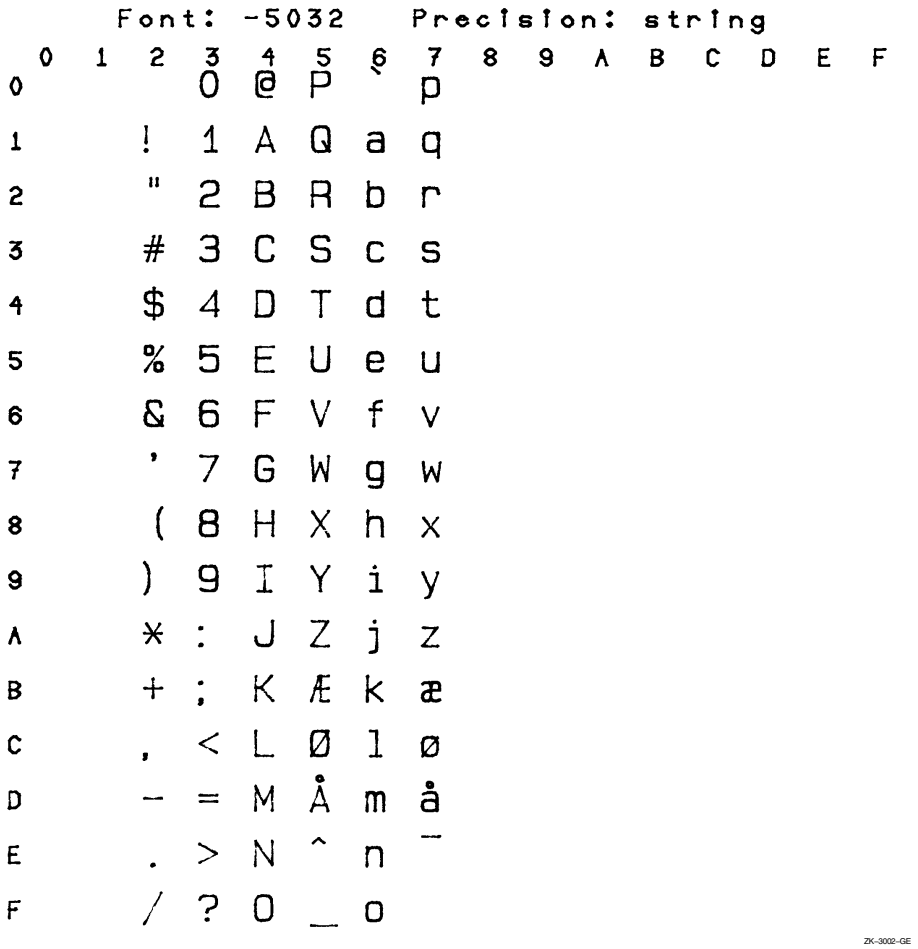


Figure 8–13 LVP16 Font Number –5033

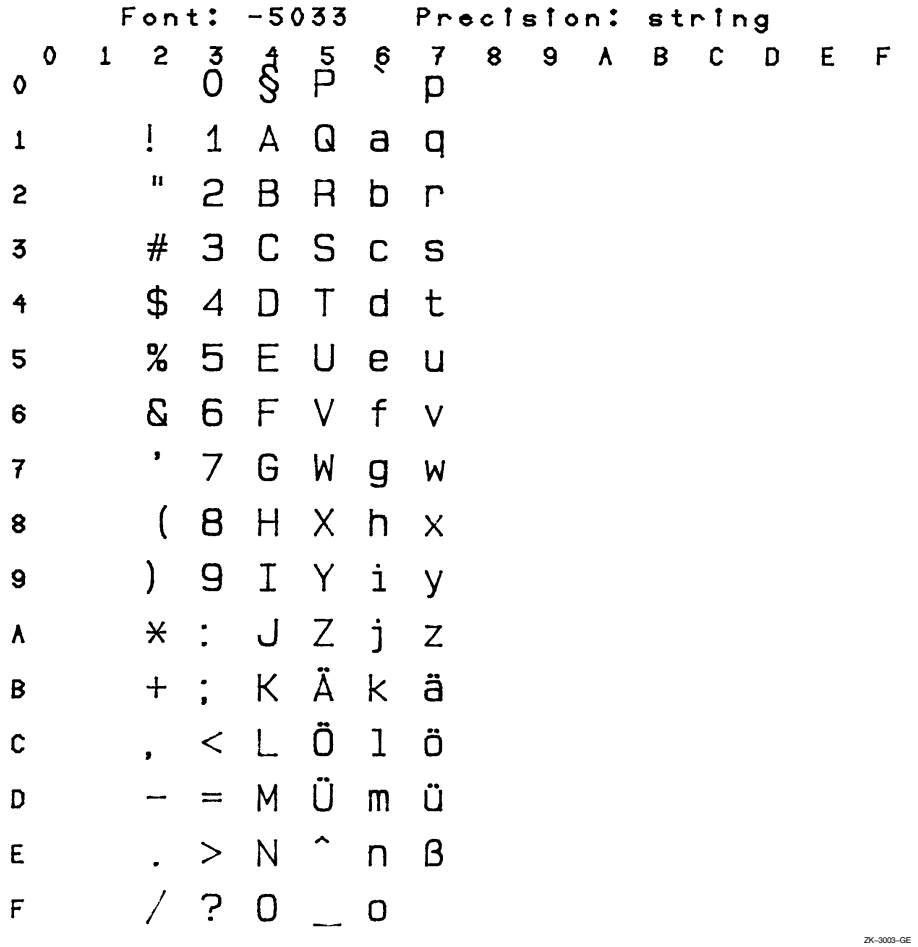


Figure 8–14 LVP16 Font Number –5034

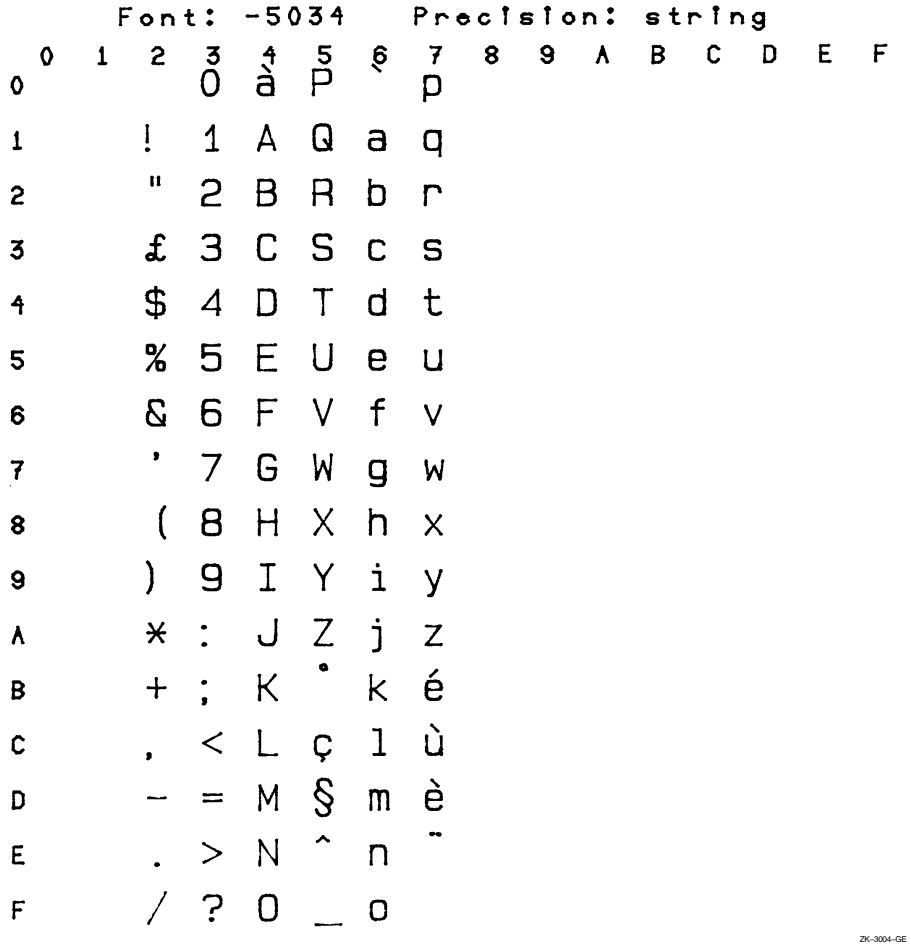


Figure 8–15 LVP16 Font Number –5035

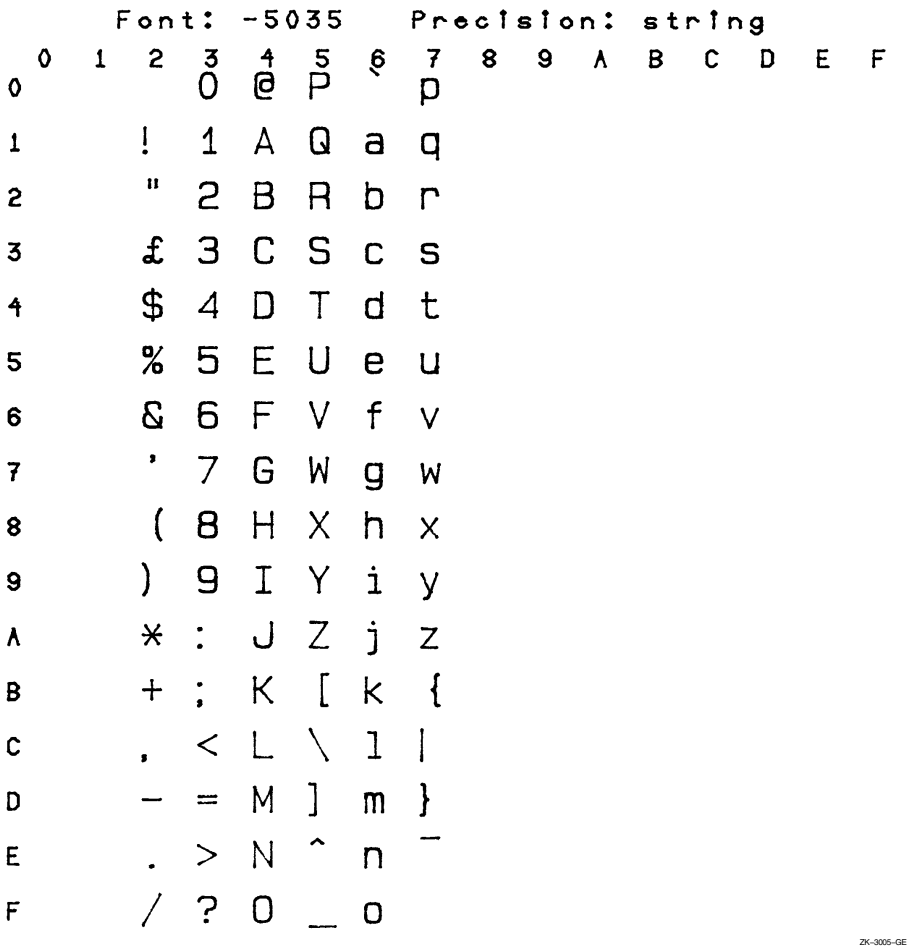


Figure 8–16 LVP16 Font Number –5036

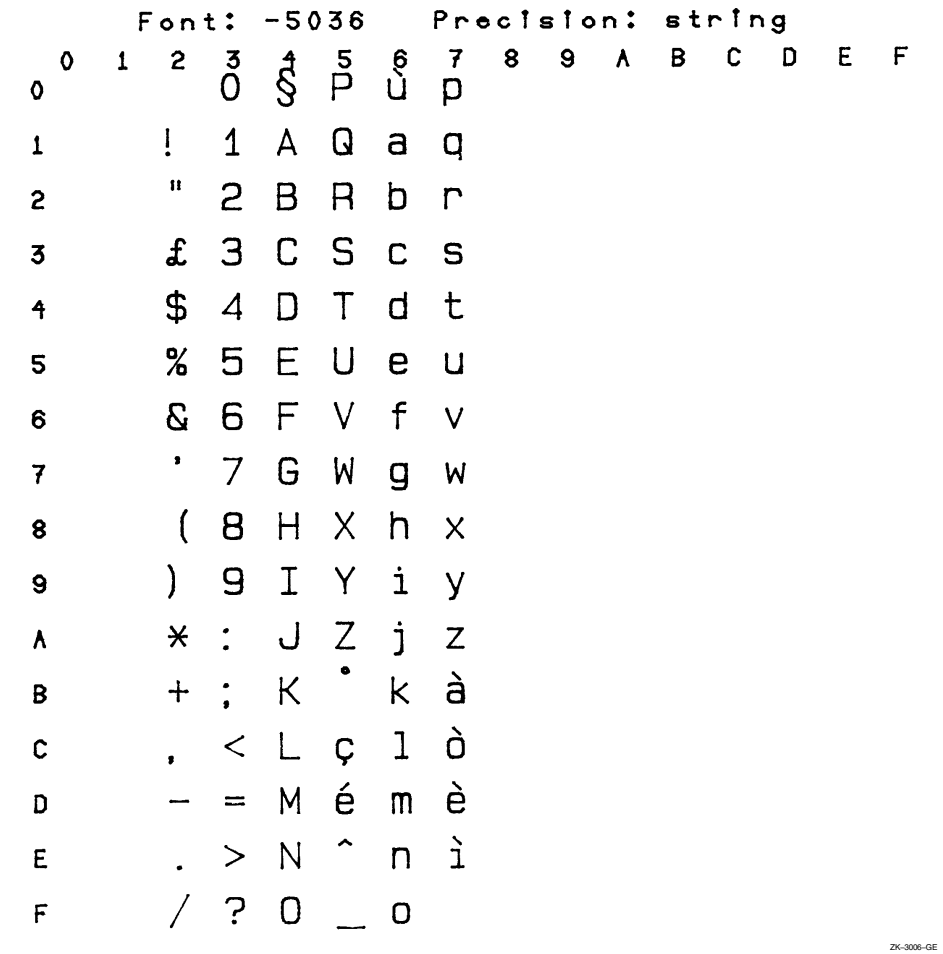


Figure 8–17 LVP16 Font Number –5037

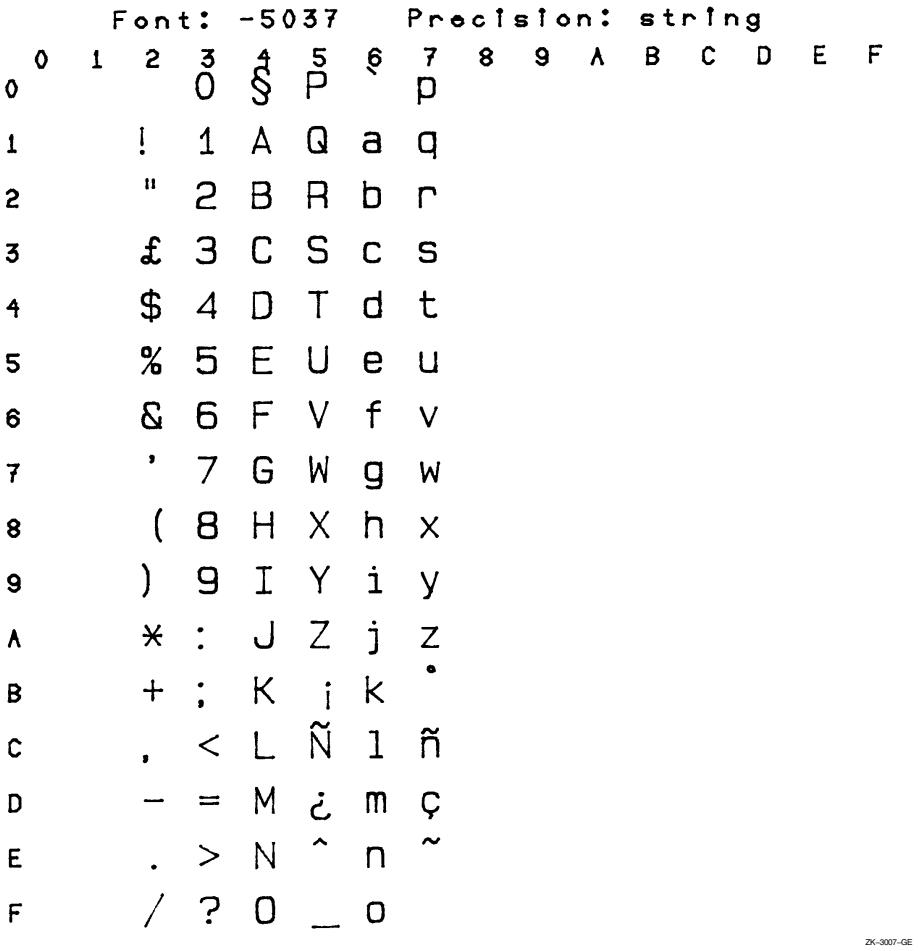
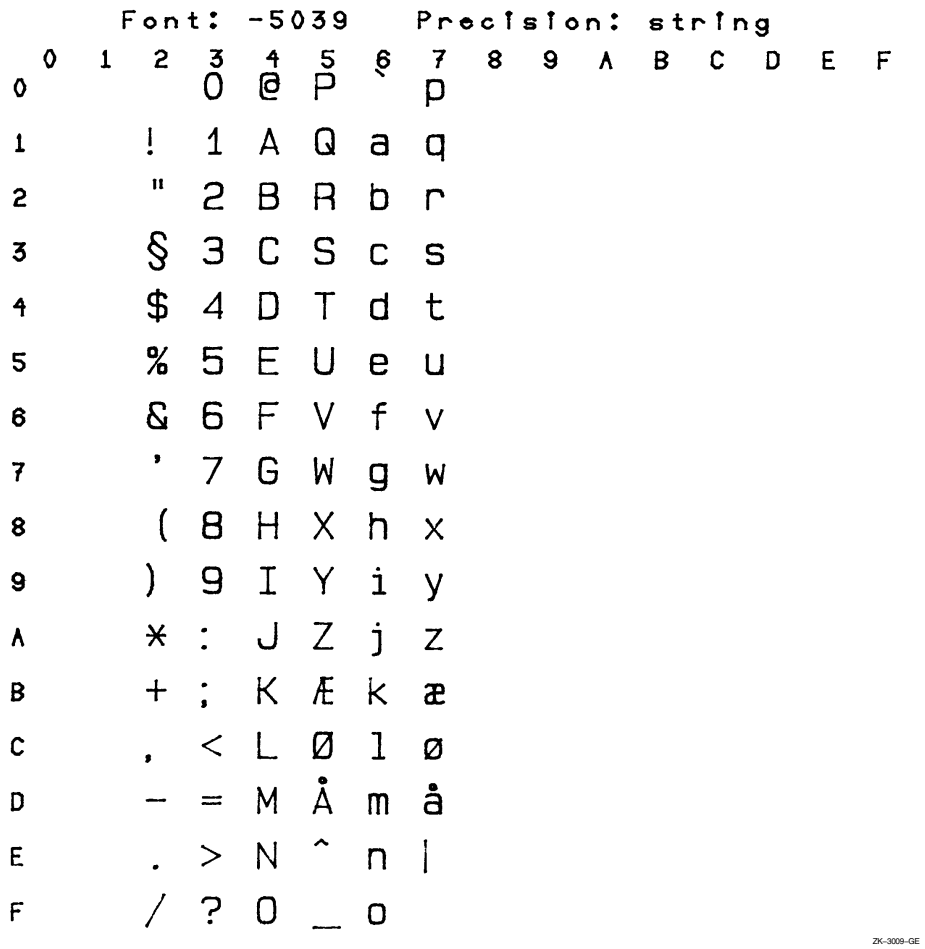


Figure 8–18 LVP16 Font Number –5038

Figure 8–19 LVP16 Font Number –5039



OSF/Motif Workstation

9
OSF/Motif Workstation

This chapter describes the information you need to use DEC GKS and DEC PHIGS with the OSF/Motif workstation. All information applies to both DEC GKS and DEC PHIGS unless otherwise indicated.

To use DEC GKS or DEC PHIGS on an OSF/Motif workstation, the workstation must meet the following minimum requirements:

- Run X11® display.
- Have OSF/Motif software installed as a client where the application is actually being run.
- Have OSF/Motif software installed as a server on the display device.
- Run the OSF/Motif window manager on the display device.

9.1 Environment Options

Table 9–1 summarizes the environment options you can use with the OSF/Motif workstation.

Table 9–1 OSF/Motif Environment Options

Syntax	Description
Border Size	
GKS$DECW_BORDER_SIZE GKSdecw_border_size PHIGS$DECW_BORDER_SIZE PHIGSdecw_border_size	When you run a DEC GKS or DEC PHIGS application on an OSF/Motif workstation, geometry management conflicts may arise with different window managers. If you get the error message "BORDER SIZE attribute incorrect," set this environment option to the value printed in the error message and run the application again. For example, on OpenVMS systems, you define the DEC PHIGS logical name for the border size as follows: `$ DEFINE PHIGS$DECW_BORDER_SIZE 20` Return On UNIX systems, you define the DEC GKS environment variable for the border size as follows: `% setenv GKSdecw_border_size 20` Return

(continued on next page)

Table 9–1 (Cont.) OSF/Motif Environment Options

Syntax	Description
Color Map Size	
GKS$DECW_COLORMAP_SIZE*mmm* GKSdecw_colormap_size*mmm* PHIGS$DECW_COLORMAP_SIZE*mmm* PHIGSdecw_colormap_size*mmm*	Used in conjunction with the *mm* field in the workstation type bit mask to specify the size of the color table allocated by the workstation. For example, if the bit mask is set to FF and you define this option to be 38, DEC GKS and DEC PHIGS will use 38 colors. If you do not define this option, DEC GKS or DEC PHIGS will use 255 colors (because the hexadecimal value FF is 255). You cannot allocate more than 255 colors. On OpenVMS systems, you define the DEC PHIGS logical name to use 36 colors in the color map as follows: $ **DEFINE PHIGS$DECW_COLORMAP_SIZE255 36** Return On UNIX systems, you define the DEC GKS environment variable to use 16 colors in the color map as follows: % **setenv GKSdecw_colormap_size255 16** Return
Connection Identifier	
GKS$CONID GKSconid PHIGS$CONID PHIGSconid	Specifies the default workstation connection information. On OpenVMS systems, the startup procedure, GKSTARTUP.COM or PHIGS$STARTUP.COM, sets the default value. For example, on OpenVMS systems, you define the DEC PHIGS logical name for the connection identifier of a workstation as follows: $ **DEFINE PHIGS$CONID *NODENAME::n.n*** Return On UNIX systems, you define the DEC GKS environment variable for the connection identifier of a workstation using the TCP/IP transport as follows: % **setenv GKSconid *nodename:n.n*** Return
Double Buffering	
GKS$DOUBLE_BUFFERING GKSdouble_buffering PHIGS$DOUBLE_BUFFERING PHIGSdouble_buffering	Enables double buffering on OSF/Motif devices, if this environment option is defined to any value. Otherwise, the option is not used. For example, on OpenVMS systems, you define the DEC PHIGS logical name for the double buffering flag as follows: $ **DEFINE PHIGS$DOUBLE_BUFFERING 1** Return On UNIX systems, you define the DEC GKS environment variable as follows: % **setenv GKSdouble_buffering 1** Return To disable double buffering on an OpenVMS system, use the following command: $ **DEASSIGN PHIGS$DOUBLE_BUFFERING** Return To disable double buffering on a UNIX system, use the following command: % **unsetenv GKSdouble_buffering** Return

(continued on next page)

Table 9–1 (Cont.) OSF/Motif Environment Options

Syntax	Description
Font Index	
GKS$DECW_FONT_*nnn* GKSdecw_font_*nnn* PHIGS$DECW_FONT_*nnn* PHIGSdecw_font_*nnn*	Specifies the X font name string associated with the font index. For example, on OpenVMS systems, you define the DEC PHIGS logical name for the font index as follows: $ **DEFINE PHIGS$DECW_FONT_103 "X_font_name"** Return On UNIX systems, you define the DEC GKS environment variable for the font index as follows: % **setenv GKSdecw_font_105 "X_font_name"** Return
Font List	
GKS$DECW_FONT_LIST GKSdecw_font_list PHIGS$DECW_FONT_LIST PHIGSdecw_font_list	Defines a list of font indexes. The handler uses this list to compose the environment option that contains the X font name string. For example, on OpenVMS systems, you define the DEC PHIGS logical name for the font list as follows: $ **DEFINE PHIGS$DECW_FONT_LIST "-103, -105, -107"** Return On UNIX systems, you define the DEC GKS environment variable for the font list as follows: % **setenv GKSdecw_font_list "-110"** Return See Section 9.12 for more information on the fonts supported by the OSF/Motif workstation.
Font Mode	
GKS$DECW_FONT_MODE GKSdecw_font_mode PHIGS$DECW_FONT_MODE PHIGSdecw_font_mode	Specifies the mode that will replace the default behavior. Valid values include *no definition*, *check*, *default*, *default check*, *all*, *all check*, *all**, *all* check*. See Section 9.12.2 for more information on font modes. For example, on OpenVMS systems, you define the DEC PHIGS logical name for the font mode as follows: $ **DEFINE PHIGS$DECW_FONT_MODE "ALL"** Return On UNIX systems, you define the DEC GKS environment variable for the font mode as follows: % **setenv GKSdecw_font_mode "check"** Return

(continued on next page)

Table 9–1 (Cont.) OSF/Motif Environment Options

Syntax	Description
Font Path	
GKS$DECW_FONT_PATH GKSdecw_font_path PHIGS$DECW_FONT_PATH PHIGSdecw_font_path	Specifies the OSF/Motif font path. The font path is the full directory specification for the font path or a list of font paths separated by a comma. The default system directory is always searched before the user-supplied font path. For example, on OpenVMS systems, you define the DEC PHIGS logical name for the font path as follows: $ **DEFINE PHIGS$DECW_FONT_PATH -** Return _$ ***SYSTEM::DISK:[NAME.FONTS]*** Return On UNIX systems, you define the DEC GKS environment variable for the font path as follows: % **setenv GKSdecw_font_path** ***/usr/users/smith*** Return Note that this option is not currently implemented.
Hardware Dials and Buttons	
PHIGS$USE_DIALS_AND_ BUTTONS PHIGSuse_dials_and_buttons	Specifies whether the button and dial hardware is required to be available. If the value of this option is set to 0, DEC PHIGS emulates the button and dial boxes with on-screen widgets. If the value is set to 1, DEC PHIGS aborts if the button and dial boxes are not available. If no value is specified for this option, DEC PHIGS uses the button and dial hardware if it is available, or falls back to the on-screen emulation if it is not. For example, on OpenVMS systems, you define the DEC PHIGS logical name for the dials and buttons as follows: $ **DEFINE PHIGS$USE_DIALS_AND_BUTTONS 1** Return On UNIX systems, you define the DEC PHIGS environment variable for the dials and buttons as follows: % **setenv PHIGSuse_dials_and_buttons 1** Return For specific information on hardware dials and buttons support, see Appendix D.
Input Mode	
GKS$INPUT_FIXED GKSinput_fixed PHIGS$INPUT_FIXED PHIGSinput_fixed	Specifies whether the widgets used to display choice, string, and valuator input devices are fixed to the main output widget (value 1), or nonfixed to any widget (value 0). When input is not fixed, these widgets can be moved or minimized individually, or will be minimized with the main widget. The default value is 0. For example, on OpenVMS systems, you define the DEC PHIGS logical name for fixed input mode as follows: $ **DEFINE PHIGS$INPUT_FIXED 1** Return On UNIX systems, you define the DEC GKS environment variable for nonfixed input mode as follows: % **setenv GKSinput_fixed 0** Return

(continued on next page)

Table 9–1 (Cont.) OSF/Motif Environment Options

Syntax	Description
Language	
GKS$LANGUAGE GKSlanguage PHIGS$LANGUAGE PHIGSlanguage	Specifies whether to use the English language (value 0), Hebrew language (value 21), or Japanese language (value 22). The default value is 0. See Section 9.15 for more information on internationalization. For example, on OpenVMS systems, you define the DEC PHIGS logical name for the Hebrew language as follows: $ **DEFINE PHIGS$LANGUAGE 21** Return On UNIX systems, you define the DEC GKS environment variable for the Japanese language as follows: % **setenv GKSlanguage 22** Return
Menu Bar Size	
GKS$DECW_MENU_BAR_SIZE GKSdecw_menu_bar_size PHIGS$DECW_MENU_BAR_SIZE PHIGSdecw_menu_bar_size	When you run a DEC GKS or DEC PHIGS application on an OSF/Motif workstation, geometry management conflicts may arise with different window managers. If you get the error message "MENU BAR SIZE attribute incorrect," set this logical name to the value printed in the error message and run the application again. If you specify the value 0, the menu bar will not be created and no screen space will be used. For example, on OpenVMS systems, you define the DEC PHIGS logical name for the menu bar size as follows: $ **DEFINE PHIGS$DECW_MENU_BAR_SIZE 10** Return On UNIX systems, you define the DEC GKS environment variable for no menu bar as follows: % **setenv GKSdecw_menu_bar_size 0** Return
Resize Mode	
GKS$RESIZE_ZOOM GKSresize_zoom PHIGS$RESIZE_ZOOM PHIGSresize_zoom	Specifies the behavior of the output image when the main application widget is resized. Either the graphics can be resized to match the new dimensions, or scrolling will be enabled. If the value is 0, the handler uses the scrolling resize mode of the output image. If the value is 1, the handler uses zoom resize mode of the output image. This is the default value. For example, on OpenVMS systems, you define the DEC PHIGS logical name for the scrolling mode as follows: $ **DEFINE PHIGS$RESIZE_ZOOM 0** Return On UNIX systems, you define the DEC GKS environment variable for resizing as follows: % **setenv GKSresize_zoom 1** Return

(continued on next page)

Table 9–1 (Cont.) OSF/Motif Environment Options

Syntax	Description
Scalable Fonts	
GKS$USE_SCALABLE_FONTS GKSuse_scalable_fonts PHIGS$USE_SCALABLE_FONTS PHIGSuse_scalable_fonts	Enables the use of X11R5 scalable fonts. When this option is enabled, DEC GKS and DEC PHIGS will use a scalable font when it is available and when the requested text height does not exactly match the point sizes of any available fonts. If the value is 1, the option is enabled. The default value is 0 (disabled). For example, on OpenVMS systems, you define the DEC PHIGS logical name for scalable fonts as follows: `$ DEFINE PHIGS$USE_SCALABLE_FONTS 1` Return On UNIX systems, you define the DEC GKS environment variable for scalable fonts as follows: `% setenv GKSuse_scalable_fonts 0` Return
Standard Color Map	
GKS$USE_STANDARD_COLOR_MAP GKSuse_standard_color_map PHIGS$USE_STANDARD_COLOR_MAP PHIGSuse_standard_color_map	Allows workstations to share the same color map, thereby preventing the display of false colors and the "technicolor" effect. Before you open any workstations, you must create and name a standard color map. On UNIX systems, the standard color map can be created using the `xstdcmap` executable. For example, on OpenVMS systems, you specify the atom name for the standard color map as follows: `$ DEFINE PHIGS$USE_STANDARD_COLOR_MAP -` Return `_$ RGB_DEFAULT_MAP` Return This command specifies that the color map named RGB_DEFAULT_MAP is to be shared by all open workstations. On UNIX systems, you define the DEC GKS environment variable for the standard color map as follows: `% setenv GKSuse_standard_color_map \` Return `RGB_DEFAULT_MAP` Return This command specifies that the color map named RGB_DEFAULT_MAP is to be shared by all open workstations.
Title Size	
GKS$DECW_TITLE_SIZE GKSdecw_title_size PHIGS$DECW_TITLE_SIZE PHIGSdecw_title_size	When you run a DEC GKS or DEC PHIGS application on an OSF/Motif workstation, geometry management conflicts may arise with different window managers. If you get the error message "TITLE SIZE attribute incorrect," set this environment option to the value printed in the error message and run the application again. For example, on OpenVMS systems, you define the DEC PHIGS logical name for the title size as follows: `$ DEFINE PHIGS$DECW_TITLE_SIZE 10` Return On UNIX systems, you define the DEC GKS environment variable for the title size as follows: `% setenv GKSdecw_title_size 20` Return

(continued on next page)

Table 9–1 (Cont.) OSF/Motif Environment Options

Syntax	Description
UID Search Path	
GKS$UID_PATH GKSuid_path PHIGS$UID_PATH PHIGSuid_path	Specifies the UID search path and overrides the standard UID file area. See Section 9.13 for more information on UIL files. For example, on OpenVMS systems, you define the DEC PHIGS logical name for the UID search path as follows: $ **DEFINE PHIGS$UID_PATH *SYSTEM::DISK:[NAME.UID]*** Return On UNIX systems, you define the DEC GKS environment variable for the UID search path as follows: % **setenv GKSuid_path */usr/users/smith/fonts*** Return
Workstation Type	
GKS$WSTYPE GKSwstype PHIGS$WSTYPE PHIGSwstype	Specifies the workstation type. On OpenVMS systems, the startup procedure, GKSTARTUP.COM or PHIGS$STARTUP.COM, sets the default value. For example, on OpenVMS systems, you define the DEC PHIGS logical name for an OSF/Motif workstation type as follows: $ **DEFINE PHIGS$WSTYPE 231** Return On UNIX systems, you define the DEC GKS environment variable for an OSF/Motif workstation widget as follows: % **setenv GKSwstype 233** Return

9.2 Connection Identifier

A connection identifier must be defined for DEC GKS and DEC PHIGS to work with the OSF/Motif workstation. If you do not define the connection identifier, the OPEN WORKSTATION function returns an error. You can define the connection identifier in your code or in a logical names table to which your program has access.

The definition depends on whether you are running under the OpenVMS or UNIX operating system and transport. For more information on local transports, see Section G.1.9.

The connection identifier also depends on which type of workstation you use. The following sections are broken down by workstation type.

Workstation Types 230 and 231

For OSF/Motif workstations of type 230 and 231, the connection identifier must be defined using a valid OSF/Motif display identifier. The syntax depends on the transport mechanism.

Syntax	Transport Mechanism
nodename::n.n	Connect to display using DECnet.
nodename:n.n	Connect to display using TCP/IP.
DECW$DISPLAY	OpenVMS—specified by the SET DISPLAY command.
local:0	UNIX shared memory.

In the previous table:

- The *nodename* is the name of the host machine to which the display is physically connected.
- The first *n* is required. It specifies the display on the host machine and is usually 0.
- The second *n* is optional. It is the screen identifier and defaults to 0.

Workstation Type 232

For workstations of type 232, the connection identifier is an ASCII string consisting of the X display identifier, followed by the X drawable identifier, separated by an exclamation point. Both values are expressed as decimal numbers. An example of a valid connection identifier is:

1234857!388291

Workstation Type 233

For workstations of type 233, the connection identifier is an ASCII string representing the decimal value of the widget identifier. An example of a valid connection identifier is:

396251

9.3 Valid Bit Mask Values

When using the OSF/Motif workstation, you can specify workstation types as hexadecimal bit masks.

The OSF/Motif workstation contains a hardware color map that must be shared by all windows open on the workstation. The OSF/Motif workstation associates a virtual color map that maintains the color values for that window. If possible, the OSF/Motif workstation maps the virtual color maps onto the hardware color map so that the virtual maps do not overlap. (That is, all virtual color maps are resident.)

By default, DEC GKS and DEC PHIGS allocate a color map of 64 entries where available on the hardware. If you need a different size color map, then you can use a workstation-type modifier to specify the size of the color map.

By default, for DEC GKS, the OSF/Motif workstation color maps are shared among applications. This means that changes to DEC GKS color representations do not occur dynamically. You can use a workstation-type modifier to tell DEC GKS to use a dynamically changeable color map instead of the default color map so that color representation changes happen immediately.

The following bit masks are valid for use with the OSF/Motif workstation:

Workstation Type	Hexadecimal Value	Description
230	%x0*nmm*00E6	As an output-only device using OSF/Motif
231	%x0*nmm*00E7	As an input/output device using OSF/Motif
232	%x0*nmm*00E8	As an output-only device within an application drawable (window or pixmap)
233	%x0*nmm*00E9	As an input/output device within an application widget
240	%x0*nmm*00F0	As an output-only device using OSF/Motif PEX
241	%x0*nmm*00F1	As an input/output device using OSF/Motif PEX
242	%x0*nmm*00F2	As an output-only device within a PEX application drawable (window or pixmap)
243	%x0*nmm*00F3	As an input/output device within a PEX application widget
270	%x0000010E	As an output-only device using OSF/Motif OpenGL
271	%x0000010F	As an input/output device using OSF/Motif OpenGL
272	%x00000110	As an output-only device within an OpenGL X11 application drawable (window or pixmap)
273	%x00000111	As an input/output device within an OSF/Motif OpenGL application widget

Color Table Size

Valid values for *mm* are 00 through FF, specified in hexadecimal notation. The value *mm* specifies the size of the color table used by DEC GKS and DEC PHIGS. If *mm* is 0, the workstation uses a color table of the default size. If *mm* value is nonzero, it determines the name of the color map size environment option to be translated. The size of the color table can also affect the size and content of the bundle tables. For more information concerning the effect of color table size on bundle tables, see Section 1.8.

Color Table Dynamics

Valid values for *n* are 0 (the default behavior) and 1 (dynamic color changes). The value *n* is not supported by DEC PHIGS. A value of 1 causes all SET COLOUR REPRESENTATION function calls to change the color representation immediately; the application does not have to update the workstation.

OSF/Motif Output Only, Value 230

Workstation type 230 is output-only. In all other respects, it behaves exactly like workstation type 231, which performs both input and output.

OSF/Motif Input and Output, Value 231

Workstation type 231 performs input and output, and uses OSF/Motif software. Because of a restriction in OSF/Motif software, your application may not initialize OSF/Motif if it uses workstation types 230 or 231. In addition, you should not select events on any windows created by the DEC GKS or DEC PHIGS workstation.

You can create widgets that are children of certain widgets belonging to the DEC GKS or DEC PHIGS workstation. Escape functions are provided to obtain the identifiers of these widgets. The escapes are documented in Appendix B.

When the user or window manager resizes workstations of type 231, the picture may be clipped at the new window boundaries. A push button on the menu bar allows the user to restore the window to its default size and location. Scroll bars allow the user to pan the displayable region of a clipped picture.

OSF/Motif Drawable, Value 232

Workstation type 232 uses a preexisting window or pixmap, and is output-only. Your application must open the display and create the drawable before calling the OPEN WORKSTATION function, and it must not close the display or destroy the drawable until after it has called the CLOSE WORKSTATION function.

This workstation does not select any X events. Consequently, your application is free to select any X events on this or any other window. In addition, this workstation will *not* redraw itself when exposed or when an icon is expanded to a window. In such instances, your application should call the REDRAW ALL STRUCTURES function (for DEC PHIGS) or the REDRAW ALL SEGMENTS function (for DEC GKS) to force a redraw of the window. This workstation does not make use of OSF/Motif software; your application has unrestricted use of OSF/Motif software.

OSF/Motif Widget, Value 233

Workstation type 233 uses a preexisting OSF/Motif widget. The widget must be a bulletin board and must be realized *before* calling the OPEN WORKSTATION function.

This type of workstation allows the use of either SAMPLE or EVENT mode for DEC GKS and DEC PHIGS input in addition to using OSF/Motif software in your application. However, if you call the AWAIT EVENT function, you must set the timeout parameter to 0; otherwise, if there are no events in the queue, your application waits forever.

Note

You cannot call REQUEST mode input with this workstation type. To do so results in an error.

Do not destroy the OSF/Motif workstation widget until after a call to the CLOSE WORKSTATION function.

OSF/Motif PEX, Values 240 to 243

Workstation types 240 to 243 have the same characteristics as the DECwindows workstation types 220 to 223. The information in this chapter applies to non-PEX use of OSF/Motif software; however, the input information for OSF/Motif on PEX workstations is identical to that for OSF/Motif on non-PEX workstations. For more information on PEX workstation types, see Chapter 11.

OSF/Motif OpenGL, Values 270 to 273

Workstation types 270 to 273 have characteristics similar to those of PEX workstation types 240 to 243. This chapter does not provide OpenGL specifics; however, the input information for OSF/Motif on OpenGL workstations is identical to that for OSF/Motif on workstations without the OpenGL driver. For more information on the OpenGL workstation types, see Chapter 10.

9.4 Programming Considerations

You should review the following information before programming with DEC GKS and DEC PHIGS using the OSF/Motif workstation.

9.4.1 Display Size, Windows, and Echo Areas

The OSF/Motif workstation provides a banner that runs across the top of each window, and borders that line each side. DEC GKS and DEC PHIGS do not include borders and banners in specified window sizes or input echo area sizes. You need to adjust your window and echo area sizes for banners and borders. Use the INQUIRE DISPLAY SPACE SIZE (3) function to adjust the input echo areas so they do not overlap the output drawing area.

9.5 Overlay Plane Support

Some X and PEX servers support overlay visuals using the X property SERVER_OVERLAY_VISUALS. If you have a server that supports this technique, DEC PHIGS supports it as a DEC PHIGS 232 (Motif in an X drawable) workstation type. The program *phigs_planedemo.c* (in the examples directory) provides an example of overlay plane support. For information on how to use overlay planes, see the init_overlays function. To work correctly, DEC PHIGS requires the application to use the transparent pixel overlay technique for workstation type 232. This pixel will be used as the background for DEC PHIGS workstations created in the overlay visual. This allows you to see through anything drawn with indexed color 0.

Error number –460 has been added. The message text is as follows:

```
Workstation not started; overlay planes of type transparent mask are not
supported in routine ****
```

You will get this error if you specify a workstation to run in specialized X overlay planes, and you select a method that is not supported. If you get this error, check with the vendor of the X server on how to specify the pixel to be used. If the transparent pixel method is not supported, DEC PHIGS cannot use the overlay planes.

DEC PHIGS does not support this overlay visual as its default visual, due to color limitations. It is also not supported for PEX workstation types, or for any workstation type other than 232.

Note

There are usually very few (4 to 8) overlay planes. You should use the workstation mask to limit the number of DEC PHIGS colors used (described in the example phigs_planedemo). Otherwise, color allocation errors may occur either with DEC PHIGS or other applications running in the overlay planes.

9.6 Cell Array Restriction for DEC GKS

DEC GKS uses the following criteria to determine whether to simulate a cell array:

- The projection type is PERSPECTIVE. You set the projection type by calling the function EVALUATE VIEW MAPPING MATRIX 3.
- The cell array is clipped.
- The borders of the cell array are not parallel to the *x*- and *y*-axes of the device.

For better performance. DEC GKS also simulates cell arrays if the size of the cells is big in relation to the number of cells.

9.7 General Information

This section provides general information, you should consider when programming with DEC GKS and DEC PHIGS using the OSF/Motif workstation.

- To open or query OSF/Motif workstation types 230, 231, 232, and 233 for DEC GKS and DEC PHIGS, your application must be running on a system that runs the OSF/Motif workstation client-side software. The client does *not* need a physical display device, nor does it need the OSF/Motif workstation server-side software.
- For OSF/Motif workstation types 230 and 231, the connection identifier specifies the OSF/Motif workstation display to use.
- If you resize the window, it may be erased and redrawn causing the loss of primitives.
- The resource identification of the window created for output can be fetched using the Inquire Window Identifiers (–304) escape function.
- The OSF/Motif workstation supports double buffering in two ways. For example, on OpenVMS systems, you can enable double buffering by defining the double buffering environment option name to be any value, or you can call the escape function SET DOUBLE BUFFERING. When double buffering is enabled, output is first written to a buffer and only displayed when you call UPDATE WORKSTATION or an equivalent “flush” operation.

9.8 Minimizing Color Traversal for DEC PHIGS

On OSF/Motif X11 devices, DEC PHIGS does a special traversal for colors to determine what colors are needed in the X color table. When regenerating the display in double buffer mode, the picture may change colors briefly as the picture is drawn into the backing buffer.

To minimize color traversal, you can create a structure with:

- POLYLINE SET WITH DATA element with a different vertex color corresponding to each fixed color needed. This element can be degenerate and should be clipped away.
- SET INTERIOR REFLECTANCE EQUATION element with the diffuse equation.

- TRIANGLE STRIP 3 WITH DATA element with a different vertex color corresponding to each lighted, shaded, and depth cued color. This element can be degenerate and should be clipped away.

When this structure is posted, DEC PHIGS allocates a cell in the X color map for each color in the POLYLINE SET WITH DATA element. DEC PHIGS allocates a constant hue gamut in the X color map for each color in the TRIANGLE STRIP WITH DATA element. If the rest of the application uses only these colors, no reallocation of color map pixels takes place; no double buffer color problems occur.

9.9 Bundle Indexes

Use the program PHIGS_PREDEF (included with the DEC PHIGS development kit) or GKS_PREDEF (included with the DEC GKS development kit) to display information on the predefined bundle tables and supported escapes for other OSF/Motif workstation types. (See Example 1–1 or Example 1–2.) Use the available inquiry function in the DEC GKS or DEC PHIGS binding manuals to return the specific values for these indexes.

9.10 Pattern and Hatch Values

This section describes the available fill area pattern and hatch values for the OSF/Motif workstation. The positive numeric style values are patterns (mixtures of colors) and the negative values are hatches (device-dependent designs, such as cross-hatches, dots, horizontal lines, and so forth). The style values are passed with the SET FILL AREA STYLE INDEX function.

If you change the default color representations, all patterns using that color index use the new color representation.

DEC PHIGS does not support patterns.

9.10.1 Available Fill Area Hatch Values

The following table identifies the available fill area hatch value indexes and describes the results.

Style Index	Appearance
–1	Cross-hatches
–2	Diagonal lines at 45 degrees
–3	Diagonal lines at –45 degrees
–4	Horizontal lines
–5	Vertical lines
–6	Diagonal lines at 45 degrees—sparse
–7	Diagonal lines at –45 degrees—sparse
–8	Horizontal lines—sparse
–9	Vertical lines—sparse

9.10.2 Predefined Fill Area Pattern Values (Monochrome) for DEC GKS

The following table identifies the predefined fill area pattern values for color index 1, and describes the results.

Style Index	Appearance
1	Light diagonally woven pattern (25%)
2	Darker diagonally woven pattern (50%)
3	Dark diagonally woven pattern (75%)
4	Horizontal brick pattern
5	Vertical brick pattern
6	Brick pattern at –45 degrees
7	Brick pattern at 45 degrees
8	Finely woven grid
9	Sparsely woven grid
10	Downward scales (fish-like)
11	Upward scales
12	Rightward scales
13	Leftward scales
14 to 28	Increasing densities of grey (no hatch style), starting at 1/16 density, incrementing by 1/16, up to 15/16 density

9.10.3 Predefined Fill Area Pattern Values (Color) for DEC GKS

The following table identifies the predefined fill area pattern values for color index 1, and describes the results.

Style Index	Appearance
1	Light diagonally woven pattern (25%)
2	Darker diagonally woven pattern (50%)
3	Dark diagonally woven pattern (75%)
4	Horizontal brick pattern
5	Vertical brick pattern
6	Brick pattern at –45 degrees
7	Brick pattern at 45 degrees
8	Finely woven grid
9	Sparsely woven grid
10	Downward scales (fish-like)
12	Rightward scales
13	Leftward scales
14 to 28	Increasing densities of grey (no hatch style), starting at 1/16 density, incrementing by 1/16, up to 15/16 density
29	Vertical lines—sparse (6.25%)
30	Vertical lines—sparse (12.5%)

Style Index	Appearance
31	Vertical lines—sparse (50%)
32	Vertical lines—sparse (75%)
33	Vertical lines—very fine (50%)
34	Vertical lines (25%)
35	Vertical lines (50%)
36	Vertical lines (75%)
37	Horizontal lines—sparse (6.25%)
38	Horizontal lines—sparse (12.5%)
39	Horizontal lines—sparse (50%)
40	Horizontal lines—sparse (75%)
41	Horizontal lines—very fine (50%)
42	Horizontal lines (25%)
43	Horizontal lines (50%)
44	Horizontal lines (75%)
45	Diagonal lines at 45 degrees—sparse (6.25%)
46	Diagonal lines at 45 degrees—sparse (12.5%)
47	Diagonal lines at 45 degrees—sparse (50%)
48	Diagonal lines at 45 degrees—sparse (75%)
49	Diagonal lines at 45 degrees (25%)
50	Diagonal lines at 45 degrees (50%)
51	Diagonal lines at 45 degrees (75%)
52	Diagonal lines at –45 degrees—sparse (6.25%)
53	Diagonal lines at –45 degrees—sparse (12.5%)
54	Diagonal lines at –45 degrees—sparse (50%)
55	Diagonal lines at –45 degrees—sparse (75%)
56	Diagonal lines at –45 degrees (25%)
57	Diagonal lines at –45 degrees (50%)
58	Diagonal lines at –45 degrees (75%)
59	Sparsely woven grid
60	Sparsely woven grid
61	Sparsely woven grid
62	Sparsely woven grid
63	Sparsely woven grid
64	Downward scales (fish-like)
65	Downward scales (fish-like)

9.11 Input Information

Each of the following input class sections lists the supported logical input device numbers, and supported prompt and echo type (PET) numbers. This input class information also applies to OSF/Motif software on PEX workstations. For a complete description of these numbers, see the chapter on input functions in the DEC GKS or DEC PHIGS binding manuals.

For all input classes, you specify the echo area in device coordinates. The OSF/Motif workstation device coordinate system origin is in the lower left corner of the workstation display surface.

When you request input, the OSF/Motif device handler places the workstation viewport at the top of any other overlapping viewports. Viewport appearance before and after the input request is unchanged.

9.11.1 Choice Input Class

Supported Logical Input Devices

The following table identifies the supported choice-class logical input devices for the OSF/Motif workstation.

Choice Device Types	Input Action
1, 6, 7, 8	Select with mouse. Trigger with mouse button 1. Break by selecting Cancel button when echoing is enabled or with mouse button 2 when echoing is disabled.
2	Keypad key is selection and trigger.
3	Function key is selection and trigger.
4	Mouse button down is selection and trigger.
5	Mouse button up is selection and trigger.
9	Select and trigger software button box with mouse button 1.
10	Select and trigger hardware button box by pressing button.

Supported PETs

The choice input class for the OSF/Motif workstation (excluding choice device types 9 and 10) supports PETs –1, 1, and 3. See the input chapter in the DEC GKS or DEC PHIGS binding reference manuals for more information on PETs.

The OSF/Motif workstation choice device types 9 and 10 support PETs –1, 1, 2, and 3. See Appendix D for more information on hardware dials and buttons support.

For OSF/Motif devices, keys F1 through F6 are available and are returned as choice numbers 21 through 26. See Appendix E for more information on keypad functionality.

Default Input Values

The following table identifies the default input values for the OSF/Motif workstation choice-class logical input devices.

Input Construct	Default Value
PET	1
Initial choice	1
Initial status	STATUS_OK
Echo area	Varies by device
Data record	Varies by device—list of choice strings

9.11.2 Locator Input Class

Supported Logical Input Devices

The following table identifies the supported locator-class logical input devices for the OSF/Motif workstation.

Locator Device Types	Input Action
1, 2, 3, 4, 7	Select with mouse. Trigger with mouse button 1. Break with mouse button 2.
5	Select with mouse. Trigger with mouse button 2.
6	Select with mouse. Trigger with mouse button 3.
8	Movement is selection and trigger.

Supported PETs

The locator input class for the OSF/Motif workstation supports PETs –13 (DEC GKS only), –12, –11, –10, –9, –8, –7, –6, –5, –4, –3, –2, –1, 1, 2, 3, 4, 5, and 6. See the input chapter in the DEC GKS or DEC PHIGS binding reference manuals for more information on PETs.

Default Input Values

The following table identifies the default input values for the OSF/Motif workstation locator-class logical input devices.

Input Construct	Default Value
PET	1
Initial position	Ignored
Initial view transformation	0
Echo area	Largest square
Data record	NULL

9.11.3 Pick Input Class

Supported Logical Input Devices

The following table identifies the supported pick-class logical input devices for the OSF/Motif workstation.

Pick Device Types	Input Action
1, 2, 3, 4	Select with mouse. Trigger with mouse button 1. Break with mouse button 2.
5	Select with mouse. Trigger with mouse button 2.
6	Select with mouse. Trigger with mouse button 3.

Supported PETs

The pick input class for the OSF/Motif workstation supports PETs 1, 2, and 3. See the input chapter in the DEC GKS or DEC PHIGS binding reference manuals for more information on PETs.

Default Input Values

The following table identifies the default input values for the OSF/Motif workstation pick-class logical input devices.

Input Construct	Default Value
PET	1
Initial pick identifier	1
Initial pick path	NULL (no path) (for DEC PHIGS only)
Initial status	STATUS_OK
Echo area	Largest square
Data record	Aperture: 0.0027 in device coordinates

The size of the pick aperture is limited by the hardware cursor map.

9.11.4 String Input Class

Supported Logical Input Devices

The following table identifies the supported string-class logical input devices for the OSF/Motif workstation.

String Device Types	Input Action
1, 2, 4	Enter characters from keyboard. Trigger with Return key or Enter button. Break by selecting Cancel button when echoing is enabled, or by selecting Ctrl/U when echoing is disabled.
3	ASCII–encoded string. Keypress enters character and triggers device.

Supported PETs

The string input class for the OSF/Motif workstation supports PET 1. See the input chapter in the DEC GKS or DEC PHIGS binding reference manuals for more information on PETs.

Default Input Values

The following table identifies the default input values for the OSF/Motif workstation string-class logical input devices.

Input Construct	Default Value
PET	1
Initial string	NULL
Echo area	Varies by device
Data record	Input buffer size: 20 ASCII characters
Initial position	1

9.11.5 Stroke Input Class

Supported Logical Input Devices

The following table identifies the supported stroke-class logical input devices for the OSF/Motif workstation.

Stroke Device Types	Input Action
1, 2, 3, 4	Points are entered with mouse motion. Trigger with mouse button 1. Break with mouse button 2.

Supported PETs

The stroke input class for the OSF/Motif workstation supports PETs 1, 3, and 4. See the input chapter in the DEC GKS or DEC PHIGS binding reference manuals for more information on PETs.

Default Input Values

The following table identifies the default input values for the OSF/Motif workstation stroke-class logical input devices.

Input Construct	Default Value
PET	1
Initial number of points	0
Initial transformation	0
Echo	Largest square
Data record	Stroke buffer size: 80 points
	Editing position: 0
	x interval: 0.01 in world coordinate points
	y interval: 0.01 in world coordinate points
	Time interval: 0.0 seconds

9.11.6 Valuator Input Class

Supported Logical Input Devices

The following table identifies the supported valuator-class logical input devices for the OSF/Motif workstation.

Valuator Device Types	Input Action
1, 2, 3, 4	Select with mouse. Trigger with mouse button 1 or Enter button. Break by selecting Cancel button when echoing is enabled, or by selecting mouse button 2 when echoing is disabled.
5 to 12	Rotation of hardware dials is selection and trigger.

Supported PETs

The OSF/Motif workstation valuator device types 1, 2, 3, and 4 support PETs –4, –3, –2, –1, 1, 2, and 3. See the input chapter in the DEC GKS or DEC PHIGS binding reference manuals for more information on PETs.

The OSF/Motif workstation valuator device types 5 to 12 support PETs –4, –3, –2, –1, 1, 2, and 3. See Appendix D for more information on hardware dials and buttons support.

Default Input Values

The following table identifies the default input values for the OSF/Motif workstation valuator-class logical input devices.

Input Construct	Default Value
PET	1
Initial value	0.5
Echo area	Varies by device
Data record	Minimum: 0.0, Maximum: 1.0

9.12 Font Support

The following sections describe how to manipulate the set of fonts supported by the OSF/Motif workstation. They describe the default set of fonts for each language type.

9.12.1 Default Fonts

The default set of fonts for each language is determined by defining the *language* logical name or environment variable. (See Section 9.15.)

9.12.1.1 English and ISO–Latin–1 Fonts

The following fonts are the default fonts for English and ISO–Latin–1. They are available in string precision only.

X Font Name	Font Index
–Courier–Medium–R	1
–Times–Medium–R	–101
–Times–Medium–I	–102
–Times–Bold–R	–103
–Times–Bold–I	–104
–Helvetica–Medium–R	–105
–Helvetica–Medium–O	–106
–Helvetica–Bold–R	–107
–Helvetica–Bold–O	–108
–Courier–Medium–R	–109
–Courier–Medium–O	–110
–Courier–Bold–R	–111
–Courier–Bold–O	–112
–Symbol	–113

If the font mode option is “all”, all the fonts listed in Section 9.12.3 in the range –101 to –300 are included in the list of available fonts.

9.12.1.2 Japanese Fonts

The following fonts are the default fonts for Japanese. They are available in string precision only.

X Font Name	Font Index
–Courier–Medium–R	1
–Times–Medium–R	–101
–Times–Medium–I	–102
–Times–Bold–R	–103
–Times–Bold–I	–104
–Helvetica–Medium–R	–105
–Helvetica–Medium–O	–106
–Helvetica–Bold–R	–107
–Helvetica–Bold–O	–108
–Courier–Medium–R	–109
–Courier–Medium–O	–110
–Courier–Bold–R	–111
–Courier–Bold–O	–112
–Symbol	–113
–JDECW–Screen–*–JISX0201–RomanKana	–10001
–JDECW–Screen–*–JISX0208–Kanji11	–10001
–JDECW–Mincho–*–JISX0201.1976–0	–10101
–JDECW–Mincho–*–JISX0208.1983–1	–10101
–JDECW–Gothic–*–JISX0201.1976–0	–10102
–JDECW–Gothic–*–JISX0208.1983–1	–10102

9.12.1.3 Hebrew and ISO–Latin–8 Fonts

The following fonts are the default fonts for Hebrew and ISO–Latin–8. They are available in string precision only.

X Font Name	Font Index	Comment
–DEC–Gam–Medium–R	1	Same as Courier
–Symbol	–113	
–DEC–David–Medium–R	–301	Same as Times
–DEC–David–Medium–O	–302	Same as Times Oblique
–DEC–David–Bold–R	–303	Same as Times Bold
–DEC–David–Bold–O	–304	Same as Times Bold Oblique
–DEC–Narkisstam–Medium–R	–305	Same as Helvetica
–DEC–Narkisstam–Medium–O	–306	Same as Helvetica Oblique
–DEC–Narkisstam–Bold–R	–307	Same as Helvetica Bold
–DEC–Narkisstam–Bold–O	–308	Same as Helvetica Bold Oblique
–DEC–Gam–Medium–R	–309	Same as Courier
–DEC–Gam–Medium–O	–310	Same as Courier Oblique

X Font Name	Font Index	Comment
–DEC–Gam–Bold–R	–311	Same as Courier Bold
–DEC–Gam–Bold–O	–312	Same as Courier Bold Oblique

If the font mode option is “all”, all the fonts listed in Section 9.12.3 in the range –301 to –500 are included in the list of available fonts.

9.12.2 Font Mode Options

Table 9–2 lists the possible font mode values to use with the OpenVMS logical names GKS$DECW_FONT_MODE and PHIGS$DECW_FONT_MODE and UNIX environment variables GKSdecw_font_mode and PHIGSdecw_font_mode.

Table 9–2 OSF/Motif Font Modes

Value	Meaning
No definition	Only the default set of fonts is available. The default set depends on the current language. The set of fonts on the X server is not checked for availability. The OSF/Motif device handler checks the value of the font list option. Any fonts listed in the font list option are added to the font list or redefined as existing fonts.
“**check**”	Only the default set of fonts is available. The default set depends on the current language. The set of fonts on the X server is checked for availability. The OSF/Motif device handler checks the value of the font list option.
“**default**”	Only the default set of fonts is available. The default set depends on the current language. The set of fonts on the X server is not checked for availability. This mode is the fastest mode. The OSF/Motif device handler does not check the value of the font list option.
“**default check**”	Only the default set of fonts is available, but the default set is checked to make sure the font exists on the OSF/Motif server. This is slightly slower than the previous option. The OSF/Motif device handler does not check the value of the font list option.
“**all**”	All known OSF/Motif fonts for the current language are made available in the font list. The set of fonts on the X server is not checked for availability. (See Section 9.12.3 for a complete list.) The OSF/Motif device handler checks the value of the font list option. Any fonts listed in the font list option are added to the font list or redefined as existing fonts.
“**all check**”	All known OSF/Motif fonts for the current language are made available in the font list. The set of fonts on the X server is checked for availability. (See Section 9.12.3 for a complete list.) The OSF/Motif device handler checks the value of the font list option. Any fonts listed in the font list option are added to the font list or redefined as existing fonts.
“**all***”	All known OSF/Motif fonts for all languages are made available in the font list. The set of fonts on the X server is not checked for availability. (See Section 9.12.3 for a complete list.) The OSF/Motif device handler checks the value of the font list option. Any fonts listed in the font list option are added to the font list or redefined as existing fonts.

(continued on next page)

Table 9–2 (Cont.) OSF/Motif Font Modes

Value	Meaning
"**all* check**"	All known OSF/Motif fonts for all languages are made available in the font list. The set of fonts on the X server is checked for availability. (See Section 9.12.3 for a complete list.) The OSF/Motif device handler checks the value of the font list option. Any fonts listed in the font list option are added to the font list or redefined as existing fonts.

9.12.3 Known Fonts

The following fonts are considered known to the OSF/Motif device handler.

X Font Name	Font Index
–Courier–Medium–R	1
–Times–Medium–R	–101
–Times–Medium–I	–102
–Times–Bold–R	–103
–Times–Bold–I	–104
–Helvetica–Medium–R	–105
–Helvetica–Medium–O	–106
–Helvetica–Bold–R	–107
–Helvetica–Bold–O	–108
–Courier–Medium–R	–109
–Courier–Medium–O	–110
–Courier–Bold–R	–111
–Courier–Bold–O	–112
–Symbol	–113
–Terminal–Medium–R–Normal––ISO8859–1*	–114
–Terminal–Medium–R–DoubleWide––ISO8859–1*	–115
–Terminal–Medium–R–Narrow––ISO8859–1*	–116
–Terminal–Medium–R–Wide––ISO8859–1*	–117
–Terminal–Bold–R–Normal––ISO8859–1*	–118
–Terminal–Bold–R–DoubleWide––ISO8859–1*	–119
–Terminal–Bold–R–Narrow––ISO8859–1*	–120
–Terminal–Bold–R–Wide––ISO8859–1*	–121
–InterimDM–Medium–I–	–122
–BigelowHolmes–Menu–Medium–R	–123
–AvantGardeBook–R	–124
–AvantGardeBook–O	–125
–AvantGardeDemi–R	–126
–AvantGardeDemi–O	–127
–LubalinGraph–Book–R	–128
–LubalinGraph–Book–O	–129

X Font Name	Font Index
–LubalinGraph–Demi–R	–130
–LubalinGraph–Demi–O	–131
–NewCenturySchoolbook–Medium–R	–132
–NewCenturySchoolbook–Medium–I	–133
–NewCenturySchoolbook–Bold–R	–134
–NewCenturySchoolbook–Bold–I	–135
–Souvenir–Demi–R	–136
–Souvenir–Demi–I	–137
–Souvenir–Light–R	–138
–Souvenir–Light–I	–139
–DEC–David–Medium–R*	–301
–DEC–David–Medium–O*	–302
–DEC–David–Bold–R*	–303
–DEC–David–Bold–O*	–304
–DEC–Narkisstam–Medium–R*	–305
–DEC–Narkisstam–Medium–O*	–306
–DEC–Narkisstam–Bold–R*	–307
–DEC–Narkisstam–Bold–O*	–308
–DEC–Gam–Medium–R*	–309
–DEC–Gam–Medium–O*	–310
–DEC–Gam–Bold–R*	–311
–DEC–Gam–Bold–O*	–312
–DEC–Miriam–Medium–R*	–313
–DEC–Miriam–Medium–O*	–314
–DEC–Miriam–Bold*	–315
–DEC–Miriam–Bold–O*	–316
–DEC–MiriamFixed–Medium–R*	–317
–DEC–MiriamFixed–Medium–O*	–318
–DEC–MiriamFixed–Bold–R*	–319
–DEC–MiriamFixed–Bold–O*	–320
–DEC–FrankRuhl–Medium–R*	–321
–DEC–FrankRuhl–Medium–O*	–322
–DEC–FrankRuhl–Bold–R*	–323
–DEC–FrankRuhl–Bold–O*	–324
–DEC–Terminal–Medium–R–Normal––ISO8859–8*	–325
–DEC–Terminal–Medium–R–DoubleWide––ISO8859–8*	–326
–DEC–Terminal–Medium–R–Narrow––ISO8859–8*	–327
–DEC–Terminal–Medium–R–Wide––ISO8859–8*	–328
–DEC–Terminal–Bold–R–Normal––ISO8859–8*	–329
–DEC–Terminal–Bold–R–DoubleWide––ISO8859–8*	–330

X Font Name	Font Index
–DEC–Terminal–Bold–R–Narrow––ISO8859–8*	–331
–DEC–Terminal–Bold–R–Wide––ISO8859–8*	–332
–JDECW–Screen–*–JISX0201–RomanKana	–10001
–JDECW–Screen–*–JISX0208–Kanji11	–10001
–JDECW–Mincho–*–JISX0201.1976–0	–10101
–JDECW–Mincho–*–JISX0208.1983–1	–10101
–JDECW–Gothic–*–JISX0201.1976–0	–10102
–JDECW–Gothic–*–JISX0208.1983–1	–10102

9.13 UIL Files

Much of the widget creation logic is written in User Interface Language (UIL). When the UIL files are compiled, a User Interface Database (UID) file is created. At startup, widgets are fetched out of the UID database. There are two UID files: one containing most of the widget definitions, and a language-specific file. The language-specific file contains text strings, font specification, and may contain text direction.

The UID files for DEC GKS are:

- gks*.uid

The UID files for DEC PHIGS are:

- gfx_motif.uid
- gfx_motif_en.uid (UID language-specific file for English)
- gfx_motif_jp.uid (UID language-specific file for Japanese)

To run the OSF/Motif device handler, the UID files must be in one of the following directories:

- The standard English language UID file area for OpenVMS systems:

  ```
  DECW$USER_DEFAULTS: -- defaults to SYS$LOGIN
  DECW$SYSTEM_DEFAULTS
  ```

- The standard English language UID file area for UNIX systems:

  ```
  /usr/lib/X11/uid
  ```

  On UNIX systems, OSF/Motif software searches the user's home directory prior to searching the standard UID file area.

You can place the UID file in any directory and set the environment option for the UID search path to that directory. Specify the full directory path name, but do not include the UID file names.

9.14 Customization

You can customize certain OSF/Motif attributes through the use of an Xdefaults file.

9.14.1 Use of Xdefaults Files

Attributes modified in the Xdefaults files can either be the widget class or the actual instance of the widget. When using the widget class, prefix the class specification with the application resource. If this is not done, all widgets of that class that run from the user's session will adopt the resource change. To explicitly access the device widgets through the Xdefaults file, use the following prefix:

- Nonpopup mode: Different for each widget type
  - Choice: GFX*choice_topwidget_dialog
  - Choice button box: GFX*choiceb_topwidget_dialog
  - String: GFX*string_topwidget_dialog
  - Valuator: GFX*valuator_topwidget_dialog
- Popup mode: Different for each widget type
  - Choice: GFX*choice_topwidget_dialog_popup
  - Choice button box: GFX*choiceb_topwidget_dialog_popup
  - String: GFX*string_topwidget_dialog_popup
  - Valuator: GFX*valuator_topwidget_dialog_popup
- Nonpopup or popup mode: Different for each widget type
  - Menu bar: GFX*menubar_topwidget_menubar
  - Message: GFX*message_errors_messagebox

At the end of each of these strings, place the class or instance of the attribute you want to change. See OSF/Motif documentation or widget definition include files to obtain the class names.

The following examples illustrate how to change colors on various devices.

To change the cancel button background in the valuator device to yellow, use the following syntax:

```
GFX*valuator_cancel_pushbutton.background:yellow
```

To change all widgets of the valuator to blue, use the following syntax:

```
GFX*valuator_topwidget_dialog*background:blue
```

To change all choice menu pushbuttons (in popup and nonpopup mode) to green, use the following syntax:

```
GFX*choice_menu.XmPushButton.background:green
```

To change the menu pushbuttons only in popup mode to green, use the following syntax:

```
GFX*choice_topwidget_dialog_popop*choice_menu.XmPushButton.background:green
```

For further information on the syntax of Xdefaults file entries, see the Xdefaults file section in the worksystem documentation for the appropriate operating system. The widget class names are documented in the worksystem documentation, and are available in the widget definition include files.

9.14.2 Widget Hierarchies

Figure 9–1 through Figure 9–6 illustrate the widget hierarchy for each of the devices. These figures are provided to assist you in changing widget attributes.

When the OSF/Motif input mode is nonfixed, the top widget name will differ and the label widget is not used in the following widget hierarchies:

- Choice
- Choice button box
- Valuator
- String

The fixed widget name is on the left and the nonfixed widget name is on the right of the top of the hierarchy.

Figure 9–1 Menu Bar

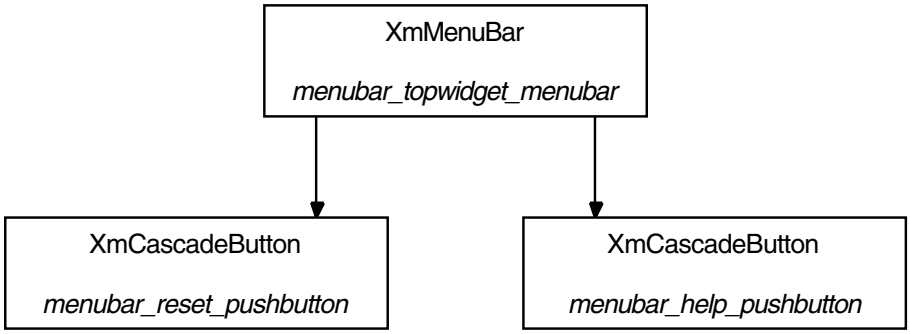
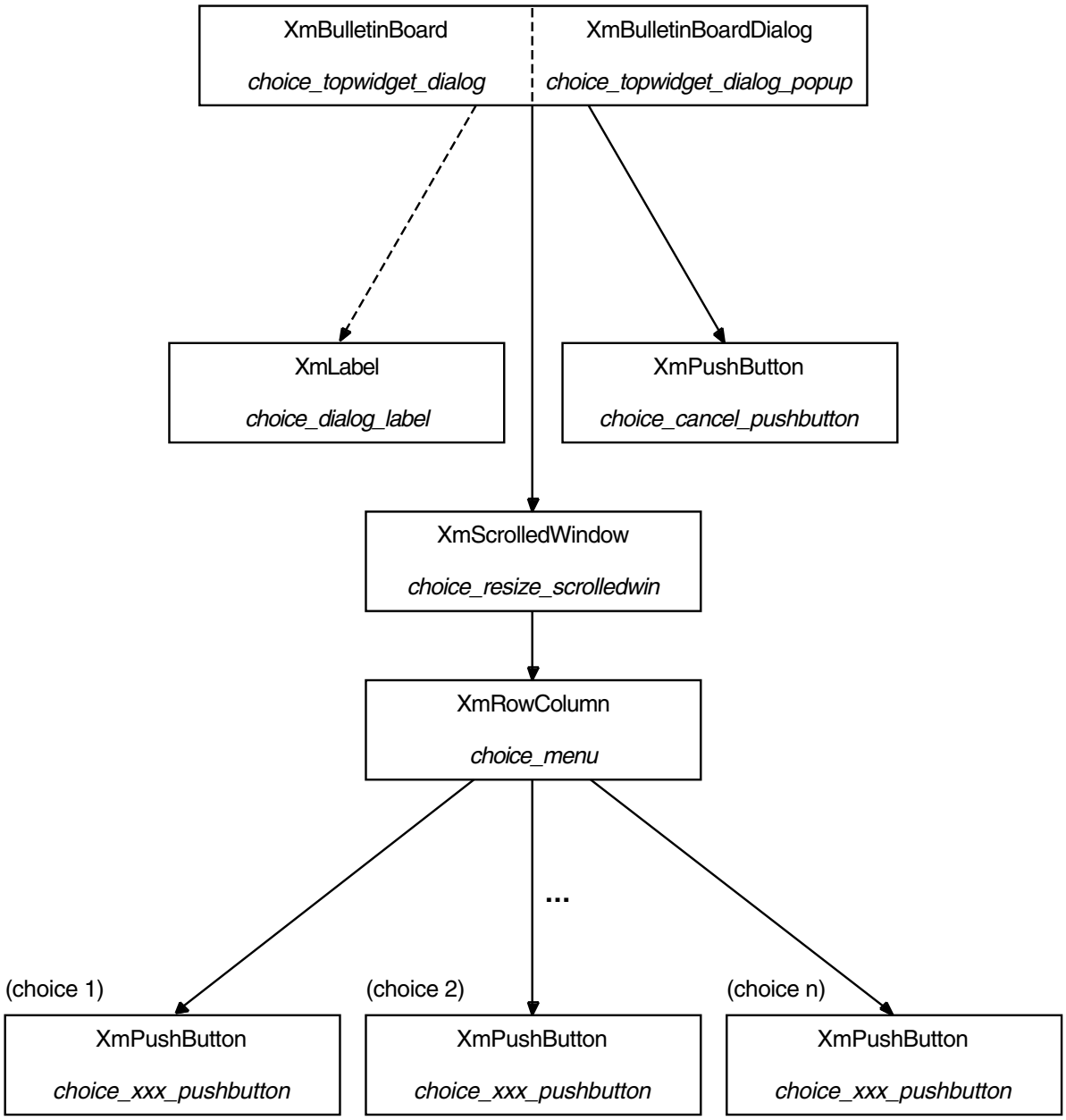


Figure 9–2 Choice Menu



xxx = default for choice PETs 2 to 5
xxx = trans for other choice PETs

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Figure 9–3 Choice Button Box (Software)

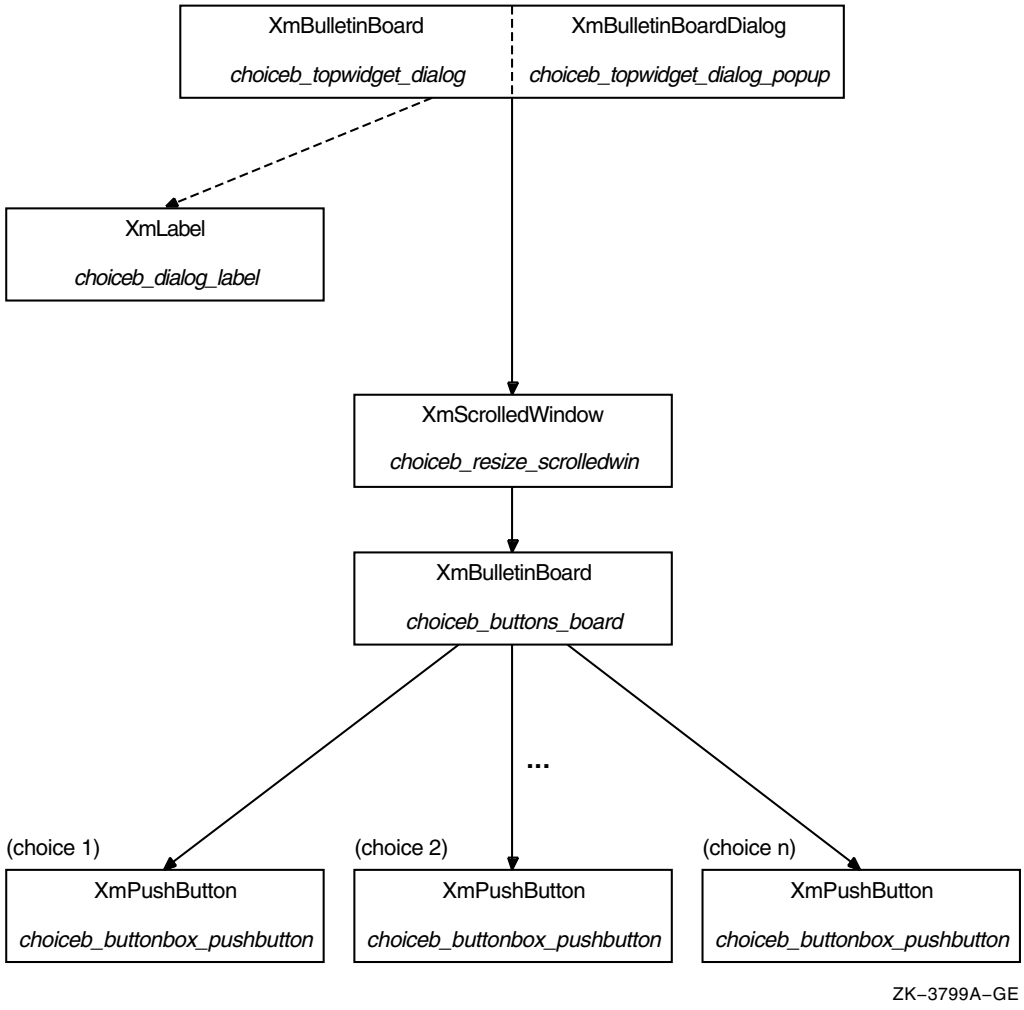

Figure 9–4 Valuator

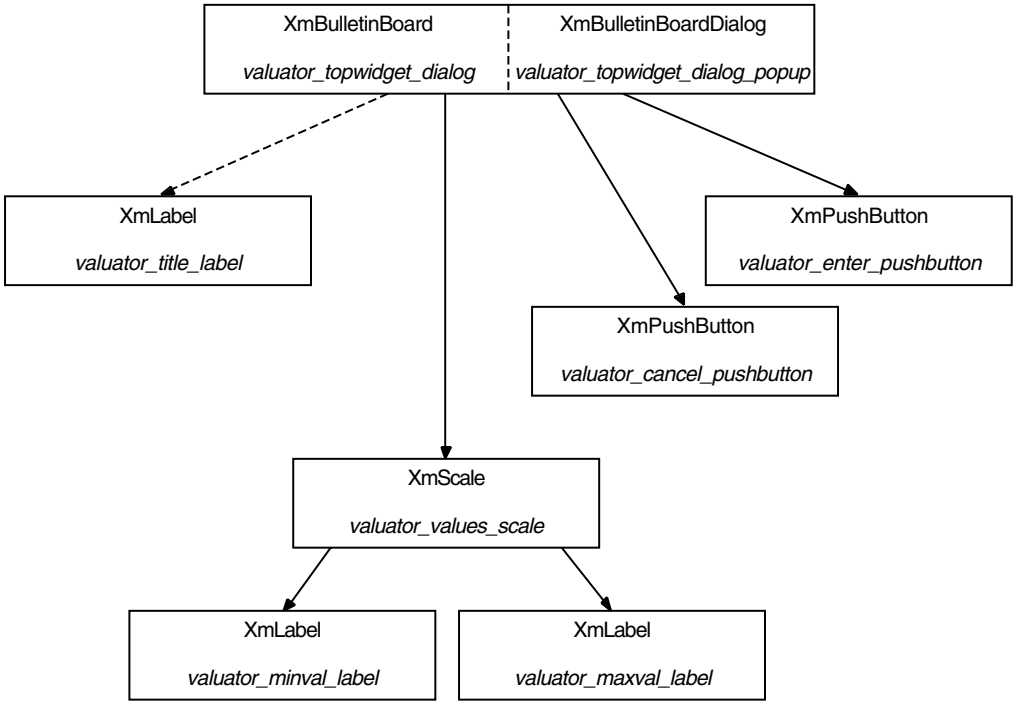

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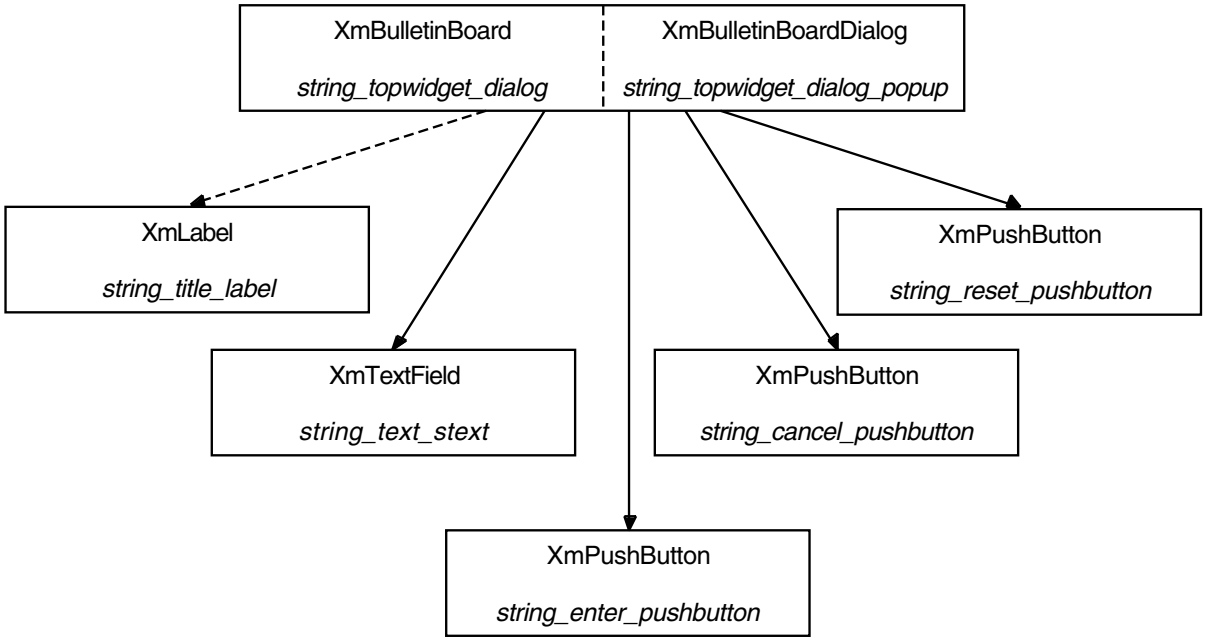
Figure 9–5 String



ZK–3804A–GE

Figure 9–6 Message Box

ZK–3805A–GE

9.15 Internationalization

The OSF/Motif device handler provides the following internationalization features:

- Default font set for the specified language
- Translated text in output widgets
- Control over text direction in output widgets

Any text that is displayed outside of a widget is not translated.

Use environment options to dictate which language to use. (See Table 9–1.) The language environment option can be set to any of the following integers:

- 0 = English
- 21 = Hebrew
- 22 = Japanese

If no language environment option is set, the default integer is 0 (English). By setting the language environment option, a language-specific UID file is read in at startup. In addition, the text direction field is set in accordance with the language type. To notify OSF/Motif of the current language in use, the language type can be set through the session manager. If a session manager is not available, the language type can be set through an environment option or with the Xdefaults file. See the OSF/Motif documentation appropriate to your operating system.

To use the Japanese fonts with English workstation types, set the language environment variable to Japanese (value 22). If you use the Japanese OSF/Motif workstation types (33*n*), you do not need to set the language environment option. The bit mask values and many other characteristics of the Japanese OSF/Motif workstation types are the same as the English OSF/Motif workstation types.

Note

Hebrew support is not included as part of the base DEC GKS or DEC PHIGS product, but is included as part of the localized version.

9.16 DEC GKS Sample Application

For a DEC GKS sample program performing pick input using workstation type 233, see the DEC GKS development kit. The program GKS_PICK233 samples the pick input device, creates a simple detectable (pickable) segment, and puts the pick input device into sample mode.

OpenGL Workstation

10
OpenGL Workstation

DEC PHIGS uses the OSF/Motif Toolkit for input support when you use OpenGL devices for output. OpenGL devices are supported only on X11 servers that support the OpenGL X11 extension. Before using an OpenGL device, you should read this chapter and Chapter 9.

Note

DEC GKS does not currently support the OpenGL X11 extension.

10.1 Environment Options

Table 10–1 summarizes the environment options you can use with the OpenGL workstations.

Table 10–1 OpenGL Environment Options

Syntax	Description
Anti-Aliasing	
PHIGS$ANTI_ALIASING PHIGSanti_aliasing	Specifies the anti-aliasing mode (0, 1, or 3). See Section 10.2.2 for detailed information on using anti-aliasing on OpenGL devices. For example, on OpenVMS systems, you define the DEC PHIGS logical name to enable anti-aliasing mode 1 as follows: `$ DEFINE PHIGS$ANTI_ALIASING 1` Return On UNIX systems, you define the DEC PHIGS environment variable to disable anti-aliasing as follows: `% setenv PHIGSanti_aliasing 0` Return

(continued on next page)

Table 10–1 (Cont.) OpenGL Environment Options

Syntax	Description
Connection Identifier	
PHIGS$CONID PHIGSconid	Specifies the default workstation connection information. On OpenVMS systems, the startup procedure PHIGS$STARTUP.COM, sets the default value. For example, on OpenVMS systems, you define the DEC PHIGS logical name for the connection identifier of a workstation as follows: $ **DEFINE PHIGS$CONID *SYSTEM_NAME*::0** Return On UNIX systems, you define the DEC PHIGS environment variable for the connection identifier of a workstation using the TCP/IP transport as follows: % **setenv PHIGSconid *nodename:n.n*** Return
Display List Indices	
PHIGS$GL_DL_BLOCK_SIZE PHIGSgl_dl_block_size	Specifies the size of the block of OpenGL display list indices that is allocated by DEC PHIGS. You can use this option to minimize the number of allocations, which can enhance the performance of your application. The default block size is 1024. Digital recommends that the block size be equal to the maximum number of primitive structure elements that will be present. For example, on OpenVMS systems, you define the DEC PHIGS logical name for the block size of the OpenGL display list indices as follows: $ **DEFINE PHIGS$GL_DL_BLOCK_SIZE 10000** Return On UNIX systems, you define the DEC PHIGS environment variable for the block size of the OpenGL display list indices as follows: % **setenv PHIGSgl_dl_block_size 1024** Return
Double Buffering	
PHIGS$DOUBLE_BUFFERING PHIGSdouble_buffering	Specifies whether double buffering is enabled (1) or disabled (0). When the value of this environment option is 1, DEC PHIGS attempts to use OpenGL double buffering. The default value is FALSE (0). For example, on OpenVMS systems, you define the DEC PHIGS logical name to enable double buffering as follows: $ **DEFINE PHIGS$DOUBLE_BUFFERING 1** Return On UNIX systems, you define the DEC PHIGS environment variable to disable double buffering as follows: % **setenv PHIGSdouble_buffering 0** Return

(continued on next page)

Table 10–1 (Cont.) OpenGL Environment Options

Syntax	Description
Hardware Dials and Buttons Flag	
PHIGS$USE_DIALS_AND_BUTTONS PHIGSuse_dials_and_buttons	Specifies whether the button and dial hardware must be available. If the value of this option is set to 0, DEC PHIGS emulates the button and dial boxes with on-screen widgets. If the value is set to 1, DEC PHIGS aborts if the button and dial box hardware is not available. If no value is specified for this option, DEC PHIGS uses the buttons and dials if they are available, or emulates them if they are not. For example, on OpenVMS systems, you define the DEC PHIGS logical name for the dials and buttons as follows: $ **DEFINE PHIGS$USE_DIALS_AND_BUTTONS 1** Return On UNIX systems, you define the DEC PHIGS environment variable for the dials and buttons as follows: % **setenv PHIGSuse_dials_and_buttons 1** Return For specific information on hardware dials and buttons support, see Appendix D.
Language	
PHIGS$LANGUAGE PHIGSlanguage	Specifies whether to use the English (value 0), Hebrew (value 21), or Japanese (value 22) language. The default value is 0. See Section 10.6 for more information on font support. For example, on OpenVMS systems, you define the DEC PHIGS logical name for the Hebrew language as follows: $ **DEFINE PHIGS$LANGUAGE 21** Return On UNIX systems, you define the DEC PHIGS environment variable for the Japanese language as follows: % **setenv PHIGSlanguage 22** Return
Stroke Font Index	
PHIGS$STROKE_FONT*nnn* PHIGS$STROKE_FONT_NEG*nnn* PHIGSstroke_font*nnn* PHIGSstroke_font_neg*nnn*	Allows you to set up file names for individual font indexes. The variable *nnn* is the font index. For example, on OpenVMS systems, you define the DEC PHIGS logical name for the stroke font index as follows: $ **DEFINE PHIGS$STROKE_FONT_NEG99 MYFONT.FNT** Return On UNIX systems, you define the DEC PHIGS environment variable for the stroke font index as follows: % **setenv PHIGSstroke_font_neg99 myfont.fnt** Return

(continued on next page)

Table 10–1 (Cont.) OpenGL Environment Options

Syntax	Description
Stroke Font List	
PHIGS$STROKE_FONT_LIST PHIGSstroke_font_list	Controls the list of font indexes for which you have set up names. Stroke font index 1 will always be in the stroke font list. DEC PHIGS attempts to open all stroke fonts in the list when it reads the environment option. If DEC PHIGS is unable to open the stroke font, it does not include the font index in its internal list. If you use a stroke font index that is not in the DEC PHIGS internal list, font index 1 is used. To determine which font index DEC PHIGS uses for the stroke font list, use the INQUIRE TEXT FACILITIES function. For example, on OpenVMS systems, you define the DEC PHIGS logical name for the stroke font list as follows: `$ DEFINE PHIGS$STROKE_FONT_LIST "-101"` Return On UNIX systems, you define the DEC PHIGS environment variable for the stroke font list as follows: `% setenv PHIGSstroke_font_list "-101, -103"` Return
Stroke Markers	
PHIGS$USE_STROKE_MARKERS PHIGSuse_stroke_markers	Specifies whether stroke markers are used. When the value of this option is 0, DEC PHIGS uses bitmap markers for all marker types. When the value of this option is 1 (the default), DEC PHIGS uses stroke markers for positive integer marker types and bitmap markers for negative integer marker types. On ZLX-* graphics options, stroke markers are rendered more quickly than bitmap markers. For example, on OpenVMS systems, you define the DEC PHIGS logical name to use stroke markers as follows: `$ DEFINE PHIGS$USE_STROKE_MARKERS 1` Return On UNIX systems, you define the DEC PHIGS environment variable to use only bitmap markers as follows: `% setenv PHIGSuse_stroke_markers 0` Return

(continued on next page)

Table 10–1 (Cont.) OpenGL Environment Options

Syntax	Description
Structure Storage	
PHIGS$DEVICE_STRUCT_SUPPORT_* PHIGSdevice_struct_support_*	Specifies where the DEC PHIGS data structure is stored. A value of 0 means that structure data is stored *only* on the X client side and all rendering is done in OpenGL immediate mode. A value of 4 means that all structure data is stored on the X client, and most output primitive data and some attribute data is also placed in OpenGL display lists to enhance performance. When structure mode 4 is being used, DEC PHIGS will render primitives by executing the OpenGL display list, where possible. In the syntax, * refers to the workstation type, for example, 270, 271, and so on. For example, on OpenVMS systems, you define the DEC PHIGS logical name for client-side structure store as follows: `$ DEFINE PHIGS$DEVICE_STRUCT_SUPPORT_270 0` Return On UNIX systems, you define the DEC PHIGS environment variable for server-side display lists as follows: `% setenv PHIGSdevice_struct_support_271 4` Return
Vertex Array Extension	
PHIGS$USE_GL_VERTEX_ARRAY_EXT PHIGSuse_gl_vertex_array_ext	Specifies whether the OpenGL vertex array extension is used. This interface allows an application to pass geometric data (such as polylines, polyline sets, and fill areas) to the server as arrays of data, which reduces the call overhead. By using this option, you can reduce the time required to transmit primitive data from the client to the server, especially when you are in OpenGL immediate mode (DEC PHIGS structure mode 0), and thus improve performance. If the value is 1 (the default), DEC PHIGS uses the vertex array interface (when it is supported by the X server) to pass the data to the server. If the value is 0, the vertex array interface is not used. Instead, DEC PHIGS uses the original vertex interface, whose individual functions (glVertex3f, glColor3f, and so on) are called once for each vertex. For example, on OpenVMS systems, you define the DEC PHIGS logical name to use the vertex array interface as follows: `$ DEFINE PHIGS$USE_GL_VERTEX_ARRAY_EXT 1` Return On UNIX systems, you define the DEC PHIGS environment variable to use the original vertex interface as follows: `% setenv PHIGSuse_gl_vertex_array_ext 0` Return

(continued on next page)

Table 10–1 (Cont.) OpenGL Environment Options

Syntax	Description
Visual Depth	
PHIGS$MAX_VISUAL_DEPTH PHIGSmax_visual_depth	Specifies the visual depth (number of color planes) to be used, where the greater the depth, the better the color resolution. If the value is 0, DEC PHIGS will create a window having the minimum depth supported by the graphics option used. For instance, when a ZLXp–E2 graphics option is used, using a value of 0 will generate a window with a depth of 8 (8 color planes). If the value is 1 (the default), DEC PHIGS will create a window having the maximum depth supported by the graphics option used. For instance, when you use a ZLXp–E2 graphics device with 24-bit double-buffered visuals disabled in the DEC Open3D server and you select a double-buffered visual, entering a value of 1 will generate a window with a depth of 12 (12 color planes). For an 8-plane device, values of 0 and 1 will result in windows of the same depth. For example, on OpenVMS systems, you define the DEC PHIGS logical name to create a window with a depth of 8 as follows: `$ DEFINE PHIGS$MAX_VISUAL_DEPTH 0` Return On UNIX systems, you define the DEC PHIGS environment variable to create a window with maximum visual depth as follows: `% setenv PHIGSmax_visual_depth 1` Return *Note: This option applies to workstation types 270 and 271 only.*

(continued on next page)

Table 10–1 (Cont.) OpenGL Environment Options

Syntax	Description
Visual Properties	
PHIGS$VISUAL_PROPERTIES PHIGSvisual_properties	Specifies the properties of the visual that will be enabled. The visual properties available are double buffering, anti-aliasing, and transparency. Each property corresponds to a single bit of hexadecimal bit mask: double buffering is controlled by bit 0, anti-aliasing by bit 1, and transparency by bit 2. You enable a property by setting the bit to 1, and disable a property by setting the bit to 0. Each combination of property settings is represented by a decimal value, which you enter to define this environment option. The decimal values are: 0 — No properties are enabled. 1 — Double buffering is enabled. This is the default. 2 — Anti-aliasing is enabled. 3 — Double buffering and anti-aliasing are enabled. 4 — Transparency is enabled. 5 — Transparency and double buffering are enabled. 6 — Transparency and anti-aliasing are enabled. 7 — Transparency, double buffering, and anti-aliasing are enabled. For example, on OpenVMS systems, you define the DEC PHIGS logical name to enable double buffering and anti-aliasing properties for the visual as follows: $ **DEFINE PHIGS$VISUAL_PROPERTIES 3** Return On UNIX systems, you define the DEC PHIGS environment variable to enable the transparency property for the visual as follows: % **setenv PHIGSvisual_properties 4** Return
Workstation Type	
PHIGS$WSTYPE PHIGSwstype	Specifies the workstation type. On OpenVMS systems, the startup procedure PHIGS$STARTUP.COM sets the default value. For example, on OpenVMS systems, you define the DEC PHIGS logical name for an OpenGL workstation type as follows: $ **DEFINE PHIGS$WSTYPE 270** Return On UNIX systems, you define the DEC PHIGS environment variable name for an OpenGL workstation type as follows: % **setenv PHIGSwstype 271** Return

10.2 Connection Identifier

A connection identifier must be defined for DEC PHIGS to work with the OpenGL devices. If you do not define the connection identifier, the OPEN WORKSTATION function returns an error. You can define the connection identifier in your code or in a logical name table to which your program has access.

The definition depends on whether you are running under the OpenVMS or UNIX operating system, and on the communication transport mechanism. (For more information on local transports, see Section G.1.9.) When using DEC PHIGS on OpenVMS systems, define the logical name PHIGS$CONID. When using DEC PHIGS on UNIX systems, define the environment variable PHIGSconid.

The connection identifier also depends on which type of workstation you are using, as defined by the display identifier. The following sections are broken down by workstation type.

Workstation Types 270 and 271

For workstations of type 270 and 271, the connection identifier must be defined using a valid X11 display identifier. The syntax depends on the communication transport mechanism, as shown in the following table.

Syntax	Transport Mechanism
nodename::n.n	Connect to display using DECnet.
nodename:n.n	Connect to display using TCP/IP.
DECW$DISPLAY	OpenVMS—specified by the SET DISPLAY command.
local:0	UNIX shared memory.
unix:0	UNIX domain sockets.

In the previous table:

- The *nodename* is the name of the host machine to which the display is physically connected.
- The first *n* is required. It specifies the display on the host machine and is usually 0.
- The second *n* is optional. It is the screen identifier and defaults to 0.

Workstation Type 272

For workstations of type 272, the connection identifier is an ASCII string consisting of the X display identifier and the X drawable identifier, separated by an exclamation point (!). Both values are expressed as decimal numbers. An example of a valid connection identifier would be:

1234857!388291

Workstation Type 273

For workstations of type 273, the connection identifier is an ASCII string representing the widget identifier. This value is expressed as a decimal number. An example of a valid connection identifier would be:

396251

10.2.1 HLHSR Mechanism Support for OpenGL Devices

All OpenGL devices support HLHSR identifiers (see Table 1–4). OpenGL devices also support the following HLHSR modes:

Mode	Description
0	HLHSR none (uses the HLHSR identifier)
2	Z buffer
5	HLHSR ignored

If the HLHSR mode is set to HLHSR_MODE_NONE, the current HLHSR identifier (a structure element) is used to determine which HLHSR mode is used.

All Digital OpenGL servers support forced color highlighting, which overrides interior and back interior color specifications. Using forced color highlighting with HLHSR may cause "artifacts" to be generated when unhighlighting is performed.

10.2.2 Anti-Aliasing Modes

For OpenGL servers, there are three modes of anti-aliasing available, each with a separate set of functionality and restrictions. These modes are:

- **Mode 0**—No anti-aliasing. When you use mode 0, no restrictions due to anti-aliasing exist.
- **Mode 1**—DEC PHIGS renders anti-aliased lines. DEC PHIGS blends each pixel on the anti-aliased line with the contents of the frame buffer. The pixels are always written, regardless of the computed value. The width of the anti-aliased line is a function of the line width.

  Anti-aliasing will function whether the HLHSR_MODE mode is set to ZBUFFER or OFF. If Z-buffering is on, the Z buffer will be updated when anti-aliased lines are drawn.
- **Mode 3**—DEC PHIGS performs essentially the same operation as in mode 1, except it blends each pixel on the anti-aliased line with the anti-alias background color (color table entry 0), rather than with the contents of the frame buffer. All pixels are written, regardless of their computed value. This mode is useful for erasing anti-aliasing lines in immediate mode, as the line color must be set to the background color to erase an anti-aliased line.

10.3 Workstation Type Values

When using the OpenGL workstation, you can specify workstation types as hexadecimal bit masks. The following table lists the different workstation type values you can use with OpenGL:

Workstation Type	Hexadecimal Value	Description
270	%x0000010E	Output-only device using OSF/Motif OpenGL
271	%x0000010F	Input/output device using OSF/Motif OpenGL
272	%x00000110	Output-only device within an OpenGL X11 application drawable (window or pixmap)
273	%x00000111	Input/output device within an OSF/Motif OpenGL application widget

OpenGL Output Only, Value 270

Workstation type 270 is output-only. DEC PHIGS creates an output window but does not select any X events. Consequently, your application is free to select any X events on this or any other window. In addition, these workstations will *not* redraw themselves when exposed or when an icon is expanded to a window. In such instances, your application should call the REDRAW ALL STRUCTURES function to force DEC PHIGS to redraw the window. These workstations do not make use of the OSF/Motif Toolkit, so your application is free to use this toolkit.

OpenGL Input and Output, Value 271

Workstation type 271 performs input and output, and uses the OSF/Motif Toolkit. Because of a restriction in the OSF/Motif Toolkit, your application may not initialize this toolkit if it uses workstation type 271. In addition, you should not select events on any windows created by the DEC PHIGS workstation.

You can create widgets that are children of some widgets belonging to the DEC PHIGS workstation. Escape functions are provided to obtain the identifiers of these widgets.

When the user or window manager resizes workstations of type 271, the picture may be clipped at the new window boundaries. A push button on the menu bar enables the user to restore the window to its default size and location. Scroll bars enable the user to pan the displayable region of a clipped picture.

OpenGL Window, Value 272

Workstation type 272 uses a pre-existing drawable, and is output only. Before opening the workstation, you must perform the following steps:

1. Open the X display.
2. Obtain a visual that is valid for use with OpenGL.

   You can obtain a visual of the correct type by using the glXChooseVisual or glGetConfig function. (Refer to Section 10.9 for an example of using the glXChooseVisual function to obtain a visual.)
3. Create a color map.

   You will probably need to create a color map for use with the visual.
4. Create a drawable using the visual type obtained in step 2.

You can then pass the drawable to the OPEN WORKSTATION function. Be sure to call the CLOSE WORKSTATION function before you close the display or destroy the drawable.

Workstation type 272 does not select any X events. Therefore, your application is free to select any X events on this or any other drawable. Furthermore, this workstation will *not* redraw itself when exposed or when an icon is expanded to

a drawable. In such instances, your application should call the REDRAW ALL STRUCTURES function to force DEC PHIGS to redraw the drawable.

This workstation does not use the OSF/Motif Toolkit, so your application has unrestricted use of this toolkit.

OpenGL Widget, Value 273

Workstation type 273 uses a pre-existing OSF/Motif Toolkit and OSF/Motif widget. Before opening the workstation, you must perform the following steps:

1. Initialize the X Toolkit.
2. Create an application context.
3. Open the X display using the X Toolkit.
4. Obtain a visual that is valid for use with OpenGL.

   You can obtain a visual of the correct type by using the glXChooseVisual or glGetConfig function. (Refer to Section 10.9 for an example of using glXChooseVisual to obtain a visual.)
5. Create a color map.

   You will probably need to create a color map for use with the visual.
6. Create an application shell using the visual obtained in step 4 and the color map created in step 5.
7. Create a main window, a bulletin board, and any other subsidiary widgets required by your application.

   You will use the bulletin board widget for your PHIGS workstation.
8. Realize the widget hierarchy you have just created.

You can then pass the bulletin board widget to the OPEN WORKSTATION function. Be sure to call the CLOSE WORKSTATION function *before* you close the display or destroy the OSF/Motif widget.

These types of workstations allow you to use either SAMPLE or EVENT mode for DEC PHIGS input in addition to using the OSF/Motif Toolkit in your application. If you use the AWAIT EVENT function, however, you must set the timeout parameter to 0 to avoid hanging up the devices.

Note

You cannot use REQUEST mode input with this workstation type. To do so results in an error.

10.4 Programming Considerations

You should review Chapter 9 before writing an application using the OpenGL devices with OSF/Motif software.

10.4.1 General Information

This section provides information and guidelines for using DEC PHIGS with an OpenGL device and OSF/Motif software:

- To open or query DEC PHIGS workstation types 270, 271, 272, and 273, your application must be running on a host that runs the OSF/Motif client-side software. The host does *not* need a physical display device, nor does it need the OSF/Motif server-side software.
- For workstation types 270 and 271, the connection identifier specifies the OSF/Motif display to use. The second argument to the OPEN WORKSTATION function names a connection identifier. If you specify an invalid display, DEC PHIGS returns an error when it attempts to open or query the workstation.
- When performing input, DEC PHIGS positions the input echo window as defined by the input echo area (in device coordinates). When generating output, DEC PHIGS positions the display window as defined by the current workstation viewport.
- DEC PHIGS provides a method to inquire about the window identifier and widget identifiers using escapes. The escapes and how to use them are described in Appendix B.

10.5 Input Information

The OpenGL devices support input devices in the same manner as OSF/Motif devices. See Chapter 9 for input information on the OSF/Motif workstation.

10.6 Font Support

All OpenGL workstation types 270-273 support 24 English fonts and a Japanese font (value –10001) in stroke precision. You can specify character or string precision for these fonts, but the OpenGL handler always uses stroke precision. To use Japanese fonts with English workstation types, you must set the language environment option to Japanese (value 22). See Table 10–1 for more information about available fonts.

10.7 Escapes

For a list of supported escapes, run the PHIGS_PREDEF program.

10.8 Limitations

When using the OpenGL driver, you should be aware of the following limitations:

- **Spread Angle of the Spot Light**

  The spread angle of the spot light in DEC PHIGS can vary from 0 to 180 degrees. When you use the OpenGL driver, however, this angle can be only from 0 to 90 degrees. Note, though, that the OpenGL driver does support the case when the DEC PHIGS spread angle is 180 degrees.

- **Reflectance Properties**

  DEC PHIGS allows reflectance be to calculated for front facing area primitives, back facing area primitives, or both. The OpenGL driver, however, calculates reflectance only for both front and back facing area primitives; it does not allow reflectance calculations for a single side.

  Therefore, if the facet distinguishing mode is YES, and the application specifies that front facing area primitives are lit and back facing area primitives are not, OpenGL will light both front and back facing primitives according to the setting of the SET REFLECTANCE MODEL function. If, instead, the back facing primitives are lit and the front facing primitives are not, both sets of primitives will be lit according to the setting of the SET BACK REFLECTANCE MODEL function.

- **Shading**

  DEC PHIGS allows an application to specify an interior shading method and a back interior shading method. When the facet distinguishing mode is YES, both shading methods are applied to area primitives. The OpenGL driver, however, does not allow different shading methods to be applied to front and back facing area primitives. As a result, if the facet distinguishing mode is YES, and the interior shading method or back interior shading method is set to COLOR, the COLOR setting will be applied to both the front and back facing primitives.

  Note

  The OpenGL driver supports only the NONE and COLOR settings of the SET INTERIOR SHADING METHOD and SET BACK INTERIOR SHADING METHOD functions.

- **Facet Normals and Vertex Colors**

  Quad mesh and triangle strip area primitives with facet normals and vertex colors defined are handled differently by the PEX and OpenGL drivers. Unlike PEX, OpenGL does not process facet normals. Therefore, when OpenGL encounters a quad mesh or triangle strip area primitive with facet normals and vertex colors defined, it divides these primitives into separate rectangles and triangles, respectively. As a result, these primitives may not be shaded in the same way on PEX and on OpenGL.

- **Specular Highlighting Effects**

  The specular exponent defined in the SET REFLECTANCE PROPERTIES function does not generate the same display on PEX and OpenGL workstations. To achieve the PEX specular highlighting effects on OpenGL, the application should multiply the specular exponent defined on PEX by two.

10.9 Examples

The examples in this section show how to create windows for workstation types 272 and 273. Because window creation for workstation types 270 and 271 is easier than for types 272 and 273, only the 272 and 273 type examples are provided in this document.

Example 10–1 illustrates the calls you could use to create a window for workstation type 272.

Example 10–1 Creating a Window for Workstation Type 272

```
int create_gl_window(
    int want_double_buffering,
    Window *Phigs_window
)
{
    Visual                *visual;
    XSetWindowAttributes  xswa;
    XVisualInfo           *visual_info;
    XWindowAttributes     window_attb;
    /* Define the OpenGL visual attributes preferred */
    int                   visual_attributes[] =
        {GLX_RGBA, GLX_RED_SIZE, 1, GLX_GREEN_SIZE, 1,
         GLX_BLUE_SIZE, 1, GLX_DEPTH_SIZE, 16, None};
    int                   visual_attributes_with_db[] =
        {GLX_RGBA, GLX_RED_SIZE, 1, GLX_GREEN_SIZE, 1,
         GLX_BLUE_SIZE, 1, GLX_DEPTH_SIZE, 16,
         GLX_DOUBLEBUFFER, None};
    int                   *visual_attr_ptr;
    XSetWindowAttributes  wattr;
    int                   nvals;
    unsigned long         valuemask;
    int                   dummy;
    Display               x_display;
    int                   want_double_buffering = 1;
    unsigned int          window_offset = 0;
    unsigned int          window_width = 500;
    unsigned int          window_height = 500;

    x_display = XOpenDisplay(NULL);
    if (x_display == NULL) {
        printf("could not open display");
        return( 1 );
        }

    if(!glXQueryExtension(x_display, &dummy, &dummy)) {
        printf("X server has no OpenGL GLX extension");
        return( 1 );
        }

    if ( want_double_buffering )
        visual_attr_ptr = &visual_attributes_with_db[0];
    else
    visual_attr_ptr = &visual_attributes[0];

    visual_info = glXChooseVisual(x_display, DefaultScreen( x_display ),
                  visual_attr_ptr);
    if (visual_info == NULL) {
    printf("Cannot get visual");
        return( 1 );
        }
    if (visual_info->class != TrueColor) {
    printf("Cannot get TrueColor visual");
        return( 1 );
        }
```

(continued on next page)

Example 10–1 (Cont.) Creating a Window for Workstation Type 272

```
    wattr.event_mask = ButtonPressMask | ExposureMask | StructureNotifyMask;
    wattr.background_pixel = XWhitePixel(x_display, XDefaultScreen(x_display));
    wattr.bit_gravity = CenterGravity;
    wattr.border_pixel = 0x00000000;
    valuemask = CWEventMask | CWBackPixel | CWBitGravity | CWBorderPixel;
    wattr.colormap = XCreateColormap ( x_display, RootWindow(x_display, 0),
                     visual_info->visual, AllocNone);
    XInstallColormap (x_display, wattr.colormap);
    valuemask |= CWColormap;
    *Phigs_window = XCreateWindow(x_display, RootWindow( x_display, 0 ),
                  window_offset, window_offset,
                  window_width, window_height,
                  1,
                  visual_info->depth,
                  InputOutput,
                  visual_info->visual,
                  valuemask,
                  &wattr);
    XSetWindowColormap (x_display, *Phigs_window, wattr.colormap);

    return( 0 );
}
```

Example 10–2 illustrates the calls you could use to create a window for workstation type 273.

Example 10–2 Creating a Window for Workstation Type 273

```
#include <Xm/Xm.h>                  /* General Motif header */
#include <X11/Shell.h>              /* Shell widget class */
#include <Xm/MainW.h>               /* Main Window widget class */
#include <Xm/RowColumn.h>           /* Row Column widget class */
#include <Xm/CascadeB.h>            /* Cascade Button widget class */
#include <Xm/BulletinB.h>           /* Bulletin Board widget class */
#include <Mrm/MrmAppl.h>            /* UIL */

#include <GL/gl.h>
#include <GL/glu.h>
#include <GL/glx.h>

typedef void (*VoidProc) ();
typedef struct
    {
    VoidProc    proc;
    int         tag;
    }
MyCallback;

void   exit_pushed( Widget widget );

static MyCallback callbacks[] = {{exit_pushed, NULL}, NULL};
```

(continued on next page)

Example 10–2 (Cont.) Creating a Window for Workstation Type 273

```
Widget  create_gl_widget(
    int         double_buffering,
    char        *program_name,
    char        *program_class,
    MyCallback  callbacks[],
    int         argc,
    char        *argv[]
)
{
    Display       *display;
    Widget         top_level;
    Widget         main_widget;
    Widget         phigs_widget;
    Widget         menu_bar;
    Widget         exit_button;
    Arg            arg_list[ARG_MAX];
    Cardinal       arg_count;
    XtAppContext   app_context;
    int            *visual_attributes;
    XVisualInfo    *vi;
    Colormap       cmap;
    static int     dblBuf[] = {
        GLX_DOUBLEBUFFER, GLX_RGBA, GLX_DEPTH_SIZE, 16,
        GLX_RED_SIZE, 1, GLX_GREEN_SIZE, 1, GLX_BLUE_SIZE, 1,
        None
        };
    static int     *snglBuf = &dblBuf[1];

    XtToolkitInitialize ();

    app_context = XtCreateApplicationContext ();

    display = XtOpenDisplay (
              app_context,                      /* Application context */
              NULL,                             /* Display name */
              program_name,                     /* Application name */
              program_class,                    /* Class name */
              NULL,                             /* Optional argument list */
              0,                                /* Optional argument count */
              &argc,                            /* Standard argument count */
              argv);                            /* Standard argument values */

    if (display == NULL)
        {
    printf ("ERROR - Failed to open default display.\n");
    return  NULL;
        }

    if (double_buffering)
        {
        visual_attributes = dblBuf;
        }
    else
        {
        visual_attributes = snglBuf;
        }
    vi = glXChooseVisual( display, DefaultScreen(display), visual_attributes );
    if (vi == NULL)
        {
        XtAppError(app_context, "no RGB visual with depth buffer");
        }
```

(continued on next page)

Example 10–2 (Cont.) Creating a Window for Workstation Type 273

```
/*
 * Create an application shell widget
 */
 arg_count = 0;
 XtSetArg (arg_list[arg_count], XtNallowShellResize, TRUE); arg_count++;
 XtSetArg (arg_list[arg_count], XmNwidth,  (Dimension)800); arg_count++;
 XtSetArg (arg_list[arg_count], XmNheight, (Dimension)800); arg_count++;
 top_level = XtAppCreateShell (program_name,  /* Name */
                               program_class, /* Class */
                               applicationShellWidgetClass,
                                            /* Widget class */
                               display,      /* Display */
                               arg_list,     /* Argument list */
                               arg_count);   /* Argument count */

 cmap = XCreateColormap(display, RootWindow(display, vi->screen),
           vi->visual, AllocNone);
 /*
  * Establish the visual, depth, and colormap of the top_level
  * widget _before_ the widget is realized.
  */
 XtVaSetValues(top_level, XtNvisual, vi->visual, XtNdepth, vi->depth,
       XtNcolormap, cmap, NULL);

/*
 * Create a main window widget
 */
 arg_count = 0;
 main_widget = XmCreateMainWindow (top_level,    /* Parent */
                                   "main",       /* Name */
                                   arg_list,     /* Argument list */
                                   arg_count);   /* Argument count */
 XtManageChild (main_widget);

/*
 * Create Menu bar
 */
 arg_count = 0;
 menu_bar = XmCreateMenuBar (main_widget,     /* Parent */
                             "menu_bar",      /* Name */
                             arg_list,        /* Argument list */
                             arg_count);      /* Argument count */
 XtManageChild (menu_bar);

/*
 * Create an Exit cascade button
 */
 arg_count = 0;
 XtSetArg (arg_list[arg_count], XmNlabelString,
           XmStringCreateLtoR ("Exit", "")); arg_count++;
 XtSetArg (arg_list[arg_count], XmNactivateCallback, callbacks);
 arg_count++;
 exit_button = XmCreateCascadeButton (
               menu_bar,               /* Parent */
               "exitbutton",           /* Name */
               arg_list,               /* Argument list */
               arg_count);             /* Argument count */
 XtManageChild (exit_button);
```

(continued on next page)

Example 10–2 (Cont.) Creating a Window for Workstation Type 273

```
    /*
     * Create a bulletin board widget for PHIGS
     */
     arg_count = 0;
     XtSetArg (arg_list[arg_count], XmNmarginWidth, 0); arg_count++;
     XtSetArg (arg_list[arg_count], XmNmarginHeight, 0); arg_count++;
     phigs_widget = XmCreateBulletinBoard (
                    main_widget,           /* Parent */
                    "phigs",               /* Name */
                    arg_list,              /* Argument list */
                    arg_count);            /* Argument count */
     XtManageChild (phigs_widget);

    /*
     * Place menu bar, PHIGS window and scroll bars on main window
     */
     XmMainWindowSetAreas (main_widget,    /* Widget to set up */
                           menu_bar,       /* Menu bar widget */
                           NULL,           /* No command window */
                           NULL,           /* No horizontal scrollbar */
                           NULL,           /* No vertical scrollbar */
                           phigs_widget);  /* Work area */

    /*
     * Widgets must be realized before the call to popenws ()
     */
     XtRealizeWidget (top_level);
     return  phigs_widget;
}
```

PEX Workstation

11
PEX Workstation

DEC GKS and DEC PHIGS use the DECwindows and OSF/Motif Toolkits for input support when you use PEX for output. Workstation type 241 uses the OSF/Motif Toolkit for input and PEX for output. Workstation type 221 uses the DECwindows Toolkit for input and PEX for output.

PEX devices are supported only on X11 servers that support the PEX X11 extension.

11.1 Environment Options

Table 11–1 summarizes the environment options you can use with the PEX workstations.

Table 11–1 PEX Environment Options

Syntax	Description
Anti-Aliasing	
GKS$ANTI_ALIASING GKSanti_aliasing PHIGS$ANTI_ALIASING PHIGSanti_aliasing	Specifies the anti-aliasing mode, in the range 0 to 3. See Section 11.2.2 for detailed information on using anti-aliasing on PEX devices. For example, on OpenVMS systems, you define the DEC PHIGS logical name to enable anti-aliasing mode 1 as follows: $ **DEFINE PHIGS$ANTI_ALIASING 1** Return On UNIX systems, you define the DEC GKS environment variable to disable anti-aliasing as follows: % **setenv GKSanti_aliasing 0** Return
Clear the Image and Z Buffer	
PHIGS$CLEAR_IZ PHIGSClear_IZ	Specifies that the server automatically clear the image and Z buffer when it starts a structure traversal. Clearing the image and Z buffers simultaneously has performance advantages on some platforms (compared to clearing the image and Z buffers separately). The value of this option defaults to TRUE (1). For example, on OpenVMS systems, you define the DEC PHIGS logical name for clearing the image and Z-buffer as follows: $ **DEFINE PHIGS$CLEAR_IZ 1** Return On UNIX systems, you define the DEC PHIGS environment variable to disable clearing the image and Z-buffer as follows: % **setenv PHIGSClear_IZ 0** Return

(continued on next page)

Table 11–1 (Cont.) PEX Environment Options

Syntax	Description
Connection Identifier	
GKS$CONID GKSconid PHIGS$CONID PHIGSconid	Specifies the default workstation connection information. On OpenVMS systems, the startup procedure, GKSTARTUP.COM or PHIGS$STARTUP.COM, sets the default value. For example, on OpenVMS systems, you define the DEC PHIGS logical name for the connection identifier of a workstation as follows: $ **DEFINE PHIGS$CONID *SYSTEM_NAME*::0** Return On UNIX systems, you define the DEC GKS environment variable for the connection identifier of a workstation using the TCP/IP transport as follows: % **setenv GKSconid *nodename:n.n*** Return
Default Color Map	
GKS$USE_DEFAULT_COLOR_MAP GKSuse_default_color_map PHIGS$USE_DEFAULT_COLOR_MAP PHIGSuse_default_color_map	Specifies the color map to be used. If the value of this option is 1, the workstation will use only the default color map that is associated with the root window. If the value of this option is 0, the workstation will use the color map that has a sufficient number of color cells. This can be either the default (root window) color map or a private color map, depending on the workstation type and the default visual type of the system. For example, on OpenVMS systems, you define the DEC PHIGS logical name for the default color map as follows: $ **DEFINE PHIGS$USE_DEFAULT_COLOR_MAP 1** Return On UNIX systems, you define the DEC GKS environment variable to use a color map that has enough memory as follows: % **setenv GKSuse_default_color_map 0** Return

(continued on next page)

Table 11–1 (Cont.) PEX Environment Options

Syntax	Description
Digital PEX Extension	
GKS$USE_MPEX GKSuse_mpex PHIGS$USE_MPEX PHIGSuse_mpex	Controls whether DEC GKS and DEC PHIGS will generate any Digital Proprietary MPEX requests. Setting this environment option to 0 forces DEC GKS and DEC PHIGS to strictly generate standard PEX protocol. In general, you do not need to set this environment option. On connect to a PEX server, DEC GKS and DEC PHIGS query to see if the server supports the MPEX extensions. If the server supports MPEX requests, DEC GKS and DEC PHIGS will use them. If the server does not support MPEX, DEC GKS and DEC PHIGS will not use MPEX requests. There are cases in which DEC GKS and DEC PHIGS cannot simulate what MPEX requests can do. If there is no equivalent PEX request for an MPEX request, DEC GKS and DEC PHIGS will not support the feature provided by the MPEX request. PEX Version 5.1 offers more MPEX features than does Version 5.0. For example, if USE_MPEX is 0, picking will not function on PEX Version 5.0 servers, but will function on PEX Version 5.1 servers. With the circle primitive, if USE_MPEX is 1, DEC GKS and DEC PHIGS use the MPEX circle primitive. If USE_MPEX is 0, DEC GKS and DEC PHIGS uses the PEXNurbCurve primitive to simulate the primitive. For example, on OpenVMS systems, you define the DEC PHIGS logical name to enable the Digital PEX extension as follows: $ **DEFINE PHIGS$USE_MPEX 1** Return On UNIX systems, you define the DEC GKS environment variable to use only the standard PEX protocol as follows: % **setenv GKSuse_mpex 0** Return
Double Buffering	
GKS$DOUBLE_BUFFERING GKSdouble_buffering PHIGS$DOUBLE_BUFFERING PHIGSdouble_buffering	Specifies whether double buffering is enabled (1) or disabled (0). The default value is FALSE (0). When the value of this environment option is 1, DEC GKS and DEC PHIGS first attempt to use MIT double buffering. If MIT double buffering is not supported by the server, DEC GKS and DEC PHIGS use pixmap double buffering. If you want pixmap double buffering, set the double buffering flag to 1, and the MIT double buffering flag to 0. For example, on OpenVMS systems, you define the logical name to enable double buffering as follows: $ **DEFINE PHIGS$DOUBLE_BUFFERING 1** Return On UNIX systems, you define the environment variable to disable double buffering as follows: % **setenv GKSdouble_buffering 0** Return

(continued on next page)

Table 11–1 (Cont.) PEX Environment Options

Syntax	Description
Hardware Dials and Buttons Flag	
PHIGS$USE_DIALS_AND_BUTTONS PHIGSuse_dials_and_buttons	Specifies whether the button and dial hardware must be available. If the value of this option is set to 0, DEC PHIGS emulates the button and dial boxes with on-screen widgets. If the value is set to 1, DEC PHIGS aborts if the button and dial box hardware is not available. If no value is specified for this option, DEC PHIGS uses the buttons and dials hardware if they are available, or emulates them if they are not. For example, on OpenVMS systems, you define the DEC PHIGS logical name for the dials and buttons as follows: $ **DEFINE PHIGS$USE_DIALS_AND_BUTTONS 1** Return On UNIX systems, you define the DEC PHIGS environment variable for the dials and buttons as follows: % **setenv PHIGSuse_dials_and_buttons 1** Return For specific information on hardware dials and buttons support, see Appendix D.
Language	
GKS$LANGUAGE GKSlanguage PHIGS$LANGUAGE PHIGSlanguage	Specifies whether to use the English (value 0), Hebrew (value 21), or Japanese (value 22) language. The default value is 0. See Section 11.7 for more information on font support. For example, on OpenVMS systems, you define the DEC PHIGS logical name for the Hebrew language as follows: $ **DEFINE PHIGS$LANGUAGE 21** Return On UNIX systems, you define the DEC GKS environment variable for the Japanese language as follows: % **setenv GKSlanguage 22** Return

(continued on next page)

Table 11–1 (Cont.) PEX Environment Options

Syntax	Description
MIT Double Buffering	
GKS$MIT_DB_ENABLE GKSmit_db_enable PHIGS$MIT_DB_ENABLE PHIGSmit_db_enable	Specifies which type of double buffering is to be enabled. MIT double buffering is supported on all platforms except VS3520. Pixmap double buffering is supported on all workstations that support double buffering. When swapping buffers, pixmap double buffering is slower than MIT double buffering. However, when doing window repairs following an expose event, pixmap double buffering is faster. This option defaults to a value of TRUE (1). When the value of the double buffering flag is 1, DEC GKS and DEC PHIGS first attempt to use MIT double buffering. If MIT double buffering is not supported by the server, DEC GKS and DEC PHIGS use pixmap double buffering. If you want pixmap double buffering, set the double buffering flag to 1, and the MIT double buffering flag to 0. For example, on OpenVMS systems, you define the DEC PHIGS logical name to enable MIT double buffering as follows: $ **DEFINE PHIGS$MIT_DB_ENABLE 1** Return On UNIX systems, you define the DEC GKS environment variable to disable MIT double buffering as follows: % **setenv GKSmit_db_enable 0** Return
Number of Blues in the Color Cube	
PHIGS$NUM_BLUE_FOR_TRUE PHIGSnum_blue_for_true	Specifies the number of shades of blue that DEC PHIGS allocates in the true color map. The value of this option defaults to four shades of blue. This environment option is used only when DirectColor PseudoColor visuals are encountered. PseudoColor visuals are common on PEX 8-plane workstations. For example, on OpenVMS systems, you define the DEC PHIGS logical name for the number of blues to 2 as follows: $ **DEFINE PHIGS$NUM_BLUE_FOR_TRUE 2** Return On UNIX systems, you define the DEC PHIGS environment variable for the number of blues to 4 as follows: % **setenv PHIGSnum_blue_for_true 4** Return

(continued on next page)

Table 11–1 (Cont.) PEX Environment Options

Syntax	Description
Number of Fixed Colors	
GKS$NUM_FIXED_COLORS GKSnum_fixed_colors PHIGS$NUM_FIXED_COLORS PHIGSnum_fixed_colors	If the visual type of the screen is PseudoColor, this option specifies the number of colors to allocate for use by free-standing widgets such as the choice or valuator windows. The default value is 6 and the minimum value is 4. For example, on an OpenVMS system, you define the DEC PHIGS logical name to allocate 32 colors for DEC PHIGS as follows: $ **DEFINE PHIGS$NUM_FIXED_COLORS 32** Return On UNIX systems, you define the DEC PHIGS environment variable to allocate 16 colors for DEC PHIGS as follows: % **setenv GKSnum_fixed_colors 16** Return
Number of Greens in the Color Cube	
PHIGS$NUM_GREEN_FOR_TRUE PHIGSnum_green_for_true	Specifies the number of shades of green that DEC PHIGS allocates in the true color map. The value of this option defaults to four shades of green. This environment option is used only when DirectColor PseudoColor visuals are encountered. PseudoColor visuals are common on PEX 8-plane workstations. For example, on OpenVMS systems, you define the DEC PHIGS logical name for the number of greens to 2 as follows: $ **DEFINE PHIGS$NUM_GREEN_FOR_TRUE 2** Return On UNIX systems, you define the DEC PHIGS environment variable for the number of greens to 4 as follows: % **setenv PHIGSnum_green_for_true 4** Return
Number of Pseudo Colors	
PHIGS$NUM_PSEUDO_COLORS PHIGSnum_pseudo_colors	Specifies the number of color cells that DEC PHIGS uses for its pseudo color table. The value of this option defaults to 64 color cells. For example, on OpenVMS systems, you define the DEC PHIGS logical name for the number of pseudo colors to 0 as follows: $ **DEFINE PHIGS$NUM_PSEUDO_COLORS 0** Return On UNIX systems, you define the DEC PHIGS environment variable for the number of pseudo colors to 32 as follows: % **setenv PHIGSnum_pseudo_colors 32** Return

(continued on next page)

Table 11–1 (Cont.) PEX Environment Options

Syntax	Description
Number of Reds in the Color Cube	
PHIGS$NUM_RED_FOR_TRUE PHIGSnum_red_for_true	Specifies the number of shades of red that DEC PHIGS allocates in the true color map. The value of this option defaults to eight shades of red. This environment option is used only when DirectColor PseudoColor visuals are encountered. PseudoColor visuals are common on PEX 8-plane workstations. For example, on OpenVMS systems, you define the DEC PHIGS logical name for the number of reds to 4 as follows: $ **DEFINE PHIGS$NUM_RED_FOR_TRUE 4** Return On UNIX systems, you define the DEC PHIGS environment variable for the number of reds to 2 as follows: % **setenv PHIGSnum_red_for_true 2** Return
Structure Storage	
GKS$DEVICE_STRUCT_SUPPORT_* GKSdevice_struct_support_* PHIGS$DEVICE_STRUCT_SUPPORT_* PHIGSdevice_struct_support_*	Specifies client-side or server-side structure storage. In the syntax, * refers to the workstation type, for example, 240, 241, and so on. The possible values are 0 (client-side structure store) and 3 (server-side structure store). The default value is 3. For example, on OpenVMS systems, you define the DEC PHIGS logical name for client-side structure store as follows: $ **DEFINE PHIGS$DEVICE_STRUCT_SUPPORT_240 0** Return On UNIX systems, you define the DEC GKS environment variable for server-side structure store as follows: % **setenv GKSdevice_struct_support_241 3** Return
Standard Color Map	
GKS$USE_STANDARD_COLOR_MAP GKSuse_standard_color_map PHIGS$USE_STANDARD_COLOR_MAP PHIGSuse_standard_color_map	Allows several DEC GKS or DEC PHIGS 24*x* and 22*x* series workstations to share a single color map, so that separate workstations do not cause their neighboring workstations to display false colors. To use an X standard color map, set this environment option to the X standard color map you want to use, such as RGB_DEFAULT_MAP. For example, on OpenVMS systems, you define the DEC PHIGS logical name for the standard color map as follows: $ **DEFINE PHIGS$USE_STANDARD_COLOR_MAP RGB_DEFAULT_MAP** Return On UNIX systems, you define the DEC GKS environment variable for the standard color map as follows: % **setenv GKSuse_standard_color_map RGB_DEFAULT_MAP** Return

(continued on next page)

Table 11–1 (Cont.) PEX Environment Options

Syntax	Description
Stroke Font Index	
GKS$PEX_STROKE_FONT*nnn* GKS$PEX_STROKE_FONT_NEG*nnn* GKSpex_stroke_font*nnn* GKSpex_stroke_font_neg*nnn* PHIGS$PEX_STROKE_FONT*nnn* PHIGS$PEX_STROKE_FONT_NEG*nnn* PHIGSpex_stroke_font*nnn* PHIGSpex_stroke_font_neg*nnn*	Allows you to set up file names for individual font indexes. The variable *nnn* is the font index. For example, on OpenVMS systems, you define the DEC PHIGS logical name for the stroke font index as follows: $ **DEFINE PHIGS$PEX_STROKE_FONT_NEG99 MYFONT.FNT** Return On UNIX systems, you define the DEC GKS environment variable for the stroke font index as follows: % **setenv GKSpex_stroke_font_neg99 myfont.fnt** Return
Stroke Font List	
GKS$PEX_STROKE_FONT_LIST GKSpex_stroke_font_list PHIGS$PEX_STROKE_FONT_LIST PHIGSpex_stroke_font_list	Controls the list of font indexes for which you have set up names. Stroke font index 1 will always be in the stroke font list. DEC GKS and DEC PHIGS attempt to open all stroke fonts in the list when they read the environment option. If DEC GKS and DEC PHIGS are unable to open the PEX stroke font, they do not include the font index in their internal list. If you use a stroke font index that is not in the DEC GKS and DEC PHIGS internal list, font index 1 is used. To determine which font index DEC GKS and DEC PHIGS use for the stroke font list, use the INQUIRE TEXT FACILITIES function. For example, on OpenVMS systems, you define the DEC PHIGS logical name for the stroke font list as follows: $ **DEFINE PHIGS$PEX_STROKE_FONT_LIST "-101"** Return On UNIX systems, you define the DEC GKS environment variable for the stroke font list as follows: % **setenv GKSpex_stroke_font_list "-101, -103"** Return
Workstation Type	
GKS$WSTYPE GKSwstype PHIGS$WSTYPE PHIGSwstype	Specifies the workstation type. On OpenVMS systems, the startup procedure GKSTARTUP.COM or PHIGS$STARTUP.COM sets the default value. For example, on OpenVMS systems, you define the DEC PHIGS logical name for a PEX workstation type as follows: $ **DEFINE PHIGS$WSTYPE 240** Return On UNIX systems, you define the DEC GKS environment variable for a PEX device as a device within an application widget, as follows: % **setenv GKSwstype 243** Return

11.2 Connection Identifier

A connection identifier must be defined for DEC GKS and DEC PHIGS to work with the PEX devices. If you do not define the connection identifier, the OPEN WORKSTATION function returns an error. You can define the connection identifier in your code or in a logical names table to which your program has access.

The definition depends on whether you are running under the OpenVMS or UNIX operating system, and on the communication transport mechanism. (For more information on local transports, see Section G.1.9.) When using DEC PHIGS:

- On OpenVMS systems, define the logical name PHIGS$CONID.
- On UNIX systems, define the environment variable PHIGSconid.

When using DEC GKS:

- On OpenVMS systems, define the logical name GKS$CONID.
- On UNIX systems, define the environment variable GKSconid.

The connection identifier also depends on which type of workstation you are using, as defined by the display identifier. The following sections are broken down by workstation type.

Workstation Types 220, 221, 240, and 241

For workstations of type 220, 221, 240, and 241 the connection identifier must be defined using a valid DECwindows and OSF/Motif display identifier. The syntax depends on the communication transport mechanism, as shown in the following table.

Syntax	Transport Mechanism
nodename::n.n	Connect to display using DECnet.
nodename:n.n	Connect to display using TCP/IP.
DECW$DISPLAY	OpenVMS—specified by the SET DISPLAY command.
local:0	UNIX shared memory.
unix:0	UNIX domain sockets.

In the previous table:

- The *nodename* is the name of the host machine to which the display is physically connected.
- The first *n* is required. It specifies the display on the host machine and is usually 0.
- The second *n* is optional. It is the screen identifier and defaults to 0.

Workstation Types 222 and 242

For workstations of type 222 and 242, the connection identifier is an ASCII string consisting of the X display identifier and the X drawable identifier, separated by an exclamation point. Both values are expressed as decimal numbers. An example of a valid connection identifier would be:

1234857!388291

Workstation Types 223 and 243

For workstations of types 223 and 243, the connection identifier is an ASCII string representing the widget identifier. Both values are expressed as decimal numbers. An example of a valid connection identifier would be:

396251

11.2.1 HLHSR Mechanism Support for PEX Devices

All PEX devices support HLHSR identifiers (see Table 1–3 and Table 1–4). PEX devices also support the following HLHSR modes:

Mode	Description
0	HLHSR none (uses the HLHSR identifier)
2	Z-buffer
5	HLHSR ignored

If the HLHSR mode is set to HLHSR_MODE_NONE, the current HLHSR identifier (a structure element) is used to determine which HLHSR mode is used.

All Digital PEX servers support forced color highlighting, which overrides interior and back interior color specifications. The use of forced highlighting with HLHSR may cause “artifacts” to be generated when unhighlighting is performed.

11.2.2 Anti-Aliasing Modes

If you have DEC Open3D installed on your system, you can use the PXG, SPXg and SPXgt, SFB+, and ZLX graphics accelerators with DEC PHIGS. The following sections describe how to use anti-aliasing on the different graphics accelerators.

11.2.2.1 PXG Accelerators

For PEX servers for the DECstation 5000 series PXG class accelerators, there are three available settings for anti-aliasing, each with a separate set of functionality and restrictions. The three modes are as follows:

- **Mode 0**—No anti-aliasing. When you use mode 0, no restrictions due to anti-aliasing exist.
- **Mode 1**—Lines are 2.5 pixels wide. DEC PHIGS blends the anti-aliased lines from the line color to the anti-aliasing background color (color table entry 0).

  DEC PHIGS writes pixels only when the computed pixel value is greater than the value of the existing pixel. When you use arbitrary colors, overlapping lines are distorted because the numerical value of a pixel is not necessarily a good indication of pixel brightness. For example, the values of pixels within a PseudoColor visual are indices into a color map, rather than color values themselves. It is the client’s responsibility to set up the color map appropriately.

  Anti-aliasing is enabled when the HLHSR_MODE is set to OFF. When the HLHSR_MODE mode is set to ZBUFFER, anti-aliasing is suppressed.
- **Mode 2**—Lines are 2.5 pixels wide. DEC PHIGS blends the anti-aliased lines from the line color to the anti-aliasing background color (color table entry 0).

  DEC PHIGS writes all pixels of a line, regardless of existing pixel values.

Anti-aliasing is enabled when the HLHSR_MODE is set to OFF. When the HLHSR_MODE mode is set to ZBUFFER, anti-aliasing is suppressed.

11.2.2.2 VAXstation SPXg and SPXgt Accelerators

For PEX servers for the VAXstation accelerators SPXg and SPXgt, there are three available settings for anti-aliasing, each with a separate set of functionality and restrictions. The three modes are as follows:

- **Mode 0**—No anti-aliasing. When you use mode 0, no restrictions due to anti-aliasing exist.
- **Mode 1**—DEC PHIGS uses the anti-aliasing technique of drawing the three closest integer pixel locations along the direction of the minor axis, for each major axis unit step. The intensity of the pixels is weighted as a function of the fractional error with the ideal floating-point coordinate value. DEC PHIGS uses four bits of subpixel resolution and a Gaussian weighting function.

  If Z-buffering is on, the Z-buffer will be updated when anti-aliased lines are drawn. However, DEC PHIGS updates only the location in the the Z-buffer that corresponds to the middle of the three pixels being drawn. You can disable the updating of the Z-buffer by setting the OpenVMS logical name STP_AA_ZUPDATE_MODE (see Restrictions).

  DEC PHIGS takes the maximum of the larger pixel value that is already in the frame buffer with the pixel value to be drawn, on a color component basis to blend the pixels. This yields a graceful blend with the frame buffer, when each of the color components of the original line to be drawn is brighter than what is already in the frame buffer.

  Anti-aliasing will function whether the HLHSR_MODE mode is set to ZBUFFER or set to OFF.
- **Mode 3**—DEC PHIGS overwrites the three closest integer pixel locations along the direction of the minor axis, for each major axis unit step, with the pixel value of the line color. If the current line color in the PHIGS traversal state list is set to the background color, you can use this mode to erase lines drawn with anti-aliasing mode 1. DEC PHIGS updates only the location in the Z-buffer that corresponds to the middle of three pixels being drawn.

Restrictions

There are some restrictions when using anti-aliasing on the SPXg and SPXgt PEX servers. Anti-aliasing will be performed under the following conditions:

- The line width is 1.
- There are no patterned lines.
- DEC PHIGS is not in text mode.
- Picking is disabled.
- Highlighting is disabled.
- Color space "888" approximation (RGB) is the only supported color format for 24-plane systems. If the application calls any other color approximation technique, the system reverts to standard (no anti-aliasing) rendering.
- Color per vertex, constant color, color interpolation, and depth queuing is supported.

Also, for the SPXg and SPXgt PEX servers, the logical name STP_AA_ZUPDATE_MODE allows you to control whether drawing anti-aliased lines will update the Z-buffer. When the value is 0 in your private server startup command file (SYS$MANAGER:DECW$PRIVATE_SERVER_SETUP.COM), the Z-buffer will not be updated when an anti-aliased line is drawn. This assumes that anti-aliased line drawing is the last operation performed. Under these conditions, proper Z-buffer operation and anti-aliasing blending with the frame buffer occurs. This ensures that proper anti-aliasing blending occurs at intersecting lines. If the anti-aliased line is not drawn last, improper Z-buffer display can occur, and blending to an incorrect background color can occur.

If you want to preserve Z-buffer correctness at the expense of anti-aliasing quality, use the default value (1). Intersecting lines and lines over surfaces may not blend correctly. If you want to allow for correct anti-aliasing blending at the expense of occasional incorrect Z-buffer action (and only when the line is not drawn last), set the value to 0.

11.2.2.3 SFB+ Accelerators

For PEX servers with the SFB+ accelerators, there are four available settings for anti-aliasing, each with a separate set of functionality and restrictions. The four modes are as follows:

- **Mode 0**—No anti-aliasing. When you use mode 0, no restrictions due to anti-aliasing exist.
- **Mode 1**—Lines are 2.5 pixels wide. DEC PHIGS blends the anti-aliased lines from the line color to the anti-aliasing background color (color table entry 0).

  DEC PHIGS writes pixels only when the computed pixel value is greater than the value of the existing pixel. When you use arbitrary colors, overlapping lines are distorted because the numerical value of a pixel is not necessarily a good indication of pixel brightness. For example, the values of pixels within a PseudoColor visual are indices into a color map, rather than color values themselves. It is the client's responsibility to set up the color map appropriately.

  Anti-aliasing is enabled when the HLHSR_MODE is set to OFF. When the HLHSR_MODE mode is set to ZBUFFER, anti-aliasing is suppressed.
- **Mode 2**—Lines are 2.5 pixels wide. DEC PHIGS blends the anti-aliased lines from the line color to the anti-aliasing background color (color table entry 0).

  DEC PHIGS writes all pixels of a line, regardless of existing pixel values.

  Anti-aliasing is enabled when the HLHSR_MODE is set to OFF. When the HLHSR_MODE mode is set to ZBUFFER, anti-aliasing is suppressed.
- **Mode 3**—DEC PHIGS performs essentially the same operation as in mode 1, except it blends each pixel on the anti-aliased line with the anti-alias background color (color table entry 0), rather than with the contents of the frame buffer. All pixels are written, regardless of their computed value. This mode is useful for erasing anti-aliasing lines in immediate mode, as the line color must be set to the background color to erase an anti-aliased line.

11.2.2.4 ZLX Accelerators

For PEX servers with the ZLX options, there are three available settings for anti-aliasing, each with a separate set of functionality and restrictions. The three modes are:

- **Mode 0**—No anti-aliasing. When you use mode 0, no restrictions due to anti-aliasing exist.
- **Mode 1**—DEC PHIGS renders anti-aliased lines. DEC PHIGS blends each pixel on the anti-aliased line with the contents of the frame buffer. The pixels are always written, regardless of the computed value. The width of the anti-aliased line is a function of line width.

  Anti-aliasing will function whether the HLHSR_MODE mode is set to ZBUFFER or OFF. If Z-buffering is on, the Z-buffer will be updated when anti-aliased lines are drawn.
- **Mode 3**—DEC PHIGS performs essentially the same operation as in mode 1, except it blends each pixel on the anti-aliased line with the anti-alias background color (color table entry 0), rather than with the contents of the frame buffer. All pixels are written, regardless of their computed value. This mode is useful for erasing anti-aliasing lines in immediate mode, as the line color must be set to the background color to erase an anti-aliased line.

11.3 Workstation Type Values

When using the PEX workstation, you can specify workstation types as hexadecimal bit masks. The following table lists the different workstation type values you can use with PEX:

Workstation Type	Hexadecimal Value	Description
220	%x000000DC	As an output-only device
221	%x000000DD	As an input/output device using the DECwindows Toolkit and OSF/Motif software
222	%x000000DE	As an output-only application window
223	%x000000DF	As an input/output device within an application widget
240	%x000000F0	As an output-only device using OSF/Motif PEX
241	%x000000F1	As an input/output device using OSF/Motif PEX
242	%x000000F2	As an output-only device within a PEX application drawable (window or pixmap)
243	%x000000F3	As an input/output device within a PEX application widget

PEX Output Only, Values 220 and 240

Workstation types 220 and 240 are output-only. DEC GKS and DEC PHIGS create an output window but do not select any X events. Consequently, your application is free to select any X events on this or any other window. In addition, these workstations will *not* redraw themselves when exposed or when an icon is expanded to a window. In such instances, your application should call the REDRAW ALL SEGMENTS function (for DEC GKS) or the REDRAW ALL STRUCTURES function (for DEC PHIGS) to force DEC GKS and DEC PHIGS to redraw the window. These workstations do not make use of the

DECwindows Toolkit and OSF/Motif software, so your application is free to use the DECwindows Toolkit and OSF/Motif software.

PEX Input and Output, Values 221 and 241

Workstation type 221 performs input and output, and uses the DECwindows Toolkit and OSF/Motif software. Workstation type 241 performs input and output, and uses the OSF/Motif Toolkit and OSF/Motif software. Because of a restriction in the DECwindows Toolkit and OSF/Motif software, your application may not initialize the DECwindows Toolkit and OSF/Motif software if it uses workstation type 221. In addition, you should not select events on any windows created by the DEC GKS and DEC PHIGS workstation.

You can create widgets that are children of certain widgets belonging to the DEC GKS and DEC PHIGS workstation. Escape functions are provided to obtain the identifiers of these widgets.

When the user or window manager resizes workstations of types 221 and 241, the picture may be clipped at the new window boundaries. A push button on the menu bar enables the user to restore the window to its default size and location. Scroll bars enable the user to pan the displayable region of a clipped picture.

PEX Drawable, Values 222 and 242

Workstation types 222 and 242 use a preexisting drawable, and are output only. Your application must open the display and create the drawable before calling the OPEN WORKSTATION function, and it must not close the display or destroy the drawable until after it has called the CLOSE WORKSTATION function.

These workstations do not select any X events. Consequently, your application is free to select any X events on this or any other drawable. In addition, these workstations will *not* redraw themselves when exposed or when an icon is expanded to a drawable. In such instances, your application should call the REDRAW ALL STRUCTURES function (for DEC PHIGS), or the REDRAW ALL SEGMENTS function (for DEC GKS) to force DEC GKS and DEC PHIGS to redraw the drawable. These workstations do not use the DECwindows Toolkit and OSF/Motif Toolkit, so your application has unrestricted use of the DECwindows Toolkit or OSF/Motif Toolkit.

PEX Widget, Values 223 and 243

Workstation type 223 uses a preexisting DECwindows Toolkit and OSF/Motif widget. Workstation type 243 uses a preexisting OSF/Motif Toolkit and OSF/Motif widget. The widget must be a bulletin board and must be realized *before* calling the OPEN WORKSTATION function.

These types of workstations allow the use of either SAMPLE or EVENT mode for DEC GKS and DEC PHIGS input in addition to using the DECwindows Toolkit and OSF/Motif Toolkit in your application. However, if you call the AWAIT EVENT function, you must set the timeout parameter to 0 to avoid hanging up the devices.

Note

You cannot use REQUEST mode input with this workstation type. To do so results in an error.

Do not destroy the DECwindows and OSF/Motif widgets until after a call to the CLOSE WORKSTATION function.

11.3.1 Opening Multiple Motif Workstations

Applications that open multiple Motif workstations of type 230, 231, 240, or 241 must use the same value for the workstation type each time. There is a limitation in these device handlers that breaks X event handling if the workstation type value is different. For example, opening two workstations using type %x000a00d3 for each is acceptable, but opening one with %X000000d3 and the other with %x000a00d3 (workstation type 211 with default number of colors and with 10 colors) yields unpredictable handling of asynchronous events.

11.4 Programming Considerations

You should review Chapter 4 or Chapter 9, before writing an application using the PEX devices with DECwindows and OSF/Motif software.

11.4.1 General Information

This section provides information and guidelines for using DEC GKS and DEC PHIGS with a PEX device and DECwindows and OSF/Motif software:

- To open or query DEC GKS and DEC PHIGS workstation types 220, 221, 222, 223, 240, 241, 242, and 243, your application must be running on a host that runs the DECwindows and OSF/Motif client-side software. The host does *not* need a physical display device, nor does it need the DECwindows and OSF/Motif server-side software.
- For workstation types 220, 221, 240, and 242, the connection identifier specifies the DECwindows and OSF/Motif display to use. The second argument to the OPEN WORKSTATION function names a connection identifier. If you specify an invalid display, DEC GKS and DEC PHIGS return an error when they attempt to open or query the workstation.
- When performing input, DEC GKS and DEC PHIGS position the input echo window as defined by the input echo area (in device coordinates). When generating output, DEC GKS and DEC PHIGS position the display window as defined by the current workstation viewport.
- DEC GKS and DEC PHIGS provide a method to inquire about the window identifier and widget identifiers using escapes. The escapes and how to use them are described in Appendix B.

11.5 Input Information

The PEX devices support input devices in the same manner as DECwindows and OSF/Motif devices. See Chapter 4 for input information on the DECwindows workstation. See Chapter 9 for input information on the OSF/Motif workstation.

11.6 Lighting Support for DEC PHIGS

You can use the INQUIRE LIGHT SOURCE FACILITIES function to list the maximum number of light source indexes, the maximum number of simultaneous active lights, and the number of available light source types. On PEX devices using the PXG option, the maximum number of light source indexes is 32, and the maximum number of simultaneous active lights is 12. On PEX devices using the ZLX option, the maximum number of light source indexes is 32, and the maximum number of simultaneous active lights is 32.

11.7 Font Support

All PEX servers support 24 English fonts and a Japanese font (value –10001) in stroke precision. You can specify character or string precision for these fonts, but the PEX handler always uses stroke precision.

To use Japanese fonts with English workstation types, you must set the language environment option to Japanese (value 22). If you use the Japanese PEX workstation types (32*n* or 34*n*), you do not need to set the language environment option. The bit mask values and many other characteristics of the Japanese PEX workstation types are the same as the English PEX workstation types.

11.8 Escapes

For a list of supported escapes, run the GKS_PREDEF or PHIGS_PREDEF program.

PostScript Workstation

12
PostScript Workstation

This chapter provides the information you need to use DEC GKS and DEC PHIGS with all printers that support the PostScript graphics language. DEC GKS and DEC PHIGS support these devices as workstations of category WSCAT_OUTPUT.

12.1 Environment Options

Table 12–1 summarizes the environment options you can use with the PostScript printers.

Table 12–1 PostScript Environment Options

Syntax	Description
Connection Identifier	
GKS$CONID GKSconid PHIGS$CONID PHIGSconid	Specifies the default workstation connection information. On OpenVMS systems, the startup procedure, GKSTARTUP.COM or PHIGS$STARTUP.COM, sets the default value. For example, on OpenVMS systems, you define the DEC PHIGS logical name for the connection identifier for a PostScript device as follows: $ **DEFINE PHIGS$CONID *FILE.PS*** Return On UNIX systems, you define the DEC GKS environment variable for the connection identifier for a PostScript device as follows: % **setenv GKSconid *file.ps*** Return
ISO–Latin1 Encoding	
GKS$ISO_ENCODE GKSiso_encode PHIGS$ISO_ENCODE PHIGSiso_encode	Determines whether the handler uses ISO–Latin1 characters, either enabled (1) or disabled (0). The default value is 0. For example, on OpenVMS systems, you define the DEC PHIGS logical name for the encoding flag to be enabled as follows: $ **DEFINE PHIGS$ISO_ENCODE 1** Return On UNIX systems, you define the DEC GKS environment variable for the encoding flag to be disabled as follows: % **setenv GKSiso_encode 0** Return

(continued on next page)

Table 12–1 (Cont.) PostScript Environment Options

Syntax	Description
Language	
GKS$LANGUAGE GKSlanguage PHIGS$LANGUAGE PHIGSlanguage	Specifies whether to use the English language (value 0) or Japanese (value 22) language. The default value is 0. See Section 12.6 for more information on font support. For example, on OpenVMS systems, you define the DEC PHIGS logical name for the English language as follows: $ **DEFINE PHIGS$LANGUAGE 0** Return On UNIX systems, you define the DEC GKS environment variable for the Japanese language as follows: % **setenv GKSlanguage 22** Return
Printer Description File	
GKS$PS_DESCRIPTION_*nn* GKSps_description_*nn* PHIGS$PS_DESCRIPTION_*nn* PHIGSps_description_*nn*	Allows you to pass printer-specific information to the handler. In the DEC GKS and DEC PHIGS syntax, *nn* refers to the decimal value of the particular PostScript device. See Section 12.4.2 for more information on printer description files. To use the printer description file on an OpenVMS system, give the file any valid device specification, for example 61. After you create the file, define a logical name as shown for DEC PHIGS: $ **DEFINE PHIGS$PS_DESCRIPTION_61** ***filename.ext*** Return To use the printer description file on UNIX systems, give the file any valid device specification, such as 62. After you create the file, define an environment variable as shown for DEC GKS: % **setenv GKSps_description_62** ***filename.ext*** Return
Workstation Type	
GKS$WSTYPE GKSwstype PHIGS$WSTYPE PHIGSwstype	Specifies the workstation type. On OpenVMS systems, the startup procedure, GKSTARTUP.COM or PHIGS$STARTUP, sets the default value. For example, on OpenVMS systems, you define the DEC PHIGS logical name for the monochrome PostScript printer workstation type as follows: $ **DEFINE PHIGS$WSTYPE 61** Return On UNIX systems, you define the DEC GKS environment variable for the color PostScript printer workstation type as follows: % **setenv GKSwstype 62** Return

12.2 Valid Bit Mask Values

When using the PostScript graphics handler, you can use bit masks to specify the workstation type value. The following bit masks are valid for use with a PostScript device:

Workstation Type	Hexadecimal Value	Description
61	%x*m*0*nn*003D	PostScript support
62	%x*m*0*nn*003E	Color PostScript
65	%x*m*0*nn*0041	Encapsulated PostScript
66	%x*m*0*nn*0042	Color encapsulated PostScript

The value in the first part (*m*0*nn*) specifies the paper orientation and size. The value in the second part is the hexadecimal value of the workstation type value 61, 62, 65, or 66.

The possible values for *m* include the following:

Value	Paper Orientation
0	Landscape: The picture is wider than it is tall.
1	Portrait: The picture is taller than it is wide.

The possible values for *nn* include the following:

Value	Paper Size
00	Paper size A (8.5 × 11 inches)
01	Legal paper size (8.5 × 14 inches)
02	Paper size B (11 × 17 inches)
03	Paper size C (17 × 22 inches)
04	Paper size D (22 × 34 inches)
05	Paper size E (34 × 44 inches)
10	Paper size A0 (84.1 × 118.9 centimeters)
20	Paper size A1 (59.4 × 84.1 centimeters)
30	Paper size A2 (42 × 59.4 centimeters)
40	Paper size A3 (29.7 × 42 centimeters)
50	Paper size A4 (21 × 29.7 centimeters)
60	Paper size A5 (14.8 × 21 centimeters)
70	Paper size B4 (25.7 × 36.4 centimeters)
80	Paper size B5 (18.2 × 25.7 centimeters)

The default setting for the PostScript handler is landscape orientation using the paper size 8.5 × 11 inches. The LPS40 printer supports sizes A and B only.

The specified bit mask values are also valid with color PostScript and encapsulated PostScript output.

12.3 Encapsulated PostScript

Encapsulated PostScript output allows you to include PostScript files into other documents. Therefore, it requires some different information in the PostScript file. To produce encapsulated PostScript files, certain things must be done differently in producing the files. For example, all clipping is software simulated before the PostScript commands are output into the file. Also, because encapsulated PostScript is intended to be a single page per file, the encapsulated

PostScript handler outputs multiple files instead of multiple pages when the application performs a clear workstation function or equivalent. For example, if the encapsulated PostScript output file is specified as *filename.epsf*, the first page output is placed in the file *filename.epsf*. Subsequent pages are placed in files with file names of the form *filename.epsf_nn*.

12.4 Device Considerations

The following sections provide information about device queues and printer description files.

12.4.1 Device Queues and Allocation

To use the PostScript printers as either allocated or queued devices on an OpenVMS system, set terminal characteristics by entering the following DCL command:

```
$ SET TERMINAL device_name /NOWRAP/NOBROADCAST/MODEM- Return
_$ /NODISCONNECT/NOAUTOBAUD/PASSTHRU/TAB/EIGHTBIT/HANGUP - Return
_$ /SPEED=set_speed Return
```

Replace *device_name* with the name of the PostScript device. Replace *set_speed* with a value equal to the baud rate as determined by the switches currently set on the printer.

For more information on device allocation, see the ALLOCATE command in the *OpenVMS DCL Dictionary*.

To use the PostScript printers as either allocated or queued devices on a UNIX system, set the terminal by entering the following command:

```
% stty pass8 -echo new speed raw </dev/ttynn Return
```

Replace *speed* with a value equal to the baud rate as determined by the switches currently set on the printer. Replace *nn* with the port number.

12.4.2 Printer Description Files

Because the DEC GKS and DEC PHIGS PostScript graphics handlers support numerous PostScript printers, you may need to pass printer-specific information to the handler by means of a printer description file.

The following example shows the format of a PostScript printer description file. This example is meant to show format; see your printer's user manual to obtain the correct values.

```
left_margin      0.25    /inch   ! Set a 1/4 inch left margin
right_margin     0.5     /cm     ! Set a 1/2 cm right margin
top_margin       1               ! Set a 1 cm top margin
bottom_margin    /inch   0.25    ! Set a 1/4 inch bottom margin
resolution      300      /inch   ! 300 pixels per inch
max_path        1000             ! Maximum number of points in a
                                 !   PostScript path
stack_size      300              ! Maximum size of PostScript
                                 !   operand stack
```

When creating the printer description file, note the following:

- Any or all settings can be omitted, and they can appear in any order.
- The text after the exclamation point (!) is a comment.
- Blank lines, case, and indentation are not significant.
- It is an error to omit a value or to specify a negative value.

- If you specify a real number when an integer is needed, the handler truncates the decimal portion of the real number.
- Where units are appropriate, you can specify /inch or /cm, where /cm is the default. It is an error to specify a unit value for *max_path* or *stack_size*.
- Specifying a value for *max_path* or *stack_size* that is too large for the printer may cause the printer (not DEC GKS or DEC PHIGS) to generate a fatal error.
- If a single record of this file exceeds 512 bytes, it is truncated. If significant data is lost (information other than comments or white space), the handler generates an error.
- If you attempt to use more than the allowable paper space by setting your margins to be smaller than the minimum margins supported by the printer, the device clips the picture at its minimum margin boundary.

If the translation of the logical name or environment variable is invalid or does not exist, or if you omit any of the settings in your description file, the PostScript graphics handler uses the following default values:

```
left_margin      1.0     /cm
right_margin     1.0     /cm
top_margin       1.0     /cm
bottom_margin    1.0     /cm
resolution       300     /inch
max_path        1400
stack_size       400
```

12.5 Pattern and Hatch Values

This section describes the available fill area pattern and hatch values for all PostScript printers. The positive numeric style values are patterns (mixtures of colors) and the negative values are hatches (device-dependent designs, such as cross-hatches, dots, horizontal lines, and so forth). The style values are passed with the SET FILL AREA STYLE INDEX function.

If you change the default color representations, all patterns using that color index use the new color representation.

DEC PHIGS does not support patterns.

12.5.1 Available Fill Area Hatch Values

The following table identifies the available fill area hatch value indexes and describes the results.

Style Index	Appearance
–1	Cross-hatches
–2	Diagonal lines at 45 degrees
–3	Diagonal lines at –45 degrees
–4	Horizontal lines
–5	Vertical lines
–6	Diagonal lines at 45 degrees—sparse

Style Index	Appearance
–7	Diagonal lines at –45 degrees—sparse
–8	Horizontal lines—sparse
–9	Vertical lines—sparse

12.5.2 Predefined Fill Area Pattern Values for DEC GKS

The following table identifies the predefined fill area pattern value indexes and describes the results.

Style Index	Appearance
1	Light diagonally woven pattern (25%)
2	Darker diagonally woven pattern (50%)
3	Darkest diagonally woven pattern (75%)
4	Horizontal brick pattern
5	Vertical brick pattern
6	Brick pattern at –45 degrees
7	Brick pattern at 45 degrees
8	Finely woven grid
9	Sparsely woven grid
10	Downward scales (fish-like)
11	Upward scales
12	Rightward scales
13	Leftward scales
14 to 28	Increasing densities of grey (no hatch style), starting at 1/16 density, incrementing by 1/16, up to 15/16 density
29 to 59	GKS pattern

DEC GKS supports patterns on black and white PostScript workstation types only (61 and 65).

12.6 Font Support

The DEC GKS and DEC PHIGS PostScript graphics handler supports 43 hardware fonts and two Japanese composite fonts. When you specify fonts, use caution. Not all PostScript printers support all the fonts supported by the PostScript handler. DEC GKS allows these fonts to be used in stroke precision in two-dimensional compatibility mode. Otherwise, these fonts are available in string precision.

The following table describes font support by printer type:

Font Numbers	Supporting Printers
–101 through –113	Most PostScript printers
–101 through –129	Digital LPS40 printer
–101 through –143	Some PostScript printers
–10101 through –10102	Japanese print server

For more information on fonts supported by your printer, see the documentation accompanying your printer.

The hardware fonts supported by the PostScript handler are as follows:

Font	Description
–101	Times® Roman font
–102	Times Italic font
–103	Times Bold font
–104	Times Bold Italic font
–105	Helvetica® font
–106	Helvetica Oblique font
–107	Helvetica Bold font
–108	Helvetica Bold Oblique font
–109	Courier font
–110	Courier Oblique font
–111	Courier Bold font
–112	Courier Bold Oblique font
–113	Symbol/Math font
–114	ITC Lubalin Graph® Book font
–115	ITC Lubalin Graph Book Oblique font
–116	ITC Lubalin Graph Demi font
–117	ITC Lubalin Graph Demi Oblique font
–118	New Century Schoolbook Roman font
–119	New Century Schoolbook Italic font
–120	New Century Schoolbook Bold font
–121	New Century Schoolbook Bold Italic font
–122	ITC Avant Garde Gothic® Book font
–123	ITC Avant Garde Book Oblique font
–124	ITC Avant Garde Demi font
–125	ITC Avant Garde Demi Oblique font
–126	ITC Souvenir® Light font
–127	ITC Souvenir Light Italic font
–128	ITC Souvenir Demi font
–129	ITC Souvenir Demi Italic font
–130	Helvetica Narrow font
–131	Helvetica Narrow Oblique font

Font	Description
–132	Helvetica Narrow Bold font
–133	Helvetica Narrow Bold Oblique font
–134	ITC Bookman® Light font
–135	ITC Bookman Light Italic font
–136	ITC Bookman Demi font
–137	ITC Bookman DemiItalic font
–138	Palatino® font
–139	Palatino Italic font
–140	Palatino Bold font
–141	Palatino Bold Italic font
–142	ITC Zapf Chancery® Medium Italic font
–143	ITC Zapf Dingbats® font
–10101	Japanese Ryumin–Light.Roman font
–10101	Japanese Ryumin–Light.Katakana font
–10101	Japanese Ryumin–Light–EUC–H font
–10102	Japanese GothicBBB–Medium.Roman font
–10102	Japanese GothicBBB–Medium.Katakana font
–10102	Japanese GothicBBB–Medium–EUC–H font

The PostScript handler supports all the DEC GKS and DEC PHIGS Hershey software stroke-precision fonts.

To use the Japanese fonts with English workstation types, you must set the language environment option to Japanese (value 22). If you use the Japanese PostScript workstation types (16*n*), you do not need to set the language environment option. The bit mask values and many other characteristics for the Japanese PostScript workstation types are the same as the English PostScript workstation types.

12.7 ISO–Latin1 Character Support

ISO–Latin1 characters are supported by the PostScript device handler. To enable this feature, set the ISO–Latin1 encoding flag value to 1. The default mode for this feature is disabled (ISO–Latin1 encoding flag value 0).

For compatibility with some nondigital printers, the PostScript graphics handler outputs the ISO–Latin1 characters in a 7-bit format.

Font numbers –101 to –129 are supported for ISO–Latin1. Spacing and positioning errors may occur if the other font numbers are used.

No special set up is required to output ISO–Latin1 characters on OpenVMS printer queues. On UNIX printer queues, provide the switch –x on the `lpr` command line.

ReGIS™ Graphics Protocol Workstation

13

ReGIS™ Graphics Protocol Workstation

This chapter describes the information you need to use DEC GKS and DEC PHIGS with the following ReGIS devices:

- VT125
- VT240
- VT284
- VT286
- VT330
- VT340

The Japanese ReGIS devices (VT284 and VT286) are supported on DEC GKS for OpenVMS systems only.

13.1 Environment Options

Table 13–1 summarizes the environment options you can use with ReGIS devices.

Table 13–1 ReGIS Environment Options

Syntax	Description
Connection Identifier	
GKS$CONID GKSconid PHIGS$CONID PHIGSconid	Specifies the default workstation connection information. On OpenVMS systems, the startup procedure, GKSTARTUP.COM or PHIGS$STARTUP.COM, sets the default value. For example, on OpenVMS systems, you define the DEC PHIGS logical name for the connection identifier of a ReGIS device as follows: $ **DEFINE PHIGS$CONID TT:** Return On UNIX systems, you define the DEC GKS environment variable for the connection identifier of a ReGIS device as follows: % **setenv GKSconid tt:** Return

(continued on next page)

Table 13–1 (Cont.) ReGIS Environment Options

Syntax	Description
Workstation Type	
GKS$WSTYPE GKSwstype PHIGS$WSTYPE PHIGSwstype	Specifies the workstation type. On OpenVMS systems, the startup procedure, GKSTARTUP.COM or PHIGS$STARTUP.COM, sets the default value. For example, on OpenVMS systems, you define the DEC PHIGS logical name for the Digital color VT240 workstation type as follows: $ **DEFINE PHIGS$WSTYPE 13** Return On UNIX systems, you define the DEC GKS environment variable for the Digital monochrome VT125 workstation type as follows: % **setenv GKSwstype 12** Return

13.2 Valid Bit Mask Values

When using the ReGIS graphics handler, you can use bit masks to specify the workstation type values. The following sections describe the ReGIS uses for bit masks.

13.2.1 ReGIS Bit Masks

Use the following bit masks to specify the type of ReGIS terminal in use:

Workstation Type	Hexadecimal Value	Description
10	%x0000000A	ReGIS output to a file (see Section 13.2.2)
11	%x0000000B	Digital VT125 (color)
12	%x0000000C	Digital VT125 (monochrome)
13	%x0000000D	Digital VT240 (color)
14	%x0000000E	Digital VT240 (monochrome)
16	%x00000010	Digital VT330 (monochrome)
17	%x00000011	Digital VT340 (color, mouse or tablet)
110	%x0000006E	Japanese ReGIS output to a file (see Section 13.2.2)
113	%x00000071	Digital VT286 (color)
114	%x00000072	Digital VT284 (monochrome)
65552	%x00010010	Digital VT330 (monochrome, no mouse or tablet)
65553	%x00010011	Digital VT340 (color, no mouse or tablet)

13.2.2 ReGIS Output to a File

An application program can send the ReGIS terminal commands to a file instead of directly to a terminal. You can later type the file on the ReGIS screen to see the picture.

Use the following bit masks to specify that ReGIS output be sent to a file. The application program specifies the name of the file in the connection identifier argument.

Table 13–2 Bit Masks for ReGIS File Output

Workstation Type	Hexadecimal	Description
10	%x0000000A	File suitable for any ReGIS device
110	%x0000006E	File suitable for any Japanese ReGIS device
1048586	%x0010000A	File suitable for VT125 (color)
2097162	%x0020000A	File suitable for VT125 (monochrome)
3145738	%x0030000A	File suitable for VT240 (color) or VT286 (color)
3145838	%x0030006E	File suitable for VT286 (color)
4194314	%x0040000A	File suitable for VT240 (monochrome) or VT284 (monochrome)
4194414	%x0040006E	File suitable for VT284 (monochrome)
5242890	%x0050000A	File suitable for VT330 (monochrome)
6291466	%x0060000A	File suitable for VT340 (color)

13.2.3 Bit Mask for the VT340 to Restore the Color Map

DEC GKS and DEC PHIGS change the color map when the workstation is opened, and do not restore it when the workstation is closed. Use the following bit masks to control whether the color map is restored to its original state.

Workstation Type	Hexadecimal Value	Description
17	%x00000011	Digital VT340 (color). Do not restore the color map.
16777233	%x01000011	Digital VT340 (color). Restore the color map.

The following error status is also associated with this bit mask:

–44 Error trying to save or restore VT340 color map routine ****

ERROR_NEG_44:

Error: DEC GKS or DEC PHIGS received an error from the VT340 when trying to acquire or reset the color map. This could happen if the OpenVMS device characteristics (SET TERMINAL) do not match the actual terminal characteristics.

This could also happen on UNIX systems. See the use of the stty command to display and set the terminal characteristics.

Explanation: Reset the terminal and check that the OpenVMS device characteristics match the terminal characteristics. In particular, note that this function temporarily resets the device to NO ESCAPE mode. You may need to reset the terminal to ESCAPE mode before continuing.

On UNIX systems, reset the terminal and check that the device and terminal characteristics match. Note that this function sets the terminal to raw mode. You may need to reset the terminal with the tset command before continuing.

13.3 Mode Restrictions

To make effective use of the VT330 and VT340 devices, DEC PHIGS keeps them in graphics mode while the workstation is open. Because of the mode setting, ASCII text sent to the screen via a Fortran WRITE (or similar statements in other languages), is interpreted as a ReGIS command that can leave the terminal in an unpredictable state.

To avoid this problem, use the TEXT or MESSAGE function to place text on VT330 or VT340 screens. Furthermore, Digital recommends that the error file specified in OPEN GKS or OPEN PHIGS be directed to a file to avoid having DEC PHIGS issuing error messages to the terminal. Digital also recommends using the OpenVMS command `$ SET TERMINAL/NOBROADCAST` during the DEC PHIGS session. This command prevents the display of messages sent to the terminal by the OpenVMS operating system from causing a similar problem.

13.4 Pattern and Hatch Values

This section describes the available fill area pattern and hatch values for the ReGIS devices. The positive numeric style values are patterns (mixtures of colors) and the negative values are hatches (device-dependent designs, such as cross-hatches, dots, horizontal lines, and so forth). The style values are passed with the SET FILL AREA STYLE INDEX function.

If you change the default color representations, all patterns using that color index use the new color representation.

DEC PHIGS does not support patterns.

13.4.1 Available Fill Area Hatch Values

The following table identifies the available fill area hatch value indexes and describes the results.

Style Index	Appearance
–1	Cross-hatches
–2	Diagonal lines at 45 degrees
–3	Diagonal lines at –45 degrees
–4	Horizontal lines
–5	Vertical lines
–6	Diagonal lines at 45 degrees—sparse
–7	Diagonal lines at –45 degrees—sparse
–8	Horizontal lines—sparse
–9	Vertical lines—sparse
–10 to –19	Halftone hatch densities
–33 to –126	Hatching with the corresponding ASCII character

13.4.2 Predefined Fill Area Pattern Values for DEC GKS

The following table identifies the predefined fill area pattern value indexes and describes the results.

Style Index	Appearance
1	Mixes colors 1 and 2
2	Mixes colors 2 and 3
3	Mixes colors 3 and 1
4	Mixes colors 0 and 1
5	Mixes colors 0 and 2
6	Mixes colors 0 and 3

13.5 Input Information

Each of the following input class sections lists the supported logical input device numbers, and supported prompt and echo type (PET) numbers.

On a VT125, VT240, VT284, or VT286 device, press the Return key to trigger input. You use the arrow keys to move the cursor. For pick, locator, stroke, and valuator class devices, you can use the PF3 key to move the cursor in shorter increments, and the PF4 key to move the cursor in longer increments. For detailed information on cycling logical input devices and numeric keypad functionality, see Section E.3.1 and Section E.3.2.

13.5.1 Choice Input Class

Supported Logical Input Devices

The following table identifies the supported choice-class logical input devices for ReGIS devices.

Device	Choice Device Types	Input Action
VT125	1, 3, 4, 5, 6, 7, 8	Select with arrow keys. Trigger with Return. Break with Ctrl/U.
	2	Keypad key is selection and trigger.
VT240, VT284, VT286, VT330, and VT340 (without mouse)	1, 4, 5, 6, 7, 8	Select with arrow keys. Trigger with Return. Break with Ctrl/U.
	2	Keypad key is selection and trigger.
	3	Function key is selection and trigger.
VT330 and VT340 (with mouse)	1, 6, 7, 8	Select with mouse. Trigger with mouse button 1. Break with mouse button 2.
	2	Keypad key is selection and trigger.
	3	Function key is selection and trigger.
	4	Mouse button down is selection and trigger.
	5	Mouse button up is selection and trigger.

Supported PETs

The choice input class for the VT125, VT240, VT284, VT286, and VT340 terminals support PETs –1, 1, and 3. See the input chapter in the DEC GKS or DEC PHIGS binding reference manuals for more information on PETs.

Default Input Values

The following table identifies the default input values for the ReGIS choice-class logical input devices.

Input Construct	Default Value
PET	1
Initial choice	1
Initial status	STATUS_OK
Echo area	Varies by device
Data record	Varies by device—list of choice strings

13.5.2 Locator Input Class

Supported Logical Input Devices

The following table identifies the supported locator-class logical input devices for the ReGIS devices.

Device	Locator Device Types	Input Action
VT125, VT240, VT284, VT286, VT330, and VT340 (without mouse)	1, 2, 3, 4, 5, 6, 7	Select with arrow keys. Trigger with Return. Break with Ctrl/U.
	8	Movement is selection and trigger.
VT330 and VT340 (with mouse)	1, 2, 3, 4	Select with mouse. Trigger with mouse button 1. Break with mouse button 2.
	5	Select with mouse. Trigger with mouse button 2.
	6	Select with mouse. Trigger with mouse button 3.
	7	Select with puck. Trigger with puck button 4.
	8	Movement is selection and trigger.

Supported PETs

The locator input class for the VT125, VT240, VT284, VT286, and VT340 terminals support PETs –13 (DEC GKS only), –12, –11, –10, –9, –8, –7, –6, –5, –4, –3, –2, –1, 1, 2, 3, 4, 5, and 6. See the input chapter in the DEC GKS or DEC PHIGS binding reference manuals for more information on PETs.

Default Input Values

The following table identifies the supported logical input devices for the ReGIS locator-class logical input devices.

Input Construct	Default Value
PET	1
Initial position	0.5, 0.5
Initial transformation	0
Echo area	Largest square
Data record	NULL

13.5.3 Pick Input Class

Supported Logical Input Devices

The following table identifies the supported pick-class logical input devices for the ReGIS devices.

Device	Pick Device Types	Input Action
VT125, VT240, VT284, VT286, VT330, and VT340 (without mouse)	1, 2, 3, 4, 5, 6	Select with arrow keys. Trigger with Return. Break with Ctrl/U.
VT330 and VT340 (with mouse)	1, 2, 3, 4	Select with mouse. Trigger with mouse button 1. Break with mouse button 2.
	5	Select with mouse. Trigger with mouse button 2.
	6	Select with mouse. Trigger with mouse button 3.

Supported PETs

The pick input class for the VT125, VT240, VT284, VT286, and VT340 terminals support PETs 1, 2, and 3. See the input chapter in the DEC GKS or DEC PHIGS binding reference manuals for more information on PETs.

When using the pick-class input device, the arrow keys move a small square aperture on the workstation surface. The graphics handler marks the currently picked structures (or portions of structures) by outlining the extent rectangle of all or part of the structure.

Default Input Values

The following table identifies the default input values for the ReGIS pick-class logical input devices.

Input Construct	Default Value
PET	1
Initial pick identifier	1
Initial pick path	NULL (no path)
Initial status	STATUS_OK
Echo area	Largest square
Data record	Aperture: 4.29 in device coordinates

The size of the pick aperture is limited by the hardware cursor map.

13.5.4 String Input Class

Supported Logical Input Devices

The following table identifies the supported string-class logical input devices for the ReGIS devices.

Device	String Device Types	Input Action
VT125, VT240, VT330, and VT340	1, 2, 4	Enter characters from keyboard. Trigger with Return. Break with Ctrl/U.
	3	ASCII–encoded string. Keypress enters character and triggers device.
VT284 and VT286	1	Enter characters from keyboard. (Input string with Kana–Kanji conversion.) Trigger with Return. Break with Ctrl/U.
	2, 4	Enter characters from keyboard. Trigger with Return. Break with Ctrl/U.
	3	ASCII–encoded string. Keypress enters character and triggers device.

Supported PETs

The string input class for the VT125, VT240, VT284, VT286, and VT340 terminals support PET 1. See the input chapter in the DEC GKS or DEC PHIGS binding reference manuals for more information on PETs.

Default Input Values

The following table identifies the default input values for the ReGIS string-class logical input devices.

Input Construct	Default Value
PET	1
Initial string	NULL
Echo area	Varies by device
Data record	Input buffer size: 20 ASCII characters
Initial position	1

13.5.5 Stroke Input Class

Supported Logical Input Devices

The following table identifies the supported stroke-class logical input devices for the ReGIS devices.

Device	Stroke Device Types	Input Action
VT125, VT240, VT284, VT286, VT330, and VT340 (without mouse)	1, 2, 3, 4	Enter point with space key. Trigger with Return. Break with Ctrl/U. Delete last point with Delete key.
VT330 and VT340 (with mouse)	1, 2, 3, 4	Enter point with space key. Trigger with mouse button 1. Break with mouse button 2. Delete last point with Delete key.

Supported PETs

The stroke input class for the VT125, VT240, VT284, VT286, and VT340 terminals support PETs 1 and 4. See the input chapter in the DEC GKS or DEC PHIGS binding reference manuals for more information on PETs.

Default Input Values

The following table identifies the default input values for the ReGIS stroke-class logical input devices.

Input Construct	Default Value
PET	1
Initial number of points	0
Initial transformation	0
Echo area	Largest square
Data record	Stroke buffer size: 80 points
	Editing position: 0
	x interval: 0.01 in world coordinate points
	y interval: 0.01 in world coordinate points
	Time interval: 0.0 seconds

13.5.6 Valuator Input Class

Supported Logical Input Devices

The following table identifies the supported valuator-class logical input devices for the ReGIS devices.

Device	Valuator Device Types	Input Action
VT125, VT240, VY284, VT286, VT330, and VT340 (without mouse)	1, 2, 3, 4	Select with arrow keys. Trigger with Return. Break with Ctrl/U.
VT330 and VT340 (with mouse)	1, 2, 3, 4	Select with mouse. Trigger with mouse button 1. Break with mouse button 2.

Supported PETs

The valuator input class for the VT125, VT240, VT284, VT286, and VT340 terminals support PETs 1, 2, and 3. See the input chapter in the DEC GKS or DEC PHIGS binding reference manuals for more information on PETs.

Default Input Values

The following table identifies the default input values for the ReGIS valuator-class logical input devices.

Input Construct	Default Value
PET	1
Initial value	0.5
Echo area	Varies by device
Data record	Minimum: 0.0, maximum: 1.0

Sixel Graphics Protocol Workstation

14

Sixel Graphics Protocol Workstation

This chapter provides the information you need to use DEC GKS and DEC PHIGS with the following Digital printers:

- LA50
- LA75
- LA84
- LA86
- LA100
- LA210
- LA280
- LA380
- LN03 PLUS and LN03_J PLUS
- DEClaser 2100, 2200, and 2300

DEC GKS and DEC PHIGS support these printers as workstations of the category WSCAT_OUTPUT.

14.1 Environment Options

Table 14–1 summarizes the environment options you can use with sixel printers.

Table 14–1 Sixel Printer Environment Options

Syntax	Description
Connection Identifier	
GKS$CONID GKSconid PHIGS$CONID PHIGSconid	Specifies the default workstation connection information. On OpenVMS systems, the startup procedure, GKSTARTUP.COM or PHIGS$STARTUP.COM, sets the default value. For example, on OpenVMS systems, you define the DEC PHIGS logical name for a sixel device as follows: $ **DEFINE PHIGS$CONID TT:** Return On UNIX systems, you define the DEC GKS environment variable for a sixel device as follows: % **setenv GKSconid tt:** Return

(continued on next page)

Table 14–1 (Cont.) Sixel Printer Environment Options

Syntax	Description
Workstation Type	
GKS$WSTYPE GKSwstype PHIGS$WSTYPE PHIGSwstype	Specifies the workstation type. On OpenVMS systems, the startup procedure, GKSTARTUP.COM or PHIGS$STARTUP.COM, sets the default value. For example, on OpenVMS systems, you define the DEC PHIGS logical name for the Digital LA50 workstation type as follows: $ **DEFINE PHIGS$WSTYPE 32** Return On UNIX systems, you define the DEC GKS environment variable for the Digital LA75 workstation type as follows: % **setenv GKSwstype 35** Return

14.2 Valid Bit Mask Values

You can use bit masks to specify modifiers to the workstation type values for the LA50, LA75, LA84, LA86, LA100, LA210, LA280, LA380, LN03 PLUS, LN03_J PLUS, and DEClaser devices. The following sections describe the bit masks in detail.

14.2.1 LA50, LA75, LA84, LA86, LA100, LA210, LA280, and LA380 Graphics Handlers

For the LA50, LA75, LA84, LA86, LA100, LA210, LA280, and LA380 graphics handlers, you can specify hexadecimal bit masks as workstation type values. Using these devices, you use the bit mask values to specify the paper orientation.

The following bit masks are valid for use with the LA50, LA75, LA84, LA86, LA100, LA210, LA280, and LA380 printers:

Workstation Type	Hexadecimal Value	Description
31	%x*m*000001F	Digital LA100
32	%x*m*0000020	Digital LA50 with 2:1 aspect ratio
34	%x*m*0000022	Digital LA210
35	%x*m*0000023	Digital LA75
131	%x*m*0000083	Digital LA84, LA86, LA280, and LA380

The value in the first part (*m*000) specifies the paper orientation. The value in the second part is the hexadecimal value. The printers and their associated hexadecimal values are as follows:

Printer	Hexadecimal Value
LA50	0020
LA75	0023
LA84 and LA86	0083
LA100	001F

Printer	Hexadecimal Value
LA210	0022
LA280	0083
LA380	0083

These hexadecimal values correspond to the decimal workstation type value equivalents (32 for the LA50 printer, 35 for the LA75 printer, 31 for the LA100 printer, 34 for the LA210 printer, or 131 for the LA84, LA86, LA280, and LA380 printers).

The possible values for *m* include the following:

Value	Paper Orientation
0	Landscape: The picture is wider than it is tall. This is the default setting.
1	Portrait: The picture is taller than it is wide.

14.2.2 LN03 PLUS, LN03_J PLUS, and DEClaser (LN06) Graphics Handlers

For the LN03 PLUS, LN03_J PLUS, and DEClaser graphics handlers, you can specify hexadecimal bit masks as workstation type values. Using this device, you use the bit mask values to specify the paper size.

The following bit masks are valid for use with the LN03 PLUS, LN03_J PLUS, and DEClaser printers:

Workstation Type	Hexadecimal Value	Description
37	%x*m0nn*0025	Digital DEClaser 2200 printer
38	%x*m0nn*0026	Digital LN03 PLUS laser printer
39	%x*m0nn*0027	Digital DEClaser 2100 printer
138	%x*m0nn*008A	Digital LN03_J PLUS laser printer
139	%x*m0nn*008B	Digital DEClaser 2300 printer

The value in the first part (*m*) specifies the paper orientation. The next value (*0nn*) specifies the paper size. The last value is the hexadecimal value (0026 for the LN03 PLUS printer, 008A for the LN03_J PLUS printer, or 0025, 0027, or 008B for the DEClaser printers) of the workstation type. These hexadecimal values correspond to the decimal workstation type value equivalents (38 for the LN03 PLUS printer, 138 for the LN03_J PLUS printer, or 37, 39, or 139 for the DEClaser printers).

The possible values for *m* include the following:

Value	Paper Orientation
0	Landscape: the picture is wider than it is tall. This is the default setting.
1	Portrait: the picture is taller than it is wide.

The possible values for *nn* include the following:

Value	Paper Size
00	Paper size is A (8.5 × 11 inches). This is the default setting.
50	Paper size is A4 (21 × 29.7 centimeters).
70	Paper size is B4 (25.7 × 36.4 centimeters). This is for the DEClaser 2300 printer only

14.3 Device Considerations

The following sections describe LA50 printer switch settings and device queues and allocation.

14.3.1 LA50 Switch Settings

To specify a 2:1 aspect ratio on the LA50 printer, you must leave switches SW1 to SW5 open. For more information, see your printer documentation.

14.3.2 Device Queues and Allocation

When using the sixel devices as either allocated or queued devices on OpenVMS systems, you need to set terminal characteristics by entering the following DCL command:

```
$ SET TERMINAL device_name /INTERACTIVE/NOECHO/NOTYPEAHEAD- Return
_$ /NOESCAPE/NOHOSTSYNC/TTSYNC/LOWERCASE/TAB/NOWRAP/HARDCOPY- Return
_$ /EIGHTBIT/NOBROADCAST/FORM/FULLDUP/SPEED=set_speed Return
```

Replace *device_name* with the name of the device to be allocated. Replace *set_speed* with a value equal to the baud rate as determined by the switches currently set on the printer.

Note

For many of the sixel printers, you can specify the device type using the SET TERMINAL /DEVICE=*sixel_device* command. The value *sixel_device* specifies the particular printer you are using. For more information, see the SET TERMINAL command in the *OpenVMS DCL Dictionary*.

For more information on device allocation, see the ALLOCATE command in the *OpenVMS DCL Dictionary*.

When using the sixel devices as either allocated or queued devices on UNIX systems, you need to set terminal characteristics by entering the following command:

```
% stty pass8 -echo new speed < /dev/ttynn Return
```

Replace *speed* with a value equal to the baud rate as determined by the switches currently set on the printer. Replace *nn* with the port number.

14.4 Pattern and Hatch Values

This section describes the available fill area pattern and hatch values for the Digital sixel printers. The positive numeric style values are patterns (mixtures of colors) and the negative values are hatches (device-dependent designs, such as cross-hatches, dots, horizontal lines, and so forth). The style values are passed with the SET FILL AREA STYLE INDEX function.

If you change the default color representations, all patterns using that color index use the new color representation.

DEC PHIGS does not support patterns.

14.4.1 Available Fill Area Hatch Values

The following table identifies the available fill area hatch value indexes and describes the results.

Style Index	Appearance
–1	Cross-hatches
–2	Diagonal lines at 45 degrees
–3	Diagonal lines at –45 degrees
–4	Horizontal lines
–5	Vertical lines
–6	Diagonal lines at 45 degrees—sparse
–7	Diagonal lines at –45 degrees—sparse
–8	Horizontal lines—sparse
–9	Vertical lines—sparse

14.4.2 Predefined Fill Area Pattern Values for DEC GKS

The following table identifies the 68 predefined fill area pattern values for color index 1, and describes the results.

Style Index	Appearance
1	Light diagonally woven pattern (25%)
2	Darker diagonally woven pattern (50%)
3	Dark diagonally woven pattern (75%)
4	Horizontal brick pattern
5	Vertical brick pattern
6	Brick pattern at –45 degrees
7	Brick pattern at 45 degrees
8	Finely woven grid
9	Sparsely woven grid
10	Downward scales (fish-like)
12	Rightward scales
13	Leftward scales

Style Index	Appearance
14 to 28	Increasing densities of grey (no hatch style), starting at 1/16 density, incrementing by 1/16, up to 15/16 density
29	Vertical lines—sparse (6.25%)
30	Vertical lines—sparse (12.5%)
31	Vertical lines—sparse (50%)
32	Vertical lines—sparse (75%)
33	Vertical lines—very fine (50%)
34	Vertical lines (25%)
35	Vertical lines (50%)
36	Vertical lines (75%)
37	Horizontal lines—sparse (6.25%)
38	Horizontal lines—sparse (12.5%)
39	Horizontal lines—sparse (50%)
40	Horizontal lines—sparse (75%)
41	Horizontal lines—very fine (50%)
42	Horizontal lines (25%)
43	Horizontal lines (50%)
44	Horizontal lines (75%)
45	Diagonal lines at 45 degrees—sparse (6.25%)
46	Diagonal lines at 45 degrees—sparse (12.5%)
47	Diagonal lines at 45 degrees—sparse (50%)
48	Diagonal lines at 45 degrees—sparse (75%)
49	Diagonal lines at 45 degrees (25%)
50	Diagonal lines at 45 degrees (50%)
51	Diagonal lines at 45 degrees (75%)
52	Diagonal lines at –45 degrees—sparse (6.25%)
53	Diagonal lines at –45 degrees—sparse (12.5%)
54	Diagonal lines at –45 degrees—sparse (50%)
55	Diagonal lines at –45 degrees—sparse (75%)
56	Diagonal lines at –45 degrees (25%)
57	Diagonal lines at –45 degrees (50%)
58	Diagonal lines at –45 degrees (75%)
59	Sparsely woven grid—black and white only
60	Sparsely woven grid—black and white only
61	Sparsely woven grid—black and white only
62	Sparsely woven grid—black and white only
63	Sparsely woven grid—black and white only
64 to 68	Series of special character patterns—black and white only

14.5 Printer Resolutions

This section describes the printer resolutions in dots per inch (dpi).

Printer	Horizontal	Vertical
LA50	144.0	72.0
LA75	144.0	144.0
LA84, LA86, and LA280	180.0	180.0
LA100	131.5	72.0
LA210	330.0	72.0
LN03 and LN03_J PLUS	150.0	150.0
DEClaser 2100, 2200, and 2300	300.0	300.0

Tektronix 4014 Workstation

15
Tektronix 4014 Workstation

This chapter describes the information needed when using DEC GKS and DEC PHIGS with the Tektronix 4014. DEC GKS and DEC PHIGS support this device as a workstation of category WSCAT_OUTIN.

Note

Tektronix 4014 devices are not supported on OpenVMS Alpha and Digital UNIX systems.

15.1 Environment Options

Table 15–1 summarizes the environment options you can use with Tektronix 4014 devices.

Table 15–1 Tektronix 4014 Environment Options

Syntax	Description
Connection Identifier	
GKS$CONID GKSconid PHIGS$CONID PHIGSconid	Specifies the default workstation connection information. On OpenVMS systems, the startup procedure, GKSTARTUP.COM or PHIGS$STARTUP.COM, sets the default value. For example, on OpenVMS systems, you define the DEC PHIGS logical name for the connection identifier to a terminal as follows: $ **DEFINE PHIGS$CONID TT:** Return On ULTRIX systems, you define the DEC GKS environment variable for the connection identifier to a terminal as follows: % **setenv GKSconid tt:** Return

(continued on next page)

Table 15–1 (Cont.) Tektronix 4014 Environment Options

Syntax	Description
Workstation Type	
GKS$WSTYPE GKSwstype PHIGS$WSTYPE PHIGSwstype	Specifies the workstation type. On OpenVMS systems, the startup procedure, GKSTARTUP.COM or PHIGS$STARTUP, sets the default value. For example, on OpenVMS systems, you define the DEC PHIGS logical name for the variable for the Tektronix 4014 (I/O) workstation type as follows: $ **DEFINE PHIGS$WSTYPE 70** Return On ULTRIX systems, you define the DEC GKS environment variable for the Tektronix 4014 terminal, output only, workstation type as follows: % **setenv GKSwstype 70** Return

15.2 Valid Bit Mask Values

When using the Tektronix 4014 graphics handler, you can specify hexadecimal bit masks as workstation type values. The bit mask for this device specifies the number of SYN characters to write to the screen in between generations of output primitives. The number of SYN characters written to the terminal and the current terminal baud rate determine whether the beam used to generate output has enough elapsed time between the generations to settle. If you do not allow the beam to settle for an adequate amount of time, you may lose all or part of a generated output primitive.

The following bit masks are valid for use with a Tektronix 4014 device:

Workstation Type	Hexadecimal Value	Description
70	%x*nnnn*0046	Tektronix 4014 terminal, output only
72	%x*nnnn*0048	Tektronix 4014 terminal, input/output

The value in the first part (*nnnn*) specifies the number of SYN characters written to the terminal in between primitive generations. For instance, if your terminal is running at 9600 baud, you should specify five SYN characters by defining the first part of the bit mask as 0005.

The second part of the bit mask (00WW) contains the hexadecimal value (46 for the output-only device, and 48 for the input/output device) of the workstation type. These hexadecimal values correspond to the decimal workstation type values (70 for the output-only terminal, and 72 for the input/output terminal).

When using the decimal workstation type value 70, you can pass a file specification to the connection identifier argument to the OPEN WORKSTATION function.

After program execution on OpenVMS systems, use the DCL command SET TERMINAL/PASSTHRU, which inhibits Ctrl/Y, Ctrl/C, and other line editing commands. Then type the specified file at your terminal. When you are finished, use the DCL command SET TERMINAL/NOPASSTHRU before attempting to do other work.

After program execution on ULTRIX systems, enter the following commands:

```
% stty raw Return
% cat file_name Return
```

This types the specified file at your terminal. When you are finished, use the command *tset* to restore terminal attributes before attempting to do other work.

15.3 Programming Considerations

DEC GKS and DEC PHIGS support the Tektronix 4014 terminal with the Enhanced Graphics Option (Tektronix option number 34). The Enhanced Graphics Option provides four additional vector line formats and a higher resolution.

All recently purchased Tektronix 4014 terminals include the option as a standard feature. However, early Tektronix 4014 terminals were available without the option. If you have an early model, you must add the Enhanced Graphics Option to use the terminal with DEC GKS and DEC PHIGS.

Note

For DEC GKS and DEC PHIGS, only the Tektronix 4014 with enhanced graphics module (option 34) or equivalent is supported. The emulation of a Tektronix 4014 is not supported on any hardware.

15.3.1 Echo of Characters

To avoid having each typed character echoed twice on the Tektronix 4014 terminal, set local echo on the data communication interface card to OUT.

15.3.2 GIN Mode Configuration

DEC GKS and DEC PHIGS input on the Tektronix 4014 terminal make extensive use of graphics input (GIN) mode. GIN mode is enabled by an escape sequence and terminated by user action (pressing a key on the keyboard). The Tektronix 4014 terminal sends a string of characters back to DEC GKS and DEC PHIGS. The string of characters is the PLOT 10™ representation of the current cross-hair position, plus some terminating characters. The terminating characters may be any of the following:

- A carriage return (CR) and end of take (EOT)
- A CR
- Nothing

A jumper on a board in the terminal pedestal determines which option is enabled. DEC GKS and DEC PHIGS require that the Tektronix 4014 terminal be configured for option 2 (CR). Otherwise, using the DEC GKS and DEC PHIGS input functions with the Tektronix 4014 terminal produces unpredictable results. (For example, the user must press the space bar twice to register each point in stroke input.)

To configure the Tektronix 4014 terminal for the CR option, perform the following steps:

1. Read the appendix on installation in the *Tektronix Computer Display Terminal User's Manual*.

2. Make sure the power to the Tektronix 4014 terminal is off.
3. Open the front panel on the Tektronix 4014 terminal pedestal.
4. Locate the board labeled TC–2 (usually the third board from the left).
5. Remove the ribbon cable connector.
6. Remove board TC–2 (be sure to remember the slot you removed it from).
7. Locate the jumper.
8. Make sure that the jumper is in the middle location, marked *CR ONLY*.
9. Put the board back in the same slot that you removed it from.
10. Reconnect the connector to TC–2.
11. Close the front panel.
12. Turn on the power.

If after configuring the Tektronix 4014 terminal for the CR option you have any problems with GIN input, contact your local Tektronix representative.

15.4 Pattern and Hatch Values

This section describes the available fill area pattern and hatch values for the Tektronix 4014 terminals. The positive numeric style values are patterns (mixtures of colors) and the negative values are hatches (device-dependent designs, such as cross-hatches, dots, horizontal lines, and so forth). The style values are passed with the SET FILL AREA STYLE INDEX function.

If you change the default color representations, all patterns using that color index use the new color representation.

DEC PHIGS does not support patterns.

15.4.1 Available Fill Area Hatch Values

The following table identifies the available fill area hatch value indexes and describes the results.

Style Index	Appearance
–1	Cross-hatches
–2	Diagonal lines at 45 degrees
–3	Diagonal lines at –45 degrees
–4	Horizontal lines
–5	Vertical lines
–6	Diagonal lines at 45 degrees—sparse
–7	Diagonal lines at –45 degrees—sparse
–8	Horizontal lines—sparse
–9	Vertical lines—sparse

15.5 Input Information

Each of the following input class sections lists the supported logical input device numbers, and supported prompt and echo type (PET) numbers. For a complete description of these numbers, see the input chapter in the DEC GKS or DEC PHIGS binding manuals. For detailed information on cycling logical input devices and numeric keypad functionality, see Section E.3.1 and Section E.3.2.

On a Tektronix 4014 terminal, press any key to signal the completion of input. When the documentation refers to arrow keys, use the thumbwheels to move the cursor.

15.5.1 Choice Input Class

Supported Logical Input Devices

The following table identifies the supported choice-class logical input devices for the Tektronix 4014 terminal.

Choice Device Types	Input Action
1, 2, 3, 4, 5, 6, 7, 8	Select with thumbwheels. Trigger with Return. Break with Ctrl/U.

Supported PETs

The choice input class for the Tektronix 4014 terminal supports PETs 1 and 3. See the input chapter in the DEC GKS or DEC PHIGS binding reference manuals for more information on PETs.

Default Input Values

The following table identifies the default input values for the Tektronix 4014 choice-class logical input devices.

Input Construct	Default Value
PET	1
Initial choice	1
Initial status	STATUS_OK
Echo area	Varies by device
Data record	Varies by device—list of choice strings

15.5.2 Locator Input Class

Supported Logical Input Devices

The following table identifies the supported locator-class logical input devices for the Tektronix 4014 terminal.

Locator Device Types	Input Action
1, 2, 3, 4	Select with thumbwheels. Trigger with Return. Break with Ctrl/U.

Supported PETs

The locator input class for the Tektronix 4014 terminal supports PETs 1 and 2. See the input chapter in the DEC GKS or DEC PHIGS binding reference manuals for more information on PETs.

Default Input Values

The following table identifies the default input values for the Tektronix 4014 locator-class logical input devices.

Input Construct	Default Value
PET	1
Initial position	0.5, 0.5
Initial transformation	0
Echo area	Largest square
Data record	NULL

15.5.3 Pick Input Class

Supported Logical Input Devices

The following table identifies the supported pick-class logical input devices for the Tektronix 4014 terminal.

Pick Device Types	Input Action
1, 2, 3, 4	Select with thumbwheels. Trigger with Return. Break with Ctrl/U.

Supported PETs

The pick input class for the Tektronix 4014 terminal supports PETs 1, 2, and 3. See the input chapter in the DEC GKS or DEC PHIGS binding reference manuals for more information on PETs.

Default Input Values

The following table identifies the default input values for the Tektronix 4014 pick-class logical input devices.

Input Construct	Default Value
PET	1
Initial pick identifier	1
Initial pick path	NULL (no path)
Initial status	STATUS_OK
Echo area	Largest square
Data record	Aperture: 30.71 in device coordinates

The size of the pick aperture is limited by the hardware cursor map.

15.5.4 String Input Class

Supported Logical Input Devices

The following table identifies the supported string-class logical input devices for the Tektronix 4014 terminal.

String Device Types	Input Action
1, 2, 3, 4	Enter characters from keyboard. Trigger with Return. Break with Ctrl/U.

Supported PETs

The string input class for the Tektronix 4014 terminal supports PET 1. See the input chapter in the DEC GKS or DEC PHIGS binding reference manuals for more information on PETs.

Default Input Values

The following table identifies the default input values for the Tektronix 4014 string-class logical input devices.

Input Construct	Default Value
PET	1
Initial string	NULL
Echo area	Varies by device
Data record	Input buffer size: 20 ASCII characters
Initial position	1

15.5.5 Stroke Input Class

Supported Logical Input Devices

The following table identifies the supported stroke-class logical input devices for the Tektronix 4014 terminal.

Stroke Device Types	Input Action
1, 2, 3, 4	Select with thumbwheels. Trigger with Return. Break with Ctrl/U. Enter point with space key.

Supported PETs

The stroke input class for the Tektronix 4014 terminal supports PETs 1 and 4. See the input chapter in the DEC GKS or DEC PHIGS binding reference manuals for more information on PETs.

Default Input Values

The following table identifies the default input values for the Tektronix 4014 stroke-class logical input devices.

Input Construct	Default Value
PET	1
Initial number of points	0
Initial transformation	0
Echo area	Largest square
Data record	Stroke buffer size: 80 points
	Editing position: 0
	x interval: 0.01 in world coordinate points
	y interval: 0.01 in world coordinate points
	Time interval: 0.0 seconds

15.5.6 Valuator Input Class

Supported Logical Input Devices

The following table identifies the supported valuator-class logical input devices for the Tektronix 4014 terminal.

Valuator Device Types	Input Action
1, 2, 3, 4	Select with thumbwheels. Trigger with Return. Break with Ctrl/U.

Supported PETs

The valuator input class for the Tektronix 4014 terminal supports PETs 1 and 2. See the input chapter in the DEC GKS or DEC PHIGS binding reference manuals for more information on PETs.

Default Input Values

The following table identifies the default input values for the Tektronix 4014 valuator-class logical input devices.

Input Construct	Default Value
PET	1
Initial value	0.5
Echo area	Varies by device
Data record	Minimum 0.0, maximum 1.0

Tektronix 4100, 4200, and VS500 Series Workstations

16

Tektronix 4100, 4200, and VS500 Series Workstations

This chapter describes the information you need to use DEC GKS and DEC PHIGS with the following devices:

- Tektronix 4107
- Tektronix 4207
- Tektronix 4128
- Tektronix 4129
- Digital VS500

DEC GKS and DEC PHIGS support these devices as workstations of category WSCAT_OUTIN.

Note

These devices are not supported on OpenVMS Alpha and Digital UNIX systems.

16.1 Environment Options

Table 16–1 summarizes the environment options you can use with the Tektronix and VS500 series devices.

Tektronix 4100, 4200, and VS500 Series Workstations
16.1 Environment Options

Table 16–1 Tektronix Environment Options

Syntax	Description
Connection Identifier	
GKS$CONID GKSconid PHIGS$CONID PHIGSconid	Specifies the default workstation connection information. On OpenVMS systems, the startup procedure, GKSTARTUP.COM or PHIGS$STARTUP.COM, sets the default value. For example, on OpenVMS systems, you define the logical name for the connection identifier of a Tektronix workstation as follows: $ **DEFINE PHIGS$CONID TT:** Return On ULTRIX systems, you define the environment variable for the connection identifier of a VAXstation 500 as follows: % **setenv GKSconid tt:** Return See Section 16.5.1 for information on defining logical names for specific Tektronix and VS500 series devices. See Section 16.5.2 for information on using physical device to logical device mappings.
Physical Input Devices	
GKS$*mm*_INPUT_DEVICES GKS*mm*_input_devices PHIGS$*mm*_INPUT_DEVICES PHIGS*mm*_input_devices	Specifies the physical input device to use with the device specified by *mm*. In the DEC GKS and DEC PHIGS syntax, *mm* refers to the decimal workstation type value, for example, 84 for the Tektronix 4207 workstation. For example, on OpenVMS systems, to use the mouse as the pointing device for all logical input devices on the Tektronix 4207 workstation, define the DEC PHIGS logical name as follows: $ **DEFINE PHIGS$WSTYPE 84** Return $ **DEFINE PHIGS$84_INPUT_DEVICES "MOUSE(ALL)"** Return On ULTRIX systems, to use the mouse as the pointing device for all logical input devices on the Tektronix 4207 workstation, define the DEC GKS environment variable as follows: % **setenv GKSwstype 84** Return % **setenv GKS84_input_devices "mouse(all)"** Return See Section 16.5.1 for information on defining logical names for specific Tektronix and VS500 series devices. See Section 16.5.2 for information on using physical device to logical device mappings.
Workstation Type	
GKS$WSTYPE GKSwstype PHIGS$WSTYPE PHIGSwstype	Specifies the workstation type. On OpenVMS systems, the startup procedure, GKSTARTUP.COM or PHIGS$STARTUP.COM, sets the default value. For example, on OpenVMS systems, you define the logical name for the Tektronix 4207 workstation type as follows: $ **DEFINE PHIGS$WSTYPE 84** Return On ULTRIX systems, you define the environment variable for the VAXstation 500 workstation type as follows: % **setenv GKSwstype 88** Return

16.2 Valid Bit Mask Values

When using with the Tektronix 4100 and 4200 series, and the Digital VS500 graphics handlers, you can specify hexadecimal bit masks as workstation type values. The bit mask for these devices specify the number of SYN characters to write to the screen in between generations of output primitives. The number of SYN characters written to the terminal and the current terminal baud rate determine whether the beam used to generate output has enough elapsed time between the generations to settle. If you do not allow the beam to settle for an adequate amount of time, you may lose all or part of a generated output primitive.

The following bit masks are valid for use with the Tektronix 4100 and 4200 series, and the Digital VS500 devices:

Workstation Type	Hexadecimal Value	Description
80	%x*nnnn*0050	Tektronix 4107 terminal, output only
82	%x*nnnn*0052	Tektronix 4107 terminal
83	%x*nnnn*0053	Tektronix 4207 terminal, output only
84	%x*nnnn*0054	Tektronix 4207 workstation
85	%x*nnnn*0055	Tektronix 4128 workstation, output only
86	%x*nnnn*0056	Tektronix 4128 workstation
87	%x*nnnn*0057	Tektronix 4129 and Digital VS500 workstations, output only
88	%x*nnnn*0058	Tektronix 4129 and Digital VS500 workstations

The value in the first part (*nnnn*) specifies the number of SYN characters written to the terminal in between primitive generations. For instance, if your terminal is running at 9600 baud, you should specify five SYN characters by defining the first part of the bit mask as 0005.

The second part of the bit mask (00WW) contains the hexadecimal value (for example, 56 for an input/output device, and 57 for an output-only device) of the workstation type. These hexadecimal values correspond to the decimal workstation type values (for example, 86 for an output-only terminal, and 87 for an input/output device).

When using the decimal workstation type values 80, 83, 85, and 87, you can pass a file specification to the connection identifier argument to the OPEN WORKSTATION function. After program execution, type the file at your terminal to view the generated picture.

16.3 Programming Considerations

You should review the following sections before programming with DEC GKS and DEC PHIGS using the Tektronix 4100 series or the 4207 workstation.

16.3.1 Setup Requirement

When using DEC GKS or DEC PHIGS with the devices listed at the beginning of this chapter, you need to set the setup command FLAGGING to the value IN/OUT at the setup prompt, as follows:

*FLAGGING IN/OUT Return

This setting should be saved in nonvolatile memory for the Tektronix 4100 series and 4207 devices, as follows:

*NVSAVE Return

16.3.2 Resetting the Terminal After an Interrupt

If you cause a DEC GKS or DEC PHIGS program to interrupt (for instance, by generating an access violation) while the terminal is in vector mode, you need to reset the terminal. Follow the instructions under the type of Tektronix device you use.

Resetting the Tektronix 4107 and 4207 Devices

To reset the terminal, press the Setup key, type the string *reset*, and press Return. If completely resetting your terminal is too time-consuming, perform the following steps:

1. Press the Setup key.
2. Type the string *local* and press Return.
3. Press the Setup key again.
4. Press Shift, Ctrl, and the dash (–) key at the same time.
5. Press the Setup key again.
6. Type the string *local no* and press Return.
7. Type the string *acursor 2* and press Return.
8. Type the string *code ansi* and press Return.
9. Press the Setup key again.

This process resets only the values affected by the interrupted DEC GKS or DEC PHIGS program.

Resetting the Tektronix 4128 and 4129, and the Digital VS500 Devices

To reset the terminal, press the Reset button on the graphics processor. If completely resetting your terminal is too time-consuming, perform the following steps:

1. Press the Local key.
2. Press Shift, Ctrl, and the dash (–) key at the same time.
3. Press the Local key again.
4. Press the Setup key.
5. Type the string *code ansi* and press Return.
6. Press the Setup key again.

This process resets only the values affected by the interrupted DEC GKS or DEC PHIGS program.

Note

If a DEC GKS or DEC PHIGS program is interrupted while the Tektronix or Digital VS500 device has a graphics input (GIN) device active, deactivate the GIN device before you run another DEC GKS or DEC PHIGS program. To learn how to deactivate the GIN device, see the Tektronix reference manual for your device.

16.4 Tektronix 4107 and 4207 Pattern and Hatch Values

This section describes the available fill area pattern and hatch values for Tektronix 4100 and 4200 series devices. The positive numeric style values are patterns (mixtures of colors) and the negative values are hatches (device-dependent designs, such as cross-hatches, dots, horizontal lines, and so forth). The style values are passed with the SET FILL AREA STYLE INDEX function.

If you change the default color representations, all patterns using that color index use the new color representation.

DEC PHIGS does not support patterns.

16.4.1 Available Fill Area Hatch Values

The following table identifies the available fill area hatch value indexes and describes the results.

Style Index	Appearance
–1	Cross-hatches
–2	Diagonal lines at 45 degrees
–3	Diagonal lines at –45 degrees
–4	Horizontal lines
–5	Vertical lines
–6	Diagonal lines at 45 degrees—sparse
–7	Diagonal lines at –45 degrees—sparse
–8	Horizontal lines—sparse
–9	Vertical lines—sparse

16.4.2 Predefined Fill Area Pattern Values for DEC GKS

The following table identifies the predefined fill area pattern value indexes and describes the results.

Style Index	Appearance
1	White cross-hatches
2	White vertical zig zag

Style Index	Appearance
3	White horizontal zig zag
4	White horizontal lines
5	White squares
6	Red brick
7	White vertical lines
8	White diagonal lines
9	Dense white dots
10	White dots
11	White dashed diagonals
12	White vertical dots
13	White sparse dots
14	White vertical dashes
15	Rainbow vertical lines
16	Black and white stone fence

16.5 Input Information

Each of the following input class sections lists the supported logical input device numbers, and supported prompt and echo type (PET) numbers. For a complete description of these numbers, see the input chapter in the DEC GKS or DEC PHIGS binding reference manuals. For detailed information on cycling logical input devices and numeric keypad functionality, see Section E.3.1 and Section E.3.2.

For locator-, pick-, stroke-, and valuator-class devices, you can press the Shift key while using the joydisk and thumbwheels to move the cursor in shorter increments.

Note

On certain 4207 devices, holding the Shift key does nothing. On these devices, the speed of the cursor increases if you press harder on the joydisk.

16.5.1 How to Use Additional Physical Devices

The default input device for the Tektronix 4107 and 4207 devices is the joydisk. For the Tektronix 4128, 4129, and the Digital VS500 devices, the default input devices are thumbwheels.

If you want to use additional physical input devices with any of these terminals or workstations on an OpenVMS system, you must define the following logical names as shown for DEC PHIGS:

Terminal	Logical Name
Tektronix 4107	$ DEFINE PHIGS$82_INPUT_DEVICES ("*physical_device logical_device*,...")
Tektronix 4207	$ DEFINE PHIGS$84_INPUT_DEVICES ("*physical_device logical_device*,...")
Tektronix 4128	$ DEFINE PHIGS$86_INPUT_DEVICES ("*physical_device logical_device*,...")
Tektronix 4129 and VS500	$ DEFINE PHIGS$88_INPUT_DEVICES ("*physical_device logical_device*,...")

If you want to use additional physical input devices with any of these terminals or workstations on ULTRIX systems, you must define the following environment variables as shown for DEC GKS:

Terminal	Logical Name
Tektronix 4107	% setenv GKS82_input_devices ("*physical_device logical_device*,...")
Tektronix 4207	% setenv GKS84_input_devices ("*physical_device logical_device*,...")
Tektronix 4128	% setenv GKS86_input_devices ("*physical_device logical_device*,...")
Tektronix 4129 and VS500	% setenv GKS88_input_devices ("*physical_device logical_device*,...")

Tektronix 4107 and 4207, and VS500 Physical Device Information

The following table lists all the physical devices, the terminals on which they are valid, and a brief description about how to use the device.

Device	Terminal Number	Description
JOYDISK	4107, 4207	Default
THUMBWHEELS	4128, 4129, VS500	Default
MOUSE	4128, 4129, VS500, 4207	Mouse
JOYSTICK	4128, 4129, VS500	Joystick plugged into joystick port

Note

See the Tektronix programmer's reference guide for your terminal for more information on ABSOLUTE and RELATIVE modes.

16.5.2 Using Logical Device Mappings

Using a logical device name can become even more complex than defining physical devices. For example, you can separate different physical device to logical device mappings by commas, as in the following example shown for DEC PHIGS:

```
OpenVMS:
$ DEFINE PHIGS$82_INPUT_DEVICES "MOUSE(CHOICE(ALL),PICK(ALL))" Return

ULTRIX:
% setenv PHIGS82_input_devices "mouse(choice(all),pick(all))" Return
```

The result of this mapping is that all choice and pick devices use the mouse; all other input devices use the default input device.

You can also specify specific logical devices, as shown in the following example for DEC GKS:

```
OpenVMS:
$ DEFINE GKS$82_INPUT_DEVICES "MOUSE(CHOICE(1))" Return

ULTRIX:
% setenv GKS82_input_devices "mouse(choice(1))" Return
```

In this example, choice device 1 uses the mouse. All other input devices use the default physical input device.

The following is a list of the recognized logical device keywords:

- CHOICE
- LOCATOR
- PICK
- STRING
- STROKE
- VALUATOR

You can combine all these physical and logical device features. Any illegally specified strings result in the use of the previously specified physical devices, which in most cases will be the default.

Note

Errors often occur because of misplaced parentheses and misspelled keywords.

Consider the following examples for DEC PHIGS.

```
OpenVMS:
$ DEFINE PHIGS$84_INPUT_DEVICES "PORT0(LOCATOR(1,2), VALUATOR(1,2,3))" Return

ULTRIX:
% setenv PHIGS84_input_devices "port0(locator(1,2), valuator(1,2,3))" Return
```

The previous example defines the devices and ports as follows:

- The tablet at PORT0 is used for LOCATOR 1 and 2, and VALUATOR 1, 2, and 3.
- The joydisk is used for the remaining devices.

```
OpenVMS:
$ DEFINE PHIGS$84_INPUT_DEVICES "MOUSE(ALL)" Return

ULTRIX:
% setenv PHIGS84_input_devices "mouse(all)" Return
```

In this example, the mouse is defined for all input devices, except string.

```
OpenVMS:
$ DEFINE PHIGS$84_INPUT_DEVICES "MOUSE(CHOICE(1,2,5-8))" Return

ULTRIX:
% setenv PHIGS84_input_devices "mouse(choice(1,2,5-8))" Return
```

In this example, the mouse is defined as choice devices 1, 2, 5, 6, 7, and 8. The joydisk is used for all remaining devices.

16.5.3 Choice Input Class

Supported Logical Input Devices

The following table identifies the supported choice-class logical input devices for the Tektronix 4100 and 4200 series, and Digital VS500 workstations.

Input Device	Choice Device Types	Input Action
No mouse or puck	1, 3, 4, 5, 6, 7, 8	Select with arrow keys or joydisk. Trigger with Return. Break with Ctrl/U.
	2	Keypad key is selection and trigger.
Mouse (3 buttons)	1, 3, 6, 7, 8	Select with mouse. Trigger with mouse button 1. Break with mouse button 2.
	2	Keypad key is selection and trigger.
	4	Mouse or puck button down is selection and trigger.
	5	Mouse button up is selection and trigger.
Puck (4 buttons)	1, 3, 5, 6, 7, 8	Select with puck. Trigger with puck button 1. Break with puck button 2.
	2	Keypad key is selection and trigger.
	4	Puck button down is selection and trigger.

Supported PETs

The choice input class for the Tektronix 4100 and 4200 series, and Digital VS500 devices support PETs –1, 1, and 3.

Default Input Values

The following table identifies the default input values for the Tektronix 4100 and 4200 series, and Digital VS500 choice-class logical input devices.

Input Construct	Default Value
PET	1
Initial choice	1
Initial status	STATUS_OK
Echo area	Varies by device
Data record	Varies by device—list of choice strings.

16.5.4 Locator Input Class

Supported Logical Input Devices

The following table identifies the supported locator-class logical input devices for the Tektronix 4100 and 4200 series, and Digital VS500 workstations.

Input Device	Locator Device Types	Input Action
No mouse or puck	1, 3, 4, 5, 6, 7	Select with arrow keys or joydisk. Trigger with Return. Break with Ctrl/U.
	8	Movement is selection and trigger.
Mouse (3 buttons)	1, 2, 3, 4, 7	Select with mouse. Trigger with mouse button 1. Break with mouse button 2.
	5	Select with mouse. Trigger with mouse button 2.
	6	Select with mouse. Trigger with mouse button 3.
	8	Movement is selection and trigger.
Puck (4 buttons)	1, 2, 3, 4	Select with puck. Trigger with puck button 1. Break with puck button 2.
	5	Select with puck. Trigger with puck button 2.
	6	Select with puck. Trigger with puck button 3.
	7	Select with puck. Trigger with puck button 4.
	8	Movement is selection and trigger.

Supported PETs

The locator input class for the Tektronix 4100 and 4200 series, and Digital VS500 devices support PETs –13 (DEC GKS only), –12, –11, –5, –4, –3, –2, –1, 1, 2, 3, 4, 5, and 6.

Default Input Values

The following table identifies the default input values for the Tektronix 4100 and 4200 series, and Digital VS500 locator-class logical input devices.

Input Construct	Default Value
PET	1
Initial position	0.5, 0.5
Initial transformation	0
Echo area	Largest square
Data record	NULL

16.5.5 Pick Input Class

Supported Logical Input Devices

The following table identifies the supported pick-class logical input devices for the Tektronix 4100 and 4200 series, and Digital VS500 workstations.

Input Device	Pick Device Types	Input Action
No mouse	1, 2, 3, 4, 5, 6	Select with arrow keys or joydisk. Trigger with Return. Break with Ctrl/U.
Mouse or puck	1, 2, 3, 4	Select with mouse or puck. Trigger with mouse or puck button 1. Break with mouse or puck button 2.
	5	Select with mouse or puck. Trigger with mouse puck button 2.
	6	Select with mouse or puck. Trigger with mouse or puck button 3.

Supported PETs

The pick input class for the Tektronix 4100 and 4200 series, and Digital VS500 devices support PETs 1, 2, and 3.

Default Input Values

The following table identifies the default input values for the Tektronix 4100 and 4200 series, and Digital VS500 pick-class logical input devices.

Input Construct	Default Value
PET	1
Initial pick identifier	1
Initial pick path	NULL (no path)
Initial status	STATUS_OK
Echo area	Largest square
Data record	Aperture: 3.07 in device coordinates
	3.26 in device coordinates for the Tektronix 4128 and 4129, and the Digital VS500

The size of the pick aperture is limited by the hardware cursor map.

16.5.6 String Input Class

Supported Logical Input Devices

The following table identifies the supported string-class logical input devices for the Tektronix 4100 and 4200 series, and Digital VS500 workstations.

String Device Types	Input Action
1, 2, 4	Enter characters from keyboard. Trigger with Return. Break with Ctrl/U.
3	ASCII–encoded string. Keypress enters character and triggers device.

Supported PETs

The string input class for the Tektronix 4100 and 4200 series, and Digital VS500 devices support PET 1.

Default Input Values

The following table identifies the default input values for the Tektronix 4100 and 4200 series, and Digital VS500 string-class logical input devices.

Input Construct	Default Value
PET	1
Initial string	NULL
Echo area	Varies by device
Data record	Input buffer size: 20 ASCII characters
Initial position	1

16.5.7 Stroke Input Class

Supported Logical Input Devices

The following table identifies the supported stroke-class logical input devices for the Tektronix 4100 and 4200 series, and Digital VS500 workstations.

Input Device	Stroke Device Types	Input Action
No mouse or puck	1, 2, 3, 4	Enter point with space key. Trigger with Return. Break with Ctrl/U. Delete last point with Delete key.
Mouse or puck	1, 2, 3, 4	Enter point with mouse or puck button 3. Trigger with mouse or puck button 1. Break with mouse or puck button 2. Delete last point with Delete key.

Supported PETs

The stroke input class for the Tektronix 4100 and 4200 series, and Digital VS500 devices support PETs 1 and 4.

Default Input Values

The following table identifies the default input values for the Tektronix 4100 and 4200 series, and Digital VS500 stroke-class logical input devices.

Input Construct	Default Value
PET	1
Initial number of points	0
Initial transformation	0
Echo area	Largest square
Data record	Stroke buffer size: 80 points
	Editing position: 0
	x interval: 0.01 in world coordinate points
	y interval: 0.01 in world coordinate points
	Time interval: 0.0 seconds

16.5.8 Valuator Input Class

Supported Logical Input Devices

The following table identifies the supported valuator-class logical input devices for the Tektronix 4100 and 4200 series, and Digital VS500 workstations.

Input Device	Valuator Device Types	Input Action
No mouse or puck	1, 2, 3, 4	Select with arrow keys. Trigger with Return. Break with Ctrl/U.
Mouse	1, 2, 3, 4	Select with mouse. Trigger with mouse button 1. Break with mouse button 2.

Supported PETs

The valuator input class for the Tektronix 4100 and 4200 series, and Digital VS500 devices support PETs 1, 2, and 3.

Default Input Values

The following table identifies the default input values for the Tektronix 4100 and 4200 series, and Digital VS500 valuator-class logical input devices.

Input Construct	Default Value
PET	1
Initial value	0.5
Echo area	Varies by device
Data record	Minimum 0.0, maximum 1.0

VWS Workstation

17
VWS Workstation

This chapter describes the information you need to use DEC GKS and DEC PHIGS with devices running VAXstation Workstation Software (VWS).

DEC GKS and DEC PHIGS support these devices as workstations of category WSCAT_OUTIN.

Note

DEC GKS and DEC PHIGS support these devices under the OpenVMS VAX operating system *only*, and not under the OpenVMS Alpha, ULTRIX, or Digital UNIX operating systems. Japanese VWS devices are supported on DEC GKS for OpenVMS VAX systems only.

17.1 Environment Options

Table 17–1 summarizes the environment options you can use with VWS devices.

Table 17–1 VWS Environment Options for OpenVMS Systems

Syntax	Description
Color Map Size	
GKS$VWS_COLOR_MAP_SIZE*mmm* PHIGS$VWS_COLOR_MAP_SIZE*mmm*	Used in conjunction with the *mm* field in the workstation type bit mask to specify the size of the color table allocated by the workstation. For example, if the bit mask is set to FF and you define this option to be 38, DEC GKS and DEC PHIGS will use 38 colors. If you do not define this option, DEC GKS or DEC PHIGS will use 255 colors (because the hexadecimal value FF is 255). You cannot allocate more than 255 colors. On OpenVMS systems, you define the DEC PHIGS logical name to use 36 colors in the color map as follows: $ **DEFINE PHIGS$VWS_COLORMAP_SIZE255 36** Return

(continued on next page)

Table 17–1 (Cont.) VWS Environment Options for OpenVMS Systems

Syntax	Description
Connection Identifier	
GKS$CONID PHIGS$CONID	Specifies the default workstation connection information. The startup procedure, GKSTARTUP.COM or PHIGS$STARTUP.COM, sets the default value. For example, on OpenVMS systems, you define the DEC PHIGS logical name for a connection identifier of a VWS device as follows: $ **DEFINE PHIGS$CONID *NODENAME::n.n*** Return
Workstation Type	
GKS$WSTYPE PHIGS$WSTYPE	Specifies the workstation type. The startup procedure, GKSTARTUP.COM or PHIGS$STARTUP.COM, sets the default value. For example, on OpenVMS systems, you define the DEC PHIGS logical name for a VWS workstation type as follows: $ **DEFINE PHIGS$WSTYPE 41** Return

17.2 Valid Bit Mask Values

When using the VWS workstation graphics handler, you can specify hexadecimal bit masks as workstation type values. Using the VWS workstation, you use the bit mask values to control color mapping.

The VWS workstation contains a hardware color map that must be shared by all windows open on the workstation. The VWS workstation associates a virtual color map that maintains the color values for that window. If possible, the VWS workstation maps the virtual color map onto the hardware color map so that the virtual maps do not overlap. (That is, all virtual color maps are resident.)

However, if the hardware map cannot accommodate all the necessary virtual maps, then selecting a given window causes the colors in one or more of the other windows to temporarily change due to virtual color maps overlapping on the hardware color map. The colors change in the other windows because their portion of the virtual color map for that window is swapped out to make room for the virtual color map of the current window.

By default, DEC GKS and DEC PHIGS allocate the largest possible virtual color map when you open a VWS workstation. This is not a problem when your programs open a single workstation at a time. However, when you open multiple workstations at one time, the virtual color maps overlap. If you do not need the full-size virtual color map, use a workstation-type bit mask to tell DEC GKS and DEC PHIGS to allocate a smaller virtual color map for a given workstation.

You can also use a workstation-type bit mask to tell DEC GKS and DEC PHIGS to keep a workstation's virtual color map resident in the hardware color map. In this case, no other workstation process can access that portion of the hardware color map. This means that the colors specified by the DEC GKS or DEC PHIGS workstation that reserved the physical color map section cannot be changed by the overlapping of the virtual color map of another workstation or process.

The following bit mask is valid for use with the VWS workstation:

Workstation Type	Hexadecimal Value	Description
41	%x0*mnn*0029	VWS workstation
141	%x0*mnn*008D	Japanese VWS workstation

The value in the first part (0*mnn*) specifies that the workstation needs a specific size virtual map or requires a resident virtual map (which reserves a physical color map section for the workstation's virtual map). If the workstation requires a resident virtual map, then the first part also specifies the number of color indexes to reserve in the physical color map section.

The value in the second part (0029 or 008D) is the hexadecimal value of the VWS workstation type value (41 or 141).

Acceptable values for *m* are as follows:

Value	Description
0	Specifies that the virtual color map need not be made resident. Because most DEC GKS and DEC PHIGS programs usually do not execute in conjunction with other programs that require overlapping of virtual color maps, this is the default VWS workstation setting.
1	Specifies that you wish to have a resident virtual color map.

The VWS graphics handler converts *nn* to a decimal value, appends it to the logical name VWS_COLOR_MAP_SIZE_, and checks to see if there is a valid translation for that logical name. If the logical name translates to a valid integer, the graphics handler reserves the number of colors specified by the translation. If there is no valid translation, the graphics handler uses the appended decimal number *nn* as the number of reserved colors.

For example, for DEC PHIGS, if you specified 20 as the hexadecimal value for *nn*, the graphics handler attempts to translate the logical name PHIGS$VWS_COLOR_MAP_SIZE_32. If it does not translate to a valid integer, the graphics handler reserves 32 colors in the physical color map section.

Acceptable values for *nn* depend on the number of previously reserved indexes. Use caution when reserving color indexes. The VWS workstation has a limit of reservable indexes, depending on whether you have a 4- or 8-plane system. The physical color map of a 4-plane VWS workstation has 16 entries, while that of an 8-plane system has 256 entries. If several processes are attempting to reserve too many total colors in the resulting color map, an error is generated.

Also, the number of color indexes that you reserve can affect the size and content of the bundle tables.

When you reserve colors, DEC GKS and DEC PHIGS pass the number of colors to VWS. VWS reserves the number of colors that corresponds to the next power of 2. For example if you reserve 16 color indexes, VWS reserves 16 indexes. If you reserve 17 indexes, VWS reserves 32 indexes.

Note

DEC GKS and DEC PHIGS are layered on the VAXstation Workstation Software (VWS). However, DEC GKS and DEC PHIGS do not support calls to VWS from a DEC GKS and DEC PHIGS program.

17.3 Device Considerations

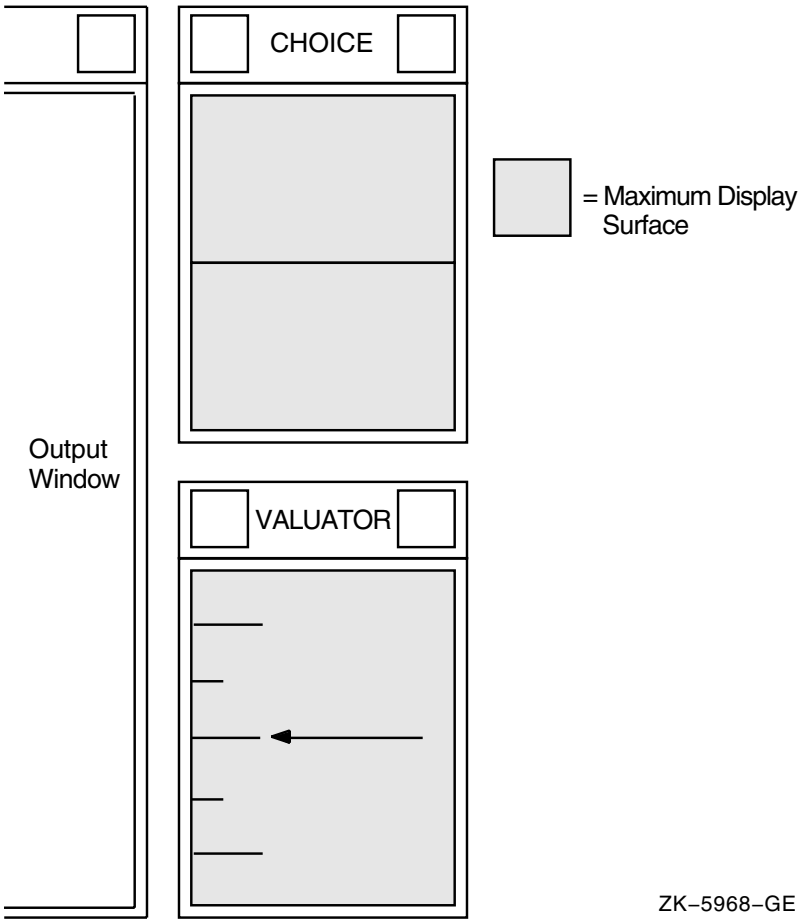
You should review the following information before you program with DEC PHIGS or DEC GKS for any of the VAXstation workstations running VWS.

17.3.1 Display Size, Windows, and Echo Areas

VWS provides a banner that runs across the top of each window, and borders that line each side. DEC GKS and DEC PHIGS do not include borders and banners in specified window sizes or input echo area sizes. You must adjust your window and echo area sizes for banners and borders.

Assuming that you have defined two input devices, active at the same time on the right side of the display surface, Figure 17–1 illustrates the dimensions written to the arguments of the function INQUIRE DISPLAY SPACE SIZE. Notice that DEC GKS and DEC PHIGS do not include the amount of space used by the single banner at the top of the surface and the single border outlining the display surface.

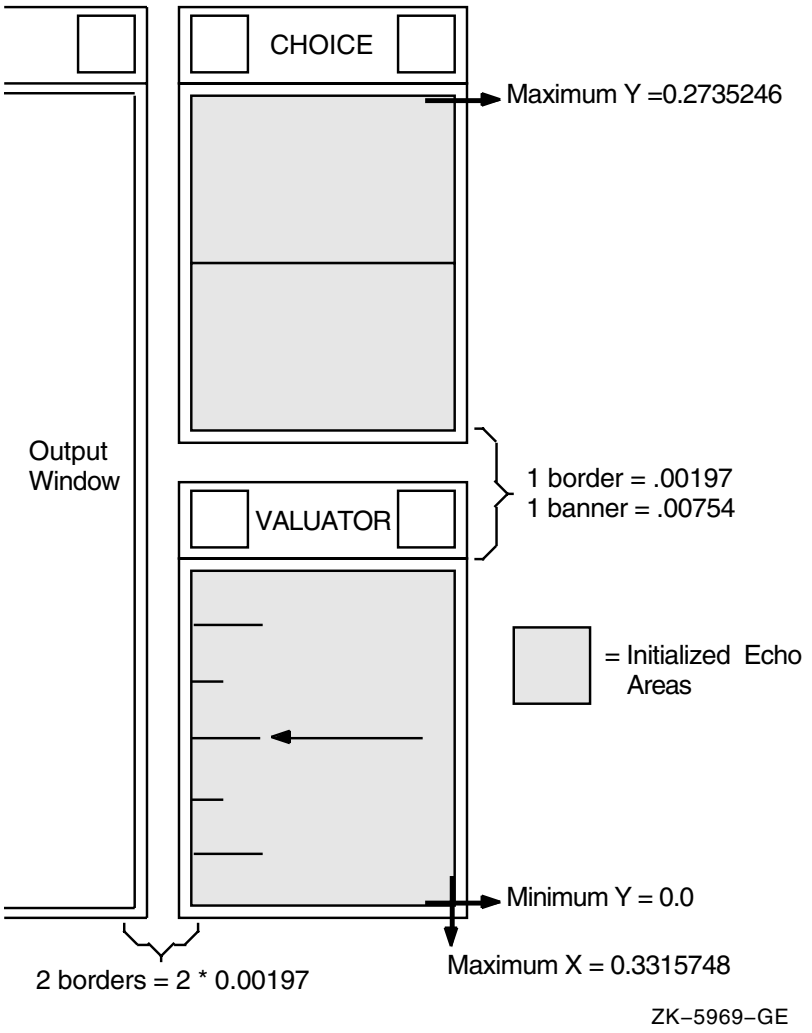
Figure 17–1 VWS Maximum Display Size



When you define input echo areas, you need to adjust each area for any banners or borders that DEC GKS and DEC PHIGS need for each active device. The echo area that you specify can only be the area *inside* the window that contains the input values; this area does not include the window banner or its border. All banners are 0.00754 meters in height; all borders are 0.00197 meters in width.

Consequently, if you want to define contiguous, nonoverlapping echo areas, you must add the meter values equal to one banner and one border to the end of one device's echo area to determine where the next echo area begins. You must also adjust the width of the echo area by two borders so that it does not overlap with the current workstation viewport window. Figure 17–2 illustrates the adjustments you need to make to correctly define nonoverlapping input echo areas. The shaded areas are the dimensions that you pass to the INITIALIZE (class) functions specifying the echo area.

Figure 17–2 Adjusting VWS Echo Area Windows



By default, DEC GKS and DEC PHIGS use the type of input device (CHOICE, LOCATOR, and so forth) as a title located in the banner. If you choose, you can replace this title by supplying extra components to the input data record. If you want to eliminate the banner from an input echo area, you can pass a null value to the first of the extra data record components of the device's data record. You cannot eliminate the borders. For more information on placing titles on input echo areas, see the input chapter in the DEC GKS or DEC PHIGS binding reference manuals.

17.3.2 Additional Information

Note the following additional information about VAXstation workstations running VWS:

- If you are logged in to a system other than a VAXstation workstation running VWS, you cannot inquire the DEC PHIGS or DEC GKS description tables. You must be logged in to a VAXstation workstation that is running VWS, to call DEC PHIGS or DEC GKS description table inquiry functions using the workstation type value 41.

- When performing input, DEC GKS and DEC PHIGS position the display window as defined by the input echo area (device coordinates). When generating output, DEC GKS and DEC PHIGS position the display window as defined by the current workstation viewport. If you resize or move the display window, DEC GKS and DEC PHIGS perform an implicit call to SET WORKSTATION VIEWPORT, and then performs an implicit regeneration (which has the same effect as calling UPDATE WORKSTATION and passing the constant PERFORM_FLAG). For more information on implicit regenerations, see the control chapter in the DEC GKS or DEC PHIGS binding reference manuals.
- The second argument to OPEN WORKSTATION names a connection identifier for all the workstations supported by DEC GKS and DEC PHIGS except the VWS workstation. The VWS graphics handler uses the string specified as the second argument to OPEN WORKSTATION to label the auxiliary window used for generated output. If you specify CONID_DEFAULT as the second argument without defining the logical name PHIGS$CONID for DEC PHIGS, or GKS$CONID for DEC GKS, the label TT: is centered at the top of the output window.
- The VWS graphics handler supports five marker sizes. The handler maps the specified marker size scale factor to the nearest size marker. The nominal marker size (which is also the smallest marker produced by the VAXstation workstation) is 0.00163984 device coordinate units (meters). The largest marker produced by the VWS workstation is 0.010167 device coordinate units.

17.4 Cell Array Restriction for DEC GKS

DEC GKS uses the following criteria to determine whether to simulate a cell array:

- The projection type is PERSPECTIVE. You set the projection type by calling the function EVALUATE VIEW MAPPING MATRIX 3.
- The cell array is clipped.
- The borders of the cell array are not parallel to the *x*- and *y*-axes of the device.

For better performance. DEC GKS also simulates cell arrays if the size of the cells is big in relation to the number of cells.

17.5 Pattern and Hatch Values

This section describes the available fill area pattern and hatch values for color VAXstation workstations. The positive numeric style values are patterns (mixtures of colors) and the negative values are hatches (device-dependent designs, such as cross-hatches, dots, horizontal lines, and so forth). The style values are passed with the SET FILL AREA STYLE INDEX function.

If you change the default color representations, all patterns using that color index use the new color representation.

DEC PHIGS does not support patterns.

17.5.1 Available Fill Area Hatch Values

The following table identifies the available fill area hatch value indexes and describes the results.

Style Index	Appearance
–1	Cross-hatches
–2	Dark diagonal lines at 45 degrees
–3	Dark diagonal lines at –45 degrees
–4	Dark horizontal lines
–5	Dark vertical lines
–6	Light diagonal lines at 45 degrees—sparse
–7	Light diagonal lines at –45 degrees—sparse
–8	Light horizontal lines—sparse
–9	Light vertical lines—sparse
–10	Diagonal lines at 45 degrees
–11	Diagonal lines at –45 degrees
–12	Horizontal lines
–13	Vertical lines
–14	Very light diagonal lines at 45 degrees—sparse
–15	Very light diagonal lines at –45 degrees—sparse
–16	Very light horizontal lines—sparse
–17	Very light vertical lines—sparse
–18	Darkest diagonal lines at 45 degrees
–19	Darkest diagonal lines at –45 degrees
–20	Darkest horizontal lines
–21	Darkest vertical lines
–22	Dark diagonal lines at 45 degrees—sparse
–23	Dark diagonal lines at –45 degrees—sparse
–24	Dark horizontal lines—sparse
–25	Dark vertical lines—sparse
–26	Darkest diagonal lines at 45 degrees—sparse
–27	Darkest diagonal lines at –45 degrees—sparse
–28	Darkest horizontal lines—sparse
–29	Darkest vertical lines—sparse
–30	Dark horizontal lines—very fine
–31	Dark vertical lines—very fine
–32	Finely woven grid
–33	Sparsely woven grid

17.5.2 Predefined Fill Area Pattern Values (Monochrome) for DEC GKS

The following table identifies the predefined fill area pattern value indexes for monochrome VAXstation workstations. This table applies to DEC GKS only.

Style Index	Appearance
1	Light diagonally woven pattern (25%)
2	Darker diagonally woven pattern (50%)
3	Darkest diagonally woven pattern (75%)
4	Horizontal brick pattern
5	Vertical brick pattern
6	Brick pattern at –45 degrees
7	Brick pattern at 45 degrees
8	Finely woven grid
9	Sparsely woven grid
10	Downward scales (fish-like)
11	Upward scales
12	Rightward scales
13	Leftward scales
14 to 28	Available

17.5.3 Predefined Fill Area Pattern Values (Color) for DEC GKS

The following table identifies the predefined fill area pattern value indexes for color VAXstation workstations.

Style Index	Appearance
1	Light diagonally woven pattern (25%)
2	Light diagonally woven pattern (25%)
3	Light diagonally woven pattern (25%)
4	Light diagonally woven pattern (25%)
5	Light diagonally woven pattern (25%)
6	Light diagonally woven pattern (25%)
7	Light diagonally woven pattern (25%)
8	Darker diagonally woven pattern (50%)
9	Darker diagonally woven pattern (50%)
10	Darker diagonally woven pattern (50%)
11	Darker diagonally woven pattern (50%)
12	Darker diagonally woven pattern (50%)
13	Darker diagonally woven pattern (50%)
14	Darker diagonally woven pattern (50%)
15	Darkest diagonally woven pattern (75%)
16	Darkest diagonally woven pattern (75%)

Style Index	Appearance
17	Darkest diagonally woven pattern (75%)
18	Darkest diagonally woven pattern (75%)
19	Darkest diagonally woven pattern (75%)
20	Darkest diagonally woven pattern (75%)
21	Darkest diagonally woven pattern (75%)
22	Horizontal brick pattern
23	Horizontal brick pattern
24	Horizontal brick pattern
25	Horizontal brick pattern
26	Horizontal brick pattern
27	Horizontal brick pattern
28	Horizontal brick pattern
29	Vertical brick pattern
30	Vertical brick pattern
31	Vertical brick pattern
32	Vertical brick pattern
33	Vertical brick pattern
34	Vertical brick pattern
35	Vertical brick pattern
36	Brick pattern at –45 degrees
37	Brick pattern at –45 degrees
38	Brick pattern at –45 degrees
39	Brick pattern at –45 degrees
40	Brick pattern at –45 degrees
41	Brick pattern at –45 degrees
42	Brick pattern at –45 degrees
43	Brick pattern at 45 degrees
44	Brick pattern at 45 degrees
45	Brick pattern at 45 degrees
46	Brick pattern at 45 degrees
47	Brick pattern at 45 degrees
48	Brick pattern at 45 degrees
49	Brick pattern at 45 degrees
50	Finely woven grid
51	Finely woven grid
52	Finely woven grid
53	Finely woven grid
54	Finely woven grid
55	Finely woven grid
56	Finely woven grid

Style Index	Appearance
57	Sparsely woven grid
58	Sparsely woven grid
59	Sparsely woven grid
60	Sparsely woven grid
61	Sparsely woven grid
62	Sparsely woven grid
63	Sparsely woven grid
64	Downward scales (fish-like)
65	Downward scales (fish-like)
66	Downward scales (fish-like)
67	Downward scales (fish-like)
68	Downward scales (fish-like)
69	Downward scales (fish-like)
70	Downward scales (fish-like)
71	Upward scales
72	Upward scales
73	Upward scales
74	Upward scales
75	Upward scales
76	Upward scales
77	Upward scales
78	Rightward scales
79	Rightward scales
80	Rightward scales
81	Rightward scales
82	Rightward scales
83	Rightward scales
84	Rightward scales
85	Leftward scales
86	Leftward scales
87	Leftward scales
88	Leftward scales
89	Leftward scales
90	Leftward scales
91	Leftward scales
92 to 196	Increasing densities, incrementing first by color, starting at 1/16 density, incrementing by 1/16, up to 15/16 density

17.6 Input Information

Each of the following sections lists the supported logical input device numbers, and supported prompt and echo type (PET) numbers. For a complete description of these numbers, see the input chapter in the DEC GKS or DEC PHIGS binding reference manuals. For detailed information on cycling logical input devices and numeric keypad functionality, see Section E.3.1 and Section E.3.2.

For VAXstation workstations running VWS, the default PET for each device class is the value 1. Echoing is enabled by default. For all input classes, you specify the echo area in device coordinates. The VAXstation device coordinate system origin is in the lower left corner of the workstation surface. By default, the handler uses an echo area whose lower left corner is located in the lower left corner of the display surface (the origin of the device coordinate system).

If you use valuator, choice, or string input devices (device numbers 1, 3, 4), the graphics handler creates an input window that is auxiliary to the one used for generating output (your current workstation viewport). For these logical input devices, the graphics handler positions this auxiliary window according to your specified echo area. The graphics handler generates an error if the echo area exceeds the maximum display surface size.

If during input you move the mouse outside the echo area auxiliary viewport, the graphics handler disables mouse tracking until the mouse is once again within the echo area.

For input classes locator, stroke, and pick, the sensitized area is the intersection of the echo area and the workstation viewport. Be aware that if the application changes the size or position of the auxiliary window, the graphics handler implicitly calls SET WORKSTATION WINDOW and regenerates the surface.

When you request input, the graphics handler places the workstation viewport at the top of any other overlapping viewports. Viewport appearance before and after the input request is unchanged.

17.6.1 Choice Input Class

Supported Logical Input Devices

The following table identifies the supported choice-class logical input devices for VAXstation workstations running VWS.

Choice Device Types	Input Action
1, 6, 7, 8	Select with mouse. Trigger with mouse button 1. Break with mouse button 2.
2	Keypad key is selection and trigger.
3	Function key is selection and trigger.
4	Mouse button down is selection and trigger.
5	Mouse button up is selection and trigger.

Supported PETs

The choice input class for VWS supports PETs –1, 1, and 3. See the input chapter in the DEC GKS or DEC PHIGS binding reference manuals for more information on PETs.

Default Input Values

The following table identifies the default input values for VWS choice-class logical input devices.

Input Construct	Default Value
PET	1
Initial choice	1
Initial status	STATUS_OK
Echo area	Varies by device
Data record	Varies by device—list of choice strings

17.6.2 Locator Input Class

Supported Logical Input Devices

The following table identifies the supported locator-class logical input devices for VAXstation workstations running VWS.

Locator Device Types	Input Action
1, 2, 3, 4	Select with mouse. Trigger with mouse button 1. Break with mouse button 2.

Supported PETs

The locator input class for VWS supports PETs –13 (DEC GKS only), –12, –11, –10, –9, –8, –7, –6, –5, –4, –3, –2, –1, 1, 2, 3, 4, 5, and 6. See the input chapter in the DEC GKS or DEC PHIGS binding reference manuals for more information on PETs.

Default Input Values

The following table identifies the default input values for VWS locator-class logical input devices.

Input Construct	Default Value
PET	1
Initial position	0.5, 0.5
Initial transformation	0
Echo area	Largest square
Data record	NULL

17.6.3 Pick Input Class

Supported Logical Input Devices

The following table identifies the supported pick-class logical input devices for VAXstation workstations running VWS.

Pick Device Types	Input Action
1, 2, 3, 4	Select with mouse. Trigger with mouse button 1. Break with mouse button 2.

Supported PETs

The pick input class for VWS supports PETs 1, 2, and 3. See the input chapter in the DEC GKS or DEC PHIGS binding reference manuals for more information on PETs.

Default Input Values

The following table identifies the default input values for VWS pick-class logical input devices.

Input Construct	Default Value
PET	1
Initial pick identifier	1
Initial pick path	NULL (no path)
Initial status	STATUS_OK
Echo area	Largest square
Data record	Aperture: 0.0027 in device coordinates

The size of the pick aperture is limited by the hardware cursor map.

17.6.4 String Input Class

Supported Logical Input Devices

The following table identifies the supported string-class logical input devices for VAXstation workstations running VWS.

Device	String Device Types	Input Action
VWS	1, 3, 4	Enter characters from keyboard. Trigger with Return. Break with Ctrl/U.
	2	SMG–encoded string. Keypress enters character and triggers device.
Japanese VWS	1	Enter characters from keyboard. (String input with Kana–Kanji conversion.) Trigger with Return. Break with Ctrl/U.
	2	SMG–encoded string. Keypress enters character and triggers device.
	3, 4	Enter characters from keyboard. Trigger with Return. Break with Ctrl/U.

Supported PETs

The string input class for VWS supports PET 1. See the input chapter in the DEC GKS or DEC PHIGS binding reference manuals for more information on PETs.

Default Input Values

The following table identifies the default input values for VWS string-class logical input devices.

Input Construct	Default Value
PET	1
Initial string	NULL
Echo area	Varies by device
Data record	Input buffer size: 20 ASCII characters
Initial position	1

17.6.5 Stroke Input Class

Supported Logical Input Devices

The following table identifies the supported stroke-class logical input devices for VAXstation workstations running VWS.

Stroke Device Types	Input Action
1, 2, 3, 4	Points are entered with mouse motion. Trigger with mouse button 1. Break with mouse button 2.

Supported PETs

The stroke input class for VWS supports PETs 1, 3, and 4. See the input chapter in the DEC GKS or DEC PHIGS binding reference manuals for more information on PETs.

Default Input Values

The following table identifies the default input values for VWS stroke-class logical input devices.

Input Construct	Default Value
PET	1
Initial number of points	0
Initial transformation	0
Echo area	Largest square
Data record	Stroke buffer size: 80 points
	Editing position: 0
	x interval: 0.01 in world coordinate points
	y interval: 0.01 in world coordinate points
	Time interval: 0.0 seconds

17.6.6 Valuator Input Class

Supported Logical Input Devices

The following table identifies the supported valuator-class logical input devices for VAXstation workstations running VWS.

Valuator Device Types	Input Action
1, 2, 3, 4	Select with mouse. Trigger with mouse button 1. Break with mouse button 2.

Supported PETs

The valuator input class for VWS supports PETs –3, –2, –1, 1, 2, and 3. See the input chapter in the DEC GKS or DEC PHIGS binding reference manuals for more information on PETs.

Default Input Values

The following table identifies the default input values for VWS valuator-class logical input devices.

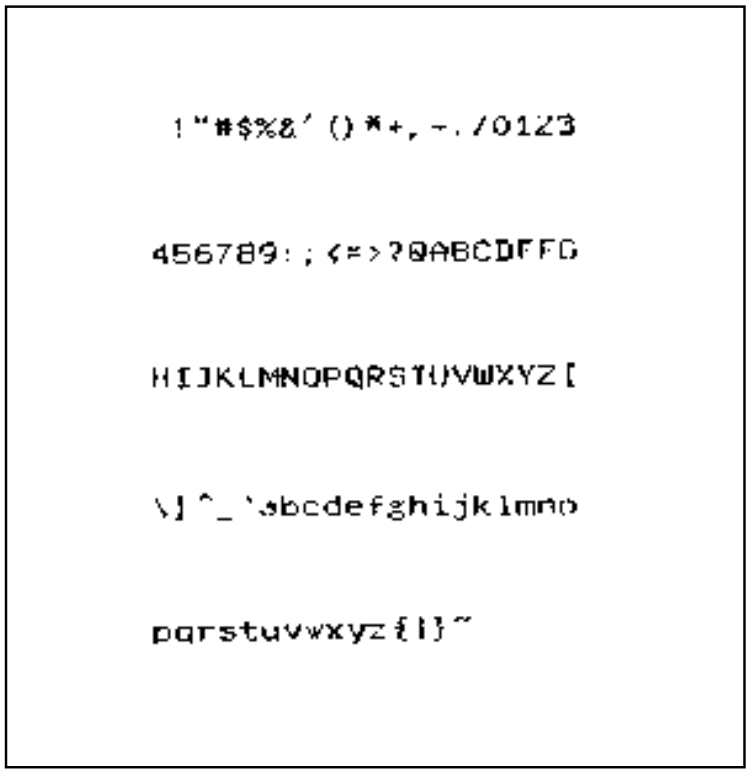
Input Construct	Default Value
PET	1
Initial value	0.5
Echo area	Varies by device
Data record	Minimum 0.0, maximum 1.0

17.7 Font Support

The VWS graphics handler supports four hardware fonts in string and character precision.

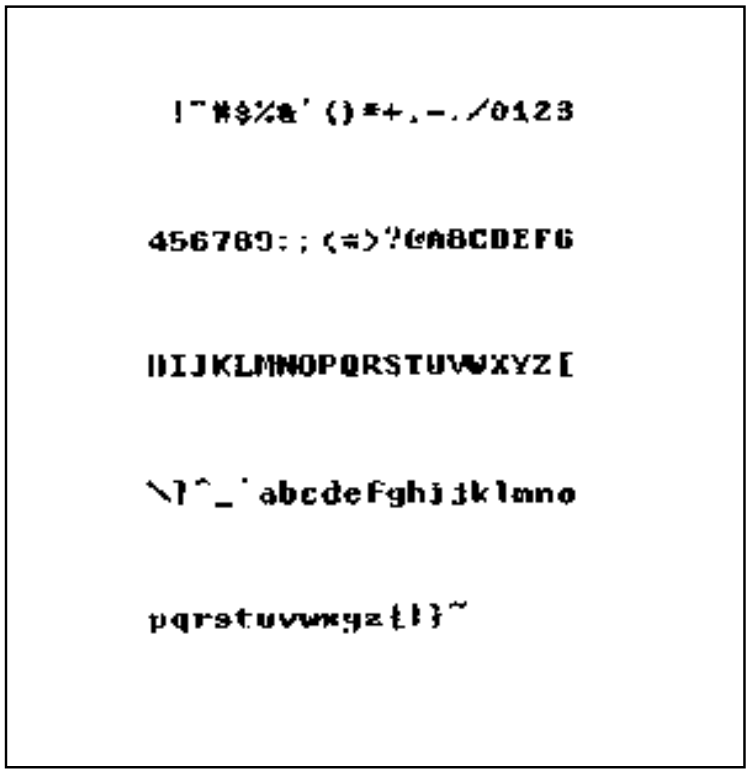
Figure 17–3 through Figure 17–6 illustrate the VWS hardware fonts.

Figure 17–3 VWS Font –200: Taber



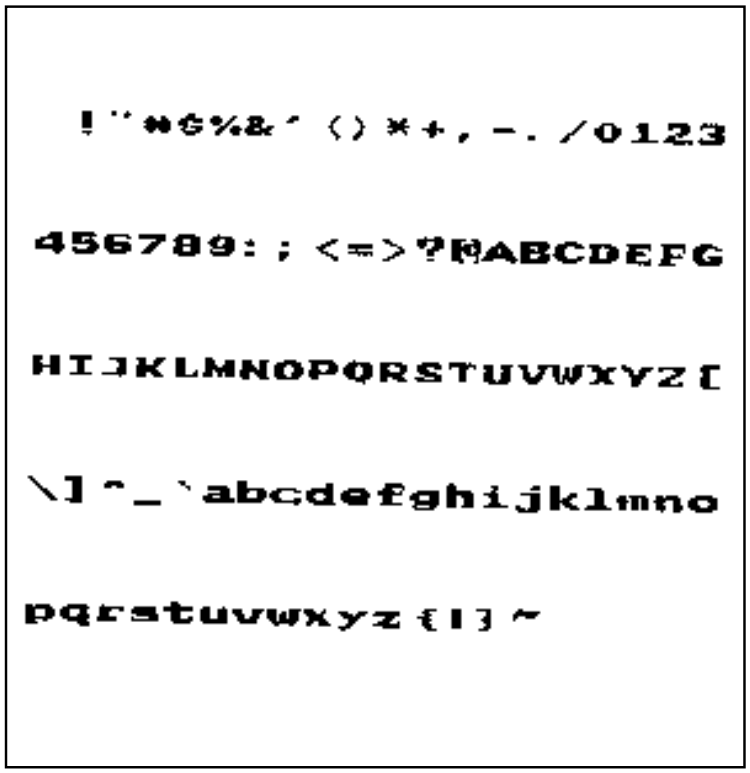
ZK–3062–GE

Figure 17–4 VWS Font –201: Bold Taber



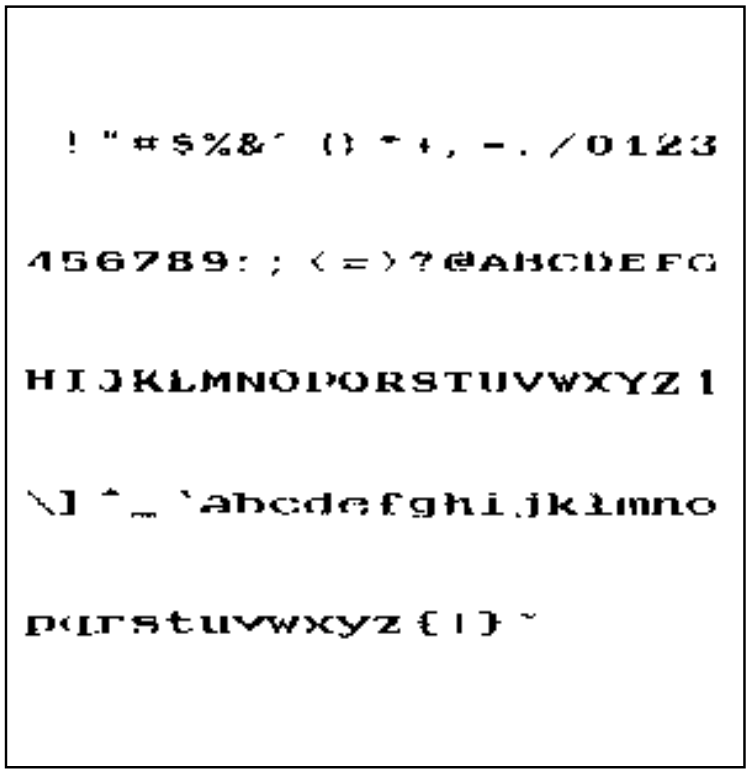
ZK–3063–GE

Figure 17–5 VWS Font –203: Bold Wide Taber



ZK–3064–GE

Figure 17–6 VWS Font –202: Wide Taber



ZK–3065–GE

Device-Independent Fonts

A

Device-Independent Fonts

This appendix provides information about the environment options and fonts that can be accessed from the DEC GKS and DEC PHIGS software in stroke precision text.

A.1 Device-Independent Fonts

Font 1 is used as the standard DEC GKS and DEC PHIGS font for stroke precision text. Figure A–6 illustrates the DEC GKS and DEC PHIGS multinational font. It is a monospaced font; all characters have the same extent. DEC GKS and DEC PHIGS use this as the default font.

The Hershey fonts are also available. The character information for these fonts has been organized into 23 fonts, as shown in Figures A–8 to A–30. The Hershey fonts are not monospaced; each character extent is a different size. The character extent for each character is not necessarily the same size as the character. In most cases, the character extent is larger than the character, although for some characters (for example, those with descenders) the character may go outside its extent.

A.2 Font File Formats

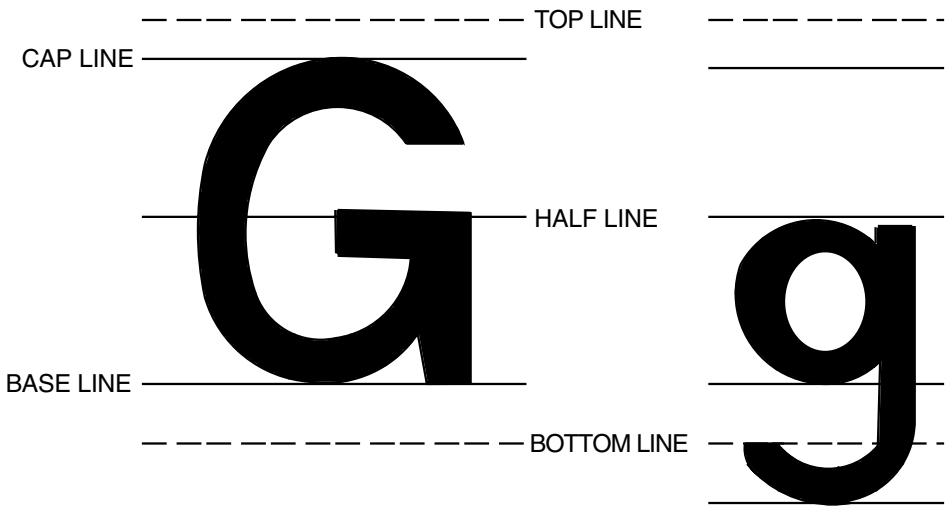
The center line for all fonts lies exactly halfway between the left and right lines of each character.

Similarly, the half line lies exactly halfway between the base line and the cap line.

This restriction applies to the font file formats because the center line and the halfline are calculated by DEC GKS and DEC PHIGS and are not data items in the font file. Digital reserves the right to change font file formats in future releases.

Figure A–1 illustrates the font lines.

Figure A–1 DEC GKS and DEC PHIGS Font Lines

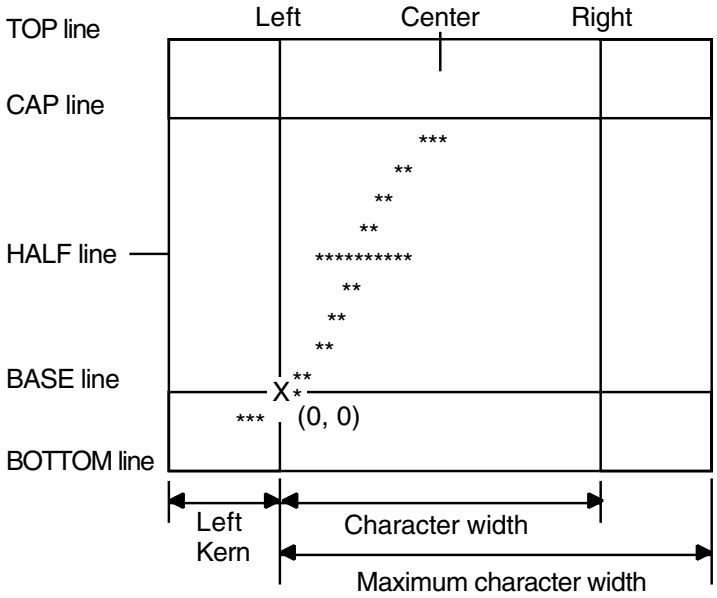


ZK–1449–GE

A.3 Font Design

Figure A–2 illustrates the design of the stroke font.

Figure A–2 Stroke Font Design



X is the origin of this coordinate.

ZK–1582A–GE

The character shapes are drawn using a coordinate system in which the base line is $y = 0$, and the left line is $x = 0$.

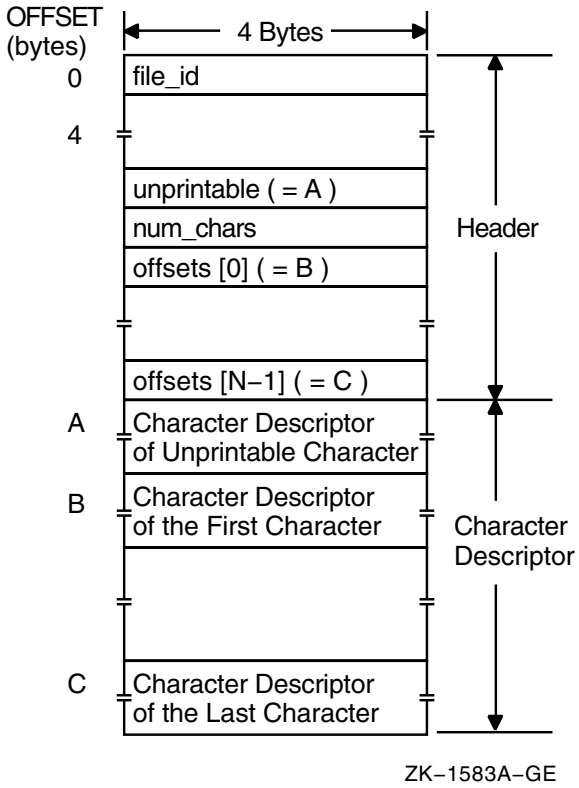
Each character in a font file is stored as one or more polylines. The origin for these polylines is the left base point of the character. The points of the polylines are specified in integer numbers.

In DEC GKS and DEC PHIGS, the *x* and *y* coordinates of a character are normalized by the distance between the CAP and BASE lines. The value of the distance between CAP and BASE defines the precision of the character design. That is, if this value is large, you can make a more detailed design for a polyline.

A.4 Stroke Font File

Figure A–3 illustrates the stroke font file structure.

Figure A–3 Stroke Font File Structure



This structure is divided into two parts; the header and a set of character descriptors.

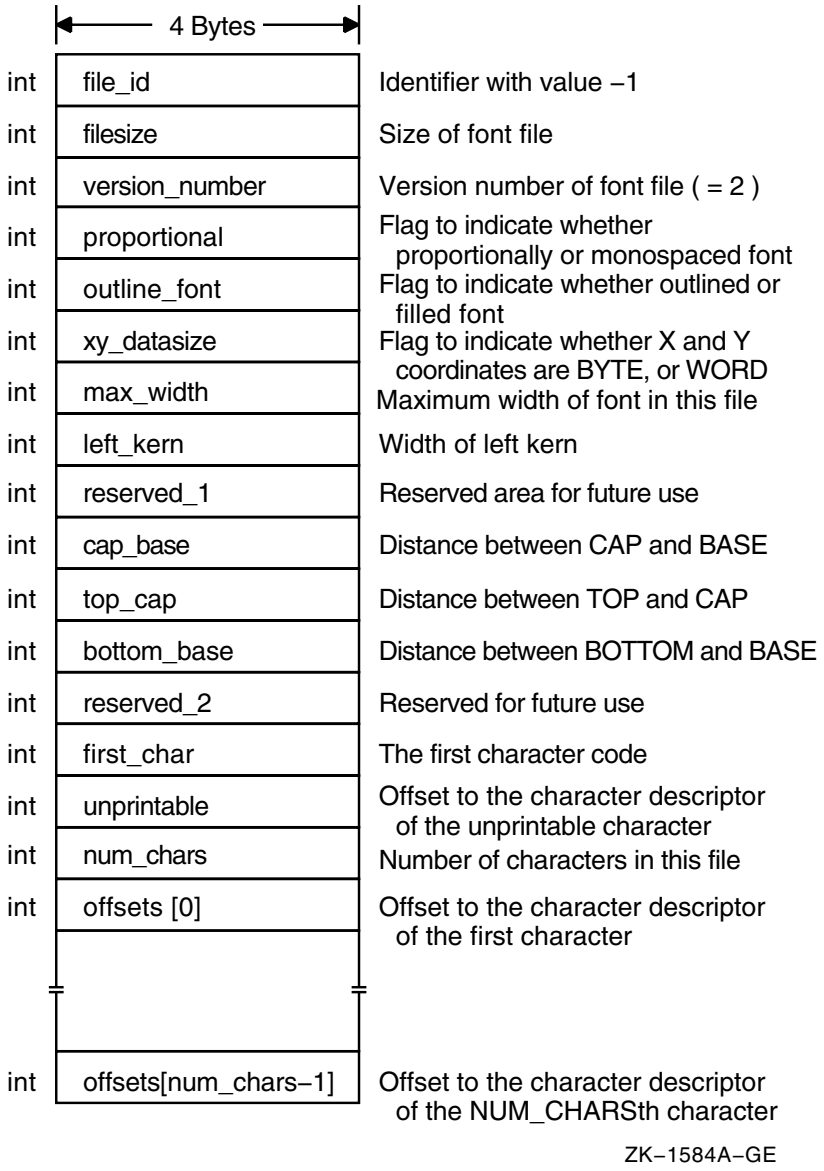
The header structure has common information for all characters in a stroke font file and control data. Each character descriptor contains the data for each character. To point to each character descriptor, there are offset arrays in the header structure. The index of an offset array is calculated by subtracting the first character from the output character code. Each offset array has the number of bytes from the top of the stroke font file.

A character descriptor has all the information to make a character. This includes the number of polylines in a character, the character width, and the data set of each polyline, which contains the number of points in the polyline and the set of *x* and *y* point coordinates.

A.4.1 Stroke Font File Header

Figure A–4 illustrates the structure of the header of the stroke font file.

Figure A–4 Stroke Font File Header Structure



The header contains the following elements:

- **file_id**

  This element helps identify the file as a DEC GKS and DEC PHIGS font file. In DEC GKS for example, this identifier is a 32-bit integer with the value –1.

- **filesize**

  This element specifies the size of the font file, in bytes. This is used to map the font file into virtual memory. It is stored as an integer value.

- **version_number**

  This element specifies the version number of the stroke font file. This identifier is a 32-bit integer with the value 2.

- **proportional**

  This element indicates whether the font is proportionally spaced. This integer is 1 if the font is proportionally spaced, and 0 if it is monospaced. Proportionally spaced means that different characters have different widths. Monospaced means that every character has the same width.

- **outline_font**

  This element is an integer flag that indicates if the font is stored as outline. If the value of this element is not equal to 0, then the font is assumed to be stored as outline. This means that the polylines specified are filled instead of being drawn.

- **xy_datasize**

  This element indicates whether *x* and *y* coordinates are stored as a byte signed integer (byte) or as a 2-byte signed integer (word). If this element is 1, the *x* and *y* coordinates are stored as a byte. If this element is 2, the coordinates are stored as a word.

- **max_width**

  This element specifies the width of the font characters. This is an integer. If the font is proportionally spaced, this number specifies the maximum width of the font.

- **left_kern**

  This element specifies the maximum length of the negative direction for the *x* coordinate of the character in the stroke font file. This element is an integer.

- **reserved_1**

  Reserved for future use.

- **cap_base**

  This element specifies the distance of the cap line above the base line. This element is an integer.

- **top_cap**

  This element specifies the distance of the top line above the cap line. This element is an integer.

- **bottom_base**

  This element specifies the distance of the bottom line below the base line. This element is an integer.

- **reserved_2**

  Reserved for future use.

- **first_char**

  This element specifies the numeric value of the first character in the font. (First refers to an ascending order. For example, for the ASCII character set, the first noncontrol character is a space that has the numeric value of 32. The corresponding entry in the font file would contain the number 32.) This element is an integer.

- **unprintable**

  This element specifies the offset to the character descriptor of the unprintable character. This element is an integer.

- **num_chars**

  This element specifies the number of characters supported in the font file. There should be no gaps in the number of characters supported. If there are characters that should not be displayed, they should be indicated by *number of polylines = 0*, which generates a space. This element is an integer.

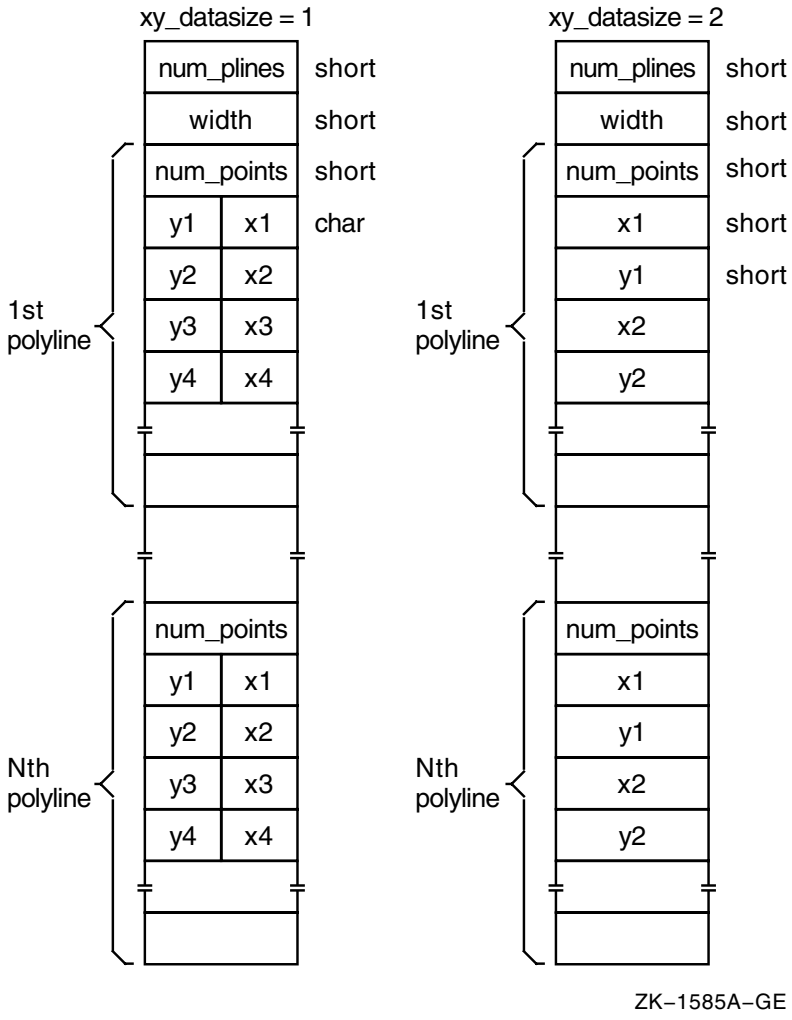
- **offsets**

  This element is an array of *num_chars* entry points. This array contains the offsets to the character descriptor of each character to be displayed.

A.4.2 Character Descriptor

Figure A–5 illustrates the structure of the character descriptor.

Figure A–5 Character Descriptor Structure



The character descriptor contains the following elements:

- **num_plines**

  This element specifies the number of polylines making up a character. This element is a word.

- **width**

  This element specifies the width of a character. This element is a word, and is ignored for monospaced fonts.

- **num_points**

  This element specifies the number of points in a polyline. This element is a word.

- **x and y**

  These element specify the *x* and *y* coordinate values of a point. If *xy_datasize* in the header is 1, these values are 1-byte signed integers. If *xy_datasize* is 2, these values are 2-byte signed integers.

A.5 Stroke Font Environment Support

The following sections describe the environment options for DEC GKS and DEC PHIGS. These environment options include stroke font path, stroke font list and stroke font.

A.5.1 Stroke Font Path

The stroke font path environment option allows you to change the default directory for stroke fonts. For example, on OpenVMS systems, define the logical name for DEC PHIGS as PHIGS$STROKE_FONT_PATH. On UNIX systems, set the environment variable for DEC GKS to GKSstroke_font_path.

The stroke font path environment option will be used only if there is no path in the environment string for the stroke font file name (environment string *stroke_font*). For example, on UNIX systems, if the stroke file name is defined as follows for DEC PHIGS, the stroke font path will not be used:

```
% setenv PHIGSstroke_font_neg100 /usr/users/jim/my_font_neg100 Return
```

A.5.2 Stroke Font List and Stroke Font

The stroke font list and stroke font environment options allow you to change the mapping of font indexes to stroke font files and the list of stroke fonts available. For example, on OpenVMS systems, define logicals for DEC PHIGS as PHIGS$STROKE_FONT_NEG*%d*, PHIGS$STROKE_FONT*%d*, and PHIGS$STROKE_FONT_LIST. On UNIX systems, set environment variables for DEC GKS to GKSstroke_font_neg*%d*, GKSstroke_font*%d*, and GKSstroke_font_list. For either system, *%d* is the font index.

A.6 Device-Independent Fonts

This section presents the DEC GKS and DEC PHIGS device-independent fonts. These figures represent the ASCII characters 33 to 126, beginning in the upper left corner and incrementing horizontally to the lower right corner. Not all characters are present in all the fonts. Fonts 1 and –1 specify the same font.

The program FONTS_HEX is included with the DEC GKS and DEC PHIGS development kits. It displays the hexadecimal values for the ASCII characters within each font. For example, Figure A–6 represents the display of Font Number 1 (ISO Standard Character Set) on a DECwindows workstation. The hexadecimal value for ASCII character 0 is 30. The hexadecimal value for ASCII character C is 43.

On OpenVMS systems, FONTS_HEX is located in the directory `SYS$COMMON:[SYSHLP.EXAMPLES.GKS]` for DEC GKS, and in the directory `SYS$COMMON:[SYSHLP.EXAMPLES.PHIGS]` for DEC PHIGS. On UNIX systems, FONTS_HEX is located in the directory `/usr/lib/GKS/examples` for DEC GKS, and in the directory `/usr/lib/PHIGS/examples` for DEC PHIGS.

Figure A–6 through Figure A–30 illustrate the device-independent fonts. Each figure includes a name that describes the font. The characters are described as uniplex, duplex, or triplex according to the number of parallel strokes used in the construction of the character. The description as simplex, complex, or gothic indicates the extent to which the characters contain tapered segments.

Figure A–6 ISO Standard Character Set

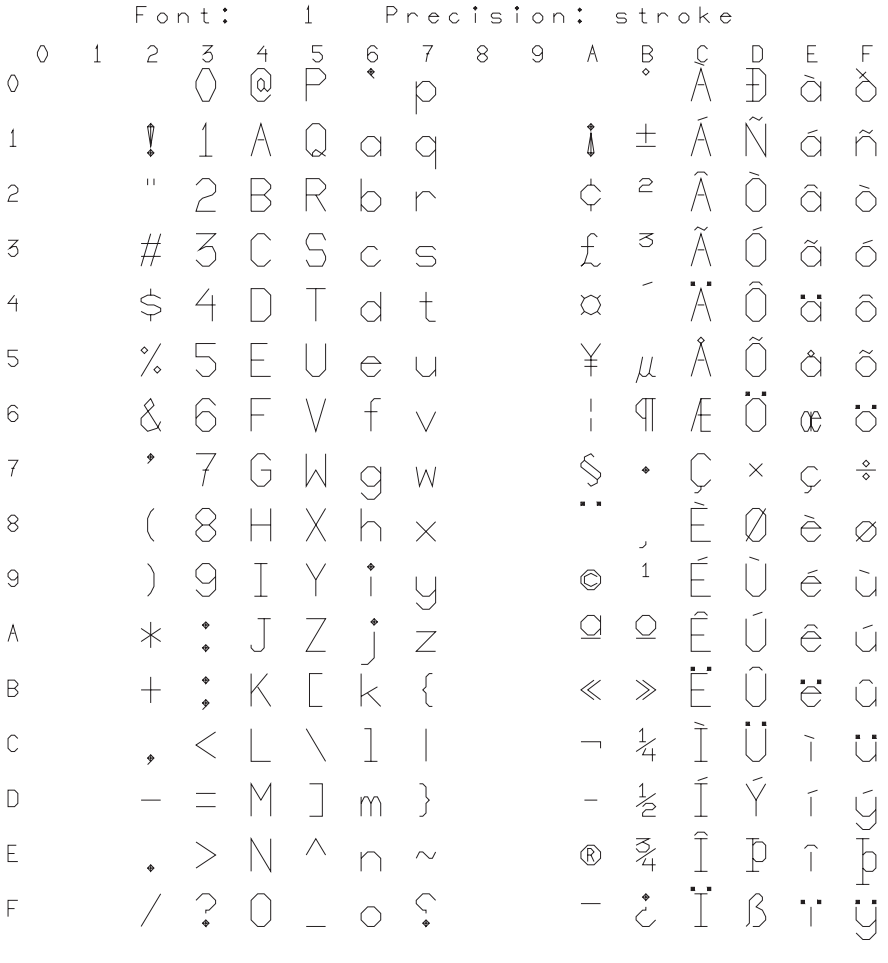


Figure A–7 ISO Standard Character Set

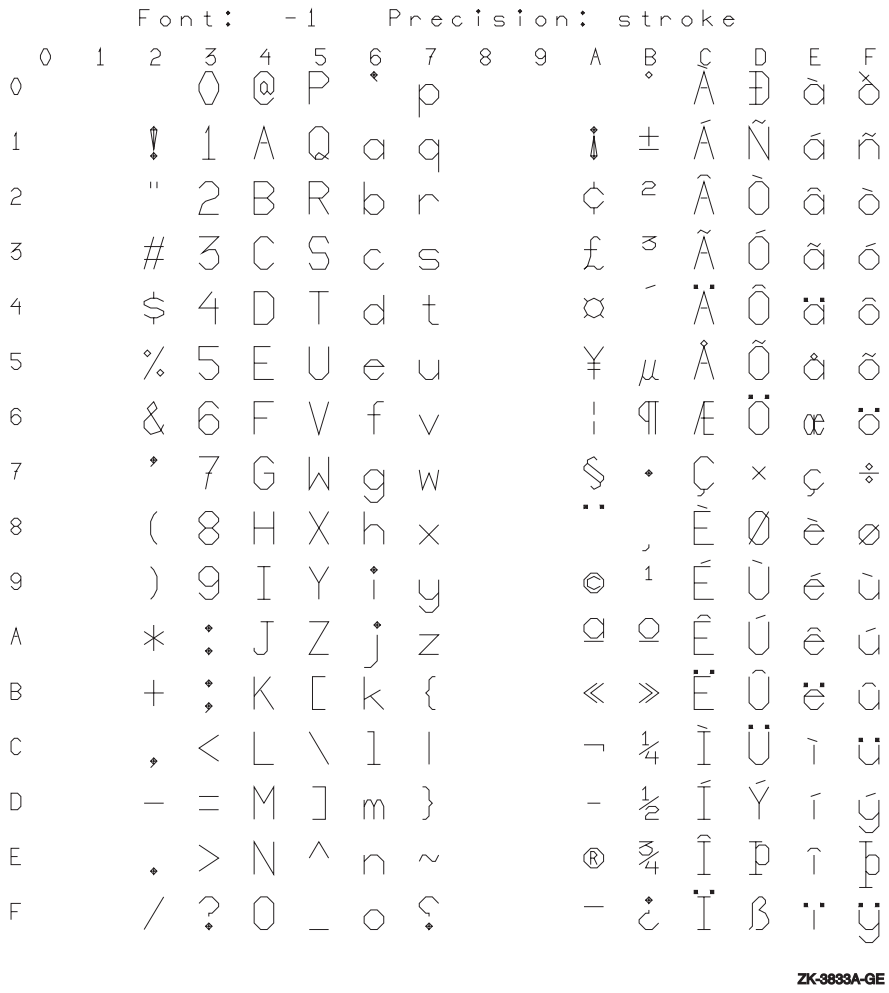


Figure A–8 Small Simplex Roman and Greek

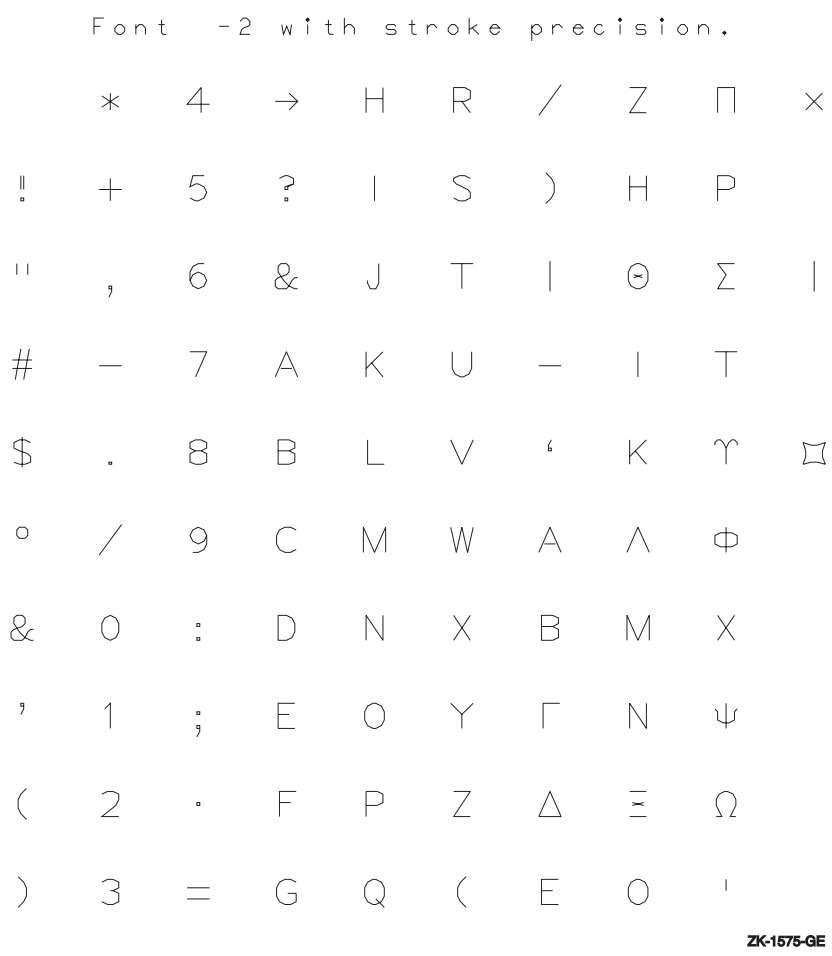


Figure A–9 Large Simplex Roman

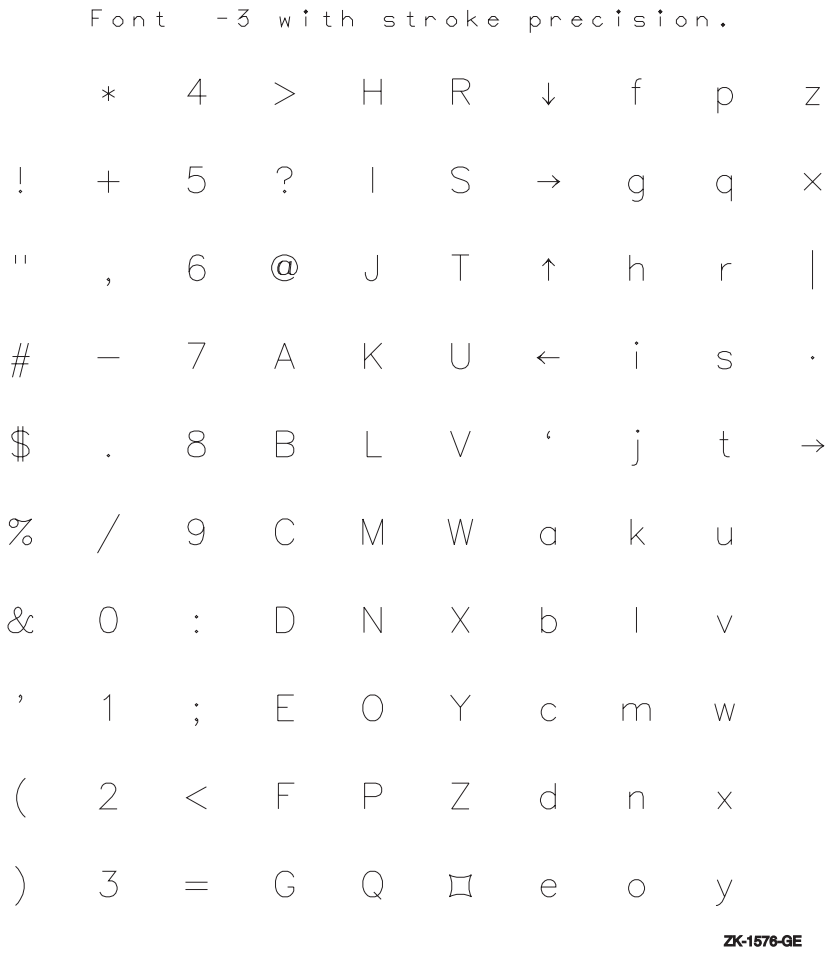


Figure A–10 Large Simplex Greek

Figure A–11 Large Simplex Script

Figure A–12 Medium Duplex Roman

Figure A–13 Medium Duplex Greek

Figure A–14 Medium Duplex Italic

Figure A–15 Large Complex Roman

Figure A–16 Large Complex Greek

Figure A–17 Large Complex Italic

Figure A–18 Large Simplex Roman

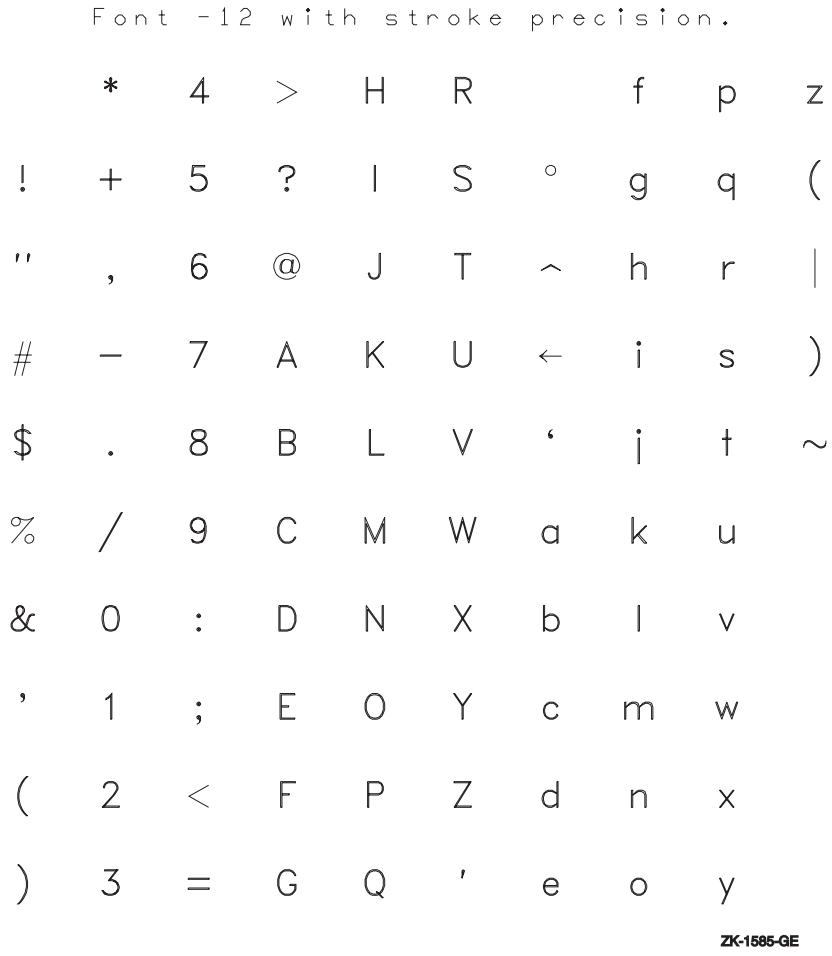


Figure A–19 Large Complex Script

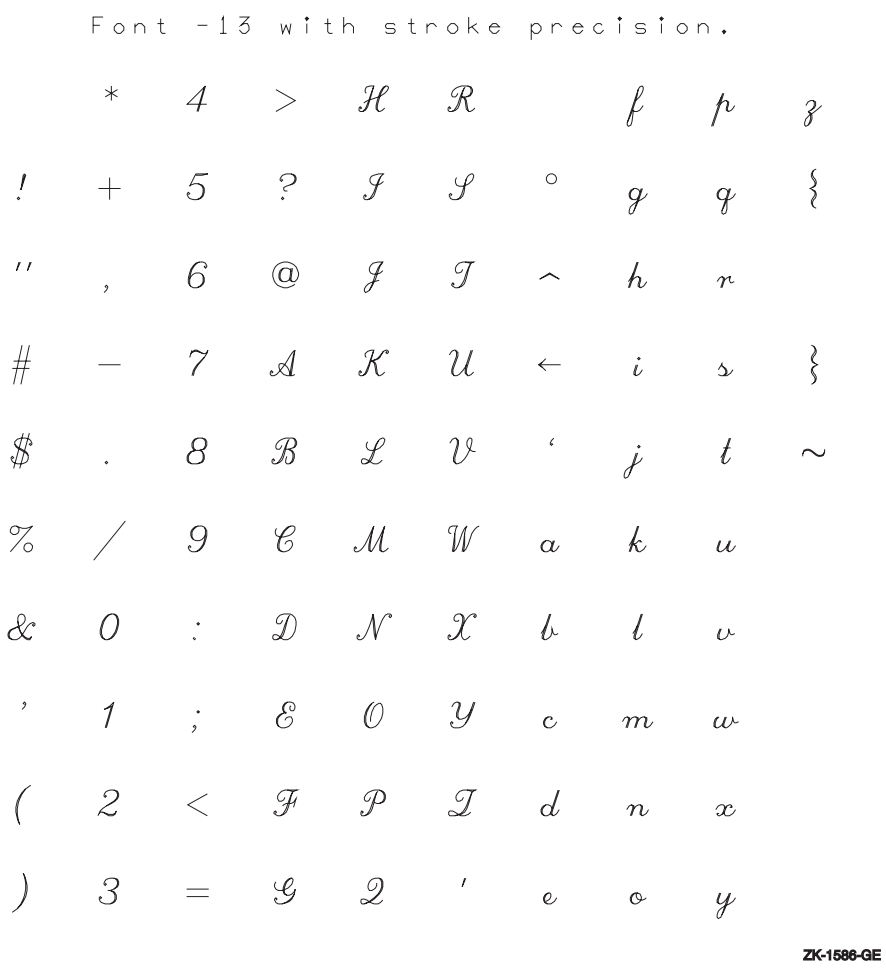


Figure A–20 Large Complex Cyrillic

Figure A–21 Large Complex Roman

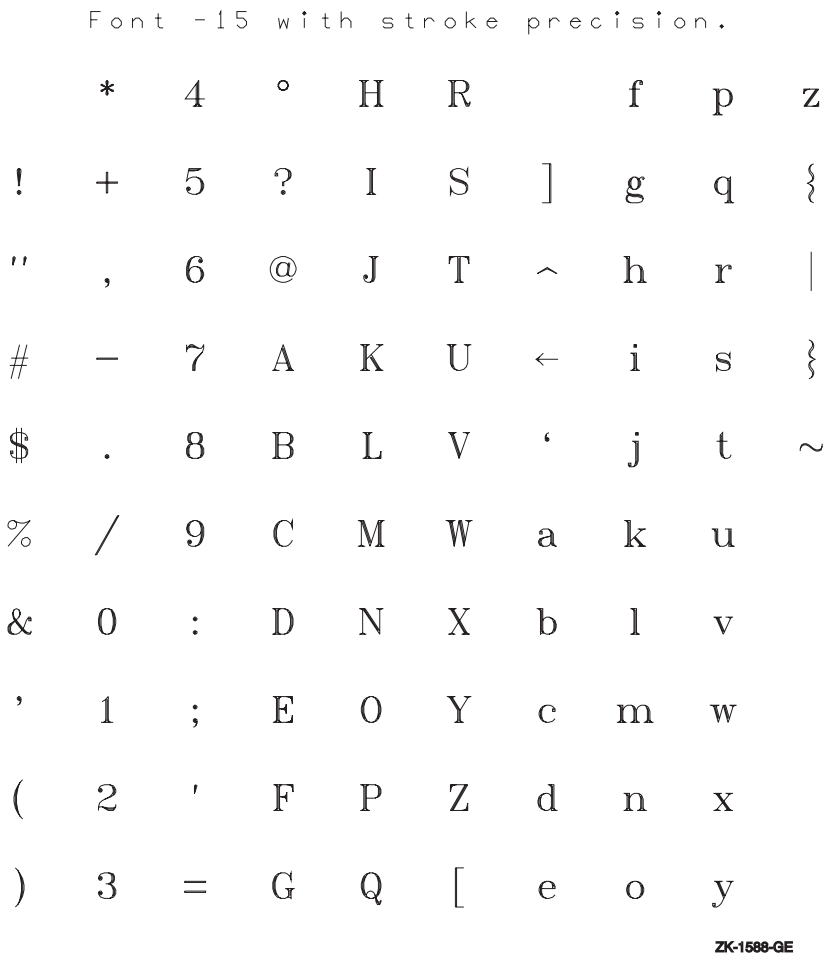


Figure A–22 Large Complex Italic

Figure A–23 Large Gothic German

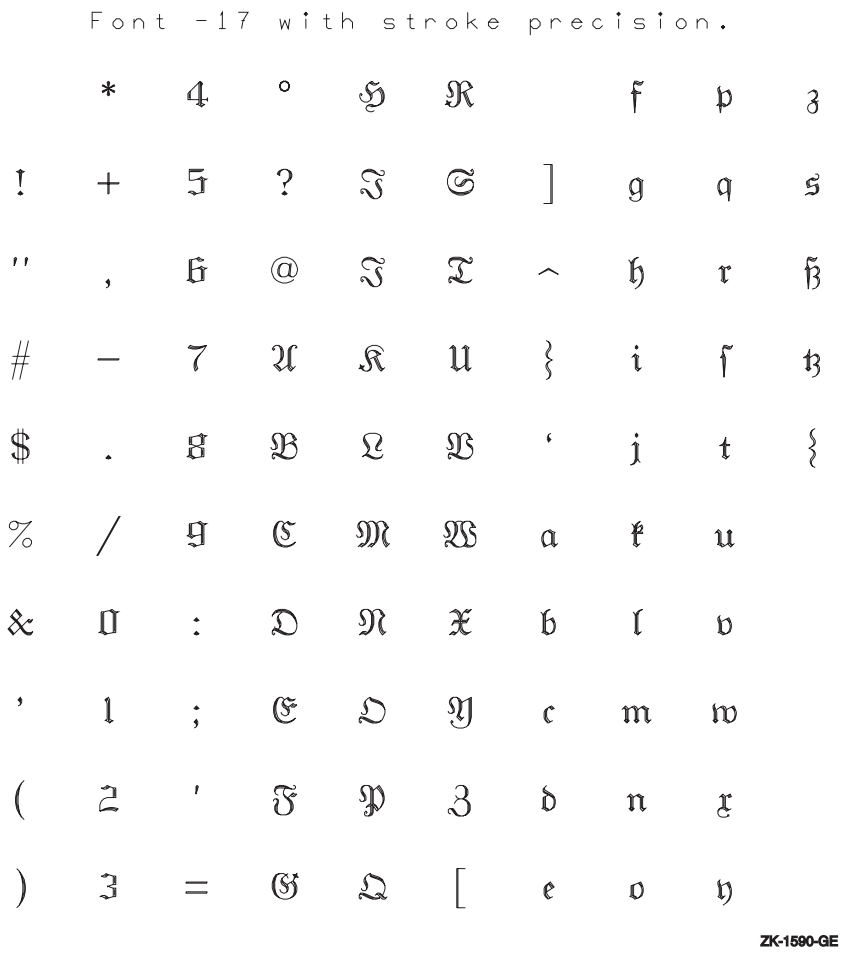


Figure A–24 Large Gothic English

Figure A–25 Large Gothic Italian

Figure A–26 Medium Complex Special Characters

Figure A–27 Music, Astronomy, and Business

Figure A–28 Large Special Characters

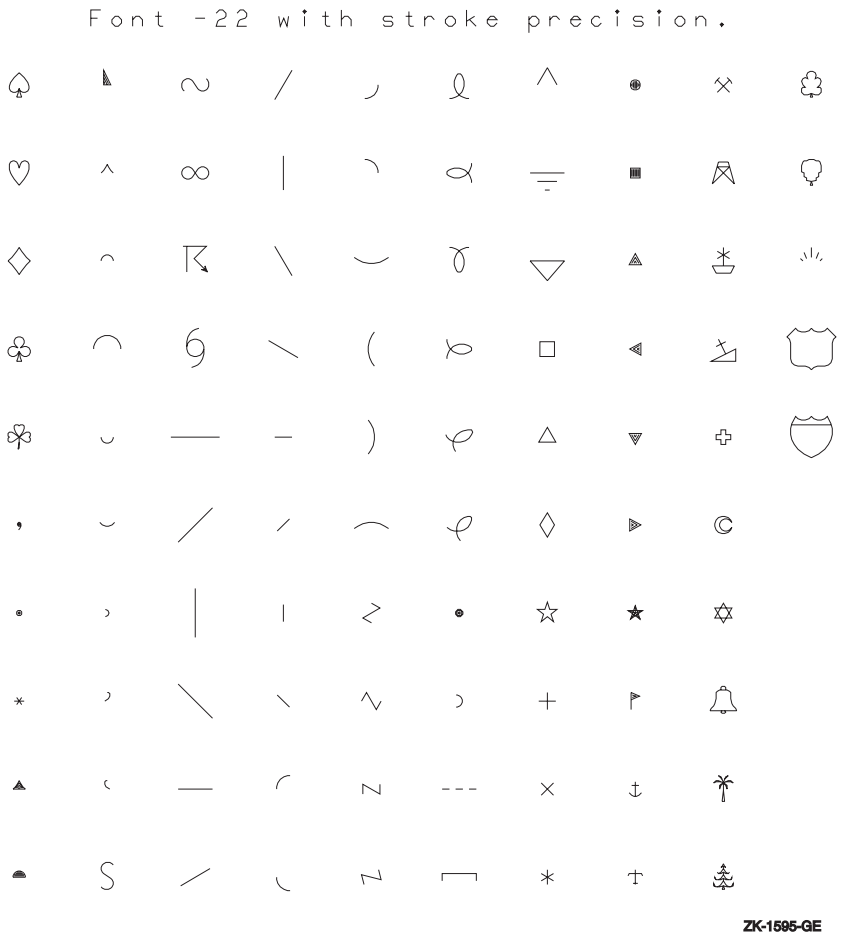


Figure A–29 Large Special Characters

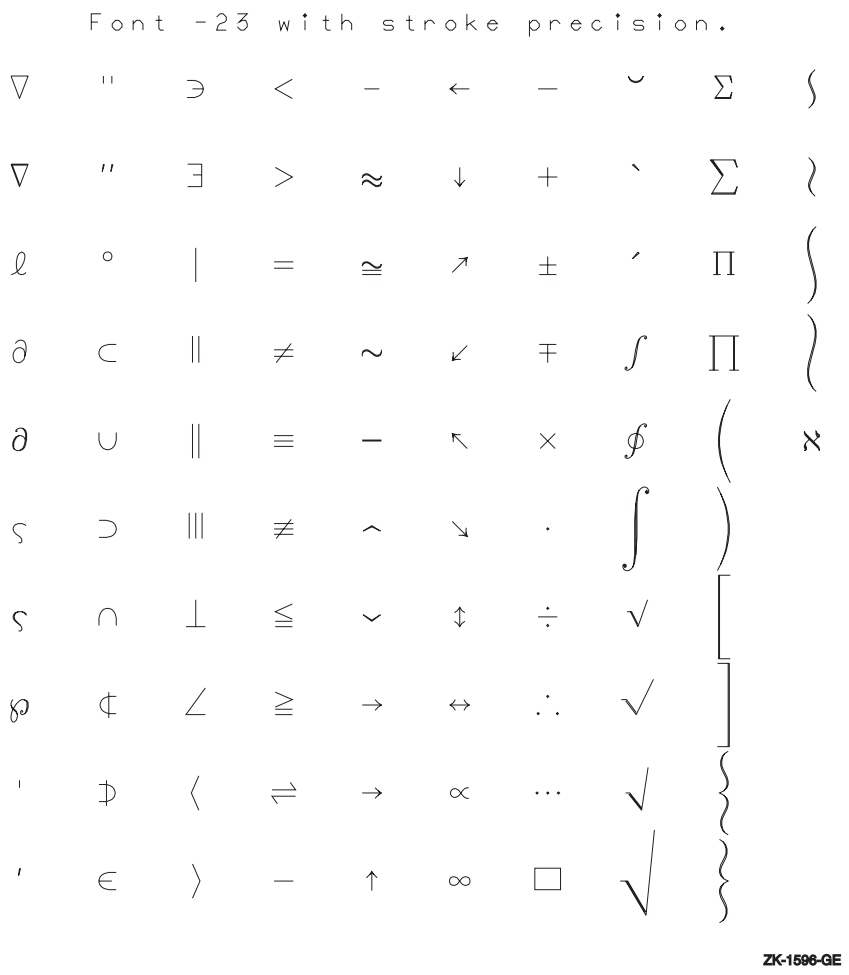
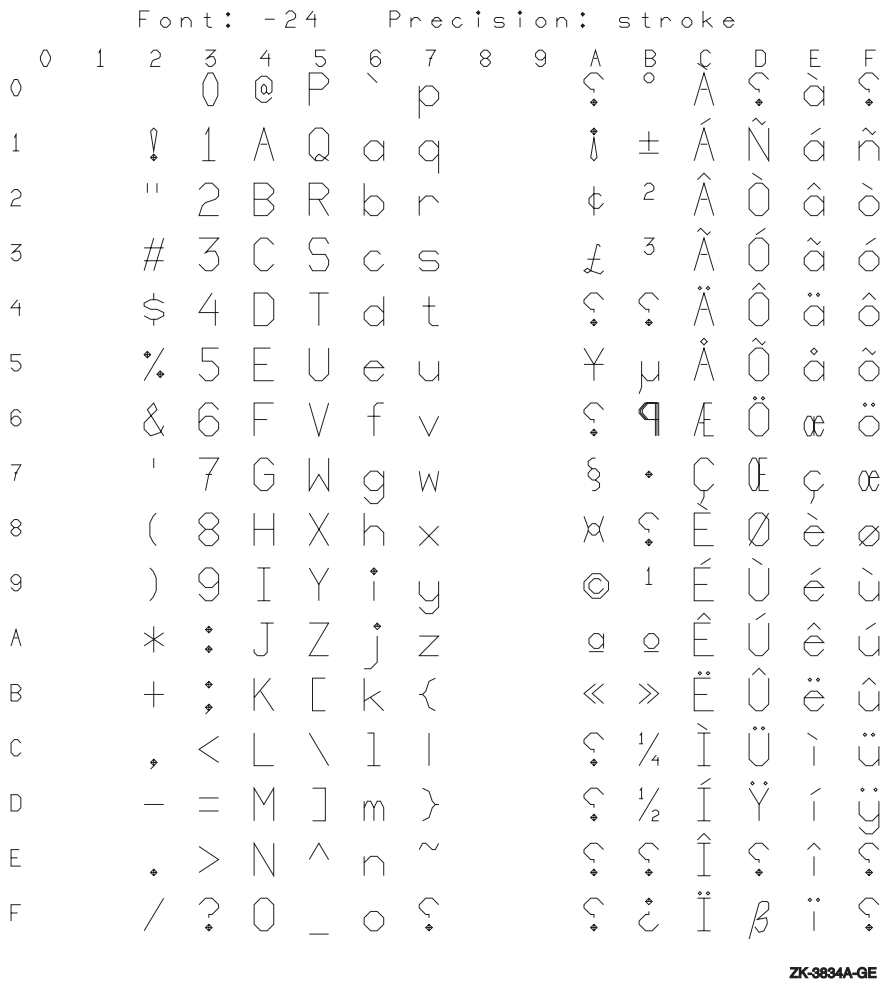


Figure A–30 Small Simple Roman



Escapes

B
Escapes

This appendix describes the DEC GKS and DEC PHIGS escapes. Escapes are functions you use to access implementation or device-dependent features other than output generation.

The escape record format has been changed to expect a structure for the data record argument. The data record format change is required because of the 64-bit addresses and 64-bit long integers on the Digital UNIX system. You can continue to use previous escape record formats on other operating systems, but Digital recommends that you use the new format to gain maximum portability between supported platforms. The escapes documented in this chapter include the new format.

Some of the escape functions inquire about information in the state lists and description tables. These inquiry functions write an integer value called *error_status* to the output data record. If *error_status* is the value 0, the remaining output data record is valid. If *error_status* is not the value 0, the remaining output data record is invalid.

B.1 Escape Function Changes

The addition of 64-bit addresses and data types requires changes to the escape data record. In previous versions of DEC GKS and DEC PHIGS, pointers were returned in the integer array, as were some data objects (such as X11 identifiers), which were declared long in C. On OpenVMS and MIPS ULTRIX systems, an integer, an address, and a C long all fit into a 32-bit quantity. On Digital UNIX systems, only the integer is a 32-bit quantity; the address and the C long are both 64-bit quantities.

The new escape data record structure for DEC GKS is as follows:

```
typedef struct {
    Gint        nints;            /* number of integers */
    Gint        nfloats;          /* number of floats */
    Gint        nstrings;         /* number of strings */
    Gint       *int_array;        /* pointer to the integer array */
    Gfloat     *float_array;      /* pointer to the float array */
    Gint       *str_len_array;    /* pointer to the string length array */
    Gchar     **str_ptr_array;    /* pointer to the string pointer array */
    Gint        npointers;        /* number of generic pointers */
    Gchar     **ptr_ptr_array;    /* pointer to the generic pointer array */
    Gint        nlongs;           /* number of longs */
    Glong      *long_array;       /* pointer to the long array */
} Guesc_idatarec;
```

The new escape data record structure for DEC PHIGS is as follows:

```
typedef struct {
    Pint        nints;              /* number of integers */
    Pint        nfloats;            /* number of floats */
    Pint        nstrings;           /* number of strings */
    Pint       *int_array;          /* pointer to the integer array */
    Pfloat     *float_array;        /* pointer to the float array */
    Pint       *str_len_array;      /* pointer to the string length array */
    Pchar     **str_ptr_array;      /* pointer to the string pointer array */
    Pint        npointers;          /* number of generic pointers */
    Pchar     **ptr_ptr_array;      /* pointer to the generic pointer array */
    Pint        nlongs;             /* number of longs */
    Plong      *long_array;         /* pointer to the long array */
} Pescaperecord;
```

The data structures contain four new items:

- A count of generic pointers
- An array of generic pointers
- A count of longs
- An array of longs

To use the new data record format, perform the following steps:

1. Convert your arrays to data records. The include files contain language-specific escape data records.
2. Make sure you are passing both an input and output record. In previous versions of DEC GKS and DEC PHIGS, you could have a 0 size output data record when no data was to be returned. Using both input and output data records allows DEC GKS and DEC PHIGS to distinguish the old format from the new format.
3. Load the appropriate sections of the data record for the escape to be performed. Make sure to enter 0 in all counts that are not used, and make sure unused pointers are a safe invalid value (such as NULL in C). This is true for both the input and output data records, even if they are not used. If the escape is one of the escapes listed in Section B.1.1, you must rearrange some of the data.
4. Make sure the sizes passed for the data records are correct, especially if your sizes were previously hardcoded. Use a compiler or language feature (such as the C `sizeof()` operator) to get the size in bytes, because the size will vary depending on the architecture and operating system.

B.1.1 New Escape Record Definitions

Digital UNIX supports only the new escape record format. Escapes that previously passed pointers or objects (such as X11 identifiers) declared long in C will require the most changes. These escapes are as follows:

- Inquire Background Pixmap (–503)
- Inquire Closest Color (–516)
- Inquire Double Buffer Buffers (–513)
- Inquire Double Buffer Pixmap (–502)
- Inquire Menu Bar Identifier (–308)
- Inquire Pasteboard Identifier (–307)

- Inquire Shell Identifier (–309)
- Inquire Window Identifiers (–304)
- Set Background Pixmap (–501)
- Set Marker Pattern (–512)
- Set Plane Mask (–511)

B.2 List of Escape Identifiers

This appendix presents the escape identifiers in numerical order. Table B–1 lists the escapes in alphabetical order and includes the corresponding escape identifier.

Table B–1 Alphabetical Listing of Escapes

Escape Function	Escape Identifier
Associate Workstation Type and Connection Identifier	–110
Beep	–103
Begin Transformation Block	–160
Begin Transformation Block 3	–164
End Transformation Block	–161
Evaluate DC Mapping of an NDC Point	–401
Evaluate NDC Mapping of a DC Point	–403
Evaluate NDC Mapping of a WC Point	–400
Evaluate WC Mapping of an NDC Point	–402
Generate Hardcopy of Workstation Surface	–101
Inquire BQUM Flags	–526
Inquire BQUM Range	–524
Inquire Background Pixmap	–503
Inquire Closest Color	–516
Inquire Current Display Speed	–300
Inquire Default Display Speed	–351
Inquire Double Buffer Buffers	–513
Inquire Double Buffer Pixmap	–502
Inquire Current Edge Attributes	–254
Inquire Current Line Cap Style	–252
Inquire Current Line Join Style	–253
Inquire Current Writing Mode	–251
Inquire Edge Facilities	–354
Inquire Edge Representation	–359
Inquire Extent of a GDP	–404
Inquire Highlighting Method	–306
Inquire Language Identifier	–360

(continued on next page)

Table B–1 (Cont.) Alphabetical Listing of Escapes

Escape Function	Escape Identifier
Inquire Line Cap and Join Facilities	–352
Inquire List of Available Escapes	–350
Inquire List of Edge Indexes	–302
Inquire List of Highlighting Methods	–358
Inquire Maximum Number of Edge Bundles	–356
Inquire Menu Bar Identifier	–308
Inquire Pasteboard Identifier	–307
Inquire Predefined Edge Representation	–355
Inquire Segment Extent	–303
Inquire Segment Highlighting Method	–305
Inquire Shell Identifier	–309
Inquire Vendor String	–517
Inquire View Dirty Flag	–531
Inquire Viewport Data	–255
Inquire Window Identifiers	–304
Inquire Workstation Structure Memory	–533
Pop Workstation	–106
Push Workstation	–107
Render Element Range	–532
Set Anti-Alias Mode	–508
Set Background Pixmap	–501
Set BQUM Range	–523
Set BQUM Flags	–525
Set Cancel String	–204
Set Connection Identifier String	–440
Set Display Speed	–100
Set Double Buffering	–500
Set Edge Aspect Source Flag (ASF)	–158
Set Edge Color Index	–156
Set Edge Control Flag	–153
Set Edge Index	–157
Set Edge Representation	–200
Set Edge Type	–154
Set Edge Width Scale Factor	–155
Set Enter String	–205
Set Error Handling Mode	–108
Set Highlighting Method	–163
Set Icon Bitmaps	–206

(continued on next page)

Table B–1 (Cont.) Alphabetical Listing of Escapes

Escape Function	Escape Identifier
Set Line Cap Style	–151
Set Line Join Style	–152
Set Line Pattern	–509
Set Marker Pattern	–512
Set PEX Begin Render Clear Action	–520
Set PEX Clear Region	–521
Set Plane Mask	–511
Set Reset String	–203
Set Segment Highlighting Method	–162
Set Swap Mode	–514
Set Transparency	–552
Set View Dirty Flag	–530
Set Viewport Event	–109
Set Window Title	–202
Set Writing Mode	–150
Software Clipping	–111
Swap Buffers	–515
Toggle Double Buffering Target	–528

B.3 Escape Syntax

This section describes the DEC GKS and DEC PHIGS escape functions in detail. For a list of the escape functions supported on your device, run the *GKS_PREDEF* or *PHIGS_PREDEF* program.

–100 Set Display Speed

Operating States for DEC GKS: WSOP, WSAC, SGOP
Operating States for DEC PHIGS: PHOP, WSOP, *, *
Supporting Workstations: The LVP16 and all HP–GL protocol plotter workstations

This escape controls the speed of output generation. DEC GKS or DEC PHIGS measures the speed in device coordinate vector/second measurements.

The plotters supported by DEC GKS or DEC PHIGS have pen speeds that are within the range 0.38 to 38.1 cm/second. The graphics handlers round your increment values to the nearest multiple of 0.38. You can specify the value 0.0 to obtain the default speed of 0.38 cm/second. If you are using one of the plotters to produce acetate slides, the recommended speed is 10 cm/second.

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (1) number of reals (1) number of strings (0) address of integer array (*ws_id*) address of real array (*display_speed*) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

The input data record contains the following elements:

Component	Description
ws_id	The workstation identifier.
display_speed	A real number specifying the display speed, expressed in centimeters per second. This value must be greater than or equal to 0.

–101 Generate Hardcopy of Workstation Surface

Operating States for DEC GKS: WSOP, WSAC, SGOP
Operating States for DEC PHIGS: PHOP, WSOP, *, *
Supporting Workstations: The ReGIS devices and Tektronix 4014 terminals

This escape generates a hardcopy of the currently displayed picture on a printer attached to the workstation.

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (1) number of reals (0) number of strings (0) address of integer array (*ws_id*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

The input data record contains the following element:

Component	Description
ws_id	The workstation identifier

–103 Beep

Operating States for DEC GKS: WSOP, WSAC, SGOP
Operating States for DEC PHIGS: PHOP, WSOP, *, *
Supporting Workstations: The VWS workstations, ReGIS devices, VT output-only devices, Tektronix 4014 and Tektronix 4107 workstations, DECwindows PEX workstations (types 221, 222, and 223), and the OSF/Motif PEX workstations (types 241, 242, and 243)

This escape signals the application user by ringing a bell or by using some other sound generator.

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (1) number of reals (2) number of strings (0) address of integer array (*ws_id*) address of real array (*rel_loudness*, *sound_duration*) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

The input data record contains the following elements:

Component	Description
ws_id	The workstation identifier.
rel_loudness	The relative loudness of the sound on a scale from 0.0 (silent) to 1.0 (loudest possible for the device).
sound_duration	The number of seconds to maintain the sound. This value must be greater than or equal to 0.

–106 Pop Workstation

Operating States for DEC GKS: WSOP, WSAC, SGOP
Operating States for DEC PHIGS: PHOP, WSOP, *, *
Supporting Workstations: The VWS, DECwindows, OSF/Motif, and PEX workstations

This escape places the display window containing the specified workstation in front of all other display windows. Remember that if you pop a workstation window, you pop all input windows associated with that workstation.

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (1) number of reals (0) number of strings (0) address of integer array (*ws_id*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

The input data record contains the following element:

Component	Description
ws_id	The workstation identifier

–107 Push Workstation

Operating States for DEC GKS: WSOP, WSAC, SGOP
Operating States for DEC PHIGS: PHOP, WSOP, *, *
Supporting Workstations: The VWS, DECwindows, OSF/Motif, and PEX workstations

This escape places the display window containing the specified workstation behind all other display windows. Remember that if you push a workstation window, you push all input windows associated with that workstation.

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (1) number of reals (0) number of strings (0) address of integer array (*ws_id*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

The input data record contains the following element:

Component	Description
ws_id	The workstation identifier

–108 Set Error Handling Mode

Operating States for DEC GKS: GKOP, WSOP, WSAC, SGOP
Supporting Workstations: All workstations

This escape allows you to suppress as much error checking as possible if set to off. Otherwise, DEC GKS executes normally and logs errors as necessary, returning those errors specified by standard and internal errors.

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (1) number of reals (0) number of strings (0) address of integer array (*error_mode*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

The input data record contains the following elements:

Component	Description
error_mode	The error mode, either 0 (off) or 1 (on)

–109 Set Viewport Event

Operating States for DEC GKS: WSOP, WSAC, SGOP
Supporting Workstations: The VWS, DECwindows, PEX, and OSF/Motif workstations

This escape allows an application to receive events that the workstation viewport has changed in some way. These events are reported through the input event queue with the input class viewport constant. There is no corresponding GET INPUT function or escape. The event simply indicates that something in the workstation viewport has changed.

The application can use the appropriate workstation inquiry functions to determine what values have actually changed. This type of event is normally reported where the DEC GKS workstation is implemented in a windowing environment. The user may change the workstation viewport through the window system. The DEC GKS VAXstation User Interface System (UIS) workstation type and the DECwindows series of workstation types are windowing environments where this event can be reported.

See –255 Inquire Viewport Data for related viewport data information.

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (2) number of reals (0) number of strings (0) address of integer array (*ws_id*, *on_off*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

The input data record contains the following elements:

Component	Description
ws_id	The workstation identifier.
on_off	A flag used to turn on or off the reporting of the change in the workstation viewport. TRUE turns it on; FALSE turns it off.

–110 Associate Workstation Type and Connection Identifier

Operating States for DEC GKS: GKOP, WSOP, WSAC, SGOP
Supporting Workstations: DECwindows, PEX, and OSF/Motif workstations

This escape associates a connection identifier with a specified workstation type. When the association is made, a workstation description table inquiry function returns information for the workstation-connection identifier pair. This lets the user inquire from the workstation description table from different locations, such as from a DECwindows workstation. Apart from this escape, DEC GKS provides minimal support for distributed environments. The association can also be canceled.

For DEC GKS, if no association is defined, the environment options GKS$CONID (OpenVMS systems) and GKSconid (UNIX systems) are used if workstation type and connection identifier pairing is needed, as in DECwindows workstation.

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (2) number of reals (0) number of strings (1) address of integer array (*ws_type*, *set*) address of real array (0) address of string lengths array (*length_conid*) address of string pointer array (*conid*) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

The input data record contains the following elements:

Component	Description
ws_type	The workstation identifier
set	A flag used to define (1) or to cancel (0) an association
length_conid	The length of the connection identifier string
conid	The connection identifier string

–111 Software Clipping

Operating States for DEC GKS: WSOP, WSAC, SGOP
Supporting Workstations: All workstations

Because some hardware may not correctly clip very large primitives, you can force DEC GKS to use software clipping, in some cases. DEC GKS uses hardware clipping by default if the graphics device has this capability. The parameter (*clip_flag*) controls this behavior.

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (2) number of reals (0) number of strings (0) address of integer array (*ws_id*, *clip_flag*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

The input data record contains the following elements:

Component	Description
ws_id	The workstation identifier.
clip_flag	A flag that determines whether software clipping is always used (1) or used only if hardware clipping is unavailable (0).

–150 Set Writing Mode

Operating States for DEC GKS: GKOP, WSOP, WSAC, SGOP
Operating States for DEC PHIGS: PHOP, *, *, *
Supporting Workstations: ReGIS, DECwindows, OSF/Motif, PEX, LJ250, LA324, and LCG01 workstations

This escape sets the current *writing mode* entry for all subsequently drawn primitives that use this facility. An example of a writing mode is complement mode, which reverses the foreground and background colors when text is generated.

The initial writing mode is 1, which is workstation-dependent. If a workstation cannot implement a specified writing mode, DEC GKS or DEC PHIGS uses mode number 1.

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (DEC GKS: 1, or DEC PHIGS: 2) number of reals (0) number of strings (0) address of integer array (DEC GKS: *wr_mode*, or DEC PHIGS: *ws_id*, *wr_mode*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

For DEC GKS, the input data record contains the following element:

Component	Description
wr_mode	The writing mode

For DEC PHIGS, the input data record contains the following elements:

Component	Description
ws_id	The workstation identifier
wr_mode	The writing mode

The element *wr_mode* can have the following values:

Mode	Description
<=1	Workstation dependent.
2	Complement mode.
3	Erase underlying graphics.
4	Overlay on underlying graphics.
>=5	Reserved for future use.

For DEC PHIGS, the Set Writing Mode escape includes support for writing modes on PEX, OSF/Motif, and DECwindows workstations. However, not all PEX servers support all the writing modes. For example, XOR writing mode is supported on all PXG PEX servers, but not on the SPXg or SPXgt PEX server. The writing modes are also supported on Motif and DECwindows workstations. The constants map to the equivalent X11 writing modes.

See the appropriate language definition file for a list of constants and values to be used with this escape.

–151 Set Line Cap Style

Operating States for DEC GKS: GKOP, WSOP, WSAC, SGOP
Operating States for DEC PHIGS: PHOP, *, *, *
Supporting Workstations: The PostScript, DDIF, DECwindows, OSF/Motif, and PEX workstations

This escape sets the current *line cap style* entry for all subsequently drawn polylines that use this facility. The line cap style determines the appearance of the polyline endpoints.

The initial line cap style is 1, which is workstation-dependent. If a workstation cannot implement a specified style, DEC GKS or DEC PHIGS uses style number 1.

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (DEC GKS: 1, or DEC PHIGS: 2) number of reals (0) number of strings (0) address of integer array (DEC GKS: *cap_style*, or DEC PHIGS: *ws_id*, *cap_style*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

–151 Set Line Cap Style

For DEC GKS, the input data record contains the following element:

Component	Description
cap_style	The line cap style

For DEC PHIGS, the input data record contains the following elements:

Component	Description
ws_id	The workstation identifier
cap_style	The line cap style

The element *cap_style* can be one of the following values:

Style	Description
<=1	Workstation dependent.
2	Butt, squared at the endpoint.
3	Round, semicircular arc.
4	Square, projecting square cap.
>=5	Reserved for future use.

See the appropriate language definition file for a list of constants and values to be used with this escape.

–152 Set Line Join Style

Operating States for DEC GKS: GKOP, WSOP, WSAC, SGOP
Operating States for DEC PHIGS: PHOP, *, *, *
Supporting Workstations: The PostScript, DDIF, DECwindows, OSF/Motif, and PEX workstations

This escape sets the current *line join style* entry for all subsequently drawn polylines that use this facility. The line join style determines the appearance of the polyline vertices.

The initial line join style is 1, which is workstation-dependent. If a workstation cannot implement a specified style, DEC GKS or DEC PHIGS uses style number 1.

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (DEC GKS: 1, or DEC PHIGS: 2) number of reals (0) number of strings (0) address of integer array (DEC GKS: *join_style*, or DEC PHIGS: *ws_id*, *join_style*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

–152 Set Line Join Style

For DEC GKS, the input data record contains the following element:

Component	Description
join_style	The line join style

For DEC PHIGS, the input data record contains the following elements:

Component	Description
ws_id	The workstation identifier
join_style	The line join style

The element *join_style* can be one of the following values:

Style	Description
<=1	Workstation dependent.
2	Mitre, outer edges meet at a sharp point.
3	Round, circular arc at point.
4	Beveled, a short, third line connecting lines not joined at 90 degrees.
>=5	Reserved for future use.

See the appropriate language definition file for a list of constants and values to be used with this escape.

–153 Set Edge Control Flag

Operating States for DEC GKS: GKOP, WSOP, WSAC, SGOP
Supporting Workstations: All DEC GKS workstations

This escape sets the *current edge flag* entry in the DEC GKS state list to the specified value. This escape is functionally equivalent to the SET EDGE FLAG function.

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (1) number of reals (0) number of strings (0) address of integer array (*edge_flag*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

The input data record contains the following element:

Component	Description
edge_flag	A flag specifying whether edges are on (1) or off (0)

–154 Set Edge Type

Operating States for DEC GKS: GKOP, WSOP, WSAC, SGOP
Supporting Workstations: All DEC GKS workstations

This escape sets the *current edge flag* entry in the DEC GKS state list to the specified value. This escape is functionally equivalent to the SET EDGETYPE function.

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (1) number of reals (0) number of strings (0) address of integer array (*edge_type*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

The input data record contains the following element:

Component	Description
edge_type	The edge type

The *edge_type* element can be one of the following values:

Type	Description
<=0	Workstation dependent
1	Solid edge
2	Dashed edge

Type	Description
3	Dotted edge
4	Dashed-dotted edge
>=5	Reserved for future use

See the appropriate language definition file for a list of constants and values to be used with this escape.

–155 Set Edge Width Scale Factor

Operating States for DEC GKS: GKOP, WSOP, WSAC, SGOP
Supporting Workstations: All DEC GKS workstations

This escape sets the *current edge width factor* entry in the DEC GKS state list to the specified value. This escape is functionally equivalent to the SET EDGEWIDTH SCALE FACTOR function.

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (0) number of reals (1) number of strings (0) address of integer array (0) address of real array (*scale_factor*) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

The input data record contains the following element:

Component	Description
scale_factor	A real number greater than 0 that specifies the edge width scale factor

–156 Set Edge Color Index

Operating States for DEC GKS: GKOP, WSOP, WSAC, SGOP
Supporting Workstations: All DEC GKS workstations

This escape sets the *current edge color index* entry in the DEC GKS state list to the specified value. This escape is functionally equivalent to the SET EDGE COLOR INDEX function

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (1) number of reals (0) number of strings (0) address of integer array (*color_index*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

The input data record contains the following element:

Component	Description
color_index	The edge color index

–157 Set Edge Index

Operating States for DEC GKS: GKOP, WSOP, WSAC, SGOP
Supporting Workstations: All DEC GKS workstations

This escape sets the *current edge index* entry to the specified index value. This escape is functionally equivalent to the SET EDGE INDEX function.

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (1) number of reals (0) number of strings (0) address of integer array (*edge_index*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

The input data record contains the following element:

Component	Description
edge_index	The edge index

–158 Set Edge Aspect Source Flag (ASF)

Operating States for DEC GKS: GKOP, WSOP, WSAC, SGOP
Supporting Workstations: All DEC GKS workstations

This escape establishes the aspect source flag (ASF) setting for each of the edge attributes. Each flag can either be bundled (value 0—use the bundled attributes), or individual (value 1—use the individual attributes). All initial ASF flags are set to individual.

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (4) number of reals (0) number of strings (0) address of integer array (*asf_flags*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

The input data record contains the following element:

Component	Description
asf_flags	Flags that specify either bundled or individual attributes for each of the edge attribute settings, in the following order: 1. Edge control flag 2. Edge type flag 3. Edge width scale factor flag 4. Edge color index flag

–158 Set Edge Aspect Source Flag (ASF)

See the following escapes for more information on edge attributes:

–153 Set Edge Control Flag
–154 Set Edge Type
–155 Set Edge Width Scale Factor
–156 Set Edge Color Index

–160 Begin Transformation Block

Operating States for DEC GKS: WSOP, WSAC
Supporting Workstations: All DEC GKS workstations

This escape applies the specified transformation to all subsequently drawn primitives not contained in segments. The transformation continues until you call –161 End Transformation Block, or until you open a segment.

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (1) number of reals (6) number of strings (0) address of integer array (*ws_id*) address of real array (*xform*) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

The input data record contains the following elements:

Component	Description
ws_id	The workstation identifier
xform	An array of reals that specifies the values for the transformation matrix

For more information on transformation matrices, see the description of the EVALUATE TRANSFORMATION MATRIX function in the DEC GKS binding reference manuals.

–161 End Transformation Block

Operating States for DEC GKS: WSOP, WSAC
Supporting Workstations: All DEC GKS workstations

This escape ends the transformation process initiated by the call to –160 Begin Transformation Block.

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (1) number of reals (0) number of strings (0) address of integer array (*ws_id*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

The input data record contains the following element:

Component	Description
ws_id	The workstation identifier

–162 Set Segment Highlighting Method

Operating States for DEC GKS: WSOP, WSAC, SGOP
Supporting Workstations: All DEC GKS workstations

This escape sets the segment highlighting method, but it does not change the highlighted state of a segment. Use the SET HIGHLIGHTING function to change the segment highlighted state. If the segment is currently highlighted when this escape is called, and the segment highlighting method or attributes are different, the segment is unhighlighted and then highlighted again with the new attributes. This function may also cause a regeneration of the workstation display, depending on the workstation regeneration mode.

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (6) number of reals (2) number of strings (0) address of integer array (*segment_name*, *high_method*, *color_index*, *linetype*, *fill_style*, *fill_index*) address of real array (*line_width*, *expand_factor*) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

The input data record contains the following elements:

Component	Description
segment_name	The name of the segment for which the highlighting attributes are to be set.
high_method	The highlighting method.
color_index	The color index to use with the highlighting method color.
linetype	The line type to use with the highlighting method.
fill_style	The fill area attributes to use with the highlighting method.
fill_index	The fill index to use with the highlighting method.
line_width	The line width scale factor for the line drawn around the extent of the item being highlighted.
expand_factor	The distance the highlighted region should extend around the item being highlighted. It is defined in terms of a scale factor of the nominal line width.

The *high_method* is one of the following constants:

Value	Description
0	Use the workstation-dependent default highlighting method.
1	Highlight the segment by drawing it in complement mode.
2	Highlight the segment by drawing it using the color index specified in the integer array.
3	Highlight the segment by drawing an extent box around it, using the line attributes specified in the integer and float arrays. The extent box is drawn using complement mode. The extent will be expanded by *expand_factor* times the nominal line width.
4	Highlight the segment by drawing a complement mode fill area around it, using the fill area attributes specified in the integer array. The extent box will be expanded by *expand_factor* times the nominal line width.
5	Highlight the segment by drawing both a line and fill area around it, using the attributes specified. The extent box will be expanded by *expand_factor* times the nominal line width.

If the highlighting method is not available on the workstation on which the segment is displayed, the default value of 0 is used.

–163 Set Highlighting Method

Operating States for DEC GKS: GKOP, WSOP, WSAC, SGOP
Supporting Workstations: All DEC GKS workstations

This escape sets the primitive highlighting method to be used for pick highlighting. This information is meaningful only on a workstation that is capable of both input and output. All subsequent primitives are highlighted in the manner specified until this escape is used again.

If you use pick prompt and echo type 1, the information applies to each primitive and is stored when the primitives are created. If you use pick prompt and echo type 2, the information applies to the group of primitives with the same pick identifier. The information is stored the first time a primitive with a different pick identifier than any other primitive in a particular segment is stored. If you use pick prompt and echo type 3, the information is stored when a segment is created and applies to all primitives within a particular segment.

If a WISS segment is inserted into the open segment, the highlighting method is applied as follows:

- Highlighting methods bound to primitives when the primitives were entered into the WISS will be transferred to the inserted primitives in the open segment.
- If the same pick identifier exists in the open segment and the WISS segment, the highlighting method bound to the pick identifier in the open segment will be applied.
- The highlighting method bound to the open segment when it was created will be applied to all primitives when you use prompt and echo type 3.

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (5) number of reals (2) number of strings (0) address of integer array (*high_method*, *color_index*, *linetype*, *fill_style*, *fill_index*) address of real array (*line_width*, *expand_factor*) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

Argument	Required Value
out_data	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

The input data record contains the following elements:

Component	Description
high_method	The highlighting method.
color_index	The color index to use with the highlighting method color.
linetype	The line type to use with the highlighting method.
fill_style	The fill area attributes to use with the highlighting method.
fill_index	The fill index to use with the highlighting method.
line_width	The line width scale factor for the line drawn around the extent of the item being highlighted.
expand_factor	The distance the highlighted region should extend around the item being highlighted. It is defined in terms of a scale factor of the nominal line width.

The *high_method* is one of the following constants:

Value	Description
0	Use the workstation-dependent default highlighting method.
1	Highlight the segment by drawing it in complement mode.
2	Highlight the segment by drawing it using the color index specified in the integer array.
3	Highlight the segment by drawing an extent box around it, using the line attributes specified in the integer and float arrays. The extent box is drawn using complement mode. The extent will be expanded by *expand_factor* times the nominal line width.
4	Highlight the segment by drawing a complement mode fill area around it, using the fill area attributes specified in the integer array. The extent box will be expanded by *expand_factor* times the nominal line width.
5	Highlight the segment by drawing both a line and fill area around it, using the attributes specified. The extent box will be expanded by *expand_factor* times the nominal line width.

If the highlighting method is not available on the workstation on which the segment is displayed, the default value of 0 is used.

–164 Begin Transformation Block 3

Operating States for DEC GKS: WSOP, WSAC
Supporting Workstations: All DEC GKS workstations

This escape applies the specified transformation to all subsequently drawn primitives not contained in segments. The transformation continues until you call the escape function –161 End Transformation Block, or until you open a segment.

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (1) number of reals (12) number of strings (0) address of integer array (*ws_id*) address of real array (*xform*) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

The input data record contains the following elements:

Component	Description
ws_id	The workstation identifier
xform	An array of reals that specifies the values for the transformation matrix

For more information on transformation matrices, see the description of the EVALUATE TRANSFORMATION MATRIX 3 function in the DEC GKS binding reference manuals.

–200 Set Edge Representation

Operating States for DEC GKS: WSOP, WSAC, SGOP
Supporting Workstations: All DEC GKS workstations

This escape function sets the representation for a given edge bundle index.

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (5) number of reals (1) number of strings (0) address of integer array (*ws_id*, *edge_index*, *edge_flag*, *edge_type*, *color_index*) address of real array (*scale_factor*) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

The input data record contains the following elements:

Component	Description
ws_id	The workstation identifier
edge_index	The edge index
edge_flag	The edge flag
edge_type	The edge type
color_index	The edge color index
scale_factor	A real number that specifies the edge width scale factor to be associated with the specified edge bundle index

–202 Set Window Title

Operating States for DEC GKS: WSOP, WSAC, SGOP
Operating States for DEC PHIGS: PHOP, WSOP, *, *
Supporting Workstations: DECwindows workstation types 210 and 211; PEX workstation types 221 and 222; and OSF/Motif workstation types 231, 232, and 233

This escape changes the string displayed in the title bar.

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (1) number of reals (0) number of strings (1) address of integer array (*ws_id*) address of real array (0) address of string lengths array (*length_of_new_title*) address of string pointer array (*new_title*) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

The input data record contains the following elements:

Component	Description
ws_id	The workstation identifier
length_of_new_title	An integer array containing the length of *new_title* (in bytes)
new_title	The new window title character string

–203 Set Reset String

Operating States for DEC GKS: WSOP, WSAC, SGOP
Operating States for DEC PHIGS: PHOP, WSOP, *, *
Supporting Workstations: DECwindows workstation types 210 and 211; PEX workstation types 220, and 221; and OSF/Motif workstation types 230, and 231

This escape changes the string displayed in the reset button on the menu bar.

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (1) number of reals (0) number of strings (1) address of integer array (*ws_id*) address of real array (0) address of string lengths array (*length_of_new_string*) address of string pointer array (*new_string*) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

The input data record contains the following elements:

Component	Description
ws_id	The workstation identifier
length_of_new_string	An integer array containing the length of *new_string* (in bytes)
new_string	The new reset button character string

–204 Set Cancel String

Operating States for DEC GKS: WSOP, WSAC, SGOP
Operating States for DEC PHIGS: PHOP, WSOP, *, *
Supporting Workstations: DECwindows workstation type 211, PEX workstation type 221, and OSF/Motif workstation type 231

This escape sets the string used by the cancel buttons of input devices. It has no effect on input devices presently displayed.

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (1) number of reals (0) number of strings (1) address of integer array (*ws_id*) address of real array (NULL) address of string lengths array (*length_of_new_string*) address of string pointer array (*new_string*) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

The input data record contains the following elements:

Component	Description
ws_id	The workstation identifier
length_of_new_string	An integer array containing the length of *new_string* (in bytes)
new_string	The new cancel button character string

–205 Set Enter String

Operating States for DEC GKS: WSOP, WSAC, SGOP
Operating States for DEC PHIGS: PHOP, WSOP, *, *
Supporting Workstations: DECwindows workstation type 211, PEX workstation type 221, and OSF/Motif workstation type 231

This escape sets the string used by the enter buttons of input devices. It has no effect on input devices presently displayed.

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (1) number of reals (0) number of strings (1) address of integer array (*ws_id*) address of real array (NULL) address of string lengths array (*length_of_new_string*) address of string pointer array (*new_string*) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

The input data record contains the following elements:

Component	Description
ws_id	The workstation identifier
length_of_new_string	An integer array containing the length of *new_string* (in bytes)
new_string	The new enter button character string

–206 Set Icon Bitmaps

Operating States for DEC GKS: WSOP, WSAC, SGOP
Operating States for DEC PHIGS: PHOP, WSOP, *, *
Supporting Workstations: DECwindows workstation types 210 and 211; PEX workstation type 221; and OSF/Motif workstation type 231

Icon bitmaps are defined one integer per pixel. The integer values are used in a device-dependent manner to determine the icon appearance. Where possible, the integers will specify the DEC GKS or DEC PHIGS color indexes to be used for each pixel. The pixels are specified in row-major order, with pixel (0,0) being the upper left corner of the icon (left-to-right, then top-to-bottom).

If the icon height and width are specified as 0, then the default icon bitmap will be used instead, and the bitmap definition string for that icon must not be specified.

Some devices may not need more than one icon bitmap, in which case only the small icon should be specified. The large icon height and large icon width parameters should be set to 0.

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (5 + (*siw* * *sih*) + (*liw* * *lih*)) number of reals (0) number of strings (0) address of integer array (*ws_id*, *siw*, *sih*, *liw*, *lih*, (*siw* * *sih*) integers, (*liw* * *lih*) integers) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

The input integer array contains the elements shown in the following table:

Component	Component Name	Description
1	ws_id	Workstation identifier
2	siw	Small icon width, in pixels
3	sih	Small icon height, in pixels
4	liw	Large icon width, in pixels
5	lih	Large icon height, in pixels
6 . . .	Small_Icon	Color indexes for the small icon bit map
(siw * sih +6) . . .	Large_Icon	Color indexes for the large icon bit map

–251 Inquire Current Writing Mode

Operating States for DEC GKS: GKOP, WSOP, WSAC, SGOP
Supporting Workstations: All DEC GKS workstations

This escape writes the value of the current writing mode (see –150 Set Writing Mode) to its output data record.

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (2) number of reals (0) number of strings (0) address of integer array (*error_status*, *writing_mode*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

The output data record contains the following elements:

Component	Description
error_status	The error status.
writing_mode	The writing mode. See the appropriate language definition file for a list of values for this element.

–252 Inquire Current Line Cap Style

Operating States for DEC GKS: GKOP, WSOP, WSAC, SGOP
Supporting Workstations: All DEC GKS workstations

This escape writes the value of the current line cap style (see –151 Set Line Cap Style) to its output data record.

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (2) number of reals (0) number of strings (0) address of integer array (*error_status*, *cap_style*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

The output data record contains the following elements:

Component	Description
error_status	The workstation identifier.
cap_style	The line cap style. See the appropriate language definition file for a list of values for this element.

–253 Inquire Current Line Join Style

Operating States for DEC GKS: GKOP, WSOP, WSAC, SGOP
Supporting Workstations: All DEC GKS workstations

This escape writes the value of the current line join style (see –152 Set Line Join Style) to its output data record.

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (2) number of reals (0) number of strings (0) address of integer array (*error_status*, *join_style*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

The output data record contains the following elements:

Component	Description
error_status	The error status.
join_style	The line join style. See the appropriate language definition file for the list of values for this element.

–254 Inquire Current Edge Attributes

Operating States for DEC GKS: GKOP, WSOP, WSAC, SGOP
Supporting Workstations: All DEC GKS workstations

This escape writes all the values of the current edge attributes to its output data record.

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (9) number of reals (1) number of strings (0) address of integer array (*error_status*, *edge_index*, *edge_flag*, *edge_type*, *edge_color*, *edge_flag_ASF*, *edge_type_ASF*, *edge_width_ASF*, *edge_color_ASF*) address of real array (*edge_width*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

The output data record contains the following elements:

Component	Description
error_status	The error status
edge_index	The current edge index
edge_flag	The current edge control flag
edge_type	The current edge type
edge_color	The current edge color index
edge_flag_ASF	The edge control flag aspect source flag (ASF)
edge_type_ASF	The edge type ASF
edge_width_ASF	The edge width scale factor ASF
edge_color_ASF	The edge color ASF
edge_width	The current edge width scale factor

–255 Inquire Viewport Data

Operating States for DEC GKS: WSOP, WSAC, SGOP
Supporting Workstations: All DECwindows, PEX, and OSF/Motif workstations

This escape returns the region of the workstation that has been changed or exposed since the last time this escape was called.

See –109 Set Viewport Event for related viewport event information.

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (1) number of reals (0) number of strings (0) address of integer array (*ws_id*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (1) number of reals (4) number of strings (0) address of integer array (*error_status*) address of real array (*viewport*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

The input data record contains the following element:

Component	Description
ws_id	The workstation identifier

The output data record contains the following elements:

Component	Description
error_status	The error status.
viewport	The viewport that defines the region changed or exposed, in device coordinates (XMIN, XMAX, YMIN, YMAX). If XMAX and YMAX are 0, nothing has changed concerning the workstation viewport since the last time this escape was called.

–300 Inquire Current Display Speed

Operating States for DEC GKS: WSOP, WSAC, SGOP
Operating States for DEC PHIGS: PHOP, WSOP, *, *
Supporting Workstations: The LVP16 printer and all HP–GL plotter workstations

This escape writes the current display speed (see –100 Set Display Speed) to the output data record.

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (1) number of reals (0) number of strings (0) address of integer array (*ws_id*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (1) number of reals (1) number of strings (0) address of integer array (*error_status*) address of real array (*display_speed*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

The input data record contains the following element:

Component	Description
ws_id	The workstation identifier

The output data record contains the following elements:

Component	Description
error_status	The error status
display_speed	A real specifying the current display speed of the specified workstation

–302 Inquire List of Edge Indexes

Operating States for DEC GKS: WSOP, WSAC, SGOP
Supporting Workstations: All DEC GKS workstations

This escape returns the list of indexes supported by a given workstation. (See –157 Set Edge Index.)

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (1) number of reals (0) number of strings (0) address of integer array (*ws_id*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (3 + *ret_indexes*) number of reals (0) number of strings (0) address of integer array (*error_status*, *total_indexes*, *ret_indexes*, *index_list*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

The input data record contains the following element:

Component	Description
ws_id	The workstation identifier

–302 Inquire List of Edge Indexes

The output data record contains the following elements:

Component	Description
error_status	The error status
total_indexes	The total number of edge indexes supported by the workstation
ret_indexes	The number of edge indexes written to the remaining elements of the output data record's integer array
index_list	The edge indexes

–303 Inquire Segment Extent

Operating States for DEC GKS: WSOP, WSAC, SGOP
Supporting Workstations: All DEC GKS workstations

This escape writes the coordinate range of the segment extent rectangle corresponding to the specified segment name. For more information concerning segment names, see the chapter on segments in the DEC GKS binding manuals.

This escape will not report correct values if the segment is off the display surface. This is a design restriction.

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (2) number of reals (0) number of strings (0) address of integer array (*ws_id*, *segment_id*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (1) number of reals (4) number of strings (0) address of integer array (*error_status*) address of real array (*xmin*, *xmax*, *ymin*, *ymax*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

The input data record contains the following elements:

Component	Description
ws_id	The workstation identifier
segment_id	The segment name

The output data record contains the following elements:

Component	Description
error_status	The error status
xmin, xmax, ymin, ymax	The four world coordinate (XMIN, XMAX, YMIN, YMAX) values of the segment's extent rectangle, using the current transformation values

–304 Inquire Window Identifiers

Operating States for DEC GKS: WSOP, WSAC, SGOP
Operating States for DEC PHIGS: PHOP, WSOP, *, *
Supporting Workstations: All DECwindows workstation types; PEX workstation types 221, 222, and 223; and OSF/Motif workstation types 231, 232, and 233

This escape returns the display and window identifiers of the DEC GKS or DEC PHIGS output window.

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (1) number of reals (0) number of strings (0) address of integer array (*ws_id*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (1) address of generic pointer array (*display_id*) number of longs (1) address of long array (*window_id*)

The input data record contains the following element:

Component	Description
ws_id	The workstation identifier

The output data record contains the following elements:

Component	Description
display_id	The X11 display identifier
window_id	The X11 window identifier

–305 Inquire Segment Highlighting Method

Operating States for DEC GKS: WSOP, WSAC, SGOP
Supporting Workstations: All DEC GKS workstations

This escape writes the values of the segment highlighting method and attributes to its output data record.

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (1) number of reals (0) number of strings (0) address of integer array (*ws_id*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (6) number of reals (2) number of strings (0) address of integer array (*error_status*, *high_method*, *color_index*, *linetype*, *fill_style*, *fill_index*) address of real array (*line_width*, *expand_factor*) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

The input data record contains the following element:

Component	Description
ws_id	The workstation identifier

The output data record contains the following elements:

Component	Description
error_status	The error status.
high_method	The highlighting method.
color_index	The color index to use with the highlighting method color.
linetype	The line type to use with the highlighting method.
fill_style	The fill area attributes to use with the highlighting method.
fill_index	The fill index to use with the highlighting method.
line_width	The line width scale factor for the line drawn around the extent of the item being highlighted.
expand_factor	The distance the highlighted region should extend around the item being highlighted. It is defined in terms of a scale factor of the nominal line width.

The *high_method* element is one of the following constants:

Value	Description
0	Use the workstation-dependent default highlighting method.
1	Highlight the segment by drawing it in complement mode.
2	Highlight the segment by drawing it using the color index specified in the integer array.
3	Highlight the segment by drawing an extent box around it, using the line attributes specified in the integer and float arrays. The extent box is drawn using complement mode. The extent will be expanded by *expand_factor* times the nominal line width.
4	Highlight the segment by drawing a complement mode fill area around it, using the fill area attributes specified in the integer array. The extent box will be expanded by *expand_factor* times the nominal line width.
5	Highlight the segment by drawing both a line and fill area around it, using the attributes specified. The extent box will be expanded by *expand_factor* times the nominal line width.

If the highlighting method is not available on the workstation on which the segment is displayed, the default value of 0 is used.

–306 Inquire Highlighting Method

Operating States for DEC GKS: GKOP, WSOP, WSAC, SGOP
Supporting Workstations: All DEC GKS workstations

This escape writes the values of the current primitive highlighting method and attributes to its output data record.

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (6) number of reals (2) number of strings (0) address of integer array (*error_status*, *high_method*, *color_index*, *linetype*, *fill_style*, *fill_index*) address of real array (*line_width*, *expand_factor*) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

The output data record contains the following elements:

Component	Description
error_status	The error status.
high_method	The highlighting method.
color_index	The color index to use with the highlighting method color.
linetype	The line type to use with the highlighting method.
fill_style	The fill area attributes to use with the highlighting method.
fill_index	The fill index to use with the highlighting method.
line_width	The line width scale factor for the line drawn around the extent of the item being highlighted.
expand_factor	The distance the highlighted region should extend around the item being highlighted. It is defined in terms of a scale factor of the nominal line width.

The *high_method* element is one of the following constants:

Value	Description
0	Use the workstation-dependent default highlighting method.
1	Highlight the segment by drawing it in complement mode.
2	Highlight the segment by drawing it using the color index specified in the integer array.
3	Highlight the segment by drawing an extent box around it, using the line attributes specified in the integer and float arrays. The extent box is drawn using complement mode. The extent will be expanded by *expand_factor* times the nominal line width.
4	Highlight the segment by drawing a complement mode fill area around it, using the fill area attributes specified in the integer array. The extent box will be expanded by *expand_factor* times the nominal line width.
5	Highlight the segment by drawing both a line and fill area around it, using the attributes specified. The extent box will be expanded by *expand_factor* times the nominal line width.

If the highlighting method is not available on the workstation on which the segment is displayed, the default value of 0 is used.

–307 Inquire Pasteboard Identifier

Operating States for DEC GKS: WSOP, WSAC, SGOP
Operating States for DEC PHIGS: PHOP, WSOP, *, *
Supporting Workstations: DECwindows workstation types 210 and 211, PEX workstation type 221, and OSF/Motif workstation type 231.

This escape is for OpenVMS systems only.

This escape returns the widget identifier of the DEC GKS or DEC PHIGS pasteboard widget. The pasteboard is a dialogue box that contains the DEC GKS or DEC PHIGS output window widget and all input widgets. You should not change the size of this widget.

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (1) number of reals (0) number of strings (0) address of integer array (*ws_id*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (1) address of generic pointer array (*widget_id*) number of longs (0) address of long array (NULL)

The input data record contains the following element:

Component	Description
ws_id	The workstation identifier

The output data record contains the following element:

Component	Description
widget_id	The pasteboard widget identifier

–308 Inquire Menu Bar Identifier

Operating States for DEC GKS: WSOP, WSAC, SGOP
Operating States for DEC PHIGS: PHOP, WSOP, *, *
Supporting Workstations: DECwindows workstation types 210 and 211, PEX workstation type 221, and OSF/Motif workstation type 231

This escape is for OpenVMS systems only.

This escape returns the widget identifier of the menu bar widget.

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (1) number of reals (0) number of strings (0) address of integer array (*ws_id*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (1) address of generic pointer array (*widget_id*) number of longs (0) address of long array (NULL)

The input data record contains the following element:

Component	Description
ws_id	The workstation identifier

The output data record contains the following element:

Component	Description
widget_id	The menu bar widget identifier

–309 Inquire Shell Identifier

Operating States for DEC GKS: WSOP, WSAC, SGOP
Operating States for DEC PHIGS: PHOP, WSOP, *, *
Supporting Workstations: DECwindows workstation types 210 and 211, PEX workstation type 221, and OSF/Motif workstation type 231

This escape is for OpenVMS systems only.

This escape returns the widget identifier of the DEC GKS or DEC PHIGS application shell widget.

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (1) number of reals (0) number of strings (0) address of integer array (*ws_id*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (1) address of generic pointer array (*widget_id*) number of longs (0) address of long array (NULL)

The input data record contains the following element:

Component	Description
ws_id	The workstation identifier

The output data record contains the following element:

Component	Description
widget_id	The shell widget identifier

–350 Inquire List of Available Escapes

Operating States for DEC GKS: GKOP, WSOP, WSAC, SGOP
Operating States for DEC PHIGS: PHOP, *, *, *
Supporting Workstations: All DEC GKS and DEC PHIGS supported workstations

This escape returns the list of escapes supported by a specified workstation.

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (1) number of reals (0) number of strings (0) address of integer array (*ws_type*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (3 + *num_escapes*) number of reals (0) number of strings (0) address of integer array (*error_status*, *total_escapes*, *ret_escapes*, *escape_list*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

The input data record contains the following element:

Component	Description
ws_type	The workstation type

The output data record contains the following elements:

Component	Description
num_escapes	Number of elements (escapes) you want returned
error_status	Inquiry error status
total_escapes	Total number of escapes supported by the workstation type
ret_escapes	Number of escape identifiers written to the remaining elements of the output data record's integer array
escape_list	Identifiers of the supported escapes

–351 Inquire Default Display Speed

Operating States for DEC GKS: GKOP, WSOP, WSAC, SGOP
Operating States for DEC PHIGS: PHOP, *, *, *
Supporting Workstations: The LVP16 printer and all HP–GL plotter workstations

This escape writes the default speed, for the specified workstation type, to its output data record. (See –100 Set Display Speed.)

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (1) number of reals (0) number of strings (0) address of integer array (*ws_id*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (1) number of reals (1) number of strings (0) address of integer array (*error_status*) address of real array (*def_speed*) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

The input data record contains the following element:

Component	Description
ws_id	The workstation identifier

The output data record contains the following elements:

Component	Description
error_status	The error status
def_speed	A real specifying the default display speed of the specified workstation

–352 Inquire Line Cap and Join Facilities

Operating States for DEC GKS: GKOP, WSOP, WSAC, SGOP
Operating States for DEC PHIGS: PHOP, WSOP, *, *
Supporting Workstations: DECwindows, OSF/Motif, and PostScript workstations

This escape writes the line cap and line join facilities, for the specified workstation type, to the output data record. (See –151 Set Line Cap Style and –152 Set Line Join Style.)

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (1) number of reals (0) number of strings (0) address of integer array (*ws_type*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (5 + *ret_cap_styles* + *ret_join_styles*) number of reals (0) number of strings (0) address of integer array (*error_status*, *num_cap_styles*, *ret_cap_styles*, *num_join_styles*, *ret_join_styles*, *cap_style_list*, *join_style_list*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

The input data record contains the following element:

Component	Description
ws_type	The workstation type

The output data record contains the following elements:

Component	Description
error_status	The error status
num_cap_styles	The total number of line cap styles supported by the workstation type
ret_cap_styles	The number of cap styles written to the returned integer array
num_join_styles	The total number of line join styles supported by the workstation type
ret_join_styles	The number of join styles written to the returned integer array
cap_style_list	The variable list of the supported cap styles
join_style_list	The variable list of the supported join styles

–354 Inquire Edge Facilities

Operating States for DEC GKS: GKOP, WSOP, WSAC, SGOP
Supporting Workstations: All DEC GKS workstations

This escape writes the edge facilities available for the specified workstation type to the output data record.

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (1) number of reals (0) number of strings (0) address of integer array (*ws_type*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (5 + *number_edge_types*) number of reals (3) number of strings (0) address of integer array (*error_status*, *total_edge_types*, *num_edge_types*, *number_edge_widths*, *num_indexes*) address of real array (*nom_edge_width*, *min_edge_width*, *max_edge_width*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

The input data record contains the following element:

Component	Description
ws_type	The workstation type

The output data record contains the following elements:

Component	Description
error_status	The error status
total_edge_types	The total number of edge types available
num_edge_types	The number of edge types returned
num_edge_widths	The number of edge widths available
num_indexes	The number of predefined edge bundle table entries
nom_edge_width	The nominal edge width
min_edge_width	The minimum edge width
max_edge_width	The maximum edge width

–355 Inquire Predefined Edge Representation

Operating States for DEC GKS: GKOP, WSOP, WSAC, SGOP
Supporting Workstations: All DEC GKS workstations

This escape writes the predefined edge bundle information for the specified workstation type to the output data record.

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (2) number of reals (0) number of strings (0) address of integer array (*ws_type*, *bundle_index*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (4) number of reals (0) number of strings (0) address of integer array (*error_status*, *control_flag*, *edge_type*, *color_index*) address of real array (*edge_width*) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

The input data record contains the following elements:

Component	Description
ws_type	The workstation type
bundle_index	The edge bundle index

The output data record contains the following elements:

Component	Description
error_status	The error status
control_flag	The edge control flag
edge_type	The edge type
color_index	The edge color index
edge_width	The edge width scale factor

–356 Inquire Maximum Number of Edge Bundles

Operating States for DEC GKS: GKOP, WSOP, WSAC, SGOP
Supporting Workstations: All DEC GKS workstations

This escape writes the maximum number of edge bundle table entries for the specified workstation type to the output data record.

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (1) number of reals (0) number of strings (0) address of integer array (*ws_type*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (2) number of reals (0) number of strings (0) address of integer array (*error_status*, *max_num_bundles*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

The input data record contains the following element:

Component	Description
ws_type	The workstation type

The output data record contains the following elements:

Component	Description
error_status	The error status
max_num_bundles	The maximum number of edge bundle table entries

–358 Inquire List of Highlighting Methods

Operating States for DEC GKS: GKOP
Supporting Workstations: All DEC GKS workstations

This escape returns the list of supported segment and primitive highlighting methods.

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (1) number of reals (0) number of strings (0) address of integer array (*ws_type*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (3 + *total_methods*) number of reals (0) number of strings (0) address of integer array (*error_status*, *total_methods*, *ret_methods*, *methods_list*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

The input data record contains the following element:

Component	Description
ws_type	The workstation type

–358 Inquire List of Highlighting Methods

The output data record contains the following elements:

Component	Description
error_status	The error status
total_methods	The total number of highlighting methods supported by the workstation type
ret_methods	The number of highlighting methods written to the remaining elements of the output data record's integer array
methods_list	The list of highlighting methods

–359 Inquire Edge Representation

Operating States for DEC GKS: WSOP, WSAC, SGOP
Supporting Workstations: All DEC GKS workstations

This escape returns the edge bundle representation for a given workstation.

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (3) number of reals (0) number of strings (0) address of integer array (*ws_id*, *bundle_index*, *set_realized*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (4) number of reals (0) number of strings (0) address of integer array (*error_status*, *control_flag*, *edge_type*, *color_index*) address of real array (*edge_width*) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

The input data record contains the following elements:

Component	Description
ws_id	The workstation identifier
bundle_index	The edge bundle index
set_realized	The return type of the values—either SET or REALIZED

The output data record contains the following elements:

Component	Description
error_status	The error status
control_flag	The edge control flag
edge_type	The edge type
color_index	The edge color index
edge_width	The edge width scale factor

–360 Inquire Language Identifier

Operating States for DEC GKS: WSOP, WSAC, SGOP
Operating States for DEC PHIGS: PHOP, WSOP, *, *
Supporting Workstations: All workstations

This escape returns the language identifier that is associated with the environment option.

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (3) number of reals (0) number of strings (0) address of integer array (*error_status*, *flag*, *lang_id*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

The output data record contains the following elements:

Component	Description
error_status	The error status.
flag	If you defined the environment option correctly, this argument is TRUE (value 1). Otherwise, this argument is FALSE (value (0)).
lang_id	The language identifier.

–400 Evaluate NDC Mapping of a WC Point

Operating States for DEC GKS: GKOP, WSOP, WSAC, SGOP
Supporting Workstations: All DEC GKS workstations

This escape accepts a world coordinate point and a normalization transformation number, and writes the corresponding normalized device coordinate point value to the output data record.

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (1) number of reals (2) number of strings (0) address of integer array (*norm_xform*) address of real array (NULL) address of real array (*x_value*, *y_value*) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (0) number of reals (2) number of strings (0) address of integer array (NULL) address of real array (*nx_value*, *ny_value*) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

The input data record contains the following element:

Component	Description
norm_xform	The normalized transformation number
x_value	The *x*-coordinate value of a world coordinate point
y_value	The *y*-coordinate value of a world coordinate point

The output data record contains the following elements:

Component	Description
nx_value	The *x*-coordinate value of the corresponding normalized device coordinate point
ny_value	The *y*-coordinate value of the corresponding normalized device coordinate point

–401 Evaluate DC Mapping of an NDC Point

Operating States for DEC GKS: WSOP, WSAC, SGOP
Supporting Workstations: All DEC GKS workstations

This escape accepts a normalized device coordinate point, calculates the corresponding device coordinate point using the current workstation transformation, and writes the device coordinate value to the output data record.

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (1) number of reals (2) number of strings (0) address of integer array (*ws_id*) address of real array (*x_value*, *y_value*) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (0) number of reals (2) number of strings (0) address of integer array (NULL) address of real array (*dx_value*, *dy_value*) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

The input data record contains the following elements:

Component	Description
ws_id	The workstation identifier
x_value	The *x*-coordinate value of a normalized device coordinate point
y_value	The *y*-coordinate value of a normalized device coordinate point

The output data record contains the following elements:

Component	Description
dx_value	The *x*-coordinate value of the corresponding device coordinate point
dy_value	The *y*-coordinate value of the corresponding device coordinate point

–402 Evaluate WC Mapping of an NDC Point

Operating States for DEC GKS: GKOP, WSOP, WSAC, SGOP
Supporting Workstations: All DEC GKS workstations

This escape accepts a normalized device coordinate point and a normalization transformation number, calculates the corresponding world coordinate point, and writes the world coordinate value to the output data record.

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (1) number of reals (2) number of strings (0) address of integer array (*norm_xform*) address of real array (*x_value*, *y_value*) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (0) number of reals (2) number of strings (0) address of integer array (NULL) address of real array (*wx_value*, *wy_value*) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

The input data record contains the following elements:

Component	Description
norm_xform	The normalized transformation number to use to map the normalized device coordinate point to world coordinate points
x_value	The *x*-coordinate value of a normalized device coordinate point
y_value	The *y*-coordinate value of a normalized device coordinate point

The output data record contains the following elements:

Component	Description
wx_value	The *x*-coordinate value of the corresponding world coordinate point
wy_value	The *y*-coordinate value of the corresponding world coordinate point

–403 Evaluate NDC Mapping of a DC Point

Operating States for DEC GKS: GKOP, WSOP, WSAC, SGOP
Supporting Workstations: All DEC GKS workstations

This escape accepts a device coordinate point, calculates the corresponding normalized device coordinate point using the current workstation transformation, and writes the device coordinate value to the output data record.

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (1) number of reals (2) number of strings (0) address of integer array (*ws_id*) address of real array (*x_value*, *y_value*) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (0) number of reals (2) number of strings (0) address of integer array (NULL) address of real array (*nx_value*, *ny_value*) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

The input data record contains the following elements:

Component	Description
ws_id	The workstation identifier
x_value	The *x*-coordinate value of a device coordinate point
y_value	The *y*-coordinate value of a device coordinate point

The output data record contains the following elements:

Component	Description
nx_value	The *x*-coordinate value of the corresponding normalized device coordinate point
ny_value	The *y*-coordinate value of the corresponding normalized device coordinate point

–404 Inquire Extent of a GDP

Operating States for DEC GKS: WSOP, WSAC, SGOP
Supporting Workstations: All DEC GKS workstations

This escape writes the coordinate range, representing the GDP extent rectangle, to its output data record.

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (4) number of reals (0) number of strings (0) address of integer array (*gdp_info*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (3) address of generic pointer array (address of *gdp_info.x_points*) number of longs (0) address of long array (NULL)
out_data	number of integers (1) number of reals (4) number of strings (0) address of integer array (*error_status*) address of real array (*coord_range*) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

The *gdp_info* structure is defined, in C terms, as follows:

```
struct {
  Gint      ws_id;             /* workstation identifier */
  Gint      num_points;        /* number of points that define the GDP */
  Gint      gdp_id;            /* GDP identifier */
  Gint      gdp_rec_size;      /* size of the GDP data record, in bytes */
  Gfloat   *x_points;          /* address of the array containing the GDP
                                  x points */
  Gfloat   *y_points;          /* address of the array containing the GDP
                                  y points */
  Ggdprec  *gdp_rec_address;   /* address of the GDP data record */
} gdp_info;
```

The output data record contains the following elements:

Component	Description
error_status	The error status
coord_range	The four world coordinate values of the segment's extent rectangle, using the current transformation values

–440 Set Connection Identifier String

Operating States for DEC GKS: GKOP, WSOP, WSAC, SGOP
Supporting Workstations: All workstations

This escape can only be used by application programs that use the Fortran binding.

This escape sets the connection identifier string to be used in the next call to OPEN WORKSTATION. If multiple calls to OPEN WORKSTATION are to be made, this escape should be called before each OPEN WORKSTATION call.

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (0) number of reals (0) number of strings (1) address of integer array (0) address of real array (0) address of string length array (*length_of_new_string*) address of string pointer array (*conid*) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

The input data record contains the following elements:

Component	Description
length_of_new_string	Length of the new connection identifier string
conid	The connection identifier string

Example B–1 illustrates how a data record is packed with a connection identifier and how the escape function is called.

Example B–1 Using the Fortran Escape Function –440

```
*     PROGRAM FB_ESC_EXAMPLE

      INCLUDE   'SYS$LIBRARY:GKS$FORBND.FOR'
      INTEGER      WKID, KCONID, WSTYPE
      PARAMETER   (WKID = 1, KCONID = 0, WSTYPE = 211)
      INTEGER      FCTID, LIDR, MLODR, LODR
      INTEGER      IL, IA, RL, RA, SL, LSTR(1), ERRIND, LDR
      CHARACTER*80 IDR(ID), STR(1), ODR
      REAL X(2), Y(2), Z(2)

*     INIT GKS
      CALL GOPKS  (1, 10000)

*     Define the conid string by use of Pack record and the Fortran binding
*     Escape function --440. Here it is a remote DECwindows server.
      IL = 0
      IA = 0
      RL = 0
      RA = 0
      SL = 1
      MLDR = 10
      LSTR(1) = LEN ('NODE::0.0')
      STR(1) = 'NODE::0.0'
      CALL GPREC (IL, IA, RL, RA, SL, LSTR, STR, MLDR, ERRIND, LDR, IDR )

      FCTID = --440
      MLODR = 0
      LODR  = 0
      CALL GESC (FCTID, LDR, IDR, MLODR, LODR, ODR )

*     Open and Activate the Workstation
      CALL GOPWK (WKID, KCONID, WSTYPE)
      CALL GACWK (WKID)
      CALL GSDS  (WKID, 0, 1)
*     Draw the object
      CALL GSLWSC (2.0)
      CALL GSPLCI (2)
      CALL GCRSG (1)
      Z(1) =  0.0
      Z(2) =  0.0
      X(1) =  0.0
      Y(1) =  0.0
      X(2) =  1.0
      Y(2) =  1.0
      CALL GPL3 (2, X, Y, Z)
      CALL GCLSG
      PAUSE

20    CONTINUE
      CALL GDAWK (WKID)

      CALL GCLWK (WKID)
      CALL GCLKS
      END
```

–500 Set Double Buffering

Operating States for DEC GKS: WSOP, WSAC, SGOP
Operating States for DEC PHIGS: PHOP, WSOP, *, *
Supporting Workstations: All DECwindows, PEX, and OSF/Motif workstations

This escape sets the double buffering state to either ON or OFF.

For DECwindows and OSF/Motif workstations, if double buffering is turned ON using the escape function, an optional third integer should exist. If the third integer is not present, the pixmap is initialized by copying the pixmap from the window. If the third integer is present and equal to the value 1, the pixmap is explicitly cleared and initialized by redrawing from the display list.

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (2) number of reals (0) number of strings (0) address of integer array (*ws_id*, *control_flag*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

The input data record contains the following elements:

Component	Description
ws_id	The workstation identifier
control_flag	A flag that indicates whether double buffering is enabled (1) or disabled (0)

–501 Set Background Pixmap

Operating States for DEC GKS: WSOP, WSAC, SGOP
Operating States for DEC PHIGS: PHOP, WSOP, *, *
Supporting Workstations: All DECwindows, PEX, and OSF/Motif workstations

On DECwindows, PEX, and OSF/Motif workstations, the pixmap is defined as the background image. When you specify a background pixmap, DEC GKS or DEC PHIGS creates a pixmap and copies the application-specified background pixmap to its own pixmap. After this call, DEC GKS or DEC PHIGS never references the application pixmap.

To modify the background pixmap, inquire the DEC GKS or DEC PHIGS background pixmap identifier and then modify it.

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (1) number of reals (0) number of strings (0) address of integer array (*ws_id*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (1) address of long array (*pixmap_id*)
out_data	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

The input data record contains the following elements:

Component	Description
ws_id	The workstation identifier
pixmap_id	The pixmap identifier

–502 Inquire Double Buffer Pixmap

Operating States for DEC GKS: WSOP, WSAC, SGOP
Operating States for DEC PHIGS: PHOP, WSOP, *, *
Supporting Workstations: All DECwindows, PEX, and OSF/Motif workstations

When double buffering is enabled on the DECwindows, PEX, and OSF/Motif workstations, DEC GKS or DEC PHIGS writes to a pixmap. This escape queries the X11 pixmap identifier, so the application can write to that pixmap.

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (1) number of reals (0) number of strings (0) address of integer array (*ws_id*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (1) address of long array (*pixmap_id*)

The input data record contains the following element:

Component	Description
ws_id	The workstation identifier

The output data record contains the following element:

Component	Description
pixmap_id	The pixmap identifier

–503 Inquire Background Pixmap

Operating States for DEC GKS: WSOP, WSAC, SGOP
Operating States for DEC PHIGS: PHOP, WSOP, *, *
Supporting Workstations: All DECwindows, PEX, and OSF/Motif workstations

When double buffering is enabled and a background pixmap is defined on the DECwindows, PEX, and OSF/Motif workstations, this escape allows the application to query the pixmap identifier.

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (1) number of reals (0) number of strings (0) address of integer array (*ws_id*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (1) address of long array (*pixmap_id*)

The input data record contains the following element:

Component	Description
ws_id	The workstation identifier.

The output data record contains the following element:

Component	Description
pixmap_id	The pixmap identifier

–508 Set Anti-Alias Mode

Operating States for DEC PHIGS: PHOP, WSOP, *, *
Supporting Workstations: DECstation 5000 series (modes 1 and 2) and VAXstation 4000/xx SPXg/SPXgt (modes 1 and 3) workstations

This escape allows you to enable anti-aliasing mode for a workstation. If the flag in the input data record is set to 0, anti-aliasing will be disabled. If the flag is set to 1, anti-aliasing will be enabled. The change takes effect at the next structure traversal or at the next call to the immediate mode function BEGIN RENDERING.

See Section 11.2.2 for more information on using anti-aliasing on PEX workstations.

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (2) number of reals (0) number of strings (0) address of integer array (*ws_id*, *anti_alias_mode*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

The input data record contains the following elements:

Component	Description
ws_id	The workstation identifier
anti_alias_mode	A flag that specifies whether anti-aliasing is enabled (1) or disabled (0)

–509 Set Line Pattern

Operating States for DEC PHIGS: PHOP, WSOP, *, *
Supporting Workstations: PEX and OSF/Motif workstations except the VAXstation 3500 series

This escape allows you to specify line patterns in addition to those provided by the SET LINE TYPE function: solid, dotted, dotted and dashed-dotted. The line pattern is described as a series of segments, alternately drawn in foreground and background colors. If you specify an odd number of segments, the pattern is repeated to make an even number.

Restrictions:

- This is supported only on PEX and OSF/Motif workstations except the VAXstation 3500 series. Other implementations will return an invalid escape error.
- Each segment length must be in the range from 1 to 255.
- The segments are specified in terms of pixels. The total of all segments must be 16 pixels. Unspecified pixels default to background.
- The *phase_start* must be 0. Any other value will be ignored.

ESCAPE Arguments:

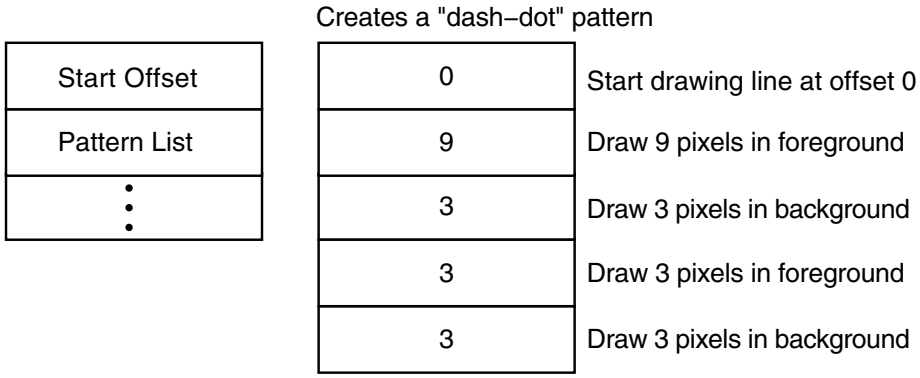
Argument	Required Value
in_data	number of integers (4 + num_segments) number of reals (0) number of strings (0) address of integer array (*ws_id*, *linetype*, *num_segments*, *phase_start*, *seg_length1*, *seg_length2* . . . *seg_length_last*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

The input data record contains the following elements:

Component	Description
ws_id	The workstation identifier.
linetype	The line type.
num_segments	The number of segments.
phase_start	The phase start. This must be 0.
seg_length1	The length of the first segment, in pixels.
seg_length2	The length of the second segment, in pixels.
.	
.	
.	
seg_length_last	The length of the last segment, in pixels.

Figure B–1 illustrates how the line pattern data is arranged. The example on the left shows the empty data vector, where the start offset is the first element, and the remaining elements specify the pattern list. The example on the right shows a sample data vector with filled elements.

Figure B–1 Integer Data Vector Format



–511 Set Plane Mask

Operating States for DEC PHIGS: PHOP, WSOP, *, *
Supporting Workstations: DECwindows, PEX, and OSF/Motif workstations

This escape allows an application to restrict the planes to which the display is rendered. By default, all planes are used. The plane mask does not affect Z-buffering.

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (1) number of reals (0) number of strings (0) address of integer array (*ws_id*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (1) address of long array (*plane_mask*)
out_data	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

The input data record contains the following elements:

Component	Description
ws_id	The workstation identifier
plane_mask	The plane mask

–512 Set Marker Pattern

Operating States for DEC PHIGS: PHOP, WSOP, *, *
Supporting Workstations: PEX and OSF/Motif workstations

This escape allows an application to define a new marker pattern. Valid marker type numbers are –1 to –128.

The marker is defined using a 16-element array of 16 bit values, with the low order bit on the left. Each word specifies a row of the marker. The center of the marker is specified by the *offset_x* and *offset_y* values measured from the upper left corner of the marker, with positive *y* increasing downward. Marker scale is ignored when rendering user-defined marker patterns.

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (4) number of reals (0) number of strings (0) address of integer array (*ws_id*, *marker_type*, *offset_x*, *offset_y*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (1) address of generic pointer array (address of 16-element word array for the pattern) number of longs (0) address of long array (NULL)
out_data	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

The input data record contains the following elements:

Component	Description
ws_id	The workstation identifier.
marker_type	The marker type. The valid values for this element are –1 to –128.
offset_x	The *x* offset to the center of the marker.
offset_y	The *y* offset to the center of the marker.

–513 Inquire Double Buffer Buffers

Operating States for DEC PHIGS: PHOP, WSOP, *, *
Supporting Workstations: PEX and OSF/Motif workstations

Fetches the buffers used for Massachusetts Institute of Technology (MIT) double buffering. This allows applications to use these buffers for their own purposes, such as providing backing store.

If MIT double buffering is not being used, 0 is returned for all values.

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (1) number of reals (0) number of strings (0) address of integer array (*ws_id*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (1) number of reals (0) number of strings (0) address of integer array (*buffer_index*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (2) address of long array (*front_buffer*, *back_buffer*)

The input data record contains the following element:

Component	Description
ws_id	The workstation identifier

The output data record contains the following elements:

Component	Description
buffer_index	The current buffer index
front_buffer	The identifier for the front buffer
back_buffer	The identifier for the back buffer

–514 Set Swap Mode

Operating States for DEC PHIGS: PHOP, WSOP, *, *
Supporting Workstations: PEX and OSF/Motif workstations

This escape allows an application to control whether DEC PHIGS will automatically display the backing buffer when in double buffer mode.

If the flag is set to TRUE, DEC PHIGS disables the automatic display of the backing buffer. The application must call –515 Swap Buffers to force DEC PHIGS to display the backing buffer.

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (2) number of reals (0) number of strings (0) address of integer array (*ws_id*, *swap_mode*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

The input data record contains the following elements:

Component	Description
ws_id	The workstation identifier.
swap_mode	The swap mode flag. If the flag is set to 0, DEC PHIGS automatically displays the backing buffer. If the flag is set to 1, DEC PHIGS disables the automatic display of the backing buffer.

–515 Swap Buffers

Operating States for DEC PHIGS: PHOP, WSOP, *, *
Supporting Workstations: PEX and OSF/Motif workstations

This escape allows an application to force DEC PHIGS to display the backing buffer when in double buffer mode.

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (1) number of reals (0) number of strings (0) address of integer array (*ws_id*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

The input data record contains the following elements:

Component	Description
ws_id	The workstation identifier

–516 Inquire Closest Color

Operating States for DEC PHIGS: PHOP, WSOP, *, *
Supporting Workstations: PEX and OSF/Motif workstations

This escape allows an application to inquire an X11 color map index that DEC PHIGS has allocated and is closest to a specified color. This allows applications that combine X11 calls and DEC PHIGS calls to share color map entries more effectively.

The desired color may be specified as an indexed color or in any supported DEC PHIGS direct color format. Either the TRUE color approximation map (color approximation index 0) or any of the PSEUDO color approximation maps (color approximation index 1 to *n*) can be searched for a closest color match. Only the TRUE color approximation map can be searched for indexed colors.

ESCAPE Arguments:

The following table describes the data record format for an indexed color:

Argument	Required Value
in_data	number of integers (4) number of reals (0) number of strings (0) address of integer array (*ws_id*, *color_approx_index*, *indexed_color_model*, *color_index*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (2) address of long array (*colormap_id*, *pixel*)

The input data record contains the following elements:

Component	Description
ws_id	The workstation identifier
color_approx_index	The color approximation index
indexed_color_model	The indexed color model
color_index	The color index

The output data record contains the following elements:

Component	Description
colormap_id	The X11 color map identifier
pixel	The X11 pixel

The following table describes the data record format for a direct color:

Argument	Required Value
in_data	number of integers (3) number of reals (3) number of strings (0) address of integer array (*ws_id*, *color_approx_index*, *color_model*) address of real array (*color_triple*) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (2) address of long array (*colormap_id*, *pixel*)

The input data record contains the following elements:

Component	Description
ws_id	The workstation identifier
color_approx_index	The color approximation index
color_model	The direct color model
color_triple	The color values

The output data record contains the following elements:

Component	Description
colormap_id	The X11 color map identifier
pixel	The X11 pixel

–517 Inquire Vendor String

Operating States for DEC PHIGS: PHOP, WSOP, *, *
Supporting Workstations: DECstation 5000/200 PXG series workstations

This escape allows an application to inquire what server platform the client (vendor) is connected to. This information includes such things as the model number, software version number, and hardware options.

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (1) number of reals (0) number of strings (0) address of integer array (*ws_id*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (0) number of reals (0) number of strings (1) address of integer array (NULL) address of real array (NULL) address of string lengths array (*vendor_string_length*) address of string pointer array (*vendor_string*) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

The input data record contains the following element:

Component	Description
ws_id	The workstation identifier

The output data record contains the following elements:

Component	Description
vendor_string_length	The length of the vendor string
vendor_string	The vendor string

–520 Set PEX Begin Render Clear Action

Operating States for DEC PHIGS: PHOP, WSOP, *, *
Supporting Workstations: PEX workstations

This escape allows an application to control whether DEC PHIGS performs the following actions:

- Clear the image buffer
- Clear the Z-buffer
- Which regions to clear (specified in device coordinates)

The real array contains *num_clip* sets of 4 reals (XMIN, YMIN, XMAX, YMAX). The values are in device coordinates (meters). To clip a pair of rectangular regions 0.1 meters in size, one with its corner at the origin and the other at the upper corner of the former, the array would contain (0.0, 0.0, 0.1, 0.1, 0.1, 0.1, 0.2, 0.2), where (0.0, 0.0, 0.1, 0.1) is the first clip region and (0.1, 0.1, 0.2, 0.2) is the second clip region.

The Z clear control capability is present only on Digital PEX platforms. On other PEX platforms, it will revert to default PEX behavior. If the image (I) clear is not present on the PEX platform, DEC PHIGS can perform a requested clear. The clipping rectangles work on all platforms.

This escape will not cause the swapping of double buffers. To perform that action, either call UPDATE WORKSTATION (while not rendering) or use –515 Swap Buffers to force the swap (if double buffering is enabled).

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (4) number of reals (*num_clip**4) number of strings (0) address of integer array (*ws_id*, *clear_I*, *clear_Z*, *num_clip*) address of real array (*num_clip**4 reals) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

Argument	Required Value
out_data	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

The input data record contains the following elements:

Component	Description
ws_id	The workstation identifier.
clear_I	An integer specifying whether to clear the image at each call to BEGIN RENDER. The possible values are as follows: • PEX_IMM_CLR_I_NOCLEAR (0)—Do not clear. This is the default value. • PEX_IMM_CLR_I_CLEAR (1)—Clear. • PEX_IMM_CLR_I_DEFAULT (2)—Return DEC PHIGS to its default behavior.
clear_Z	A Boolean specifying whether to clear the Z-buffer at each call to BEGIN RENDER. The possible values are as follows: • PEX_IMM_CLR_Z_NOCLEAR (0)—Do not clear. • PEX_IMM_CLR_Z_CLEAR (1)—Clear. This is the default value.
num_clip	The number of clip regions to be set. If this value is 0, DEC PHIGS uses the whole window as the clip region.

See the appropriate language definition file for a list of the constants and values to be used with this escape.

–521 Set PEX Clear Region

Operating States for DEC PHIGS: PHOP, WSOP, *, *
Supporting Workstations: VS3100/SPX and DECstation 5000 series, and VAXstation 4000/xx SPXgt PEX workstations

This escape allows you to clear a region during an immediate mode rendering on a PEX workstation. It also allows you to control whether DEC PHIGS should clear the image or Z-buffer. By default, this escape implicitly sets the clip region to the specified region but performs no clearing. You could use this escape to handle exposure events. This escape implicitly causes a *begin rendering* to cause these actions to occur.

The real array contains *num_clip* sets of 4 reals (XMIN, YMIN, XMAX, YMAX). The values are in device coordinates (meters). To clear a pair of rectangular regions .1 meters in size, one with its corner at the origin and the other at the upper corner of the former, the array would contain (0.0, 0.0, 0.1, 0.1, 0.1, 0.1, 0.2, 0.2), where (0.0, 0.0, 0.1, 0.1) is the first clip region and (0.1, 0.1, 0.2, 0.2) is the second clip region.

The Z clear control capability is present only on Digital PEX platforms. On other PEX platforms, it will revert to default PEX behavior. If the image (I) clear is not present on the PEX platform, use a requested clear. The clipping rectangles work on all platforms.

In addition, this escape will not cause the swapping of double buffers. To perform that action, use –515 Swap Buffers to force the swap (if double buffering is enabled).

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (4) number of reals (*num_clip**4) number of strings (0) address of integer array (*ws_id*, *clear_I*, *clear_Z*, *num_clip*) address of real array (*num_clip**4 reals) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

Argument	Required Value
out_data	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

The input data record contains the following elements:

Component	Description
ws_id	The workstation identifier.
clear_I	A Boolean specifying whether to clear the image. The possible values are as follows: • PEX_IMM_CLR_I_NOCLEAR (0)—Do not clear. This is the default value. • PEX_IMM_CLR_I_CLEAR (1)—Clear.
clear_Z	A Boolean specifying whether to clear the Z-buffer. This element must be specified. The possible values are as follows: • PEX_IMM_CLR_Z_NOCLEAR (0)—Do not clear. • PEX_IMM_CLR_Z_CLEAR (1)—Clear.
num_clip	The number of clip regions to be set. If this value is 0, DEC PHIGS uses the whole window as the clip region.

See the appropriate language definition file for a list of constants and values to be used with this escape.

–522 Set Transparency

Operating States for DEC PHIGS: PHOP, WSOP, *, *
Supporting Workstations: VS3100 SPX, PXG, and ZLX series, and DECstation 5000 series, and VAXstation 4000/xx SPXgt PEX workstations (when you use a 24-bit visual type)

This escape allows you to enable or disable transparency. If the transparency flag is 0, transparency is disabled. If the transparency flag is 1, transparency is enabled. The change takes effect at the next structure traversal, or at the next call to the immediate mode function BEGIN RENDERING.

In structure mode, DEC PHIGS automatically makes multiple passes during structure traversal to render the opaque and transparent polygons.

In immediate mode, the application needs to make multiple passes to render the opaque and transparent polygons. The immediate mode function END RENDERING returns either SUCCESS (indicates normal completion) or ERROR_NEG_1717 (indicates another pass is needed).

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (2) number of reals (0) number of strings (0) address of integer array (*ws_id*, *transparency_flag*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

–522 Set Transparency

The input data record contains the following elements:

Component	Description
ws_id	The workstation identifier
transparency_flag	A flag specifying whether transparency is disabled (0) or enabled (1)

–523 Set BQUM Range

Operating States for DEC PHIGS: PHOP, WSOP, *, *
Supporting Workstations: All

This escape allows a DEC PHIGS application to perform multiple edit operations within the currently open structure that result in a single quick update action. A quick update action is defined as being one traversal to erase one or more primitives that are affected by the edit, followed by a second traversal to redraw primitives affected by the edits. This assumes that the structure is currently posted to a workstation and the workstation is in quick update mode. Such a function is useful when an application wants to change two attributes of a primitive (for example, color and current local transformation), but would like a single quick update to happen as a result of the two edits.

The Set BQUM (Batch Quick Update Method) Range escape uses a three step process:

1. Call Set BQUM Range to activate a watch range.
2. Carry out all edits to be batched.
3. Call Set BQUM Range to deactivate the watch range.

After step 3 is completed, DEC PHIGS will have initiated a quick update erase traversal, followed by a quick update draw traversal. For the erase traversal, DEC PHIGS will accumulate the pipeline state up to the element just before the starting element of the watch range, then erase all primitives defined within the watch range. The watch range is a closed interval (range includes end points).

For the draw traversal, DEC PHIGS will use the same pipeline state as was used for the erase traversal, then redraw all primitives within the watch range. If after the watch range is activated, the application edits elements that have an offset smaller than the start of the watch range, those edits may not have any effect on the quick update.

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (4) number of reals (0) number of strings (0) address of integer array (*watch_state*, *watch_id*, *offset_start*, *offset_end*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

Argument	Required Value
out_data	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

The input data record contains the following elements:

Component	Description
watch_state	The watch state. DEC PHIGS activates the watch range if this value is 1, and deactivates the watch range if this value is 0.
watch_id	DEC PHIGS ignores this argument. The escape can only be called when a structure is open, and DEC PHIGS assumes the range is within the currently open structure.
offset_start	The offset start, in the range 0 to n + 1, where n is the current number of elements in the open structure.
offset_end	The offset end, in the range 0 to n, where n is the current number of elements in the open structure.

If you pass a value for either offset that is less than the allowable range, the offset is set to the low end of the range. Similarly, if you pass a value for either offset that is greater than the allowable range, the offset is set to the high end of the allowable range.

The watch range is a closed interval. This means that the watch range is null when the ending offset is equal to one less than the starting offset. This also means that the *offset_end* must be greater than or equal to the *offset_start*–1.

As a result of the edits done between the activate BQUM range and deactivate BQUM range, the watch range starting and ending offsets can change. Elements inserted just before and just after the watch range are included in the watch range. If the starting element is deleted, the starting offset is incremented. If the ending element is deleted, the ending offset is decremented. If the entire watch range is deleted, the starting offset is set to be one greater than the end of the watch range, and the ending offset is unchanged.

DEC PHIGS will only honor an application's request to activate a BQUM range under the following conditions:

- The current display update modification mode is UQUM.
- The current state of visual representation is CORRECT or SIMULATED.

- A structure is currently open.
- The currently opened structure is posted.

The following events result in an implicit deactivation of the current BQUM range:

- Close structure
- Empty structure
- Post structure
- Delete all structures, delete structure
- Unpost structure, unpost all structures
- Activation of another BQUM range

Note that the last condition implies that if an application has an active BQUM range and wants to replace the range, it needs to activate only the new range.

When an implicit or explicit regeneration is done while a BQUM range is active, DEC PHIGS will carry out the regeneration and reactivate the BQUM range. Note that the state of visual representation changes to SIMULATED for any structure edits that are done once a BQUM range becomes active.

–524 Inquire BQUM Range

Operating States for DEC PHIGS: PHOP, WSOP, *, *
Supporting Workstations: All

This escape allows a DEC PHIGS application to determine if DEC PHIGS honored its request to activate a BQUM range.

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (4) number of reals (0) number of strings (0) address of integer array (*watch_state*, *watch_id*, *offset_start*, *offset_end*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

The output data record contains the following elements:

Component	Description
watch_state	The watch state. If the value is 1, the watch ranger is active. If it is 0, the watch range is not active.
watch_id	DEC PHIGS ignores this argument. The escape can be called only when a structure is open, and DEC PHIGS assumes the range is within the currently open structure.
offset_start	The offset start, in the range 0 to $n + 1$, where n is the current number of elements in the open structure.
offset_end	The offset end, in the range 0 to n, where n is the current number of elements in the open structure.

The watch range is a closed interval. This means that the watch range is null when the ending offset is equal to one less than the starting offset. This also means that the *offset_end* must be greater than or equal to the *offset_start*–1.

As a result of the edits done between the activate BQUM range and deactivate BQUM range, the watch range starting and ending offsets can change. Elements inserted just before and just after the watch range are included in the watch range. If the starting element is deleted, the starting offset is incremented. If the ending element is deleted, the ending offset is decremented. If the entire watch range is deleted, the starting offset is set to be one greater than the end of the watch range, and the ending offset is unchanged.

–525 Set BQUM Flags

Operating States for DEC PHIGS: PHOP, WSOP, *, *
Supporting Workstations: All

This escape allows a DEC PHIGS application to set two flags in all currently open workstations that determine whether quick update erase and quick update draw traversals are performed for BQUMs.

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (2) number of reals (0) number of strings (0) address of integer array (*erase_flag*, *draw_flag*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

The input data record contains the following elements:

Component	Description
erase_flag	The erase flag. When this argument is FALSE (0), all erase traversals (that are normally done as part of BQUMs) are suppressed. When this argument is TRUE (1), all erase traversals are enabled.
draw_flag	The draw flag. When this argument is FALSE (0), all draw traversals (that are normally done as part of BQUMs) are suppressed. When this argument is TRUE (1), all draw traversals are enabled.

These flags are useful when the application knows what the visual effect of an edit will be. For example, if the application is trying to highlight a primitive through BQUMs, it can set the erase flag to FALSE. In this case, carrying out

the erase traversal does nothing to enhance the quality of the quick update, and slows down performance.

Unlike the Set BQUM Range escape, you can call Set BQUM Flags just after OPEN WORKSTATION and the flag will remain in affect for BQUMs until the workstation is closed. Note that DEC PHIGS makes no attempt to remember the state of the erase and draw flags if a workstation is closed. Each time a workstation is opened, the erase and draw flags are initialized to be TRUE.

–526 Inquire BQUM Flags

Operating States for DEC PHIGS: PHOP, WSOP, *, *
Supporting Workstations: All

This escape allows a DEC PHIGS application to inquire the values of the erase and draw flags.

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (2) number of reals (0) number of strings (0) address of integer array (*erase_flag*, *draw_flag*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

The input data record contains the following elements:

Component	Description
erase_flag	The erase flag. When this argument is FALSE (0), all erase traversals (that are normally done as part of BQUMs) are suppressed. When this argument is TRUE (1), all erase traversals are enabled.
draw_flag	The draw flag. When this argument is FALSE (0), all draw traversals (that are normally done as part of BQUMs) are suppressed. When this argument is TRUE (1), all draw traversals are enabled.

–528 Toggle Double Buffering Target

Operating States for DEC PHIGS: PHOP, WSOP, *, *
Supporting Workstations: All DECwindows, PEX, and OSF/Motif workstations

This escape allows an application to write to the front buffer when double buffering is enabled. This escape does not use any information in the input or output data records, but you should initialize the values to NULL.

The following restrictions apply:

- This escape works only for immediate mode applications.
- You must disable automatic double buffering swapping using –514 Set Swap Mode for this escape to work.
- The escape changes only a state variable, and will not take effect until the next call to BEGIN RENDERING.
- When you use this escape with pixmap double buffering, once you toggle the targets, you should toggle them back again before calling –515 Swap Buffers. If you do not, DEC PHIGS will not perform the escape.

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

–530 Set View Dirty Flag

Operating States for DEC PHIGS: PHOP, WSOP, *, *
Supporting Workstations: All

This escape allows the application to control which views in a workstation will be repainted when DEC PHIGS updates the workstation. The escape accepts pairs of view identifiers and flags. The view identifiers must be in the range 0 to 31. The flags must be either 0 (the view does not need to be updated) or 1 (the view needs to be updated).

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (2 + (2 * *num_views*)) number of reals (0) number of strings (0) address of integer array (*ws_id*, *num_views*, *view_id1*, *dirty_flag1*, *view_id2*, *dirty_flag2*, . . . , *view_id_last*, *dirty_flag_last*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

The input data record contains the following elements:

Component	Description
ws_id	The workstation identifier
num_views	The number of views to set
view_id1	The first view identifier
dirty_flag1	The first view dirty flag
view_id2	The second view identifier
dirty_flag2	The second view dirty flag
.	
.	
.	
view_id_last	The last view identifier
dirty_flag_last	The last view dirty flag

–531 Inquire View Dirty Flag

Operating States for DEC PHIGS: PHOP, WSOP, *, *
Supporting Workstations: All

This escape allows the application to inquire which views in a workstation will be repainted when DEC PHIGS updates the workstation. If the number of integers in the output integer array is less than 33, DEC PHIGS stores as many flags as possible, starting with view 0.

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (1) number of reals (0) number of strings (0) address of integer array (*ws_id*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (33) number of reals (0) number of strings (0) address of integer array (*error_status*, *dirty_flag1*, *dirty_flag2*, . . . , *dirty_flag_last*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

The input data record contains the following element:

Component	Description
ws_id	The workstation identifier

The output data record contains the following elements:

Component	Description
error_status	The error status
dirty_flag1	The first view dirty flag
dirty_flag2	The second view dirty flag
.	
.	
.	
dirty_flag_last	The last view dirty flag

–532 Render Element Range

Operating States for DEC PHIGS: PHOP, WSOP, *, *
Supporting Workstations: All

This escape allows the application to render a range of elements without entering immediate or quick update mode.

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (6) number of reals (0) number of strings (0) address of integer array (*ws_id*, *struct_id*, *start_whence*, *start_offset*, *end_whence*, *end_offset*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

The input data record contains the following elements:

Component	Description
ws_id	The workstation identifier.
struct_id	The structure identifier for the structure that contains the range to be rendered.
start_whence	Specifies what the start offset is relative to—PEXBeginning (0), PEXCurrent (1), or PEXEnd (2). This argument is for PEX workstations only.
start_offset	The offset to the element that starts the range to be rendered. For PEX workstations, the *start_whence* argument specifies the base of the offset. For all other workstations, the offset is from the beginning of the structure.

Component	Description
end_whence	Specifies what the end offset is relative to—PEXBeginning (0), PEXCurrent (1), or PEXEnd (2). This argument is for PEX workstations only.
end_offset	The offset to the element that ends the range to be rendered. For PEX workstations, the *end_whence* argument specifies the base of the offset. For all other workstations, the offset is from the beginning of the structure.

To use the constants PEXBeginning, PEXCurrent, and PEXEnd, include the file *PEX.h*, which includes the PEX C binding constants. If you are using another language, hard-code the values.

–533 Inquire Workstation Structure Memory

Operating States for DEC PHIGS: PHOP, WSOP, *, *
Supporting Workstations: All

This escape returns the memory used to hold structures on a per-workstation basis.

ESCAPE Arguments:

Argument	Required Value
in_data	number of integers (1) number of reals (0) number of strings (0) address of integer array (*ws_id*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
out_data	number of integers (6) number of reals (0) number of strings (0) address of integer array (*error_status*, *mem_total*, *struct_overhead*, *elem_overhead*, *prim_data*, *other_data*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)

The input data record contains the following element:

Component	Description
ws_id	The workstation identifier.

The output data record contains the following elements:

Component	Description
error_status	The error status
mem_total	The structure memory total
struct_overhead	The structure memory per structure overhead
elem_overhead	The structure memory per element overhead
prim_data	Structure memory primitive data
other_data	Other structure memory data

GDPs

C
GDPs

This appendix describes the DEC GKS supported generalized drawing primitives (GDPs). GDPs are output primitives you use to address special geometric workstation capabilities. Most of the GDPs are supported by all the DEC GKS workstations. For each GDP, this appendix indicates the supporting workstations.

All GDPs have negative values as identification numbers. (You pass the identification number to GENERALIZED DRAWING PRIMITIVE.) DEC GKS defines GDP constants in the definition file for your particular programming language.

For further information concerning the use of GDPs, see the control function GENERALIZED DRAWING PRIMITIVE in the DEC GKS binding manuals. The error codes appendix in each binding manual lists the errors that may be generated by using any GDP.

Some of the GDPs require additional information contained in a data record. All required data records must be passed to GENERALIZED DRAWING PRIMITIVE in the DEC GKS GDP standard data record format. For all GDPs, you must pass the exact data record size in bytes as specified in the descriptions in this appendix. If you do not, the call to GENERALIZED DRAWING PRIMITIVE generates an error.

Note

GDPs are supported only by DEC GKS. DEC PHIGS does not support GDPs.

C.1 Data Record Format

Each of the GDPs described in this appendix contains a list of arguments to the GDP function call, like the following sample list:

Argument	Required Value
n_points	3
pts_array	three points on the circumference
gdp_id	–199

Argument	Required Value
data_rec	number of integers (2) number of reals (1) number of strings (3) address of integer array (*int_value_1*, *int_value_2*) address of real array (*real_value_1*) address of string length array (*str_len_value_1*, *str_len_value_2*, *str_len_value_3*) address of string pointer array (*str_addr_value_1*, *str_addr_value_2*, *str_addr_value_3*) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
data_rec_len	sizeof (Ggdprec)

The data record portion of this GENERALIZED DRAWING PRIMITIVE description (*data_rec*) specifies that the data record has 11 components. The first component is an integer value (in this example, the value 2), specifying the number of valid elements in the integer array.

The next two components of the data record specify the number of valid elements in the real array (a value of 1) and the string arrays (a value of 3) of the data record.

The fourth component specifies the address of an integer array; the array itself contains the integers *int_value_1* and *int_value_2*. Each GDP description in this appendix describes the purpose of these integers. GENERALIZED DRAWING PRIMITIVE uses the address provided in the fourth component to locate the integer array.

The fifth component specifies the address of a real array; the array itself contains the integer *real_value_1*.

The sixth component specifies the address of a string length array; the array itself contains the integers *str_len_value_1*, *str_len_value_2* and *str_len_value_3*.

The seventh component specifies the address of a string address array; the array itself contains the integers *str_addr_value_1*, *str_addr_value_2* and *str_addr_value_3*.

Note

To place array addresses in the fourth, fifth, sixth, and seventh components of the data record, you need to use a technique specific to your programming language. For example, using DEC Fortran™, you can use the %LOC built-in function. For more information concerning addresses and pointers, see the documentation set for your programming language.

The eighth component is an integer value that specifies the number of valid pointers in the pointer array.

The ninth component of the data record specifies the address of the generic pointer array of the data record.

The tenth component is an integer value that specifies the number of valid longs in the pointer array.

The last component of the data record specifies the address of the long array of the data record.

C.2 Generalized Drawing Primitives (GDPs)

The following sections describe the generalized drawing primitives (GDPs) that DEC GKS supports. The sections identify each GDP by the following:

- The title of the primitive (for instance, "Circle")
- The list of supporting workstations
- The description of the primitive
- The list of the arguments passed to GENERALIZED DRAWING PRIMITIVE and the contents of the data record, if applicable
- The list of GDP-specific error messages, if applicable

To determine the constant equivalent of the numeric identifier, see the definition file for your programming language. For a list of possible GDP-specific error messages, see the DEC GKS binding manuals.

If you specify points to GENERALIZED DRAWING PRIMITIVE that cannot be used to uniquely define a primitive, you generate error number ERROR_NEG_158. For more information concerning error ERROR_NEG_158, see the individual GDP description in this appendix.

Most of the DEC GKS GDPs are capable of generating error number ERROR_100 (number of points is invalid in routine *name*). If it is not clear how a GDP can generate this error message, the description of the individual GDP provides additional information.

Note

In error messages, *name* is replaced by the name of the routine that generated the error.

The following information applies to all DEC GKS GDPs:

- DEC GKS applies normalization transformations to the world coordinate points of a specified GDP, but draws the GDP on the normalized device coordinate plane. This will sometimes cause unexpected results. For instance, if you include a rectangular GDP in a segment, and then rotate the segment, DEC GKS alters the coordinate points but still draws the sides of the rectangle parallel to the *x*- and *y*-axes. Also, when you specify coordinate values for circles, the current normalization transformation affects only the size of the circle, and does not alter the shape.
- All radius specifications constitute vector values. The only significance of the radius vector is its length in world coordinate points.
- You specify angles in radians. To calculate radians, use the formula *360 degrees = 2*pi radians*. Positive rotation is counterclockwise; negative rotation is clockwise.
- Some GDPs require vector values in the *x* and *y* coordinate arrays passed to GENERALIZED DRAWING PRIMITIVE. When you specify a vector value, you pass two sets of world coordinate points. DEC GKS calculates the distance, the angle, or both values, using the two specified points.

Using a GDP, you calculate all vectors from a single vector origin point. The vector origin point is the first point in a vector specification. You specify the second point of the vector specification in the *x* and *y* coordinate array that you pass to GENERALIZED DRAWING PRIMITIVE.

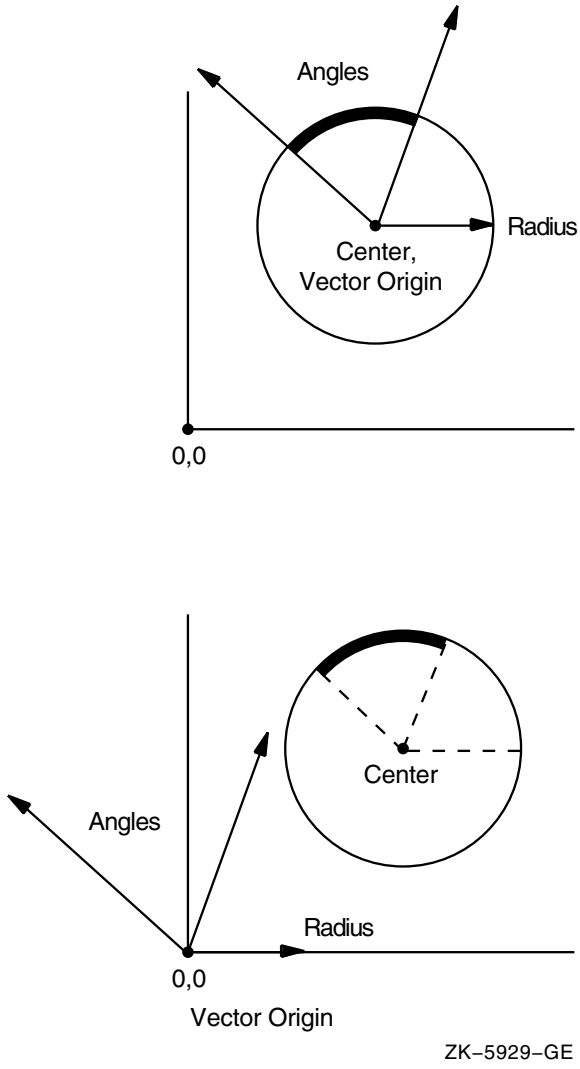
For instance, the GDP –108 (Arc: Center, 2 Vectors, and a Radius) requires, in the *x* and *y* coordinate array, the following values:

- The center point of the circular arc
- The vector origin point
- The second point in a vector whose angle determines an endpoint of the arc
- The second point in another vector whose angle determines another endpoint of the arc
- The second point in a third vector that specifies the distance used for the radius of the circular arc

DEC GKS calculates the vector values from the vector origin point to specified second points, and then applies those values to the center point of the circular arc.

Two useful vector origin points would be the center point of the arc or the origin of the world coordinate plane (0.0, 0.0). Using the center point of the arc would allow you to specify vector values in direct relation to the coordinates used to form the arc; using the origin of the world coordinate plane can make it easier for you to calculate vector values without tying them to the actual coordinate values of the arc. (For instance, the center of the arc may move due to altered normalization transformations, forcing you to keep altering your vector origin point according to the new position of the arc's center.) Figure C–1 illustrates the use of two different vector origin points.

Figure C–1 Using Vector Origin Points



The following information applies to specific types of GDPs:

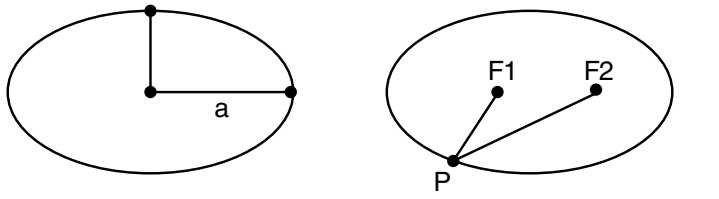
- Arc—When forming an arc, the DEC GKS GDPs begin at the first specified arc point and move towards the second point in a counterclockwise direction.
- Ellipse—You can form an ellipse in two ways. First, you can pass the center point and two axis vectors to GENERALIZED DRAWING PRIMITIVE. DEC GKS calculates which vector specifies the greater distance, and uses both the distance and angle values to form the major axis. Then, DEC GKS calculates the distance specified by the second vector and uses the distance for the minor axis.

To form an ellipse a second way, you can pass the two focal points and one point on the circumference of the ellipse to GENERALIZED DRAWING PRIMITIVE. If you pass the focal points to GENERALIZED DRAWING PRIMITIVE, DEC GKS uses the following formula to form the ellipse:

```
| focal_1 point |  +  | focal_2 point |  =  2a
```

The letter a equals the distance from the center point to the circumference along the major axis. Figure C–2 illustrates the formation of an ellipse.

Figure C–2 Forming an Ellipse



C.3 List of GDP Identifiers

This appendix presents the GDP identifiers in numerical order. Table C–1 lists the GDPs in alphabetical order and includes the corresponding GDP identifier.

Table C–1 Alphabetical Listing of GDPs

GDP Name	GDP Identifier
Arc: Center, and Two Points on Arc	–106
Arc: Center, Two Vectors, and Radius	–108
Arc: Starting Point and Angle	–110
Arc: Three Points on Circumference	–107
Arc: Two Points on Arc, and Radius	–109
Circle: Center, and Point on Circumference	–101
Circle: Center and Radius	–103
Circle: Three Points on Circumference	–102
Circle: Two Points on Circumference, and Radius	–104
Disjoint Polyline	–100
Ellipse: Center, and Two Axis Vectors	–111
Ellipse: Focal Points, and Point on Circumference	–113
Elliptic Arc: Focal Points, and Two Points on Arc	–116
Elliptic Arc: Two Axis Vectors, and Two Vectors	–114
Fill Area Set	–332

(continued on next page)

Table C–1 (Cont.) Alphabetical Listing of GDPs

GDP Name	GDP Identifier
Filled Arc: Center, and Two Points on Arc	–338
Filled Arc: Center, Two Vectors, and Radius	–340
Filled Arc: Center, Starting Point, and Angle	–342
Filled Arc: Three Points on Circumference	–339
Filled Arc: Two Points on Arc, and Radius	–341
Filled Circle: Center, and Point on Circumference	–333
Filled Circle: Center and Radius	–335
Filled Circle: Three Points on Circumference	–334
Filled Circle: Two Points on Circumference, and Radius	–336
Filled Ellipse: Center, and Two Axis Vectors	–343
Filled Ellipse: Focal Points, and Point on Circumference	–345
Filled Elliptic Arc: Center, Two Axis Vectors, and Two Vectors	–346
Filled Elliptic Arc: Focal Points, and Two Points on Arc	–348
Filled Rectangle: Two Corners	–349
Packed Cell Array	–400
Rectangle: Two Corners	–125

–100 Disjoint Polyline

Supporting Workstations: All DEC GKS workstations

This GDP creates a series of line segments connecting the first and second specified points, the third and fourth specified points, and so forth.

GDP Function Arguments:

Argument	Required Value
n_points	*n* points (two for each requested line segment)
pts_array	*n*, *x*, and *y* coordinate values
gdp_id	–100
data_rec	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (0) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
data_rec_len	0 bytes

Error Messages:

Error Number	Message and Meaning
–158	GDP primitive is not defined by the supplied data in routine *name*. For instance, if the center point and the point on the circumference are the same point, DEC GKS cannot form a circle.

–101 Circle: Center, and Point on Circumference

Supporting Workstations: All DEC GKS workstations

This GDP forms a circle from the specified center point and a single point on the circle's circumference.

GDP Function Arguments:

Argument	Required Value
n_points	2
pts_array	center and circumference point
gdp_id	–101
data_rec	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
data_rec_len	0 bytes

Error Messages:

Error Number	Message and Meaning
–158	GDP primitive is not defined by the supplied data in routine *name*. For instance, if the center point and the point on the circumference are the same point, DEC GKS cannot form a circle.

–102 Circle: Three Points on Circumference

Supporting Workstations: All DEC GKS workstations

This GDP draws the circle whose circumference includes the three specified points.

GDP Function Arguments:

Argument	Required Value
n_points	3
pts_array	three circumference points
gdp_id	–102
data_rec	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
data_rec_len	0 bytes

Error Messages:

Error Number	Message and Meaning
–158	GDP primitive is not defined by the supplied data in routine *name*. For instance, if the three points form a straight line, DEC GKS cannot generate a corresponding circle.

–103 Circle: Center and Radius

Supporting Workstations: All DEC GKS workstations

This GDP forms a circle from the specified center point and radius vector.

GDP Function Arguments:

Argument	Required Value
n_points	3
pts_array	center point, vector origin point, and radius vector endpoint
gdp_id	–103
data_rec	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
data_rec_len	0 bytes

Error Messages:

Error Number	Message and Meaning
–158	GDP primitive is not defined by the supplied data in routine *name*. For instance, if the radius vector specifies a distance of 0, then DEC GKS cannot generate a corresponding circle.

–104 Circle: Two Points on Circumference, and Radius

Supporting Workstations: All DEC GKS workstations

This GDP forms a circle from the specified circumference points and the radius vector point. The circle is drawn so that the circumference, clockwise from the first point to the second, is no greater than pi radians (half the circle).

GDP Function Arguments:

Argument	Required Value
n_points	4
pts_array	two points, vector origin point, and radius vector endpoint
gdp_id	–104
data_rec	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
data_rec_len	0 bytes

Error Messages:

Error Number	Message and Meaning
–158	GDP primitive is not defined by the supplied data in routine *name*. For instance, if the distance between points is more than twice the specified radius, then DEC GKS cannot form the circle.

–106 Arc: Center, and Two Points on Arc

Supporting Workstations: All DEC GKS workstations

This GDP forms a circular arc using the center point, the second point as a starting point of the arc, and the third point as one of the following components:

- The second point, located on the arc
- The second point of a ray (the first point is the center point), whose intersection with the circular path of the arc determines the second point of the arc

GDP Function Arguments:

Argument	Required Value
n_points	3
pts_array	center point, and the beginning and end points of the arc
gdp_id	–106
data_rec	number of integers (1) number of reals (0) number of strings (0) address of integer array (*arc_type*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
data_rec_len	sizeof (Ggdprec)

The integer array contains the following element:

Component	Description
arc_type	The arc type

The element *arc_type* can be any of the following values:

Value	Description
1	Form an arc.
2	Connect both ends of the arc to its center.
3	Connect the beginning and end points of the arc.

Error Messages:

Error Number	Message and Meaning
–158	GDP primitive is not defined by the supplied data in routine *name*. (For instance, the center point and one of the points on the circumference may be the same point.)
–159	Arc_type is invalid in routine *name*. (For instance, if you specify a value other than 1, 2, or 3.)

–107 Arc: Three Points on Circumference

Supporting Workstations: All DEC GKS workstations

This GDP forms the circular arc using a line beginning at the first point, running through the second point, and connecting to the third point.

GDP Function Arguments:

Argument	Required Value
n_points	3
pts_array	three points on the circumference
gdp_id	–107
data_rec	number of integers (1) number of reals (0) number of strings (0) address of integer array (*arc_type*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
data_rec_len	sizeof (Ggdprec)

The integer array contains the following element:

Component	Description
arc_type	The arc type

The element *arc_type* can be any of the following values:

Value	Description
1	Form an arc.
2	Connect both ends of the arc to its center.
3	Connect the beginning and end points of the arc.

Error Messages:

Error Number	Message and Meaning
–158	GDP primitive is not defined by the supplied data in routine *name*. (For instance, the three points may form a straight line.)
–159	Arc_type is invalid in routine *name*. (For instance, if you specify a value other than 1, 2, or 3.)

–108 Arc: Center, Two Vectors, and a Radius

Supporting Workstations: All DEC GKS workstations

This GDP forms a circular arc by using the two vectors to calculate directions from the center point. DEC GKS uses the vector direction to form rays whose angles, along with the radius value, determine the starting and ending points of the arc.

GDP Function Arguments:

Argument	Required Value
n_points	5
pts_array	center, vector origin point, two vectors points, and the radius vector point
gdp_id	–108
data_rec	number of integers (1) number of reals (0) number of strings (0) address of integer array (*arc_type*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
data_rec_len	sizeof (Ggdprec)

The integer array contains the following element:

Component	Description
arc_type	The arc type

The element *arc_type* can be any of the following values:

Value	Description
1	Form an arc.
2	Connect both ends of the arc to its center.
3	Connect the beginning and end points of the arc.

Error Messages:

Error Number	Message and Meaning
–158	GDP primitive is not defined by the supplied data in routine *name*. For instance, if the center point and the point on the circumference are the same point, DEC GKS cannot form a circle.
–159	Arc_type is invalid in routine *name*. (For instance, if you specify a value other than 1, 2, or 3.)

–109 Arc: Two Points on Arc, and Radius

Supporting Workstations: All DEC GKS workstations

This GDP forms an arc from the specified beginning and end points, and forms the radius vector point. The arc is drawn so that the circumference, clockwise from the first point to the second, is no greater than pi radians (half a circle).

GDP Function Arguments:

Argument	Required Value
n_points	4
pts_array	two points, vector origin point, and radius vector point
gdp_id	–109
data_rec	number of integers (1) number of reals (0) number of strings (0) address of integer array (*arc_type*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
data_rec_len	sizeof (Ggdprec)

The integer array contains the following element:

Component	Description
arc_type	The arc type

The element *arc_type* can be any of the following values:

Value	Description
1	Form an arc.
2	Connect both ends of the arc to its center.
3	Connect the beginning and end points of the arc.

Error Messages:

Error Number	Message and Meaning
–158	GDP primitive is not defined by the supplied data in routine *name*. (For instance, the number of specified points is not appropriate for the GDP function. For this GDP, two points that are not coincident are required.)
–159	Arc_type is invalid in routine *name*. (For instance, the specified arc type is not from the supported set OPEN, PIE, and CHORD.)

–110 Arc: Center, Starting Point, and Angle

Supporting Workstations: All DEC GKS workstations

This GDP forms an arc by using the distance between the center point and the arc starting point as the radius, and using the angle value to determine the endpoint of the arc.

GDP Function Arguments:

Argument	Required Value
n_points	2
pts_array	center and starting point
gdp_id	–110
data_rec	number of integers (1) number of reals (1) number of strings (0) address of integer array (*arc_type*) address of real array (*angle*) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
data_rec_len	sizeof (Ggdprec)

The argument *data_rec* contains the following elements:

Component	Description
arc_type	The arc type
angle	The angle, in radians

The element *arc_type* can be any of the following values:

Value	Description
1	Form an arc.
2	Connect both ends of the arc to its center.
3	Connect the beginning and end points of the arc.

Error Messages:

Error Number	Message and Meaning
–158	GDP primitive is not defined by the supplied data in routine *name*. For instance, if the center point and the point on the circumference are the same point, DEC GKS cannot form a circle.
–159	Arc_type is invalid in routine *name*. (For instance, the specified arc type is not from the supported set OPEN, PIE, or CHORD.)

–111 Ellipse: Center, and Two Axis Vectors

Supporting Workstations: All DEC GKS workstations

This GDP forms the ellipse using a center point, one vector to establish the distance and direction of the first axis, and a second vector to establish the distance of the second axis.

GDP Function Arguments:

Argument	Required Value
n_points	4
pts_array	center point, vector origin point, minor and major axis vectors
gdp_id	–111
data_rec	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
data_rec_len	0 bytes

Error Messages:

Error Number	Message and Meaning
–158	GDP primitive is not defined by the supplied data in routine *name*. (For instance, one of the vectors may have a length of 0.)

–113 Ellipse: Focal Points, and Point on Circumference

Supporting Workstations: All DEC GKS workstations

This GDP forms the ellipse using the two focal points and a single point on the circumference.

GDP Function Arguments:

Argument	Required Value
n_points	3
pts_array	two focal points and the point on the circumference
gdp_id	–113
data_rec	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
data_rec_len	0 bytes

Error Messages:

Error Number	Message and Meaning
–158	GDP primitive is not defined by the supplied data in routine *name*. (For instance, the point may be on the line segment between the focal points.)

–114 Elliptic Arc: Center, Two Axis Vectors, and Two Vectors

Supporting Workstations: All DEC GKS workstations

This GDP forms the elliptic arc using a center point, one axis vector (the largest of the two) to establish the distance and direction of the major axis, a second axis vector to establish the distance of the minor axis, and two vectors whose directions are used to determine the arc end points. The largest axis vector determines both the distance and direction of the major axis of the elliptic arc.

GDP Function Arguments:

Argument	Required Value
n_points	6
pts_array	center point, vector origin point, two directional axis vectors, and two end point vectors
gdp_id	–114
data_rec	number of integers (1) number of reals (0) number of strings (0) address of integer array (*arc_type*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL) address of integer array
data_rec_len	sizeof (Ggdprec)

The integer array contains the following element:

Component	Description
arc_type	The arc type

The element *arc_type* can be any of the following values:

Value	Description
1	Form an arc.
2	Connect both ends of the arc to its center.
3	Connect the beginning and end points of the arc.

Error Messages:

Error Number	Message and Meaning
–158	GDP primitive is not defined by the supplied data in routine *name*. (For instance, due to the vector values, DEC GKS may attempt to form a straight line.)
–159	Arc_type is invalid in routine *name*. (For instance, if you specify a value other than 1, 2, or 3.)

–116 Elliptic Arc: Focal Points, and Two Points on Arc

Supporting Workstations: All DEC GKS workstations

This GDP forms an elliptic arc using two focal points, the beginning point of the elliptic arc, and the end point as one of the following components:

- The end point, located on the arc
- The second point of a ray (the first point is the first specified focal point of the ellipse), whose intersection with the elliptic path of the arc determines the end point of the arc

GDP Function Arguments:

Argument	Required Value
n_points	4
pts_array	two focal points and two points on the circumference
gdp_id	–116
data_rec	number of integers (1) number of reals (0) number of strings (0) address of integer array (*arc_type*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
data_rec_len	sizeof (Ggdprec)

The integer array contains the following element:

Component	Description
arc_type	The arc type

The element *arc_type* can be any of the following values:

Value	Description
1	Form an arc.
2	Connect both ends of the arc to its center.
3	Connect the beginning and end points of the arc.

Error Messages:

Error Number	Message and Meaning
–158	GDP primitive is not defined by the supplied data in routine *name*. (For instance, due to the specified values, DEC GKS may attempt to form a straight line.)
–159	Arc_type is invalid in routine *name*. (For instance, if you specify a value other than 1, 2, or 3.)

–125 Rectangle: Two Corners

Supporting Workstations: All DEC GKS workstations

This GDP forms the rectangle from the specified diagonal corner points. The sides of the rectangle are parallel to the *x*- and *y*-axes.

GDP Function Arguments:

Argument	Required Value
n_points	2
pts_array	diagonal corner points
gdp_id	–125
data_rec	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
data_rec_len	0 bytes

Error Messages:

Error Number	Message and Meaning
–158	GDP primitive is not defined by the supplied data in routine *name*. (For instance, if the specified points have the same *x* or *y* value, DEC GKS cannot form a rectangle.)

–332 Fill Area Set

Supporting Workstations: All DEC GKS workstations

This GDP contains at least three points that together define at least one fill area.

A fill area set consists of one or more fill areas, each consisting of three or more points that may intersect. A fill area set has both interior and edge attributes. Interior attributes are similar to regular fill areas, and edge attributes are similar to polylines. These attributes are set with various DEC GKS escape functions.

The filled regions of a fill area set are determined by the even-odd rule, which considers the entire fill area set as a single primitive. It is therefore possible to create donut-like objects, where the area surrounding the hole is filled.

GDP Function Arguments:

Argument	Required Value
n_points	>=3
pts_array	*x* and *y* points
gdp_id	–332
data_rec	number of integers (number of fill areas (>=1)) number of reals (0) number of strings (0) address of integer array (number of points in each fill area) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
data_rec_len	sizeof (Ggdprec)

Error Messages:

Error Number	Message and Meaning
–158	GDP primitive is not defined by the supplied data in routine *name*. (For instance, if the specified points have the same *x* or *y* value, DEC GKS cannot form a rectangle.)

–333 Filled Circle: Center, and Point on Circumference

Supporting Workstations: All DEC GKS workstations

This GDP forms a circle from the specified center point and a single point on the circle's circumference.

GDP Function Arguments:

Argument	Required Value
n_points	2
pts_array	center point and a point on the circumference
gdp_id	–333
data_rec	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
data_rec_len	0 bytes

Error Messages:

Error Number	Message and Meaning
–158	GDP primitive is not defined by the supplied data in routine *name*. (For instance, if the center point and the point on the circumference are the same point, DEC GKS cannot form a circle.)

–334 Filled Circle: Three Points on Circumference

Supporting Workstations: All DEC GKS workstations

This GDP draws the circle whose circumference includes the three specified points.

GDP Function Arguments:

Argument	Required Value
n_points	3
pts_array	three circumference points
gdp_id	–334
data_rec	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
data_rec_len	0 bytes

Error Messages:

Error Number	Message and Meaning
–158	GDP primitive is not defined by the supplied data in routine *name*. (For instance, if the three points form a straight line, DEC GKS cannot generate a corresponding circle.)

–335 Filled Circle: Center and Radius

Supporting Workstations: All DEC GKS workstations

This GDP forms a circle from the specified center point and radius vector value.

GDP Function Arguments:

Argument	Required Value
n_points	3
pts_array	center point, vector origin point, and radius vector point
gdp_id	–335
data_rec	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
data_rec_len	0 bytes

Error Messages:

Error Number	Message and Meaning
–158	GDP primitive is not defined by the supplied data in routine *name*. (For instance, if the radius vector specifies a distance of 0, then DEC GKS cannot generate a corresponding circle.)

–336 Filled Circle: Two Points on Circumference, and Radius

Supporting Workstations: All DEC GKS workstations

This GDP forms a circle from the specified circumference points and the radius vector point. The circle is drawn so that the circumference, clockwise from the first point to the second, is no greater than pi radians (half the circle).

GDP Function Arguments:

Argument	Required Value
n_points	4
pts_array	two points, vector origin point, and the radius vector point
gdp_id	–336
data_rec	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
data_rec_len	0 bytes

Error Messages:

Error Number	Message and Meaning
–158	GDP primitive is not defined by the supplied data *name*. (For instance, if the distance between points is more than twice the specified radius, then DEC GKS cannot form the circle.)

–338 Filled Arc: Center, and Two Points on Arc

Supporting Workstations: All DEC GKS workstations

This GDP forms a filled circular arc using the center point, the second point as a starting point of the arc, and the third point as one of the following components:

- The second point, located on the arc
- The second point of a ray (the first point is the center point), whose intersection with the circular path of the arc determines the second point of the arc

GDP Function Arguments:

Argument	Required Value
n_points	3
pts_array	center point and beginning and end points of the arc
gdp_id	–338
data_rec	number of integers (1) number of reals (0) number of strings (0) address of integer array (*arc_type*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
data_rec_len	sizeof (Ggdprec)

The integer array contains the following element:

Component	Description
arc_type	The arc type

The element *arc_type* can be any of the following values:

Value	Description
2	Fill the area formed by connecting both ends of the arc to its center.
3	Fill the area formed by connecting the beginning and end points of the arc.

Error Messages:

Error Number	Message and Meaning
–158	GDP primitive is not defined by the supplied data in routine *name*. (For instance, the center point and one of the points on the circumference may be the same point.)
–159	Arc_type is invalid in routine *name*. (For instance, if you specify a value other than 2 or 3.)

–339 Filled Arc: Three Points on Circumference

Supporting Workstations: All DEC GKS workstations

This GDP forms the arc beginning at the first point, running through the second point, and connecting to the third point.

GDP Function Arguments:

Argument	Required Value
n_points	3
pts_array	three points on the circumference
gdp_id	–339
data_rec	number of integers (1) number of reals (0) number of strings (0) address of integer array (*arc_type*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
data_rec_len	sizeof (Ggdprec)

The integer array contains the following element:

Component	Description
arc_type	The arc type

The element *arc_type* can be any of the following values:

Value	Description
2	Fill the area formed by connecting both ends of the arc to its center.
3	Fill the area formed by connecting the beginning and end points of the arc.

Error Messages:

Error Number	Message and Meaning
–158	GDP primitive is not defined by the supplied data in routine *name*. (For instance, the three points may form a straight line.)
–159	Arc_type is invalid in routine *name*. (For instance, if you specify any value other than 2 or 3.)

–340 Filled Arc: Center, Two Vectors, and a Radius

Supporting Workstations: All DEC GKS workstations

This GDP forms the arc by using the two vectors to calculate directions from the center point. DEC GKS uses the vector directions to form rays that determine the starting and ending points of the arc.

GDP Function Arguments:

Argument	Required Value
n_points	5
pts_array	center, vector origin point, two vectors, and the radius vector point
gdp_id	–340
data_rec	number of integers (1) number of reals (0) number of strings (0) address of integer array (*arc_type*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
data_rec_len	sizeof (Ggdprec)

The integer array contains the following element:

Component	Description
arc_type	The arc type

The element *arc_type* can be any of the following values:

Value	Description
2	Fill the area formed by connecting both ends of the arc to its center.
3	Fill the area formed by connecting the beginning and end points of the arc.

Error Messages:

Error Number	Message and Meaning
–158	GDP primitive is not defined by the supplied data in routine *name*. For instance, if the center point and the point on the circumference are the same point, DEC GKS cannot form a circle.
–159	Arc_type is invalid in routine *name*. (For instance, if you specify any value other than 2 or 3.)

–341 Filled Arc: Two Points on Arc, and Radius

Supporting Workstations: All DEC GKS workstations

This GDP forms an arc from the specified beginning and end points, and from the radius vector point. The arc is drawn so that the circumference, clockwise from the first point to the second, is no greater than pi radians (half of a circle).

GDP Function Arguments:

Argument	Required Value
n_points	4
pts_array	two points, vector origin point, and radius vector point
gdp_id	–341
data_rec	number of integers (1) number of reals (0) number of strings (0) address of integer array (*arc_type*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
data_rec_len	sizeof (Ggdprec)

The integer array contains the following element:

Component	Description
arc_type	The arc type

The element *arc_type* can be any of the following values:

Value	Description
2	Fill the area formed by connecting both ends of the arc to its center.
3	Fill the area formed by connecting the beginning and end points of the arc.

–341 Filled Arc: Two Points on Arc, and Radius

Error Messages:

Error Number	Message and Meaning
–158	GDP primitive is not defined by the supplied data in routine *name*. (For instance, if the distance between the points is more than twice the specified radius, then DEC GKS cannot form the arc.)
–159	Arc_type is invalid in routine *name*. (For instance, if you specify a value other than 2 or 3.)

–342 Filled Arc: Center, Starting Point, and Angle

Supporting Workstations: All DEC GKS workstations

This GDP forms the filled, circular arc by using the distance between the center point and the arc starting point as a radius, and by using the angle value to determine the endpoint of the arc.

GDP Function Arguments:

Argument	Required Value
n_points	2
pts_array	center and starting point
gdp_id	–342
data_rec	number of integers (1) number of reals (1) number of strings (0) address of integer array (*arc_type*) address of real array (*angle*) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
data_rec_len	sizeof (Ggdprec)

The *data_rec* argument contains the following elements:

Component	Description
arc_type	The arc type
angle	The angle, in radians

The element *arc_type* can be any of the following values:

Value	Description
2	Fill the area formed by connecting both ends of the arc to its center.
3	Fill the area formed by connecting the beginning and end points of the arc.

Error Messages:

Error Number	Message and Meaning
–158	GDP primitive is not defined by the supplied data in routine *name*. For instance, if the center point and the point on the circumference are the same point, DEC GKS cannot form a circle.
–159	Arc_type is invalid in routine *name*. (For instance, if you specify any value other than 2 or 3.)

–343 Filled Ellipse: Center, and Two Axis Vectors

Supporting Workstations: All DEC GKS workstations

This GDP forms the ellipse using a center point, one axis vector (the largest of the two) to establish the distance and direction of the major axis, and a second axis vector to establish the distance of the minor axis.

GDP Function Arguments:

Argument	Required Value
n_points	4
pts_array	center point, vector origin point, and minor and major axis vectors
gdp_id	–343
data_rec	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
data_rec_len	0 bytes

Error Messages:

Error Number	Message and Meaning
–158	GDP primitive is not defined by the supplied data in routine *name*. (For instance, one of the vectors may have a length of 0.)

–345 Filled Ellipse: Focal Points, and Point on Circumference

Supporting Workstations: All DEC GKS workstations

This GDP forms the ellipse using the two focal points and a single point on the circumference.

GDP Function Arguments:

Argument	Required Value
n_points	3
pts_array	two focal points and the point on the circumference
gdp_id	–345
data_rec	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
data_rec_len	0 bytes

Error Messages:

Error Number	Message and Meaning
–158	GDP primitive is not defined by the supplied data in routine *name*. (For instance, the point may be on the line segment between the focal points.)

–346 Filled Elliptic Arc: Center, Two Axis Vectors, and Two Vectors

Supporting Workstations: All DEC GKS workstations

This GDP forms the elliptic arc using a center point, one axis vector (the largest of the two) to establish the distance and direction of the major axis, a second axis vector to establish the distance of the minor axis, and two vectors whose directions are used to determine the arc endpoints.

GDP Function Arguments:

Argument	Required Value
n_points	6
pts_array	the center point, vector origin point, two directional axis vectors, and two end point vectors
gdp_id	–346
data_rec	number of integers (1) number of reals (0) number of strings (0) address of integer array (*arc_type*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
data_rec_len	sizeof (Ggdprec)

The integer array contains the following element:

Component	Description
arc_type	The arc type

The element *arc_type* can be any of the following values:

Value	Description
2	Fill the area formed by connecting both ends of the arc to its center.
3	Fill the area formed by connecting the beginning and end points of the arc.

Error Messages:

Error Number	Message and Meaning
–158	GDP primitive is not defined by the supplied data in routine *name*. (For instance, due to the vector values, DEC GKS may attempt to form a straight line.)
–159	Arc_type is invalid in routine *name*. (For instance, if you specify any value other than 2 or 3.)

–348 Filled Elliptic Arc: Focal Points, and Two Points on Arc

Supporting Workstations: All DEC GKS workstations

This GDP forms the elliptic arc using two focal points, the beginning point of the elliptic arc, and the end point as one of the following components:

- The end point, located on the arc
- The second point of a ray (the first point is the first specified focus point of the ellipse), whose intersection with the elliptic path of the arc determines the end point of the arc

GDP Function Arguments:

Argument	Required Value
n_points	4
pts_array	two focal points and two points on the circumference
gdp_id	–348
data_rec	number of integers (1) number of reals (0) number of strings (0) address of integer array (*arc_type*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
data_rec_len	sizeof (Ggdprec)

The integer array contains the following element:

Component	Description
arc_type	The arc type

The element *arc_type* can be any of the following values:

Value	Description
2	Fill the area formed by connecting both ends of the arc to its center.
3	Fill the area formed by connecting the beginning and end points of the arc.

Error Messages:

Error Number	Message and Meaning
–158	GDP primitive is not defined by the supplied data in routine *name*. (For instance, due to the specified values, DEC GKS may attempt to form a straight line.)
–159	Arc_type is invalid in routine *name*. (For instance, if you specify any value other than 2 or 3.)

–349 Filled Rectangle: Two Corners

Supporting Workstations: All DEC GKS workstations

This GDP forms the rectangle from the specified diagonal corner points. The sides of the rectangle are parallel to the *x*- and *y*-axes.

GDP Function Arguments:

Argument	Required Value
n_points	2
pts_array	diagonal corner points
gdp_id	–349
data_rec	number of integers (0) number of reals (0) number of strings (0) address of integer array (NULL) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
data_rec_len	0 bytes

Error Messages:

Error Number	Message and Meaning
–158	GDP primitive is not defined by the supplied data in routine *name*. (For instance, if the specified points have the same *x* or *y* value, DEC GKS cannot form a rectangle.)

–400 Packed Cell Array

Supporting Workstations: All DEC GKS supported workstations *except* for the PostScript workstations

This GDP forms a cell array from the starting point, diagonal point, point R, and the contents of a data record. The data record includes an array that contains color indexes specified in 1, 8, or 16 bits. When you specify the color indexes in increments less than a longword, the array uses less memory and DEC GKS can read the data quicker.

You need to pass the following points to the cell array GDPs:

- Starting point.
- Diagonal point.
- Point R, which is the third point in the parallelogram moving the starting point to the diagonal point along the *x*-axis. To form a rectangular cell array, make sure that point R has the *x* value of the diagonal point and the *y* value of the starting point.

Argument	Required Value
n_points	3
pts_array	starting point, diagonal point, and point R
gdp_id	–400
data_rec	number of integers (3 + *n_longwords*) number of reals (0) number of strings (0) address of integer array (*rows*, *columns*, *bits_per_index*, *color_indexes*) address of real array (NULL) address of string lengths array (NULL) address of string pointer array (NULL) number of pointers (0) address of generic pointer array (NULL) number of longs (0) address of long array (NULL)
data_rec_len	sizeof (Ggdprec)

The integer array contains the following elements:

Component	Description
rows	This element is the number of rows in the cell array.
columns	This element is the number of columns in the cell array.

Component	Description
bits_per_index	This element is the number of bits used, within *color_indexes*, to store a single color index value. (DEC GKS uses the color index value to color the corresponding cell in the cell array.) This value may be 1, 8, or 16.
color_indexes	These components are the contiguous bit increments that specify color indexes. These elements are *n_longwords* in size and contain the color indexes in row-major order. Color indexes should be specified in row-major order.

Calculate the integer value *n_longwords* using the following formula:

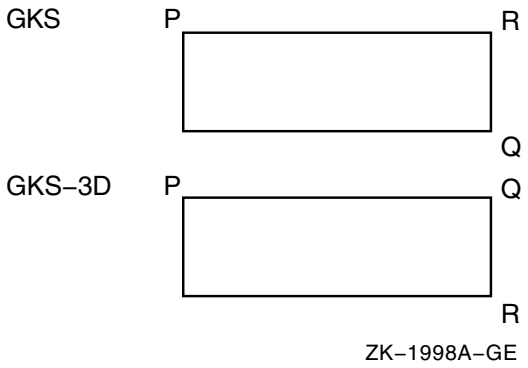
```
n_longwords = (rows * columns * bits_per_index + 31) / 32
```

Error Messages:

Error Number	Message and Meaning
–158	GDP primitive is not defined by the supplied data in routine *name*. (For instance, if the starting and diagonal points have the same *x* or *y* value, DEC GKS cannot form a cell array rectangle.)

In DEC GKS–3D™, the three points defining the image array box are ordered P, Q, and R. In DEC GKS, the three points are ordered P, R, and Q. This change allows both the cell array primitive and the image array primitive to have their PQR points defined in the same order. The image array primitive and the cell array primitives have similar functionality. Figure C–3 illustrates the order of the points used to define the GDP –400 (Packed Cell Array).

Figure C–3 GDP_IMAGE_ARRAY Order of Points



Dials and Buttons Support for DEC PHIGS

D

Dials and Buttons Support for DEC PHIGS

This appendix provides information on dial and button support. The hardware consists of a 8-dial box and a 32-button box. DEC PHIGS supports dials and buttons for use with the DECwindows, OSF/Motif, and PEX workstation types. The dial box is implemented as a series of valuator input devices numbered 5 to 12. The button box is implemented as choice input device number 10. Additionally, there is choice device 9, which is a software-simulated button box.

The dial and button box is also referred to as the Peripheral Converter Module™ (PCM™). It is connected to the host system by an RS–232 line. A server process is started on the host system that directs and reads the PCM through the RS–232 connection. This server process then communicates with a client process for commands and returns information to an application. DEC PHIGS provides the client side within the DECwindows input support. The application is therefore able to control the PCM through the standard DEC PHIGS input interface using the appropriate valuator and choice input devices.

For example, the OpenVMS logical name for the button and dial hardware is defined as PHIGS$USE_DIALS_AND_BUTTONS. The UNIX environment variable is defined as PHIGSuse_dials_and_buttons. If this logical name or environment variable value is set to 1, DEC PHIGS attempts to use the dial and button hardware. If this value is set to 0, DEC PHIGS attempts to software-simulate the dials and buttons. If this value is undefined (not set), DEC PHIGS first attempts to use the dial and button hardware. When it cannot find the hardware, DEC PHIGS attempts to software-simulate the dials and buttons.

D.1 Starting the PCM Server

The PCM server process must be started for DEC PHIGS to be able to communicate to the PCM hardware. If the PCM server process is not running, DEC PHIGS will report an error when you open a workstation. See Section D.5 for more information. Note that the PCM server will support using either the dial or button box separately.

D.1.1 PCM on OpenVMS Systems

On OpenVMS systems, the PCM server is located in SYS$SYSTEM. To start the dial and button box server process on an OpenVMS system, execute the following command file from a privileged account:

```
$ @SYS$STARTUP:PCM$STARTUP.COM Return
```

The default terminal port is csa0:. If the dial and button box is connected to a different terminal port, edit the file SYS$STARTUP:PCM$STARTUP.COM to define the correct terminal port. You may wish to add execution of this command file to your system startup file.

D.1.2 PCM on UNIX Systems

On UNIX systems, the PCM server is located in /usr/bin/pcmserver. There are two ways to start the server: manually and at system startup. The following sections describe how to start the PCM on ULTRIX and Digital UNIX systems.

Using ULTRIX Systems

To start the server manually on an ULTRIX system, be sure the file /etc/ttys contains the following entry, where *xx* is the port number:

```
ttyxx "/etc/getty std.9600" unknown off nomodem # buttons and dials
```

Execute the server as follows:

```
% /usr/bin/pcmserver [/dev/ttyxx] & Return
```

The parameter [/dev/tty*xx*] is optional. If you do not supply the parameter, the server uses /dev/tty00.

On ULTRIX systems, to start the server at system startup, edit /etc/ttys to include the following:

```
ttyxx "/usr/bin/pcmserver /dev/ttyxx" unknown on nomodem # buttons and dials
```

For more information on the syntax of /etc/ttys, see the section on ttys in your operating system documentation. To determine which tty devices are reserved for system use, see the owner's manual for your system.

Using Digital UNIX Systems

To start the server at system startup on a Digital UNIX system, be sure the file /etc/inittab contains the following entry, where *xx* is the port number:

```
pcm:3:respawn:/usr/bin/pcmserver /dev/ttyxx
```

To start the system manually, use the following command:

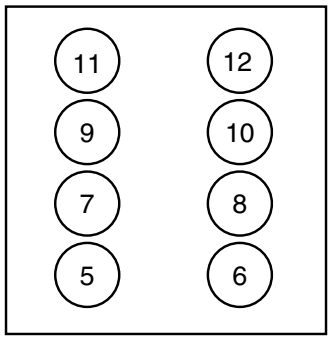
```
% /usr/bin/pcmserver [/dev/ttyxx] & Return
```

The parameter [/dev/tty*xx*] is optional. If you do not supply the parameter, the server uses /dev/tty00.

D.2 Dial Support

DEC PHIGS supports the hardware dials as type VALUATOR. Each dial on the dial box is a separate device, numbered 5 to 12. Figure D–1 illustrates the numbering of the dials on the hardware dial box.

Figure D–1 Hardware Dial Box



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Prompt and echo type (PET) –4 has been added for the INITIALIZE VALUATOR function so you can use hardware dials in your application. For example, with the DEC PHIGS C binding interface, PET –4 has the following data record:

```
typedef struct {
    Pfloat    low;
    Pfloat    high;
    Char      *title_string;
    Pint      threshold;
    Pint      smoothing;
    Pfloat    num_turns;
} Pvalpet_0004;
```

The data record for the DEC PHIGS PHIGS$ binding interface contains the following components:

```
real      low_value
real      high_value
address   title_string
integer   title_length
integer   threshold
integer   smoothing
real      num_turns
```

Check the language-appropriate constants file (phigs_defs.*) for the phigs$typ_valpet_0004 data structure and syntax.

Because the DEC PHIGS Fortran binding interface contains the low and high value as explicit arguments to the INITIALIZE VALUATOR function, include only the following three fields in the data record:

```
integer:      threshold
integer:      smoothing
real:         num_turns
```

In the data records for PET –4, the low and high fields are floating point values, and they specify the minimum and maximum return range of the valuator values.

The *title_string* is not currently implemented. A future release will feature software simulation of the hardware valuators, and this field will be used at that time. You should supply a valid string value to avoid generating an error.

The *threshold* field is an integer value between 1 and 255. The *threshold* value determines the threshold at which data is returned. For example, if the threshold is 16, dial data will not be generated unless a dial delta of 16 or more occurs. Each 360 degree turn of the dial can return a maximum of 255 data events.

The *smoothing* field is an integer value between 1 and 255. The *smoothing* value averages return values and groups together identical values into a single return value.

The *num_turns* field is a float value that must be greater than 0.0. This value controls the number of turns (360 degree rotations) from the dial that correspond to the maximum valuator range. As this value increases, the return granularity of the data increases. The recommended default value is 2.0.

All other functions involving VALUATOR devices are supported and operate as documented.

D.2.1 Spaceball Support

The PCM server and IDL libraries have spaceball support for Motif and DECwindows device handlers.

On OpenVMS systems, the PCM$STARTUP.COM file is new. DEC PHIGS does not support the spaceball at this time. However, DEC PHIGS can perceive spaceball events as dial events (valuator device numbers 5 to 12, the same as the PCM dials). To use spaceballs as dials on OpenVMS systems, perform the following steps:

1. Make sure the files PCM$STANDARD_SS.DAT and PCM$DIALS_ONLY_SS.DAT are in the SYS$MANAGER directory.
2. Replace the last line of PCM$STANDARD_SS.DAT with the following line:

   ```
   inc "SYS$MANAGER:PCM$DIALS_ONLY_SS.DAT"
   ```

3. Follow the editing instructions in PCM$STARTUP.COM for enabling the spaceball, and execute the command file.
4. Run the PHIGS application and use valuator devices 5 to 12.

The PCM$STANDARD_SS.DAT and PCM$DIALS_ONLY_SS.DAT files are spacescript files. There is no documentation available on the spacescript language.

On UNIX systems, the pcmserver startup has not changed, but there are some new options. To use the spaceball as dials, perform the following actions:

1. Make sure the files *standard.ss* and *dials_only.ss* are in the directory /usr/lib/pcm.
2. Replace the last line of *standard.ss* with the following line:

   ```
   inc "/usr/lib/pcm/dials_only.ss"
   ```

3. Start the pcmserver with the `-b` switch to inform the server of the location of the spaceball.

   ```
   pcmserver -b ttyxx &  #where xx is the tty number
   ```

4. Run the PHIGS application and use valuator devices 5 to 12.

On UNIX systems, you can also use the `-l` and `-e` options with the pcmserver to obtain a log file. For example:

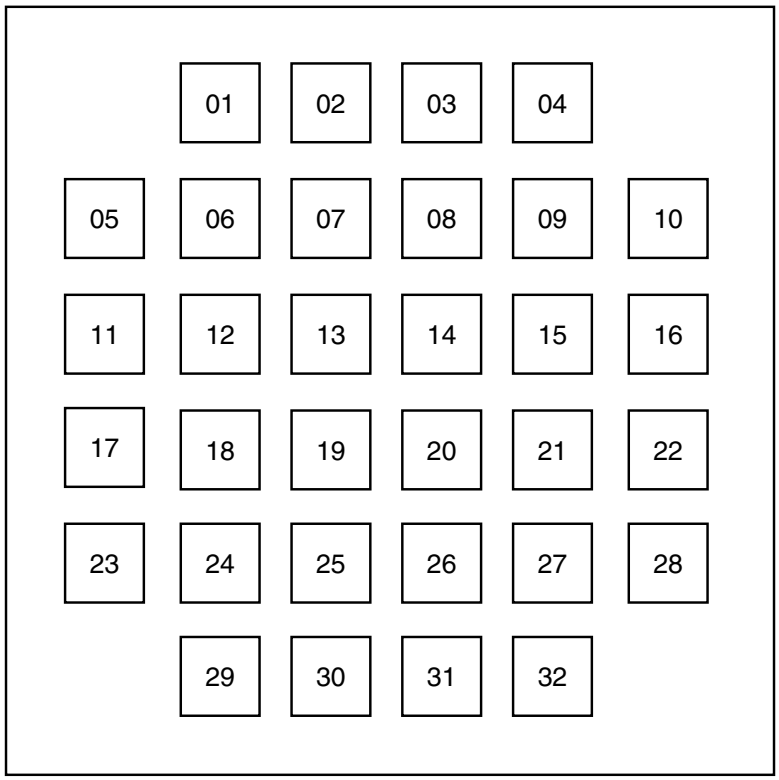
```
pcmserver -p ttyxx -le /path/filename
```

In this example, *ttyxx* is the tty device the PCM (or spaceball if you use the `-b` switch) is connected to, and /path/filename is the path and file name of the log file.

D.3 Button Support

DEC PHIGS supports the hardware buttons as type choice, device number 10. Figure D–2 illustrates the numbering of the buttons on the choice box.

Figure D–2 Hardware Choice Box Buttons



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To use hardware buttons in your application program, call the INITIALIZE CHOICE function using application prompt and echo type (PET) 2. This PET specifies the state of the 32 buttons (ON or OFF). The *init* parameter for this function is not used with the hardware buttons, but you should still supply an integer in the range 1 to 32 to avoid generating an error.

For example, with the DEC PHIGS C binding interface, PET 2 has the following data record:

```
typedef struct {
    Pint        number;         /* number of alternatives */
    Pprf        *enable;        /* array of prompts */
} Pchoicepet0002;

    typedef enum {
        PPR_OFF,
        PPR_ON
    } Pprf;
```

All other functions involving choice devices are supported and operate as documented.

D.4 Workstation Support

The following sections describe using the PCM server with the DECwindows, PEX, OSF/Motif, and PEX Motif workstation types.

Workstation Type Values 211 (DECwindows), 221 (DECwindows PEX), 231 (OSF/Motif), and 241 (PEX Motif):

You do not need to supply additional application code to use buttons and dials with these workstation type values.

Workstation Type Values 212 (DECwindows), 222 (DECwindows PEX), 232 (OSF/Motif), and 242 (PEX Motif):

Because these workstation type values are for output-only devices, the application must make direct calls to the Input Device Library (IDL). See the *DEC Open3D IDL User Guide* for more information on the IDL.

Workstation Type Values 213 (DECwindows Widget), 223 (PEX Widget), 233 (OSF/Motif Widget), and 243 (PEX Motif Widget):

The PCM server sends client messages to the X server to register button and dial events. DEC PHIGS registers a ClientMessage event handler for these events. If the application expects to receive client messages from other sources, use the following template for event handling:

```
.
.
.
static Atom pcm_atom;

/* Fetch the atom for the PCM message type. */

   if (0 == pcm_atom)
      pcm_atom = XInternAtom (decw_state->display, PCMX_MESSAGE_TYPE, 0);

/* Pass button/dial events to registered event handlers. */

   if ((event.type == ClientMessage) &&
      (event.message_type == pcm_atom))
        XtDispatchEvent (&event);
        gks$$decw_receive_pcmevent (decw_state->window, decw_state, event);
```

The *event.message_type* parameter (101 to 104) is used by the IDL for messages sent from the PCM server. See the *DEC Open3D IDL User Guide* for more information about client messages sent by the PCM server.

If the application does not receive other client messages, no special considerations are necessary.

D.5 Error Messages

The following error messages exist for PCM support.

Error	Message	User Action
ERROR_NEG_450	Valuator device could not be used—dials are not available on the PCM device in routine *name*.	Check to make sure the PCM dial box is connected properly, power cycle the PCM, and restart the PCM server.

Error	Message	User Action
ERROR_NEG_451	Choice device could not be used—buttons are not available on the PCM device in routine *name*.	Check to make sure the PCM button box is connected properly, power cycle the PCM, and restart the PCM server.
ERROR_NEG_452	PCM initialization failed—hardware dials and buttons not available in routine *name*.	Check to make sure the PCM box is connected properly, power cycle the PCM, and check to make sure the PCM server is running. If the PCM box is not available or not functioning, remove the definition of the use dials and buttons environment variable. This causes DEC PHIGS to perform software simulation of the PCM and the application will continue to execute.
ERROR_NEG_453	PCM configuration failed—valuator or choice device not initialized in routine *name*.	Check to make sure the PCM box is connected properly, power cycle the PCM, and check to make sure the PCM server is running. If the PCM box is not available or not functioning, remove the definition of the use dials and buttons environment variable. This causes DEC PHIGS to perform software simulation of the PCM and the application will continue to execute.

Input Values

E
Input Values

This appendix provides input information that is applicable to all the DEC GKS and DEC PHIGS workstations of category OUTIN. You should review this appendix before working with the DEC GKS and DEC PHIGS input functions. If you need further workstation-specific input information, see the device-specific chapters in this manual.

This chapter describes the following input values that are available for all devices supported by DEC GKS and DEC PHIGS:

- Input devices
- Prompt and echo types (PETs)
- Data records
- Keypad functionality

E.1 Logical Input Device Numbers

Logical input device numbers determine the physical device (such as a keypad or a mouse) used to control the DEC GKS and DEC PHIGS logical input devices. You pass the device numbers described in this section to the DEC GKS and DEC PHIGS input functions.

DEC GKS and DEC PHIGS define at least four logical input device numbers for each input class. If the workstation does not support the device number you specify, the workstation uses device number 1.

Several of the input devices use special sections of the keyboard available on specific workstations. If you use these devices, you should remember that you need to provide the user with the information necessary to operate them. For further information concerning input keypad functionality, see Section E.3.

To allow you to use several logical input devices of the same class during sample or event mode, DEC GKS and DEC PHIGS define different echo areas for devices of a single class. The device specific chapters in this manual list the default echo area for the default logical input device of a given class. To determine the default echo area for other devices of the same class, call one of the INQUIRE DEFAULT *class* DATA inquiry functions and pass it the appropriate device number.

For complete information concerning logical input devices, physical input devices, and the DEC GKS and DEC PHIGS input process, see the *DEC GKS User's Guide*, and the DEC GKS or DEC PHIGS binding manuals.

The following section specifies which DEC GKS and DEC PHIGS workstations implement which logical input devices.

E.2 Logical Input Devices

The following section describes the logical input devices that can be implemented on workstations supported by DEC GKS and DEC PHIGS.

E.2.1 Choice Devices

The following section describes the choice-class logical input devices and specify which DEC GKS and DEC PHIGS workstations support each device.

Digital Workstations: Using one of the Digital workstations, you can use the Lock key feature for any of the choice logical input devices. For more information, see Section E.3.

E.2.1.1 Choice 1, 6, 7, 8

Supporting Workstations: All DEC GKS and DEC PHIGS workstations of category OUTIN.

For workstations that do not have a mouse or puck, this device requires that you press the arrow keys to highlight various choices. To trigger this device, press Return. To cause a break during request mode, press Ctrl/U.

For workstations that do have a mouse or puck, this device requires that you move the tracking device to highlight various choices. To trigger this device, press the left button. To cause a break during request mode, press the middle button on the mouse or the top button on the puck or select the Cancel button.

For more information on button support for the choice input devices, see Appendix D.

E.2.1.2 Choice 2

Supporting Workstations: All DEC GKS and DEC PHIGS workstations of category OUTIN.

This device activates the arrow keys and the numeric keypad keys to highlight the various choices. (For more information concerning the numeric keypad, see Section E.3.) By pressing any of the arrow or numeric keys, you immediately trigger the device and the measure corresponds to the number assigned to the pressed key. To break input during request mode, press Ctrl/U.

E.2.1.3 Choice 3

Supporting Workstations: All DEC GKS and DEC PHIGS workstations of category OUTIN.

This device activates the top six keys of the auxiliary keypad and the keys F7 to F20 to highlight choices 1 through 20. (For more information concerning the auxiliary keypad or the keys F7 through F20, see Section E.3.) By pressing any of the arrow or numeric keys, you immediately trigger the device and the measure corresponds to the number assigned to the pressed key. To break input during request mode, press Ctrl/U.

For DECwindows and Motif devices, keys F1 to F6 are available and are returned as choice numbers 21 to 26.

E.2.1.4 Choice 4

Supporting Workstations: All DEC GKS and DEC PHIGS workstations of category OUTIN.

This device is implemented in the same manner as choice device number 1.

On the Digital VT330 and VT340 terminals (with mouse), this device can display up to four choices and does not react to the tracking device of the mouse or puck. (If you use a mouse, you should initialize the device for three choices; if you use a puck, you should initialize it for four choices.) You trigger the device by depressing a mouse or puck button.

The measure is the choice number corresponding to the button released. The left button corresponds to choice 1; the middle button corresponds to choice 2; the right button corresponds to choice 3. If you use a puck, the bottom button corresponds to choice 4.

E.2.1.5 Choice 5

Supporting Workstations: All DEC GKS and DEC PHIGS workstations of category OUTIN.

This device is implemented in the same manner as choice device number 1.

On the Digital VT330 and VT340 terminals (with mouse), this device can display up to four choices and does not react to the tracking device of the mouse or puck. (If you use a mouse, you should initialize the device for three choices; if you use a puck, you should initialize it for four choices.) You trigger the device by releasing a mouse or puck button.

The measure is the choice number corresponding to the button released. The left button corresponds to choice 1; the middle button corresponds to choice 2; the right button corresponds to choice 3. If you use a puck, the bottom button corresponds to choice 4.

E.2.2 Locator Devices

The following section describes the locator-class logical input devices and specifies which DEC GKS and DEC PHIGS workstations support each device.

Digital Workstations: Using one of the Digital workstations, you can use the Lock key feature for any of the locator-class logical input devices. For more information, see Section E.3.

E.2.2.1 Locator 1, 2, 3, and 4

Supporting Workstations: All DEC GKS and DEC PHIGS workstations of category OUTIN.

For workstations that do not have a mouse or puck, these devices require you to press the arrow keys to move the locator prompt. To trigger the device, press Return. To cause a break during request mode, press Ctrl/U.

For workstations that do have a mouse or puck, these devices require you to move the tracking device to move the locator prompt. To trigger the device, press the left button. To cause a break during request mode, press the middle button on the mouse or the top button on the puck.

On Digital ReGIS terminals, and on the Tektronix 4107 workstations, you can use the numeric keypad as a zoning mechanism using device numbers 1 and 2. (For more information concerning the numeric keypad, see Section E.3.)

E.2.3 Pick Devices

The following section describes the pick-class logical devices and specifies which DEC GKS and DEC PHIGS workstations support each device.

E.2.3.1 Pick 1, 2, 3, and 4

Supporting Workstations: All DEC GKS and DEC PHIGS workstations of category OUTIN.

For workstations that do not have a mouse or puck, these devices require you to press the arrow keys to move the pick aperture. The workstation marks the currently picked segments (or portions of segments) by outlining the extent rectangle of all or part of the segment. To trigger the device, press Return. To cause a break during request mode, press Ctrl/U.

For workstations that do have a mouse or puck, these devices require you to move the tracking device to move the pick aperture. To trigger the device, press the left button. To cause a break during request mode, press the middle button on the mouse and the top button on the puck.

On Digital ReGIS terminals, and on the Tektronix 4107 workstations, you can use the numeric keypad as a zoning mechanism using device numbers 1 and 2. (For more information concerning the numeric keypad, see Section E.3.)

E.2.4 String Devices

The following sections describe the string-class logical input devices and specify which DEC GKS and DEC PHIGS workstations support each device.

E.2.4.1 String 1 and 4

Supporting Workstations: All DEC GKS and DEC PHIGS workstations of category OUTIN.

This device returns a Digital Multinational Character Set text string to the calling program. The device requires you to enter the text string using the keyboard. To trigger this device, press Return. To cause a break during request mode, press Ctrl/U, or the Cancel button.

To edit the string while entering input (on all workstations except the Tektronix 4014), use the following keys:

- Delete, to delete the last character of the input string
- Ctrl/H, to move the cursor to the beginning of the string
- Ctrl/E, to move the cursor to the end of the string
- Ctrl/B, to recall only the initial string
- Ctrl/A, to toggle insert and overstrike modes
- Left arrow, to move the cursor to the left
- Right arrow, to move the cursor to the right

E.2.4.2 String 2

Supporting Workstations: The VWS workstations.

This device returns an SMG Encoded Key value. DEC GKS and DEC PHIGS ignore any prompt and echo type specified for this device. By pressing a key, you trigger the device; the measure of the device is the single character. For information concerning this type of text string, see the *VMS Run-Time Library Routines Volume*.

E.2.4.3 String 3

Supporting Workstations: The Digital ReGIS, DECwindows, VWS, and Tektronix 4107 workstations.

This device returns the ASCII value associated with the specified character. This device requires you to press a single key on the keyboard. When you press a key, the device accepts the keystroke without a trigger. To cause a break during request mode, press Ctrl/U. DEC GKS and DEC PHIGS ignore any prompt and echo type specified for this device.

E.2.5 Stroke Devices

The following section describes the stroke-class logical input devices and specifies which DEC GKS and DEC PHIGS workstations support each device.

VWS Workstations: Using one of the VWS workstations, you can use the Lock key feature for any of the stroke-class logical input devices. For more information, see Section E.3.

E.2.5.1 Stroke 1, 2, 3, and 4

Supporting Workstations: All DEC GKS and DEC PHIGS workstations of category OUTIN.

For workstations that do not have a mouse or puck, these devices require you to press the arrow keys to move the stroke prompt. To trigger the device, press Return. To cause a break during request mode, press Ctrl/U.

For workstations that do have a mouse or puck, these devices require you to move the tracking device to move the stroke prompt. To trigger the device, press the left button. To cause a break during request mode, press the middle button on the mouse and the top button on the puck.

On the Digital ReGIS and the Tektronix 4107 workstations, you can use the numeric keypad as a zoning mechanism when using device numbers 1 and 2. (For more information concerning the numeric keypad, see Section E.3.)

On the Digital VT330 and VT340 workstations, use the right mouse button to input a single point in the stroke.

E.2.6 Valuator Devices

The following section describes the valuator-class logical input devices and specifies which DEC GKS and DEC PHIGS workstations support each device.

VWS Workstations: Using one of the VWS workstations, you can use the Lock key feature for any of the valuator-class logical input devices. For more information, see Section E.3.

E.2.6.1 Valuator 1, 2, 3, and 4

Supporting Workstations: All DEC GKS and DEC PHIGS workstations of category OUTIN.

For workstations that do not have a mouse or puck, these devices require you to press the arrow keys to move the valuator prompt. To trigger the device, press Return. To cause a break during request mode, press Ctrl/U.

For workstations that do have a mouse or puck, these devices require you to move the tracking device to move the valuator prompt. To trigger the device, press the left button. To cause a break during request mode, press the middle button on the mouse or the top button on the puck or select the Cancel button.

On the Digital ReGIS and the Tektronix 4107 workstations, you can use the numeric keypad as a zoning mechanism when using device numbers 1 and 2. (For more information concerning the numeric keypad, see Section E.3.)

For more information on dial support for the valuator input devices, see Appendix D.

E.2.7 Input Devices and Echo Area Titles

For all choice, string, and valuator devices, and for locator devices using prompt and echo type 6, you can specify a character string that the workstation places at the top of the echo area. In this manner, you can place an application-specific title at the top of the logical input device.

VWS Workstations: If you do not pass the extra components of the data record to INITIALIZE STRING 3, DEC GKS and DEC PHIGS always place a title at the top of the input window. In this case, you cannot eliminate the title. If you want to create an input device that does not contain a title, pass a title length of 0 to the first of the extra components of the input data record.

E.2.8 Changing the Title String

You can change the title string for all the choice, string, and valuator PETs, and locator PET 6.

The default title is the name of the device class. To change the string, increase the data record size by 8, and add the following components to the end of the data record:

Component	Description	Data Type	Used or Ignored
Nexttolast	Title string address	Integer	U
Last	Title string length	Integer	U

If you want to have a blank title for a particular device, use a title string of one blank (' ') and a title string length of 1. If you do not specify the title string and the title string length, DEC GKS and DEC PHIGS use the default title. If you set the title string to NULL and the title string to 0, DEC GKS and DEC PHIGS use the default title.

Be sure the data record length accurately reflects whether you want to use the title components.

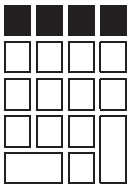
E.3 Keypad Functionality

DEC GKS and DEC PHIGS allow you to press keys other than the arrow keys to control the input prompt. This section describes how to use the various keypad buttons during input. If you use logical input devices that take advantage of these keypads, remember to provide the user with the information necessary to operate the device.

E.3.1 Cycling Logical Input Devices

Supporting Devices: All logical input devices used on a single workstation.

Supporting Workstations: The Digital ReGIS and the Tektronix 4014 and 4107 workstations.



The shaded key to the far left is the PF1 key. This key cycles through the devices present on a single workstation, in a workstation-determined order. The second shaded key from the left is the PF2 key. This key ends the cycling process and activates the prompts of all logical input devices present on a workstation. (If you are using the Tektronix 4107 terminal, these keys are labeled F5 and F6.) The third shaded key from the left is the PF3 key. This key decreases the increment size of the cursor when it is moved with the arrow keys. The shaded key to the far right is the PF4 key. This key increases the increment size of the cursor when it is moved with the arrow keys.

When you use more than one logical input device at a time, the workstations change the measures of all devices that use a physical device, by default. For example, if you simultaneously use two devices that use the arrow keys to alter the prompt, move both prompts when pressing the arrow keys.

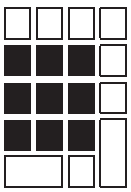
To provide the ability to choose which device's measure to alter, the workstations allow you to activate the prompts of each device individually, in a workstation-specific cycle. In this way, you can change the measure of only one device at a time.

The only restriction placed on the cycling of logical input devices is that cycling affects only those devices whose prompts are enabled. If you use a device on a workstation whose prompt is disabled (by setting the value NOECHO in one of the SET *class* MODE functions), that device's prompt is always active. You cannot cycle past a device whose echo is disabled.

E.3.2 Numeric Keypad (Zoning Mechanism)

Supporting Devices: Locator, pick, and stroke device numbers 1 and 2.

Supporting Workstations: The Digital ReGIS and the Tektronix 4107 workstations.



The workstations move the cursor to the position on the rectangular input echo area that corresponds to the position of the pressed key within the rectangular set of shaded keys. For example, if you press the shaded key in the upper left corner, the cursor moves to the upper left corner of the current echo area. If you

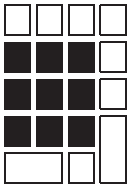
press the shaded key in the exact center, the cursor moves to the center of the echo area. If you press the rightmost shaded key in the second shaded row of keys, the cursor moves to the middle of the right border of the rectangular echo area.

E.3.3 Numeric Keypad (Choice)

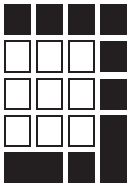
Supporting Devices: Choice device number 2.

Supporting Workstations: The Digital ReGIS and the Tektronix 4107 workstations.

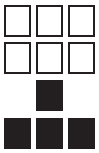
Key Set 1



Key Set 2



Key Set 3



The workstations trigger the choice that corresponds to the number assigned to the shaded keys. The number assignments are as follows:

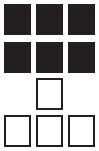
Key Set	Numbering Assignments
Key Set 1	On most supporting workstations, the numbers on these shaded keys correspond to the choice numbers 1 to 9. Incrementing from left to right, the bottom row contains keys 1, 2, and 3; the middle row contains keys 4, 5, and 6; and the top row contains keys 7, 8, and 9.
Key Set 2	Beginning with the shaded key in the lower left corner, the corresponding choice numbers increment as you move clockwise around the key set. The shaded key in the lower left corner corresponds to choice number 10. The key in the upper left corner corresponds to choice number 11; the next key (moving clockwise) in the top row corresponds to choice number 12, and so forth. The middle key on the bottom row corresponds to choice number 18.

Key Set	Numbering Assignments
Key Set 3	These shaded keys are the arrow keys. The up arrow key corresponds to choice number 19; the down arrow key corresponds to choice number 20; the left arrow key corresponds to choice number 21; and the right arrow key corresponds to choice number 22. **Tektronix 4107:** The keys F1 through F4 return valid choice numbers when using this device. **Digital VT125:** The arrow keys are located in a row in the top right portion of the keyboard.

E.3.4 Auxiliary Keypad (Choice)

Supporting Devices: Choice device number 3.

Supporting Workstations: The Digital ReGIS workstations.



These keys operate in the same manner as the numeric keypad for choice input. The upper left shaded key is equivalent to choice prompt 1, the upper right to choice prompt 3, the lower left to choice prompt 4, and the lower right to choice prompt 6.

In addition, the keys located at the top of the keyboard labeled F7 through F20 correspond to the equivalent choice prompt. The workstation triggers the choice prompt of the number you pressed. You can use this keypad (choice device number 3 on the VT240) if you have up to 20 choices. If you have nine or fewer choices, you can use the numeric keypad, for choice device number 2, on either the VT125 or the VT240.

E.3.5 The Lock Key

Supporting Devices: Choice, locator, stroke, and valuator.

Supporting Workstations: VWS workstations.

When you use several logical input devices at one time, the measure of a device can change if you move the mouse's tracking cursor across the device. If the device is in sample mode and if the application happens to sample from that device as you move the tracking cursor across the device's echo area, inappropriate values may be returned to the application program.

DEC GKS and DEC PHIGS allow you to lock a logical input device so that its measure cannot be altered until you unlock the device. If a device is locked, you can still trigger the device (if in request or event mode), but the measure cannot be altered by moving the tracking cursor across the device's echo area.

To lock a device, depress the Lock key (this activates the red Lock light at the top of the keyboard), move the cursor into the device's echo area, and press any mouse button. Once the device is locked, press the Lock key again (the Lock light turns off) and continue to enter input values in other devices. The locked device always returns the same measure.

To unlock the device, depress the Lock key (activating the Lock light), move the cursor into the locked device's echo area, and press any mouse button. Once the device is unlocked, press the Lock key again (the Lock light turns off), and you can now change the measure of the device.

Mathematical Concepts for DEC PHIGS

F

Mathematical Concepts for DEC PHIGS

This appendix provides the equations used for lighting of primitives and depth cueing for DEC PHIGS. The lighting of primitives and depth cueing equations are common to many of the device handlers, such as the LJ250 and LA324 printers, the Tektronix and VS500, GPX-supported, and DECwindows devices. Table F–1 lists the variable definitions and their sources for the lighting equations.

Table F–1 Variable Definitions for the Lighting Equations

Symbol	Description	Data Type	Source
C_a	Ambient contribution from light source	Array of three reals	[2]
C_d	Diffuse contribution from light source	Array of three reals	[2]
C_s	Specular contribution from light source	Array of three reals	[2]
C_1,C_2	Attenuation coefficients	Real	[1]
K_a	Coefficient of ambient reflection	Real	[5]
K_d	Coefficient of diffuse reflection	Real	[5]
K_s	Coefficient of specular reflection	Real	[5]
L_a	Light attenuation	Real	[2]
L_c	Light source color	Array of three reals	[1]
L_d	Light source direction	Array of three reals	[1]
L_e	Light source concentration exponent	Real	[1]
L_p	Light source position	Array of three reals	[1]
NORM	Coordinates of a unit normal vector	Array of three reals	[2]
O_d	Object diffuse color	Array of three reals	[4]
O_e	Object specular exponent	Real	[5]
O_p	Object position	Array of three reals	[3]
O_s	Object specular color	Array of three reals	[5]

(continued on next page)

Table F–1 (Cont.) Variable Definitions for the Lighting Equations

Symbol	Description	Data Type	Source
V_e	Unit vector from object to eye point	Array of three reals	[2]
V_n	Unit normal vector to object	Normal	[3]
V_r	Unit reflection vector from object	Array of three reals	[2]
V_1	Unit vector from object to light source	Array of three reals	[2]

The sources in the preceding table are defined as follows:

Source	Description
[1]	Light source representation
[2]	Calculated
[3]	Explicit or derived from object geometry
[4]	Color table, direct color, vertex color, back-face color
[5]	Surface or back-face surface properties

F.1 Lighting Equations

The dot character (·) in the following equations represents the inner product of the two operands.

Total color = sum (color contribution from each light source)

Color contribution from a light source = $C_a + C_d + C_s$

For ambient light sources:

$C_a = K_a * L_c * O_d$
$C_d = 0$
$C_s = 0$

For directional light sources:

$C_a = 0$
$C_d = K_d * O_d * L_c * V_n \cdot V_1$
$C_s = K_s * O_s * L_c * (V_e \cdot V_r)^{**}O_e$

For positional light sources:

$C_a = 0$
$C_d = K_d * O_d * L_c * V_n \cdot V_1 * L_a$
$C_s = K_s * O_s * L_c * (V_e \cdot V_r)^{**}O_e * L_a$

For spot light sources:

$C_a = 0$
$C_d = K_d * O_d * L_c * V_n \cdot V_1 * (L_d \cdot (-V_1))^{**}L_e * L_a$ [4]
$C_s = K_s * O_s * L_c * (V_e \cdot V_r)^{**}O_e * (L_d \cdot (-V_1))^{**}L_e * L_a$ [4]

For spot light sources:

Light attenuation is calculated as follows:

$L_a = 1 / (C_1 + C_2(\mathrm{NORM}(O_p - L_p)))$

The reflectance vector is calculated as follows:

$$V_r = 2 * (V_n \cdot V_1) * V_n - V_1$$

In all cases, a dot product resulting in a negative value will be replaced by 0.0.

F.2 Depth Cueing Equations

Objects are depth cued toward a specified depth cue color. The scaling of a point in between the front depth cue reference plane and the back depth cue reference plane is determined by a linear interpolation of the depth cue scale factors between the depth cue reference planes, as indicated by the following equations. Any points in front of the front depth cue reference plane or behind the back depth cue plane are rendered in a constant color, as indicated in the following equations.

If z is in front of P_f:

$$C_i' = S_f * C_i + (1 - S_f) * CD_i$$

If z is behind P_b:

$$C_i' = S_b * C_i + (1 - S_b) * CD_i$$

If z is between P_f and P_b:

$$r = S_b + (((Z - P_b) * (S_f - S_b)) / (P_f - P_b))$$
$$C_i' = r * C_i + (1 - r) * CD_i$$

Symbols used in the equations are defined as follows:

Symbol	Description
CD_i	Component of depth cue color
C_i	Component of input color
C_i'	Component of resultant color
P_b	z-coordinate of back reference plane (in normalized projection coordinate points)
P_f	z-coordinate of front reference plane (in normalized projection coordinate points)
r	Depth cue position (point)
S_b	Back scale factor
S_f	Front scale factor
Z	Depth value of point (in normalized projection coordinate points)

Performance Tuning for DEC PHIGS

G

Performance Tuning for DEC PHIGS

This appendix presents techniques for improving DEC PHIGS performance. In particular, the following subjects are discussed:

- Device-independent tuning
- DECwindows and OSF/Motif workstation tuning
- Tuning on Digital UNIX systems
- Tuning on OpenVMS VAX systems
- Tuning on OpenVMS Alpha systems

Note that this appendix does not provide absolute performance numbers.

G.1 Device-Independent Tuning

You can perform certain techniques to achieve better system performance on both DECwindows and OSF/Motif devices. These device-independent techniques include:

- Choosing a language binding
- Defining the level of primitive aggregation
- Choosing appropriate primitive types
- Providing optional primitive information
- Selecting the drawing mode: structure mode versus immediate mode
- Executing structures
- Avoiding regenerations when posting to views
- Performing quick updates
- Defining the X transport mechanism
- Using the conditional traversal feature
- Using performance DEC PHIGS tools

The following sections describe each of these tuning techniques.

G.1.1 Choosing a Language Binding

The selection of a language binding can affect system performance. The available bindings are:

- **ISO C language binding**

  This binding is the most efficient because DEC PHIGS is tuned to this binding, and because there are relatively few parameters.

- **DEC C language binding**

  This binding is very efficient, as its form is close to that of the ISO C binding.

- **PHIGS$ language binding**

  This binding is less efficient than the ISO C and DEC C bindings because it has more parameters, and these parameters do not have a one-to-one mapping with the ISO C or DEC C binding parameters.

- **Ada language binding**

  This binding is less efficient than the PHIGS$ binding because it is a layer on top of the PHIGS$ binding, and requires additional copying of data. While it is more difficult to use than the Ada binding, the PHIGS$ Ada interface (PHIGS_DEF.ADA) is more efficient than the Ada binding because less copying and reformatting of data is required.

- **Fortran language binding**

  This binding is less efficient than the PHIGS$ binding because it is a layer on top of this binding, and requires additional copying of data.

G.1.2 Defining the Level of Primitive Aggregation

Primitive aggregation involves combining many small primitives into fewer large primitives. You can combine polylines into polyline sets, and can combine fill areas into fill area sets, indexed polygons, triangle strips, or quadrilateral meshes.

The aggregation of primitives decreases the memory required for individual primitives by reducing the number of structure elements, which reduces the total fixed overhead. It also reduces processing time by limiting the setup required to draw a new primitive.

Primitive aggregation can reduce the number of transformations necessary. For example, with an indexed primitive such as an indexed polygon with data, fewer transformations are required because shared vertices are transformed only once and can be indexed to create multiple areas.

The disadvantage of using larger primitives is that pick input data indicates only the primitive picked, not the facet of the primitive that was picked. Therefore, if an application requires finer picking granularity, primitive aggregation may not be appropriate.

G.1.3 Choosing the Appropriate Primitive Types

Choosing the most appropriate primitive type can speed up processing time. Some guidelines you should follow are:

- Use nonuniform B-spline primitives (NURBS) instead of the equivalent set of lines or filled areas.
- Use the two-dimensional form of the primitive when the Z value is not present, not important, or equal to 0.0.
- Use specific primitives such as spheres, cones, cylinders, and cubes for more efficient memory usage and shorter drawing times.
- Use the DEC PHIGS extension primitives polyline set 3 or polyline set (two-dimensional) instead of the polyline set 3 with color primitive. These two primitives do not provide for color specification, and thus enable more optimal performance. The polyline set primitive may also use less memory when it is stored in a structure.

G.1.4 Providing Optional Primitive Information

With primitives such as fill area and fill area set, you can define additional DEC PHIGS information that can improve performance. For instance, the argument *shape flag* allows an application to provide data about a primitive's shapes, which can be defined as UNKNOWN, COMPLEX, NONCONVEX, or CONVEX. When a primitive's facets are defined as CONVEX, performance can be greatly improved.

Another way of obtaining better performance is to specify a facet's normals. In this way, DEC PHIGS is not required to compute the normals, which can unnecessarily slow performance.

Note, however, that certain types of optional data can decrease performance, particularly if used in rendering.

G.1.5 Selecting the Drawing Mode: Structure Versus Immediate

Two drawing modes are available with DEC PHIGS: structure mode and immediate mode. In structure mode, DEC PHIGS primitives are stored in structures, and DEC PHIGS redraws the display from the internally stored display list. Structure mode is appropriate when most of the graphic data remains static from frame to frame.

With PEX or OpenGL workstations, structures and primitives can be stored in the PEX or OpenGL server, respectively. In these cases, the primitives need not be transmitted to the server during structure traversal.

The PEX or OpenGL server may also choose to store the primitive in a state that is optimal for sending drawing commands to the graphic hardware. With primitives stored in structures, DEC PHIGS can also save extent information that can be used to clip the entire primitive without checking each of its points.

For these reasons, structure mode is usually faster than immediate mode. Other benefits of using structure mode include improved exposure event handling, better color allocation, and the ability to use pick input.

In immediate mode, the application passes each primitive to DEC PHIGS when it is to be drawn, and reduces the cost of structure creation. This mode is appropriate when many primitives change from one frame to the next. Immediate mode requires more effort by the programmer to maintain the correctness of the display, whereas structure mode manages the correctness of the display without additional programmer intervention.

Furthermore, in immediate mode, your DEC PHIGS application can control the following features:

- On PEX and OpenGL workstations, the application can determine whether the image and Z buffers are cleared when the BEGIN RENDERING function is called.
- On PEX workstations, the application can define a set of device coordinate clipping regions, which will take effect on the next call to BEGIN RENDERING.

The control of these features is enabled using escape function –520. For more information on using this escape, see Appendix B.

Combining structure and immediate modes can result in good performance. With this technique, large primitives are stored in structures that are executed in immediate mode. The sample DEC PHIGS battle zone program, provided in the PHIGS$EXAMPLES:[BATTLEZONE] (OpenVMS) or the

/usr/lib/PHIGS/examples/battlezone (Digital UNIX) directory, illustrates this technique.

G.1.6 Executing Structures

When an *execute structure* element is present during structure traversal, the DEC PHIGS traversal state list is saved before the traversal of the executed structure, and restored after this traversal. These save and restore operations can negatively affect performance.

On non-PEX workstations, if no attribute changes occur in the traversal state list, DEC PHIGS optimizes performance by not performing the save and restore of the traversal state. For information on optimizing performance on PEX workstations, refer to Chapter 11.

By using the INCLUDE STRUCTURE function, you can prevent the save and restore of the traversal state, thus causing the attributes changed by an included structure to remain in effect after this structure is traversed. Because the INCLUDE STRUCTURE function does not perform the push and pop of the attribute stack, performance can be improved.

Note

If an application coded as a PEX workstation tries to display to a PEX server supporting only Version 5.0 of the PEX protocol, DEC PHIGS will substitute the EXECUTE STRUCTURE function for the INCLUDE STRUCTURE function, which may slow down performance and modify the display results.

G.1.7 Avoiding Regenerations when Posting to Views

When working with views, you can ensure better performance as follows:

- Post structures to views to minimize regeneration. In many cases, regeneration is limited to a single view.
- Be careful with transparent views. When a transparent view must be regenerated, all lower priority views that it intersects will be at least partially regenerated.
- Be careful when posting to view 0. You should either avoid posting structures to view 0, or make view 0 a low priority view. Posting to views allows DEC PHIGS to regenerate only dirty views on each call to UPDATE WORKSTATION. DEC PHIGS marks all views as dirty if you perform the following operations:
  - Enable *xy* clipping
  - Disable a view's background
  - Deactivate a single view
  - Change view clip limits

G.1.8 Performing Quick Updates

When a quick update of a view is requested, the old geometry is drawn in the background color and then the new geometry is drawn. Quick updates are appropriate for small changes. If the changes are complex, however, it may be faster to regenerate the view.

If you want a quick update following an attribute change, Digital recommends using batch quick updates (BQUMs). See Appendix B for information on how to use the BQUM escapes.

Quick update performance on PEX workstations can be improved by turning off Z-buffering and by avoiding the use of facet or vertex colors for output primitives that support such colors.

G.1.9 Defining the X Transport Mechanism

Shared memory transport is fastest when the client and server are run on the same system. On an OpenVMS operating system, you define the transport mechanism as follows:

```
$ SET DISPLAY/TRANSPORT=LOCAL Return
$ DEFINE PHIGS$CONID DECW$DISPLAY Return
```

On a UNIX system, you define the transport mechanism as follows:

```
% setenv PHIGSconid local:0 Return
```

If you use unix:0, DEC PHIGS uses UNIX domain sockets.

DECnet or TCP/IP transport is required when the client and server are run on different systems. On an OpenVMS operating system with DECnet, you define the transport mechanism as follows:

```
$ DEFINE PHIGS$CONID node::0 Return
```

You can also define the transport mechanism using the commands:

```
$ SET DISPLAY/NODE=NODENAME Return
$ DEFINE PHIGS$CONID DECW$DISPLAY Return
```

On a UNIX system with DECnet, you define the transport mechanism as follows:

```
% setenv PHIGSconid node::0 Return
```

On a UNIX system with TCP/IP, you define the transport mechanism as follows:

```
% setenv PHIGSconid node:0 Return
```

In the previous commands, replace *node* with your node name.

G.1.10 Using the Conditional Traversal Feature

DEC PHIGS includes a feature called **conditional traversal**. This feature enables the application to alter the DEC PHIGS traversal process by providing tests that control further execution. Conditional traversal is most commonly used to determine how objects are drawn: if an object will result in only a few pixels being drawn on the display, DEC PHIGS draws a simple object, which is faster than drawing a large and complex primitive. See the conditional traversal section in the language binding manuals for more information.

Note

This feature is not available in DEC PHIGS Version 3.2.

G.1.11 Using DEC PHIGS Performance Tools

DEC PHIGS provides several methods for determining the source of performance problems within an application:

- **DEC PHIGS tracer**

  The DEC PHIGS tracer generates a log of DEC PHIGS commands that can be examined for redundant or unnecessary function calls. Activate the trace on OpenVMS systems by entering:

  ```
  $ DEFINE PHIGS$DEBUG "TRACE" Return
  $ DEFINE PHIGS$TRACE_OUTPUT TRACE.OUT Return
  ```

  Activate the trace on UNIX systems by entering:

  ```
  % setenv PHIGSdebug "TRACE" Return
  % setenv PHIGStrace_output trace.out Return
  ```

- **DEC PHIGS timer**

  The DEC PHIGS timer records the usage levels of each DEC PHIGS function and the approximate time used by the function. You can use the timer to detect unnecessarily high numbers of calls to DEC PHIGS functions. Activate the timer on OpenVMS systems by entering:

  ```
  $ DEFINE PHIGS$DEBUG "TIMER" Return
  $ DEFINE PHIGS$TIMER_OUTPUT timer.out Return
  ```

  Activate the timer on UNIX systems by entering:

  ```
  % setenv PHIGSdebug "TIMER" Return
  % setenv PHIGStimer_output timer.out Return
  ```

  Note that the timer is not supported in DEC PHIGS Version 3.2 on UNIX systems.

- **Memory usage tracking**

  Memory usage can be important for determining the system resources required. To compute the memory usage, you can request the maximum memory used to store structures during a DEC PHIGS session. This information is displayed at workstation closing and includes the memory used by DEC PHIGS on the client, but not the memory used by the PEX or OpenGL server. To obtain this information on OpenVMS systems, define the following logical name:

  ```
  $ DEFINE PHIGS$STRUCT_MEM_DUMP 1 Return
  ```

  To obtain this information on UNIX systems, define the following environment variable:

  ```
  % setenv PHIGSstruct_mem_dump 1 Return
  ```

  This information will also show whether DEC PHIGS was able to share the structure memory among multiple DEC PHIGS workstations.

G.2 Tuning DECwindows and OSF/Motif Workstations

Tuning of DECwindows X11 and OSF/Motif PEX workstation performance includes:

- Improving pick performance
- Limiting the size of primitives
- Modifying the structure mode
- Grouping primitives with the same attributes
- Changing attributes on OpenGL devices
- Choosing a double buffering method: pixmap versus MIT (PEX only)
- Disabling input devices that echo to the display
- Other tuning techniques

These tuning techniques are described in the following sections.

G.2.1 Improving Pick Performance

You can improve pick performance on DECwindows X11 and OSF/Motif workstations in several ways:

- Set the HLHSR method to painter's algorithm.

  This allows DEC PHIGS to search the paint buffer (linked list) rather than perform a structure traversal.

- Organize the application into multiple views, each with fewer output primitives.

  This enables DEC PHIGS to perform fewer structure traversals.

- Avoid using deeply nested structures.

  If you are *not* using the HLHSR method of painter's algorithm, deeply nested structures may degrade performance.

G.2.2 Limiting Primitive Size

Because X11 and PEX workstations must use X transport buffers to copy data from the DEC PHIGS client to an X server, the following limitations exist with respect to large output primitives:

- **On X11 workstations:**

  DEC PHIGS breaks down large line primitives (such as polylines and polyline sets) into multiple X line calls. Therefore, DEC GKS and DEC PHIGS can display line primitives that require more than one transport buffer without any apparent problem.

  DEC PHIGS applies a reduction algorithm to individual facets of fill primitives, however, thus allowing a large number of vertices per facet (such as fill areas or fill area sets). This algorithm enables a single facet to fit into a single transport buffer. The X11 transport buffer size varies between platforms, usually in the range 16 to 64 kilobytes. See the operating system documentation for X11 transport buffer sizes for the exact buffer size.

- **On PEX workstations:**

  A DEC PHIGS primitive cannot be larger than 256 kilobytes. If you attempt to send a primitive larger than 256 kilobytes, DEC PHIGS issues an error message and ignores the primitive.

  Note

  With OpenGL workstations, there are no limitations on primitive size.

G.2.3 Modifying the Structure Mode

For PEX and OpenGL devices, structures can be stored in the client or the server. In most cases, you can improve performance significantly by storing structures in the server.

To determine where structures will be stored on OpenVMS systems, you define the logical name:

```
$ DEFINE PHIGS$DEVICE_STRUCT_SUPPORT_xxx  n Return
```

To determine where structures will be stored on UNIX systems, you define the environment variable:

```
% setenv PHIGSdevice_struct_support_xxx  n Return
```

In both cases, *xxx* is the workstation type, which can have the value 220 to 223 or 240 to 243 on PEX devices and 270 to 273 on OpenGL devices. The value *n* is the structure mode option, which can be one of the following:

- **Structure mode = 0**

  In this mode, all DEC PHIGS structures are stored on the client. During each structure traversal, all DEC PHIGS structure elements are transmitted to the PEX or OpenGL server. This method uses the least amount of memory for storing structures, but is the slowest for PEX devices. For OpenGL devices with direct rendering support, however, the performance may be sufficient.

- **Structure mode = 3 (PEX only)**

  In this mode, all DEC PHIGS structures are stored on the server. During each structure traversal, DEC PHIGS sends only a minimum of commands to the PEX server. This mode is usually the fastest for PEX; however, it does not support all of the PHIGS PLUS or DEC PHIGS extension functions as these functions are not defined in PEX Version 5.1 (the current version of Digital PEX servers).

- **Structure mode = 4**

  In this mode, DEC PHIGS stores each primitive in a PEX or OpenGL server display list. Although attributes are not usually stored in server display lists, they may be stored there when the mapping of DEC PHIGS to OpenGL commands requires it. Structure traversal is performed by the DEC PHIGS client, which transmits attribute commands and display list execution commands to the PEX or OpenGL server.

The primitives to be stored in the PEX or OpenGL server display list are determined by an environment option, which indicates the minimum size of the primitives that will be stored on the server. To set this environment option on OpenVMS systems, enter:

```
$ DEFINE PHIGS$DEVICE_STRUCT_ELMSIZE_xxx  100 Return
```

To set the environment option on UNIX systems, enter:

```
% setenv PHIGSdevice_struct_elmsize_xxx  100 Return
```

In both cases, *xxx* is the workstation type.

The default value of the environment option is 100. If the value is too small, each small primitive will be stored in a separate display list, resulting in a large display list overhead. If the value is too large, the performance will resemble the performance when structure mode is set to 0, where no structures are stored in the PEX or OpenGL server.

Structure Mode and Server Response Time

The structure mode you select will affect the response time of the X11 server when your DEC PHIGS application is running. This response time is the time required for the X11 server to react to operator input and requests from DEC PHIGS and other X11 applications. Operator input is generated, for example, when the user moves the mouse, presses a mouse button, or types at the keyboard. In some applications, there may be a maximum allowable time by which the server must respond to a drawing request, even when the server is in the process of rendering a complicated display.

In most cases, structure modes 0 and 4 yields better server response time than structure mode 3. On the other hand, structure mode 3 results in better performance during output primitive rendering than structure modes 0 and 4. To determine which structure mode is best for your application, you will need to experiment with the different modes. If server response time is a critical concern for your application, there are two recommended methods for achieving better server response time:

- **Method 1**

  With this method, you use structure mode 3, reduce the size of your posted structure networks, and increase the number of your posted structure networks. For example, instead of posting a single structure A with 10 *execute structure* elements in it, take each of the 10 structures executed within structure A and post each separately to the workstation. In structure mode 3, DEC PHIGS sends a single command to execute each of the posted structure networks. If a structure network is large, server response time will be slower; if the structure network is small, server response time will be faster.

- **Method 2**

  With this method, you use structure modes 0 and 4 and try to improve output primitive rendering performance. One way to improve this performance is to combine as many output primitives as possible to form larger primitives. For example, if you had 10 polylines in a structure with a color change just before each polyline, you could replace all color and polyline elements with a single call to the POLYLINE SET 3 WITH COLOR function.

G.2.4 Grouping Primitives with the Same Attributes

Attribute structure elements slow down the geometry pipeline. Digital recommends that you group primitives with the same attributes, and avoid using unnecessary attribute settings.

G.2.5 Changing Attributes on OpenGL Devices

Changing attributes can degrade performance on OpenGL devices if you use structure mode 4. When DEC PHIGS primitives and attributes are mapped to OpenGL commands, many attributes can be stored in OpenGL server display lists. If these attributes are changed during editing of the DEC PHIGS structure, the next traversal will delete and re-create the OpenGL display list to maintain the correct picture. Therefore, if attributes are changed frequently, the constant reconstruction of the display list can have a negative effect on system performance.

The attributes that must be stored in OpenGL display lists are:

- Polyline-related: none
- Polymarker-related: marker type
- Text-related: all text attributes
- Annotation text-related:
  - All text attributes
  - Annotation text style
  - View index
  - Composite view transformation
  - Annotation style
  - Line attributes
- Interior-related:
  - Interior style
  - Shading method
  - Lighting method
  - Surface properties
  - Light source state
- Edge-related: edge attributes

G.2.6 Choosing a Double Buffering Method: Pixmap Versus MIT (PEX Only)

On PEX devices, DEC PHIGS supports two methods for double buffering: pixmap and MIT. MIT double buffering is the best method for animation where frame rates are important. This method takes advantage of hardware features to simply swap in the next frame.

With pixmap double buffering, the image is drawn to an offscreen pixmap, and then the entire pixmap is copied to the display. This method uses the pixmap to repair windows after exposure events, without redrawing the entire display. In most cases, the time required to repair the display is greatly reduced. MIT double buffering, on the other hand, requires that the entire screen be redrawn after an exposure event.

G.2.7 Disabling Input Devices

Input devices that echo to the output display region reduce performance significantly. To maintain the correctness of input echoes and avoid complications with asynchronous input, DEC PHIGS checks for input devices; disables the input device, if required; performs the output operation; and reenables the input devices.

Echoing input devices may reduce performance by a factor of 10, because they add a considerable number of flushes to the output stream. Therefore, when performing speed-critical drawing operations, you should turn off all input devices that draw to the output display region (for example, locator, stroke, pick).

G.2.8 Other Tuning Techniques

Depending on the graphics hardware used, certain software operations can dramatically affect performance. On graphics hardware that has a small amount of pixel memory, such as the ZLX–E1, reducing the use of pixmaps can improve performance. You can reduce the use of pixmaps, for example, by turning off the save-under attribute, using a smaller window, turning off Z-buffering, and turning off double buffering.

On some graphics devices, the use of certain software features may force the drawing to be done entirely by the software. Because the accelerated features of the graphics hardware are not used to perform drawing operations, the system performance is slower. For instance, on many graphics devices, transparency is performed by the software.

G.3 Tuning on Digital UNIX Systems

To ensure optimum performance of your three-dimensional applications, you may need to tune your Digital UNIX system. For more information, refer to the *DEC Open3D Installation Guide for Digital UNIX Systems*.

G.4 Tuning on OpenVMS VAX Systems

The DECwindows server for three-dimensional applications is very demanding on system resources and requires some specific tuning. The following sections describe how to modify various system parameters to ensure optimal server performance. For additional information on these parameters, refer to the OpenVMS documentation.

G.4.1 Minimum System Requirements

System tuning is a two-step process: you must modify both SYSTEM account quota values and the server quota values to improve performance. Table G–1 shows the minimum SYSTEM account quota values for a three-dimensional accelerated system with at least 32 MB of physical memory, running complex client applications.

Table G–1 Minimum Recommended Quotas for System Tuning

Account Quotas	Recommended Values
FILLM	400
ENQLM	1024
WSDEF	8192
WSQUO	10240
WSEXTENT	16384
PGFLQUO	200000

To set the SYSTEM account quotas to the values shown in Table G–1, you can use the AUTHORIZE utility.

In addition to the SYSTEM account quotas, you must modify the server quotas in the SYS$COMMON:[SYSMGR]DECW$PRIVATE_SERVER_SETUP.COM. If this file does not exist, copy DECW$PRIVATE_SERVER_SETUP.TEMPLATE to DECW$PRIVATE_SERVER_SETUP.COM. Then, define the following minimum values in this file:

```
$ DEFINE/NOLOG/PROC DECW$SERVER_FILE_LIMIT         400
$ DEFINE/NOLOG/PROC DECW$SERVER_ENQUEUE_LIMIT     1024
$ DEFINE/NOLOG/PROC DECW$SERVER_WSDEF             8192
$ DEFINE/NOLOG/PROC DECW$SERVER_WSQUOTA          10240
$ DEFINE/NOLOG/PROC DECW$SERVER_WSEXTENT         16384
$ DEFINE/NOLOG/PROC DECW$SERVER_PAGE_FILE       200000
```

Note

You must define quotas for both the SYSTEM account and the server, and these values should be the same.

G.4.2 System Requirements for Large Applications

If you are using a demanding application, for example, an application with lengthy animation sequences, large models, or large assemblies, you should set the working set quotas of the SYSTEM account to the values shown in Table G–2 for better performance.

Table G–2 Recommended Quotas for Demanding Applications

Parameter	Quota
WSDEF	10240
WSQUO	20480
WSEXTENT	32768

You must also set the following server quotas:

```
$ DEF/NOLOG/PROC DECW$SERVER_WSDEF      10240
$ DEF/NOLOG/PROC DECW$SERVER_WSQUOTA    20480
$ DEF/NOLOG/PROC DECW$SERVER_WSEXTENT   32768
```

G.4.3 Optimizing Performance

If the quotas shown in the preceding sections do not result in the desired performance, you may need to define even larger values. To determine if this is necessary, you should monitor the server process during the heaviest display usage to see if its working set use approaches the maximum WSEXTENT parameter value.

When monitoring the process, you should pay particular attention to the following:

- Virtual page count

  To determine the current virtual page count a process is allowed to have, use the SYSGEN utility to issue the command SHOW VIRTUALPAGECNT. If the value is less than 200,000, you can change the VIRTUALPAGECNT parameter value by adding the following line to the SYS$SYSTEM:MODPARAMS.DAT file:

  ```
  MIN_VIRTUALPAGECNT = 200000
  ```

  Note

  The *minimum* value of VIRTUALPAGECNT for a working X server is 200,000 if a ZLX–E or ZLXp–E is installed.

  Set the MIN_VIRTUALPAGECNT parameter value as high as the equivalent of your total available physical memory and page file space. If the VIRTUALPAGECNT value is less than the sum of your WSEXTENT and PGFLQUO values, the server cannot make full use of the quotas.

- Maximum size of working set

  The maximum size of the process working set, defined by the WSMAX parameter, must at least be equal to the largest WSEXTENT value set for your accounts. If this is not the case, add the following line to the SYS$SYSTEM:MODPARAMS.DAT file:

  ```
  MIN_WSMAX = 32768
  ```

- Page file

  You should increase the size of the page file (DECW$SERVER_PAGE_FILE parameter) to accommodate the page file quotas of both the server and the clients. The page file quota for the server is defined by the SYSTEM account page file quota.

You should set large parameter values only if necessary, because if values are too large, performance may be degraded. After you redefine the parameters, run AUTOGEN and reboot the system for the new values to be taken into account.

If after initial tuning and considerable use, the server is failing or is unnecessarily unresponsive, the server may be out of memory or the memory may be fragmented. For example, you may find a message similar to the following in the server error log SYS$MANAGER:DECW$SERVER_0_ERROR.LOG:

```
"xxx:  Out of memory"
```

In such a case, you should perform the following steps:

1. Increase the server's page file quota by modifying both the system quota (PGFLQUO) and the server quota (in DECW$PRIVATE_SERVER_SETUP.COM).
2. Increase the virtual page count (MIN_VIRTUALPAGECNT) in the MODPARAMS.DAT file.
3. Run AUTOGEN to take into account the new values.

If these steps do not resolve the problem, then you should submit a problem report.

G.5 Tuning on OpenVMS Alpha Systems

To ensure optimum performance of your three-dimensional applications, you may need to tune the system and the DECwindows server. For information on tuning the PEX and OpenGL extensions to the server, refer to the *DEC Open3D Installation Guide for Digital UNIX Systems*.

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