# Software Product Description

**PRODUCT NAME:** **DEC PHIGS for VMS, Version 2.1** **SPD 29.38.04**

**DESCRIPTION**

DEC PHIGS (Programmers Hierarchical Interactive Graphics System) for VMS is a sophisticated, 3D graphics support system that controls the definition, modification, and display of hierarchical graphics data. DEC PHIGS for VMS manages the organization and display of graphical data stored in a conceptually centralized database.

DEC PHIGS for VMS is Digital Equipment Corporation's implementation of the 1988 ANSI/ISO PHIGS standard for three dimensional (3D) device-independent graphics. DEC PHIGS for VMS provides the standard FORTRAN and C language bindings as well as a language-independent (PHIGS$) binding. DEC PHIGS for VMS is supported on most Digital processors running the VMS Operating System.

DEC PHIGS for VMS is device independent. That is, the same program can generate graphical output on different devices without modification to the source code. DEC PHIGS for VMS supports either DECwindows or VMS Workstation Software (VWS). DEC PHIGS for VMS also supports most of the hardcopy devices supported by DEC GKS, such as the HPGL™ series of plotters and Digital's compatible sixel devices, as well as all the terminals supported by DEC GKS.

DEC PHIGS for VMS is a subroutine library packaged as a set of shareable images which the application program is linked against. The shareable images are activated at run time as needed.

DEC PHIGS for VMS provides capabilities in addition to those specified in the PHIGS standard. Additional features include:

- Hidden line/hidden surface removal (HLHSR)
- Lighting, shading and depth cuing
- Additional primitives
  - Circles
  - Circular arcs
  - Triangle Strips
  - Quadrilateral Meshes
  - Indexed Polygons
  - Trimmed and Untrimmed NURBs (non-uniform rational B-splines)

Some functionality from the PHIGS Standard has not been implemented in DEC PHIGS for VMS.

*Functionality Not Supported by DEC PHIGS for VMS:*

- Modeling clip
- Metafiles
- Cell array
- Patterns
- Incremental spatial search

**Features**

*Structure Storage*

DEC PHIGS for VMS maintains a graphical database known as structure storage. Output primitives (polylines, polymarkers, etc.), attribute selection functions, labels, application data, name set specifications, transformation selections, and structure references are all structure elements that are placed in the structure store. These elements can be edited at any time by the application program. Graphical output is generated by a structure traversal mechanism that interprets items in the structure store.

DEC PHIGS for VMS provides an alternate traversal mechanism called immediate mode. Using immediate mode, PHIGS primitives can be rendered directly to the display surface without being placed in structure storage.

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*Viewing Operations*

DEC PHIGS for VMS allows the definition of objects in their own "modeling" coordinate systems. Transformation functions are provided to position these objects with respect to one another in a "world" coordinate system. World coordinates can have any scale. For example, one application might have a maximum range from 0 to 1000.0 while another application might limit the range from 0.01 to 0.1. DEC PHIGS for VMS automatically converts from the world coordinate systems into coordinates appropriate for the display device being used.

The user can control multiple simultaneous views of the same object on separate display surfaces, as well as the position and size of the picture on the surface.

In addition to the PHIGS standard viewing model, DEC PHIGS for VMS also provides alternate viewing functionality commonly known as "posting to views".

*Control Functions*

DEC PHIGS for VMS provides special functions for management of the picture process, including PHIGS initialization and termination, and functions that control the opening and closing of logical graphical devices.

*Output Functions*

DEC PHIGS for VMS provides functions for creating both 2D and 3D graphics elements in structure storage. Some of these functions allow lighting and shading information to be specified. The functions are as follows:

| | | |
|---|---|---|
| Polyline | - | Draws one or more connected line segments. |
| Polymarker | - | Draws one or more symbols which can mark significant points in a picture. |
| Text | - | Draws a character string. Characters can be displayed in a variety of fonts and orientations. Text size is affected by transformations. |
| Fill Area | - | Draws a polygonal area which can be hollow or filled with a uniform color or a hatch style. |
| Fill Area Set | - | Draws a set of polygonal areas with holes or disjoint regions that are treated as a single entity. Control of edge attributes is provided with this primitive. |
| Annotation Text Relative | - | Draws a character string in an X-Y plane (always readable). Characters can be displayed in a variety of fonts and orientations. Text size is not affected by transformations, but text position is affected. |
| Circle and Circular-Arc | - | Draws a circle or circular arc at the specified position in two-dimensional form. |
| Triangle Strip | - | Generates a sequence of triangles. Each triangle shares an edge with the next triangle in the strip. |
| Quadrilateral Mesh | - | Generates a sequence of quadrilateral polygons. |
| Indexed Polygons | - | Generates a sequence of polygons that permits PHIGS to take advantage of shared vertices. |
| NURBs | - | Non-Uniform Rational B-spline. Generates a 3D curve or surface from user-specified control points and approximation criteria. |

*Attributes*

Each output function has an associated set of attributes which control the appearance of the output. Attributes can be defined in groups (bundles) or individually. Attributes are:

| | | |
|---|---|---|
| Line Type | - | The programmer can control the style of a line. For example, lines can be dotted or dashed. |
| Line Width | - | In addition to line type, the width of the line can be controlled. |
| Color | - | Color selection is performed by selecting one of the predefined colors or by specifying the red, green, and blue intensities required to define a particular color on color devices. |
| Character Attributes | - | A specific font, as well as the character spacing, height, angle, path, and alignment can be specified. |

*Input Functions*

DEC PHIGS for VMS supports synchronous and asynchronous input using any of the six different input methods listed below.

| | | |
|---|---|---|
| Locator | - | Returns a point in the user's world coordinate system. |
| Stroke | - | Returns a series of points in the user's world coordinate system. |
| Valuator | - | Returns a single floating point value within a specified range. |
| Choice | - | Returns a single non-negative integer within a specified range. |
| String | - | Returns a string of characters. |
| Pick | - | Returns a pick path which consists of a list of structure identifier, pick identifier, and element number for each level in the structure network. |

DEC PHIGS for VMS includes the concept of name sets. Individual primitives can be associated with members of a name set that is used to determine eligibility for highlighting, visibility and picking. For example, in an architectural drawing, all steam pipes can be associated with one member of a name set and all water pipes with another. These sets of pipes can then be made invisible, pickable, or highlighted as a group.

*Inquiry Functions*

DEC PHIGS for VMS provides a complete set of inquiry functions which aid in developing modular, device-independent programs.

*PHIGS Archive Files*

DEC PHIGS for VMS provides an interface to archive files, which allows for all or part of structure storage to be saved so that it can be recalled later. Archive files can be used for the following purposes:

- Saving and restoring graphical information between sessions
- Transporting graphical information between DEC systems with compatible versions of DEC PHIGS
- Transporting graphical information from one DEC PHIGS application to another DEC PHIGS application
- Storing accompanying nongraphical information

*Character Fonts*

DEC PHIGS for VMS provides a series of stroke precision character fonts. These character fonts were digitized by Dr. Allen V. Hershey of the Naval Surface Weapons Laboratory, and supplied to Digital by the National Bureau of Standards.

*Language Binding*

DEC PHIGS for VMS functions can be accessed by three sets of subroutine calls. DEC PHIGS for VMS provides an interface which conforms to the proposed ANSI and ISO standard FORTRAN and C bindings to PHIGS, as well as a DEC specified PHIGS$ interface, which follows the standard VMS calling conventions, and is callable from many different languages.

The FORTRAN and C binding interfaces allow users to transport PHIGS applications which are written in FORTRAN or C, across heterogeneous operating systems with conforming implementations of PHIGS and the FORTRAN or C bindings. Calls to the C language binding cannot be mixed with calls to the other language bindings in the same application.

*Graphic Handlers*

DEC PHIGS for VMS provides support for a wide variety of Digital and non-Digital graphics devices. In addition, users can develop their own graphic device handlers for devices that Digital does not support via the DEC GKS 2D device handler interface. This is described in the *Building a DEC GKS Device Handler System Manual* which can be purchased separately (Order No. AA-MJ33A-TE). Device handlers can be developed in VAX FORTRAN, VAX C, and VAX PASCAL.

*DEC PHIGS Run-Time Only License*

Since DEC PHIGS for VMS is a graphics application development tool, Digital provides a Run-Time Only License for running graphics applications that were developed utilizing DEC PHIGS graphics. This license is offered at a substantially reduced cost per CPU. The DEC PHIGS Run-Time License does not allow the user to create new applications, but rather allows execution of applications that were previously developed on a CPU where the full PHIGS product has been installed under a Single-use License Option.

## HARDWARE REQUIREMENTS

VAX, MicroVAX or VAXstation configuration as specified in the System Support Addendum (SSA 29.38.04-x).

## SOFTWARE REQUIREMENTS*

*For Systems Using Terminals (No DECwindows Interface):*

VMS Operating System

*For workstations running VMS Workstation Software:*

VMS Operating System

VMS Workstation Software

*For workstations running VMS DECwindows:*

VMS Operating System (and the necessary components of DECwindows)

* Refer to the System Support Addendum for availability and required versions of prerequisite software and for information regarding components of VMS DECwindows (SSA 29.38.04-x).

## ORDERING INFORMATION

Development Option

Software Licenses: QL-0KBA*-**
Software Media: QA-0KBA*-**
Software Documentation: QA-0KBAA-GZ
Software Product Services: QT-0KBA*-**

Run-Time Option

Software Licenses: QL-VK1A*-**
Software Media: QA-VK1A*-**
Software Product Services: QT-VK1A*-**

* Denotes variant fields. For additional information on available licenses, services and media, refer to the appropriate price book.

## SOFTWARE LICENSING

This software is furnished under the licensing provisions of Digital Equipment Corporation's Standard Terms and Conditions. For more information about Digital's licensing terms and policies, contact your local Digital office.

## LICENSE MANAGEMENT FACILITY

This layered product supports the VMS License Management Facility.

License units for both the full development system and runtime system are allocated on a CPU-capacity basis.

For more information on the License Management Facility, refer to the VMS Operating System Software Product Description (SPD 25.01.xx) or the License Management Facility manual of the VMS Operating System documentation set.

For more information about Digital's licensing terms and policies, contact your local Digital office.

## SOFTWARE PRODUCT SERVICES

A variety of service options are available from Digital. For more information, contact your local Digital office.

## SOFTWARE WARRANTY

Warranty for this software product is provided by Digital with the purchase of a license for the product as defined in the Software Warranty Addendum of this SPD.

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