

GDDM



General Information

Version 3 Release 2

GDDM



General Information

Version 3 Release 2

Note!

Before using this information and the product it supports, be sure to read the general information under “Notices” on page vii.

I Fourth Edition (December 2001)

This edition applies to the following IBM GDDM series of licensed programs:

Program number	Program name	Version	Release	Modification
5695-167	GDDM/MVS	3	2	0
5684-168	GDDM/VM	3	2	0
5686-057	GDDM/VSE	3	2	0
5668-812	GDDM-PGF	2	1	3
5668-723	GDDM-IVU	1	1	3
5668-802	GDDM-GKS	1	1	3
5668-801	GDDM Interactive Map Definition	2	1	3
GDDM/MVS as a base element of OS/390 (program number 5645-001)				
GDDM-PGF as an optional feature of OS/390				
GDDM-REXX/MVS as an optional feature of OS/390				

and to all subsequent versions, releases, and modifications until otherwise indicated in new editions. Consult the latest edition of the applicable IBM system bibliography for current information on this product.

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Common User Access	CUA
CustomPac	DATABASE 2
DB2	DisplayWrite
DrawMaster	ES/9000
GDDM	graPHIGS

notices

Hardware Configuration Definition	IBM
IMS	Intelligent Printer Data Stream
IPDS	LoadLeveler
MVS/ESA	NetView
OfficeVision	OPC
OS/2	OS/390
PC/XT	Personal System/2
Presentation Manager	Print Services Facility
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Preface

This book introduces the IBM GDDM series of licensed programs. This is a versatile and easy-to-use family of IBM licensed programs that provides presentation services in IBM data-processing systems, particularly the services needed to present information in graphic form.

This book also describes:

- New function introduced in GDDM Version 3 Release 2 (GDDM 3.2)
- Some of the ways in which GDDM is used
- All software and hardware requirements of GDDM 3.2, including:
 - Operating systems
 - Subsystems
 - Programming languages and compilers
 - Processors
 - Control units
 - Displays
 - Printers
 - Plotters
 - Workstations
 - Scanners
 - Personal-computer systems
- The GDDM 3.2 library

Who this book is for

This book is primarily for executive and data-processing managers, but it may also be found useful by application designers, programmers, and terminal operators. It is provided for evaluation of the GDDM family of licensed programs.

How to use this book

This book is meant to be read sequentially. Readers familiar with the GDDM licensed programs will find Chapter 4, “What’s new for GDDM Version 3 Release 2” on page 43 and Chapter 6, “Software, hardware, data streams, and standards” on page 71 of most interest.

What’s new in this edition

This edition, available in softcopy only, corrects a reference to Taiwan (see “National-language support” on page 12).

Latest GDDM information

For up-to-date information on GDDM products, check our Home Page on the Internet at the following URL:

<http://www.software.ibm.com/ts/gddm/>

You might also like to look at the IBM Software Home Page at:

<http://www.software.ibm.com/>

GDDM publications

GDDM Base	<i>GDDM Base Application Programming Guide</i> , SC33-0867 <i>GDDM Base Application Programming Reference</i> , SC33-0868 <i>GDDM Diagnosis</i> , SC33-0870 <i>GDDM General Information</i> , GC33-0866 <i>GDDM/MVS Program Directory</i> , GC33-1801 <i>GDDM/VM Program Directory</i> , GC33-1802 <i>GDDM/VSE Program Directory</i> , GC33-1803 <i>GDDM Messages</i> , SC33-0869 <i>GDDM Series Licensed Program Specifications</i> , GC33-0876 <i>GDDM System Customization and Administration</i> , SC33-0871 <i>GDDM User's Guide</i> , SC33-0875 <i>GDDM Using the Image Symbol Editor</i> , SC33-0920
GDDM-GKS	<i>GDDM-GKS Programming Guide and Reference</i> , SC33-0334
GDDM-IMD	<i>GDDM Interactive Map Definition</i> , SC33-0338
GDDM-IVU	<i>GDDM Image View Utility</i> , SC33-0479
GDDM-PGF	<i>GDDM-PGF Application Programming Guide</i> , SC33-0913 <i>GDDM-PGF Programming Reference</i> , SC33-0333 <i>GDDM-PGF Interactive Chart Utility</i> , SC33-0328 <i>GDDM-PGF Vector Symbol Editor</i> , SC33-0330 <i>GDDM-PGF OPS User's Guide</i> , SC33-1776

GDDM/MVS is an element of OS/390. GDDM-REXX/MVS and GDDM-PGF are optional features of OS/390. For a complete list of the publications associated with OS/390, see the *OS/390 Information Roadmap*, GC28-1727.

A description of the GDDM publications is provided in Appendix, “The GDDM Version 3 library” on page 91.

Chapter 1. The GDDM series of licensed programs

GDDM, the Graphical Data Display Manager, is a family of IBM programs that run on host systems. The GDDM family comprises these licensed programs:

<i>Program name</i>	<i>Level</i>	<i>Program number</i>
GDDM/MVS	3.2.0	5695-167
GDDM/VM	3.2.0	5684-168
GDDM/VSE	3.2.0	5686-057
GDDM-PGF (GDDM Presentation Graphics Facility)	2.1.3	5668-812
GDDM-IVU (GDDM Image View Utility)	1.1.3	5668-723
GDDM-GKS (GDDM Graphical Kernel System)	1.1.3	5668-802
GDDM Interactive Map Definition (GDDM-IMD)	2.1.3	5668-801

GDDM/MVS, GDDM/VM, and GDDM/VSE are referred to generically as “GDDM Base.” The remaining GDDM licensed programs all require a GDDM Base program to be installed.

GDDM/MVS 3.2 is also a base element of OS/390 (program number 5645-001); GDDM-REXX/MVS and GDDM-PGF are optional features of OS/390.

The GDDM family is a versatile and easy-to-use series of programs that provide presentation services for host computers. GDDM has a powerful application-programming interface for creating, showing, and storing vector graphics, images, and alphanumerics. GDDM drives displays, printers, plotters, and scanners, and includes several utilities for end users.

GDDM’s excellence as a graphics program has caused it to be used increasingly as a graphics enabler for *other* licensed programs, such as Application System (AS) and Query Management Facility (QMF). Some of the ways in which the GDDM licensed programs are used are explored in Chapter 2, “What can GDDM do for you?” on page 23. The remainder of this chapter gives a brief explanation of what each of the GDDM licensed programs provides.

The GDDM family of products is Year 2000 Ready.¹

The GDDM Base programs

The GDDM Base programs (GDDM/MVS, GDDM/VM, and GDDM/VSE) provide a wide-ranging set of functions and utilities. Chief among these is the GDDM Base application-programming interface, which provides a large set of calls that allow manipulation of graphics, image, and alphanumerics. The calls also provide many other types of function, including support for run-time mapping and I/O support for many display and printing devices. More detail about GDDM’s application-programming interface is provided in “GDDM and the application programmer” on page 13.

¹ For one GDDM program, GDDM/graPHIGS, this book is not the source of general information. The program is based on the American National Standards Institute (ANSI) standard for Programmer’s Hierarchical Interactive Graphics System (PHIGS). It has a programming interface for creating hierarchical, three-dimensional, graphics structures on devices supported by GDDM. It is described in *Introducing graPHIGS*, SC33-8100.

In addition to its application programming interface, GDDM Base includes:

- The User Control facility
- The Image Symbol Editor
- The Composite Document Print Utility
- File-conversion utilities
- GDDM-OS/2 Link and GDDM-PCLK
- The Print Queue Manager (on MVS/TSO)

User control facility

The GDDM Base programs include a facility called *User Control* that provides a set of commonly required application functions for users of display terminals. These functions include:

- Panning and zooming of graphics and images
- Size, position, and orientation of image and graphics for printing and plotting
- Scrolling, sizing, and positioning of operator windows

User Control enhances GDDM application programs, including user-written programs, with no additional programming.

The application user starts User Control by pressing a designated program-access key (PA key) or program-function key (PF key). In response, GDDM superimposes a menu on the bottom of the screen that lists all of the User Control functions for use with the current application.

User Control is described in the *GDDM User's Guide*.

The Image Symbol Editor

An *image symbol set* is a collection of characters or shapes formed by a pattern of dots. Each dot corresponds to a display point on a device. Image symbols are of fixed size, and can be defined in one or more colors.

Several image symbols sets are supplied by GDDM for use as typefaces. Each set contains the full range of country-extended code-page (CECP) symbols, which ensure that the symbols display as intended in all GDDM-supported national languages. Image symbol sets are also provided for various shading patterns and marker characters.

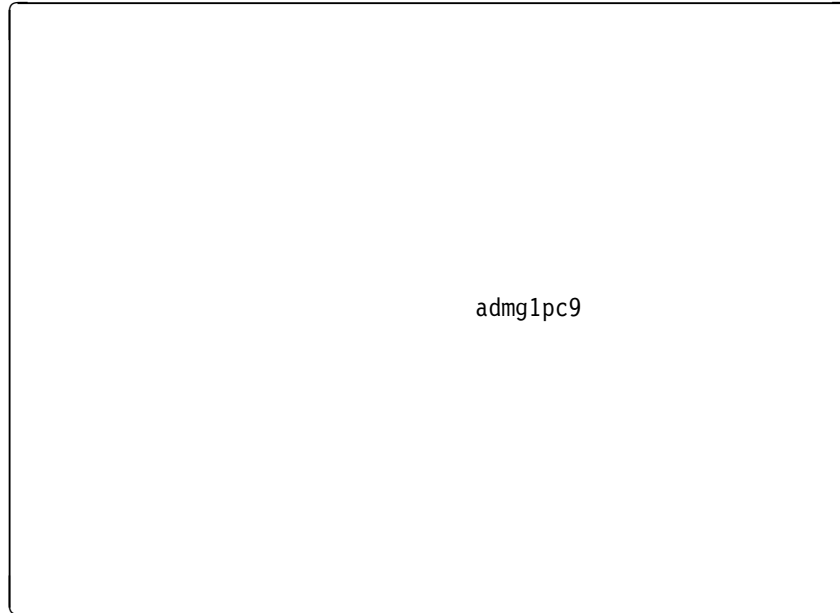


Figure 1. Image symbols

You can use GDDM's Image Symbol Editor to change any of the image symbol sets supplied with the GDDM Base program, or to create your own. For example, you can create company logos, scientific symbols, and other patterns. The Image Symbol Editor can be invoked from a terminal or from a GDDM application. It is described in the *GDDM Using the Image Symbol Editor* book.



Figure 2. Drawing image symbols using the GDDM Image Symbol Editor

The Composite Document Print Utility (CDPU)

A *composite document* contains any combination of formatted text, graphics, and images. For example, a LIST3820 file in the VM environment is a composite document.

A composite document can be in one of two formats:

- Advanced Function Printing Data Stream (AFPDS)
- Composite Document Presentation Data Stream (CDPDS)

GDDM's CDPU displays and prints composite documents.

When a composite document is displayed (in CDPU's "browse" mode), what is displayed on the screen approximates to the printed version of the document, but is not an exact representation. For example, text in different fonts is shown in different colors; an image might be displayed in detail or represented as an outline box; bar codes are shown as "icons"; and a complete document or page segment is scaled to fit the display screen (maintaining the aspect ratio).

Documents printed via the CDPU can be directed to any printer that supports printing of composite documents. Such printers are identified in Table 9 on page 81. They include Intelligent Printer Data Stream (IPDS) printers, and advanced-function printers, such as the IBM 3820 and 3900. Composite documents can also be printed via the Print Services Facility (PSF). (This feature is most useful for files submitted to the CDPU in CDPDS format rather than AFPDS format, which can be submitted direct to PSF.)

File-conversion utilities

The GDDM Base programs provide utilities for converting files from one format to another. These include:

- ADMUGIF, which converts a GDDM ADMGDF (graphics data format) file to a Graphics Interchange Format (GIF) file in the VM/CMS and MVS/TSO environments. The GIF file can be downloaded to a workstation and then used on the Internet.
- ADMUCG, which converts a Computer Graphics Metafile (CGM) to a GDDM ADMGDF (graphics data format) file in the VM/CMS and MVS/TSO environments. ADMGDF files contain GDF orders, whose format is published in the *GDDM Base Application Programming Reference* book.
- ADMUGC, which converts an ADMGDF file to CGM format in the VM/CMS and MVS/TSO environments. GDDM supports binary encoding of the CGM, as defined in ISO 8632-3.
- ADMUPCx, which converts files from ADMGDF format to Picture Interchange Format (PIF), and from PIF to ADMGDF, in the VM/CMS and MVS/TSO environments.

These utilities enable graphics data to be exchanged between GDDM and other applications.

GDDM-OS/2 Link

The GDDM-OS/2 Link component of the GDDM Base programs enables you to run GDDM applications from host-attached IBM Personal System/2 (PS/2) computers and other personal-computer systems that have OS/2 Extended Edition 1.2 (or later version of OS/2) installed. Pictures displayed by such applications can be saved in PIF (Picture Interchange Format) files and in OS/2 Presentation Manager metafiles. Metafiles can be passed to the OS/2 Presentation Manager clipboard. Output from GDDM applications can also be printed or plotted on OS/2-attached printers and plotters.

You do not require GDDM-OS/2 Link if you are running OS/2 Communications Manager/2 Release 1.1 (or later) or OS/2 Warp because this function is already included in the workstation product. Your programs can run under OS/2, DOS/Windows, or Windows 95.

GDDM-PCLK

The GDDM-PCLK component of the GDDM Base programs provides a similar service to the GDDM-OS/2 Link component, but for the DOS user. A suitable IBM 3270-terminal emulator and graphics-display adapter must be installed. Output can be saved in PIF files or directed to printers and plotters.

You do not require GDDM-PCLK for graphics support if you are running the IBM Personal Communications/3270 emulator Version 3 or later. However, if you are running under DOS and you have a different emulator that does not support host graphics, you **do** still require GDDM-PCLK.

Print queue manager

The GDDM/MVS product includes a print queue manager (ADMPQM), which allows system operators to manage the GDDM master print queue on TSO dynamically, without having to stop the TSO print utility.

See “Print Queue Manager” on page 45 for more details.

GDDM-PGF

The GDDM Presentation Graphics Facility (GDDM-PGF) comprises:

- The Interactive Chart Utility (ICU)
- The Vector Symbol Editor
- An application-programming interface
- The Online Presentation System (OPS) utility

The Interactive Chart Utility (ICU)

GDDM-PGF's ICU is an easy-to-use, versatile tool for producing:

- Line graphs
- Scatter plots
- Surface charts
- Histograms
- Bar charts, both vertical and horizontal
- Pie charts
- Venn diagrams
- Polar charts

- Tower charts
- Table charts
- Text-only charts

The simplest chart has a single set of values along the vertical (y) axis and a single set of values along the horizontal (x) axis. For more sophisticated presentations, several sets of y-axis data can be plotted against a set of x values, and the same data can be presented in either one or two different chart types. Several sets of x- and y-axis data can be presented at once, so that you can combine several very different charts into a single presentation. These charts can be either adjacent or overlapping.

There are three ways of using the ICU:

1. *Charting by example:* New users, and others who want charts as quickly and easily as possible, can use ready-made charts. The ICU displays a set of data in several chart formats, from which you select the most suitable. For example, you can choose from a line chart, a bar chart, and several other types of chart. The data can be either your own or sample data supplied by the ICU.
2. *Step-by-step refinement:* This method offers more scope for tailoring the format of the chart. A set of chart formats is presented, from which you choose one. You can then refine the chart's appearance one step at a time by selecting from successive sets, each showing variations in a single aspect of the format. For example, one set might show several positions for the heading, and another, various optional grids.
3. *Menu-driven chart definition:* You can define the chart format by entering values into menus. This is the most flexible method of all, because you can explicitly control all the variable items of the format. The ICU displays an optional preview chart on its panels so that you can judge the effects of format changes as you proceed. You can use the panels either to create a new format or to amend an existing format. This includes amending formats created by the first two methods.

For all three methods, the chart data can be typed in at the keyboard or read from a suitable file of character data. This could be, for example:

- A print file generated by an application program
- An output file from a personal-computer spreadsheet processor
- Some other sort of sequential or "flat" file

You can display, print, or plot the chart at any stage during its creation. You can also save the chart to disk at any time. Either the chart format, or the chart data, or both, can be saved. In addition, the complete chart can be saved as a picture file.

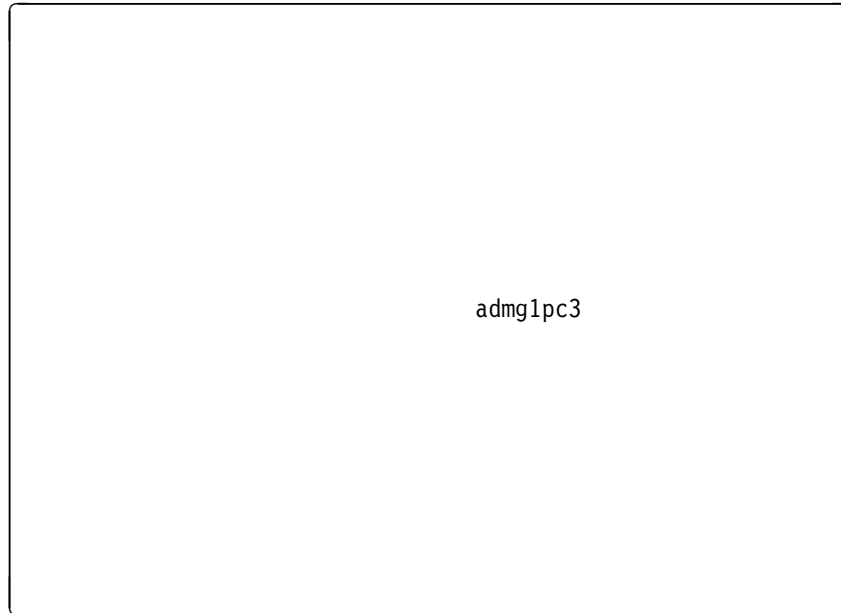


Figure 3. Step-by-step refinement of the chart format



Figure 4. Displaying the chart

The Vector Symbol Editor

A *vector symbol set* is a collection of characters or shapes formed by a series of lines and curves, possibly shaded within their outlines. Vector symbols can be displayed at any size, rotated, or sheared. Each vector symbol can be in one color only.

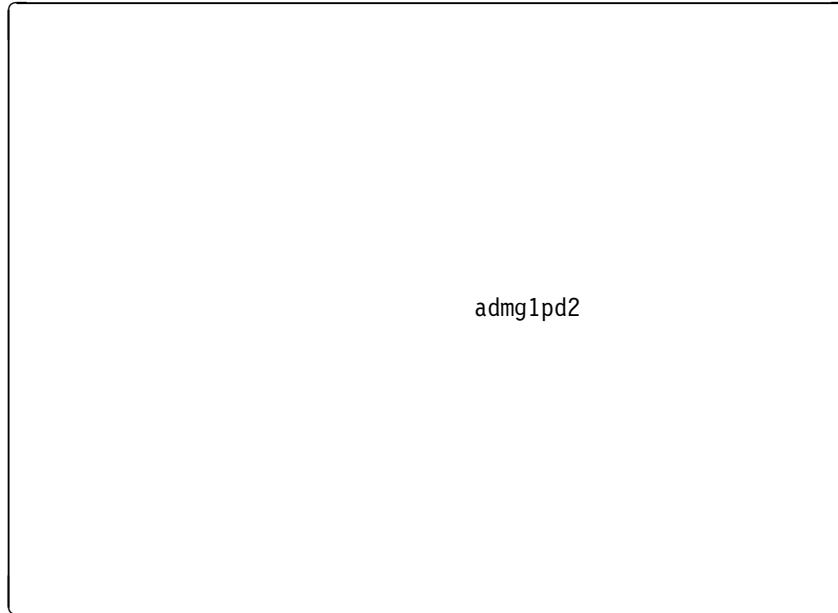


Figure 5. Vector symbols

The Vector Symbol Editor supplied with the GDDM-PGF program provides the same function as the Image Symbol Editor, but for vector symbols. That is, you can use the Vector Symbol Editor to edit any GDDM-supplied vector-symbol set or to create your own.

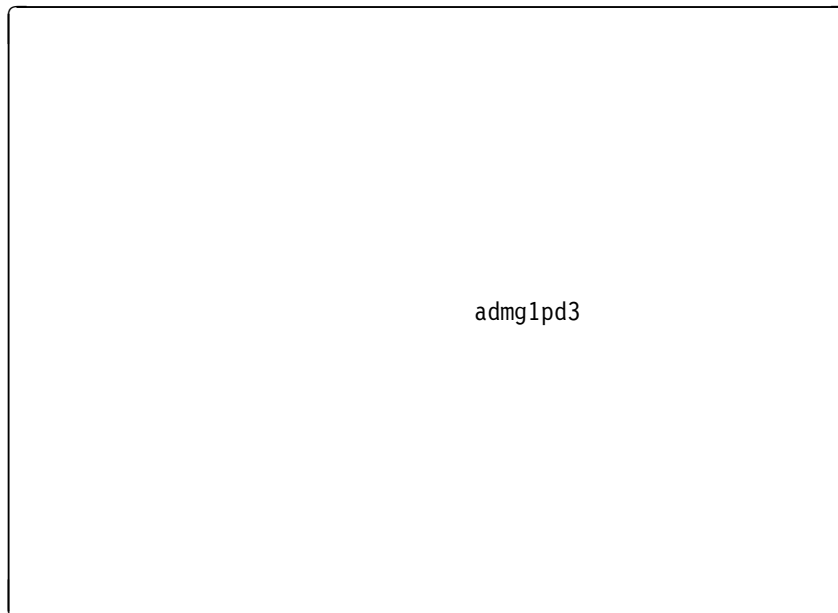


Figure 6. Drawing vector symbols using the GDDM-PGF Vector Symbol Editor

GDDM-PGF's application-programming interface

GDDM-PGF offers the programmer two methods of drawing charts:

- The ICU can be called from an application program.
- A set of presentation-graphics (PG) routines is provided for the creation and display of charts.

Calling the ICU from an application program

When the ICU is called from an application, it provides approximately the same facilities as it provides in interactive use.

For example, an application could call the ICU to chart information that already exists in a database, in a format previously defined and saved by a terminal operator. The program can extract the data from the database and pass it to the ICU, together with the name of the saved format. The program might also restrict the functions available to the terminal operator. For example, it can limit the ICU to showing the chart without allowing the operator to alter it. Alternatively, an application can call the ICU simply to print a chart or store it on disk for later display.

The ICU call interface includes a special set of routines that allow a program to put specific initial values into any of the ICU's menus. These calls have many uses in tailoring the ICU. For example, a program can call the ICU to create a chart in a particular format without the operator setting any menu values.

Query routines allow the program to discover the current value of any input field in any ICU panel. Calls to these routines are particularly useful when the operator ends an ICU session. Control returns to the program, which can then use the calls to retrieve any new values set by the operator.

The menu-setting and querying calls let you add an ICU-based, interactive facility to your own applications, without having to create menus and menu-handling dialogs. The ICU becomes, in effect, an end-user interface for your programs.

Using the presentation-graphics (PG) routines

The presentation-graphics routines allow application programs to supply data to the ICU and to control the chart types and layout. The ICU uses them to draw the charts specified in its menus. You can use them if you do not require the additional facilities provided by the ICU. The chart types that you can produce with the PG-routine interface are the same as those that you can produce with the ICU, but the routines offer a slightly greater range of formatting options. For example, they enable you to give your chart secondary x and y axes.

Unlike the ICU, the PG-routine interface provides no terminal-input functions. You have to program any user interface that the application may require, such as menus, messages, and help information.

The GDDM-PGF OPS utility

GDDM has incorporated, under MVS/TSO and VM/CMS, the IBM Online Presentation System program to enhance its presentation-producing capability.

See "The GDDM-PGF OPS utility" on page 43 for full details.

GDDM-IVU

The GDDM Image View Utility (GDDM-IVU) allows interactive manipulation of images. That is, GDDM-IVU takes images as input and displays them, allowing you to edit them, save them on disk, or create image-output files for printers.

GDDM-IVU supports a variety of edit functions, including the scaling, trimming, and merging of multiple images. The images themselves can be GDDM images (also known as GDDM *image objects*), or they can be imported. Imported images can include page segments, images in Image Object Content Architecture (IOCA or ICA) format, and images extracted from composite documents.

An IBM 3117 or 3118 scanner attached to an IBM 3193 display can be used to provide images for input to GDDM-IVU.

On MVS/TSO, GDDM-IVU Version 1.1.3 allows you to import and export images as members of a partitioned data set.

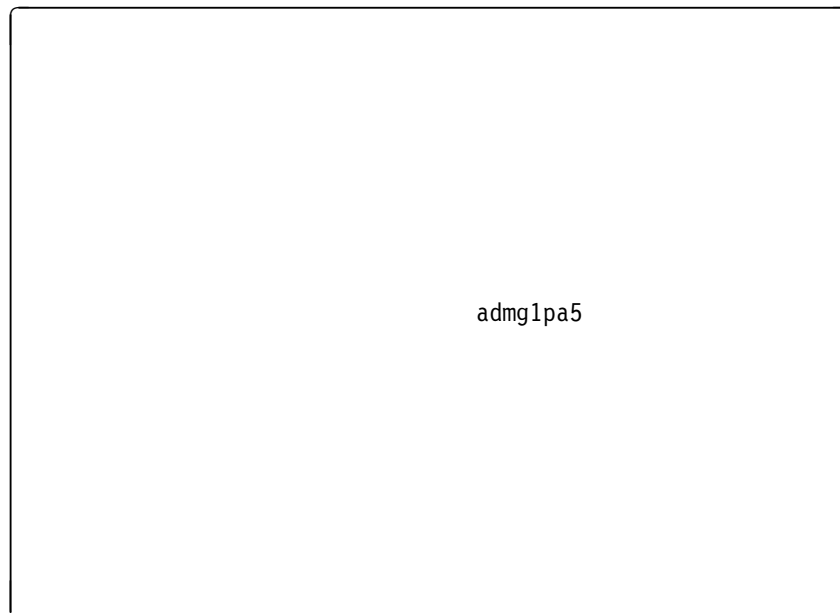


Figure 7. An image scanned for manipulation by GDDM-IVU

GDDM-IVU also has an application-programming interface. When called by an application, GDDM-IVU operates exactly as when called directly from the terminal. Batch-mode execution is not supported.

Images and reusable sets of editing instructions (known as *projections*) in main storage can be passed between the application and GDDM-IVU. You can also customize the standard GDDM-IVU functions in several ways. For example, you can specify the panel at which you enter GDDM-IVU and alter its PF-key settings.

GDDM-GKS

GKS, the Graphical Kernel System, is a programming interface defined by a standard, ISO 7942, of the International Organization for Standardization. GDDM-GKS implements Level 2b of this standard (with some minor differences). Where the standard states that a facility is either implementation-defined or undefined, GDDM-GKS follows the ANSI GKS standard.

GDDM-GKS provides a similar range of text, interactive, and output graphics functions to the GDDM Base programs. The coding of device-independent programs in GDDM-GKS is particularly straightforward.

An advantage of a standard application programming interface, such as GDDM-GKS, is that programs can be transported in source form between systems that have different implementations of the standard. It also eases the work of programmers who move from one such system to another and, because it uses widely accepted computer-graphics concepts, eases communication between programmers.

GDDM-GKS runs under TSO, MVS/Batch, TSO/Batch, and CMS. The API is based on the ANSI GKS FORTRAN language binding. Programs can also be coded in PL/I, COBOL, System/370 Assembler, APL2, and BASIC. GKS calls can be mixed with most other GDDM calls, except the GDDM Base graphics calls.

GDDM-GKS supports input to, and output from, the full range of IBM 3270 (and 3270-emulating) displays, printers, and plotters supported by the GDDM Base programs.

GDDM Interactive Map Definition

GDDM Interactive Map Definition (GDDM-IMD) is a utility for the interactive creation of *maps* (screen layouts), which are required by mapped alphanumerics. A menu, for example, could be defined in this way. Within each map, you assign names to the various alphanumeric fields. When the map is used by an application program, the fields can be referred to by name. However, the application does not need to be aware of the position of the fields within the map. While the application is running, both the program and the terminal user can put data into these alphanumeric fields.

While you are defining a map, GDDM-IMD prompts you for input, provides help information, and allows you to test maps without compiling any code. It generates the map and an application data structure (ADS) for you to include in a program.

The advantage of defining maps interactively is that it separates the process of defining the screen layout from the task of application programming. Programming is thus simplified. A single program might, for example, use different maps for different output devices. Run-time performance is also generally better with mapped alphanumerics than with screen layouts defined using the GDDM Base alphanumeric calls.

GDDM-IMD is required only for creation and modification of maps. It does not need to be available when applications that use maps are running.



Figure 8. A menu from the GDDM-PGF ICU created using GDDM-IMD

National-language support

There are no-charge, national-language features for all of the GDDM programs, except GDDM-IMD. The national-language features provide messages, panels, and other text in the following languages:

- Simplified Chinese (for the People's Republic of China)
- Traditional Chinese (Taiwan)
- Danish
- French
- French (Canadian)
- German
- Hangeul (Korean)
- Italian
- Kanji (Japanese)
- Norwegian
- Portuguese (Brazilian)
- Spanish
- U.S English

National-language features, including the U.S. English feature, must be explicitly ordered. Not all material is provided in every language. Where particular material is not available, the U.S. English version is substituted.

Country-extended code pages (CECPs)

GDDM supports country-extended code pages. When codes representing particular characters vary from country to country, GDDM is able to convert the codes, and thereby to ensure that the correct characters are displayed, printed, or plotted. For example, dollar signs entered into a file using a U.S. English language terminal will, with CECP code-page conversion, appear as dollar signs if displayed

on non-U.S. English language terminals. Without conversion, a local currency symbol might appear in place of the dollar symbol.

GDDM and the application programmer

Application-programming support is provided by the GDDM-Base, GDDM-PGF, GDDM-GKS, and GDDM-IVU programs. Application programs can be written in COBOL, FORTRAN, PL/I, System/370 Assembler, REXX, C/370, the C portion of the C/C++ compiler, APL2, and BASIC.

The application programming interface (API) provided by the GDDM programs supports three distinct types of data:

- Alphanumeric text
- Graphics pictures and text
- Images

This section looks at each of these types of data in turn. It also discusses management of the screen by the application program, the three types of programming interface, GDDM's batch-programming support, and application debugging.

Alphanumeric text

Alphanumeric text is *character data* presented in fields on the display screen. An application program can define specific attributes of the data, such as its color, and can specify that the data cannot be overwritten, for example. Other attributes, such as the typeface, size, and angle of the text cannot be specified. Alphanumeric text is intended for, and best suited to, asking the user for input and displaying responses to that input.

GDDM Base supports three sorts of alphanumeric text:

- Procedural alphanumerics (using individually positioned data fields).
- Mapped alphanumerics (using predefined screen layouts called “maps”).
- High-performance alphanumerics (using a data structure that describes all the fields on a page).

Procedural alphanumerics

The procedural-alphanumeric (or field-alphanumeric) capability of GDDM handles basic alphanumeric input and output. It allows the application to control attributes such as color, highlighting, and field protection. It gives greater dynamic control of screen formatting than mapped alphanumerics, but at the expense of ease-of-use and run-time performance.

Mapped alphanumerics

Mapped-alphanumerics functions simplify the writing of applications that use alphanumeric text and improve an application's run-time performance. The layout required for a presentation is defined in a map during application development using GDDM-IMD, which is described in “GDDM Interactive Map Definition” on page 11.

GDDM Base provides several calls that the application program issues at run-time to use the map. Where a map corresponds to the complete screen, a single call causes GDDM Base to:

- Take variable data from an application data structure (ADS). The ADS is a structure created by GDDM-IMD that contains an entry for each field in a map whose contents are alterable. The data to be displayed in a mapped field is placed in the ADS by the user's program.
- Merge it with the map.
- Send the result to the terminal.
- Wait for the terminal user to type in information.
- Update the ADS with the typed information.

When graphics calls are used, or when there is more than one map for the screen, more calls are needed, but simplicity and clarity are maintained. Image data in maps is not supported.

High-performance alphanumerics

A high-performance-alphanumerics application builds a data structure to describe all the data, and passes the structure to GDDM for output. Data entered by the device operator in response is returned to the application in the same data structure. Changes to the data are shown by status indicators, which are part of the structure.

The high-performance-alphanumerics data structure consists of three distinct objects. These are:

The *field list*, which groups together all information about the layout of alphanumeric data on one GDDM page.

The *bundle list*, which defines the field attributes (color, highlight, symbol-set) associated with each field.

The *data buffer*, which consists of data areas containing the actual characters for each field defined in the field list. The data buffer may also contain attribute information about the color, highlight, and symbol set for individual characters.

Graphics pictures and text

GDDM Base includes support for:

- Creating graphics output by specifying lines, areas, colors, and so on, and saving the results.
- Creating graphics-text output and reading graphics-text input.
- Interactive graphics input using a cursor, tablet, or mouse.

Output graphics

The output-graphics call statements enable you to create graphics pictures and display them. You can draw graphics primitives such as straight lines, arcs, and shaded areas. You can also specify attributes, such as color, line type, shading pattern, and character size.

GDDM pictures created in this way can be saved in disk files. These files can be in graphics data format (GDF), which is a published set of drawing orders. GDF files are portable between applications and between systems. GDF files can also be converted to and from Picture Interchange Format (PIF) and Computer Graphics Metafile (CGM) format. In addition, GDF files can be converted to Graphics Interchange Format (GIF) files.

GDDM pictures destined for plotters can be saved in IBM Graphics Language (IBM-GL) files, which can be accepted by IBM, Hewlett Packard, and other HP-compatible plotters.

Graphics text

GDDM Base includes calls to specify attributes for graphics text, such as size, color, symbol-set, angle, direction, and shear (italicization). When you create a text string, you can position it to pixel accuracy. For graphics-text input, you specify an area on the screen into which the operator can type using the alphanumeric keyboard.

A graphics-text string can be made up of:

- Device-hardware symbols.
- GDDM-supplied vector or image symbols.
- Vector or image symbols created or modified using one of the GDDM symbol editors.

Interactive graphics

When a terminal operator places the cursor on an element of a picture or a point on the screen, the name of the element or the screen position can be sent back to the program. This capability enables you to write powerful, interactive graphics applications, such as picture-drawing, office-planning, and production-line planning programs, where items need to be selected and moved around on the screen.

For more sophisticated applications, you can use devices such as a mouse or a tablet with a puck or stylus. A stream of x-y coordinate data (or *pointings*) representing, perhaps, a freehand sketch from an existing picture, can be entered.

Images

GDDM support for image data includes input, output, manipulation, and storage of pictures as arrays of dots (sometimes called “noncoded” data).

GDDM programs can read images of documents from an IBM 3117 or 3118 scanner, display them on devices such as the IBM 3193 display, store them on disk, and print them on printers such as the IBM 3816, IBM 3112, IBM 3116, IBM 3912, IBM 3916, or IBM 4028 printer. An application can also apply *transforms* (editing instructions) to an image during a transfer operation. For example, a part or the whole of an image can be scaled, rotated clockwise through 90°, 180°, or 270°, reflected, and converted to its “photographic negative.”

GDDM images are monochrome and bi-level: minute dots are either present at a single intensity or they are absent. Color and gray-scale are not supported. However, GDDM can emulate gray tones by varying the number of dots (half-toning).

Divisions of the screen

The screen can be divided into independent units of two kinds:

- Operator windows
- Partitions (also known as application windows)

Operator windows

Operator windows are divisions of the screen created by GDDM application programs. They can be positioned, sized, and scrolled either by application programs, or by the terminal operator using GDDM User Control functions.

An important use of GDDM operator window functions is in writing task-manager applications that allow a different GDDM program to run in each window. A GDDM program that runs on a full screen can also run in one of these operator windows.



Figure 9. GDDM windowing

Partitions

Partitions (application windows) are also divisions of the screen. They too can be created, positioned, sized, and scrolled by GDDM application programs. Unlike operator windows, however, they cannot be manipulated by the operator, and are not used to run multiple application programs.

If both types of presentation structure are on a screen at the same time, partitions appear as subdivisions of operator windows.

Three types of interface

An application program accesses GDDM functions via the GDDM interface modules that are link-edited or loaded with the application. The interface modules convert call statements in the application to a standard, internal interface to call the GDDM functions. This makes GDDM itself independent of the subsystem being used, and enables applications to use three different interfaces.

Nonreentrant interface

This is the standard interface for most application programs that use GDDM and do not require any special processing. Quasi-reentrancy (as defined by CICS) can be achieved using this interface.

Reentrant interface

This allows the programs using GDDM to be made reentrant. A reentrant program can be used by more than one user at the same time, or by the same user in multiple instances of GDDM.

System programmer interface

This is provided for programmers who intend to use GDDM as the basis for a graphics system or other software product of their own. It allows GDDM functions to be written in a coded form, it gives greater control over the subsystem environment, and it allows greater programming flexibility.

Batch processing

GDDM Base, GDDM-PGF, and GDDM-GKS can all run without being connected to a terminal. This allows you to run various routine production programs and other time-consuming jobs overnight, or at other times when the computer is lightly loaded. Jobs that might be done in batch include:

- Creating charts or other pictures for later printing, plotting, or display
- Printing charts or pictures

Problem diagnosis

There are facilities in GDDM Base, GDDM-PGF, and GDDM-GKS for passing control to a user error exit, and for returning a record containing an error code and other information to the application program. In addition, GDDM Base and GDDM-PGF display a message whenever they detect an error, unless the application specifies otherwise. GDDM-GKS writes messages to an error-logging file.

You can send trace data to a file whenever a GDDM Base, GDDM-PGF, or GDDM-GKS call is executed. The data can include the parameter values passed by the application program, a storage report, and a time stamp. In addition, you can trace internal GDDM events, such as module calls, to aid diagnosis by IBM program-support representatives when possible GDDM problems are reported.

You can activate tracing using a defaults file, in which case no change is required to the program itself. Alternatively, you can turn tracing on and off with calls added to the program.

Supported hardware and software systems

GDDM has been designed for use on many different devices and hardware systems. The *extent* to which GDDM is supported on each of these devices depends on the capabilities of the device hardware. In particular, the types of data a device can support may be limited. Often, GDDM can overcome these limitations by using a supported data type to emulate the appearance of one that is not supported. For example, graphics text can be used to emulate alphanumeric text, and graphics can be used to emulate image.

Many of the printers and displays supported by GDDM are said to belong to the 3270 family of devices because they support (or emulate) the IBM 3270 Information Display System Architecture.

GDDM-supported devices include:

Printers

- 3270-family printers that output alphanumerics, text, graphics, and images. Some are color printers. Examples of printers in this category are:
 - Graphics printers, such as the IBM 3268-2C and the IBM 3287.
 - Intelligent Printer Data Stream (IPDS) printers, such as the IBM 3816, 3112, 3116, 3912, 3916, 4028, 4230, and 4234 printers. Some IPDS printers can also function as advanced-function printers via PSF.
- Advanced-function printers, such as the IBM 3800-3, 3820, 3825, and 3900. GDDM cannot send data directly to these printers, but can produce intermediate files in Advanced Function Printing Data Stream (AFPDS) format. Such files can be printed via the Print Services Facility (PSF).
- The IBM 4250, which prints via the Composed Document Print Facility (CDPF).
- Printers attached to workstations and personal-computer systems that use the GDDM-PCLK or GDDM-OS/2 Link component of GDDM Base to communicate with the host computer. Any printer supported by OS/2 Extended Edition 1.2 or later can be accessed via GDDM-OS/2 Link. In the case of GDDM-PCLK, printers include the IBM 4019 (in 5202-emulation mode), the IBM 5201 and 5202 Quietwriter printers, and the IBM 4201, 4202, 4207, and 4208 Proprinter series.
- Alphanumerics-only printers (3270 family).
- System printers (also alphanumerics only), such as the IBM 3800-1.

Displays

- 3270-family displays that output alphanumerics, graphics, and images. Examples include the IBM 3278 (monochrome), the IBM 3179-G, 3192-G, 3279, and 3472-G (color).
- 3270-family, alphanumerics-only displays, such as the IBM 3179-1, 3178, and 3180-1.
- ASCII devices connected via an IBM 3174 controller with an Asynchronous Emulator Adapter (AEA) card that output alphanumerics, graphics, and images. These include:
 - DEC VT240, VT241, VT330, VT340
 - Tektronix 4105, 420x series
- ASCII devices connected via an IBM 3174 controller with an Asynchronous Emulator Adapter (AEA) card that output alphanumerics only. These include the IBM 3151, 3161, and 3164 displays.
- The IBM 5081 and 6091 high-function graphics displays, which can show either alphanumerics (in 3270-mode operation) or graphics and images (through the GDDM/graPHIGS program).
- Xstations running host sessions under TCP/IP.

Plotters

The IBM 618x and 737x plotters are supported when attached to a 3179-G, 3192-G, or 3472-G display.

Workstations and personal-computer systems

- IBM PS/2 series and other personal-computer systems using the GDDM-OS/2 Link component of GDDM Base.
- IBM PC, 3270-PC, and PS/2 series personal-computer systems with graphics-display adapter using the GDDM-PCLK component of GDDM Base.
- IBM 3270-PC series workstations with Programmed Symbols.
- Workstations with major desktop operating systems (OS/2, Windows 95, Windows, DOS, UNIX, or AIX) are able to access host GDDM graphical applications via emulation.

The IBM Personal Communications/3270 V4.1 emulation package supports viewing, printing, and plotting for OS/2, Windows 95, and Windows. Printing and plotting support is dependent on workstation-installed device drivers. IBM Personal Communications/3270 V4.1 includes the interactive functions of rubber-banding, rubber box, and drag that are popular with GDDM V3 GDDM-OS/2 Link users. IBM PC/3270 V4.1 for OS/2 and Windows also supports PSS (Programmed Symbol Sets).

Other IBM and non-IBM graphical emulators can be used. For example, IBM Communications Manager/2 V1.11 includes graphical support, activated per host session. OS/2 workstations with prior levels of Communications Manager/2 need to download GDDM-OS/2 Link support from GDDM. GDDM-OS/2 Link support can be downloaded to your workstation users, without notifying IBM.

Users of IBM Personal Communications/3270 V2 for DOS or OS/2 need to download GDDM-PCLK or GDDM-OS/2 Link respectively. PC/3270 V3 includes graphics support for the Windows environment.

For details of IBM 3270-PC series workstations with Programmed Symbols, see “3270 workstations supported by GDDM Version 3 Release 2” on page 86.

DOS workstations require an emulator and the download of GDDM-PCLK. GDDM-PCLK support can be downloaded to your workstation users, without notifying IBM. For details of GDDM-PCLK viewing, printing, and plotting device support, see “Printers and plotters supported by GDDM Version 3 Release 2” on page 81 and “IBM personal-computer systems supported by GDDM Version 3 Release 2” on page 87.

The X3270 emulator provides only graphics viewing for UNIX and AIX users.

Windows NT (TCP/IP only) workstations are supported via IBM PC/3270 V4.1 for Windows 95 or Windows.

Printers and plotters attached to these devices are also supported.

Scanning system

The IBM 3193 alphanumerics and image display (3270 family), together with an IBM 3117 or 3118 scanner.

Double-byte character-set systems

The IBM PS/55 personal-computer system, which can display double-byte character-set (DBCS) alphanumerics for Kanji (Japanese), traditional Chinese,

and Hangeul (Korean) text is supported, as are displays and printers in the IBM 5550 family. The displays in a DBCS system can also handle graphics and image data. Plotters can also be attached to such a device.

For a complete list of the supported devices, see Chapter 6, “Software, hardware, data streams, and standards” on page 71.

Supported subsystems

GDDM runs under these subsystems:

- TSO (including TSO batch mode)
- Batch-mode MVS/ESA
- The CMS subsystem of VM/ESA
- CICS/VSE and CICS/ESA
- IMS
- Batch-mode VSE/ESA

Not all GDDM functions are supported in all of these environments. Any variations in the way GDDM works with each of these subsystems are identified in Chapter 6, “Software, hardware, data streams, and standards” on page 71.

Programming languages

GDDM application programs can be written in COBOL, FORTRAN, PL/I, System/370 Assembler, REXX, the C portion of the C/C++ compiler, and C/370.

Interfaces to GDDM are also provided by APL2 and BASIC.

Further information about GDDM’s requirements

For a complete list of supported systems, subsystems, and programming languages, including minimum release levels and restrictions, see Chapter 6, “Software, hardware, data streams, and standards” on page 71.

For main storage and disk storage requirements, see the *GDDM Program Directory* for your operating system.

License and servicing arrangements

A separate monthly license charge is made for each GDDM program. These are GDDM/MVS, GDDM/VM, GDDM/VSE, GDDM-PGF, GDDM-IVU, GDDM-GKS, and GDDM Interactive Map Definition. A monthly license charge is also made for the GDDM-REXX component of GDDM Base.

A separate license is required for each designated machine on which the licensed program materials are to be used. There is no charge for the national-language-support feature.

The programs are warranted in accordance with the Agreement for IBM Licensed Programs. The testing period is two months (60 days outside the U.S.A.).

All programs are serviced as IBM licensed programs. All service is delivered in the form of Program Temporary Fixes (PTFs).

Service for GDDM Base (GDDM/MVS, GDDM/VM, and GDDM/VSE, including the GDDM-REXX, GDDM-OS/2 Link, and GDDM-PCLK components), GDDM-PGF, GDDM-IVU, GDDM-GKS, and GDDM Interactive Map Definition is supplied from Central Service, including IBM Support Centers, and will be available until discontinued by IBM upon six months written notice.

Refer to your IBM Marketing Representative for end-of-service dates for the GDDM licensed programs.

Chapter 2. What can GDDM do for you?

Many of you reading this book are probably new to GDDM, so are curious about GDDM's potential in your enterprise. You are almost certainly interested in GDDM because some other program names GDDM as a prerequisite, or simply suggests that it could be useful. A large number of programs do this. In the main, they use GDDM for its device support and for its graphics capabilities. GDDM is IBM's premier, host-based, general-purpose graphics program: for the breadth of the function it delivers alone, GDDM has become IBM's graphics "enabler" of choice.

Here's a reminder of what the GDDM licensed programs are and what they provide:

There are three GDDM Base programs (GDDM/MVS, GDDM/VM, and GDDM/VSE) and four others (GDDM-PGF, GDDM-IVU, GDDM-GKS, and GDDM Interactive Map Definition). Together they provide:

- A general-purpose graphics, image, and alphanumeric application-programming interface (API) that you can use to write your own graphics applications. Many of the programs that name GDDM as a prerequisite do so because they use this API.
- A set of utilities that handle diverse requirements, such as display and printing of composite documents, printing of images on advanced-function printers, and conversion of files from one format to another.
- Two editors for producing symbols, such as company logos, scientific symbols, and fonts. One (the Image Symbol Editor) is a component of the GDDM Base programs. The other (the Vector Symbol Editor) is part of the GDDM-PGF licensed program.
- The Interactive Chart Utility (ICU), a stand-alone, menu-based utility that comes with the GDDM-PGF licensed program. It is used for drawing, displaying, saving, printing, and plotting business charts. A programming interface to the ICU is also available.
- A set of presentation-graphics (PG) routines, an alternative special-purpose API for drawing charts, also part of the GDDM-PGF licensed program.
- Interactive image-handling function in the GDDM-IVU licensed program.
- An interactive utility (GDDM Interactive Map Definition) for designing alphanumeric screen and printer layouts (maps). The maps are used by application programs.
- A GKS-standard graphics API (in the GDDM-GKS licensed program).
- An interactive utility (GDDM-PGF Online Presentation System) for creating high-quality presentation material.

How other programs use GDDM

For some programs, GDDM is a mandatory prerequisite (that is, without GDDM they simply don't work). For others, GDDM is optional (a "nice-to-have," but you can get by without it). Not all programs use the same version and release of GDDM, nor do they all use the same combination of the GDDM licensed programs. Some require you to install both a GDDM Base program and GDDM-PGF, for example, while others use the GDDM Base program only. From this, it follows that

how GDDM is used

GDDM's relationship with the programs that use it is not the same in every case. Many programs use GDDM for its graphics-display functions. Application System (AS), for example, uses GDDM to display AS data in graphical format. Some programs produce files for input to GDDM. The Graphical Display and Query Facility (GDQF), for example, produces files in ADMGDF format, which can be passed to GDDM for further processing. Others, such as the Print Services Facility (PSF), accept files produced by GDDM. (PSF prints GDDM's AFPDS output.) In all of these cases, GDDM occupies a key position.

If you install GDDM because another program depends on it, you don't need to know exactly what GDDM is doing for that program. Paradoxically, GDDM is performing at its very best in these circumstances if you are unaware of it. However, if you *do* have GDDM installed for the reasons outlined here, don't forget that it can also be useful to you in its own right. When you install GDDM, you get a powerful set of graphics functions and utilities: there is no reason why you should not use them directly. If you have installed GDDM-PGF, for example, you have the ICU at your disposal. The ICU is excellent for producing business charts, and is very accessible to the new user. If you have an IBM 3117 or 3118 scanner, GDDM-IVU can alter fundamentally the way in which you store and use all manner of documents, from application forms to legal documents.

Many of the enhancements provided by GDDM are of direct benefit to the applications that name GDDM as a prerequisite. For more information about these enhancements, see Chapter 5, "What's new in GDDM Version 3 Release 1" on page 49 and Chapter 4, "What's new for GDDM Version 3 Release 2" on page 43.

The rest of this chapter gives an introduction to some of those IBM programs that require you to install GDDM (or suggest that you do). The programs discussed here do not necessarily support or use all the functions offered by GDDM or by the devices it supports. Some programs support only some configurations of devices and systems. You can get more information from the documentation of these programs.

Some of the programs that use GDDM

This selection of IBM programs does not imply that IBM intends to make these available in all countries in which IBM operates. Ask your IBM representative for information on their availability.

The APL2 program

The APL2 program is an implementation of the APL programming language. It uses GDDM to communicate with advanced-function displays and printers. GDDM is required for use of the Session Manager, the full-screen editor, the Session Manager Command auxiliary processor (AP 120), the GDDM auxiliary processor (AP 126), and the GRAPHPAK, FSM, GDMX, CHARTX, and FSC126 workspaces. GDDM is also required for display of DBCS characters by the APL2 program.

Application System (AS)

The Application System (AS) program is a data-management and information-retrieval package. It is intended for use by business professionals, managers, administrators, secretaries, and application programmers, in a variety of industries. It can be used for decision-support and business-planning applications that require graphics, reports, and specialized analysis. It allows users who are not trained in data processing to use English-language commands and conversation utilities to perform modular functions, such as data management, information retrieval, reporting, business graphics, business planning, analysis, project control, and text processing.

AS requires both GDDM Base and GDDM-PGF to be installed.

The BookManager programs

The BookManager programs (BookManager BUILD and BookManager READ) enable you to build online (or softcopy) versions of documents, such as product manuals, and to access those documents online. Some of the many advantages of the BookManager programs are:

- A single copy of a book can be accessed by multiple users.
- Retrievability of information is transformed by the processing power of the computer: the BookManager programs support searches for any word or phrase; “fuzzy” matches are supported; and resulting matches are ranked, so that matches with the best information about a search request are listed first.
- A single document or a grouping of documents (a *bookshelf*) can be searched.

BookManager BUILD requires GDDM if all-points-addressable (APA) graphics are to be included in online books. In some environments, BookManager READ uses GDDM for display of both alphanumeric and APA graphics.

The GDDM 3.2 Base library is available for use with the BookManager programs. For more information about this, see Appendix, “The GDDM Version 3 library” on page 91.

The BookMaster program

The BookMaster program provides a document-markup language for text processing. The BookMaster program processes text files that include Generalized Markup Language (GML) tags. BookMaster code interprets these tags and formats the file with chapters, headings, paragraphs, lists, tables, figures, footnotes, and all the other elements of a published document as specified by these tags. The user can output the formatted document on a display terminal or on a page printer. The BookMaster program does not require GDDM to be installed. However, page segments (PSEGs) and overlays generated by GDDM can be incorporated into BookMaster documents.

BrowseMaster

The BrowseMaster program allows documents containing merged text and graphics to be viewed on an IBM 3270-family display or on a 5080 or 6090 Graphics System. This is a valuable aid to the preparation of documents formatted for IBM page printers, such as the 3800 Model 3, 3812, 3820, and 3900. BrowseMaster uses GDDM for the display of composite documents.

DB2 Performance Monitor for MVS

DATABASE 2 Performance Monitor for MVS (DB2PM for MVS) is a systems management product for customers of IBM's Relational Database Management System solution, DB2 for MVS.

DB2 PM for MVS provides functions that monitor, analyze, and optimize the performance of DB2 for MVS. It includes interactive report generation, background reporting, an explain function, an online monitor to provide an immediate "snap-shot" view of DB2 for MVS activities while the system is operational, and precise performance data and exception processing online.

The DB2 PM Interactive Report Facility (IRF) has an optional graphics operation function used for charting the performance data. Use of the graphics function requires GDDM Base and GDDM-PGF.

The DrawMaster program

The DrawMaster program is used in the preparation of graphics line art for illustrating publications. It also has a wide application in the preparation of other materials that include a mixture of text and line art. Materials such as presentation charts, slides, online information, and education documentation can all be created using this system. The DrawMaster program uses GDDM for alphanumeric-panel support and for some graphics operations.

The GDDM/graPHIGS program

The GDDM/graPHIGS program is used for creating hierarchical, three-dimensional graphics structures. It is designed to make full use of the features of the 5080 and 6090 Graphics Systems, but other graphics devices can also use it. It has an advanced programming interface based on the proposed ANSI standard for the Programmer's Hierarchical Interactive Graphics System (PHIGS). It is intended to simplify the programming of graphics, particularly for CAD/CAM applications. GDDM/graPHIGS requires GDDM Base to be installed.

Graphical Display and Query Facility (GDQF)

GDQF allows the user to view CADAM models, APT (Automatically Programmed Tool) geometry (PUNCH) files, APT cutter location (CLFILE) files, and graphics-data-format (GDF) files. Terminal operators can use local or host-based commands to manipulate views of the drawings.

GDQF includes facilities to generate GDF files from other CAD/CAM systems, such as Circuit Board Design System 2 (CBDS 2) and Computer-Graphics Aided Three-Dimensional Interactive Application (CATIA). It provides hardcopy support for the IBM 3287 and 4250 printers, and the IBM 727x plotters. It can be used to create GDF files for use by other GDDM-based applications, such as the Composition Utility and Interactive Chart Utility.

GDQF requires GDDM Base to be installed, and can use GDDM-PGF if it is available.

Information/Management for MVS/ESA (INFO/MAN)

Information/Management for MVS/ESA (INFO/MAN) provides an online, interactive structure within which information that is valuable to the daily operation of a data processing system can be collected, retrieved, integrated, and managed.

Information/Management enables control of the data processing installation with less effort and more accuracy than ever before. Information on problems and changes can be collected as they occur, using formats and data tailored to the user's business needs and processes.

Information/Management provides the following facilities:

- Management of data processing problems and changes
- Integration of problem and change management processes
- Orderly maintainers of inventory and configuration data
- Integration with other systems management products (NetView, for example)

A powerful online search is used in step-by-step retrieval and display of data processing information. A variety of custom-tailored reports, including graphic charts, can be generated from this information.

GDDM/MVS is used in the production of chart output. Information/Manager provides a user API interface to customize the charted output.

JES/328X Print Facility

The JES/328X Print Facility extends the support of Remote Job Entry (RJE) devices provided by MVS JES2 and JES3 to include the IBM 3270 family of printers, or printers that are compatible with them, and the family of IPDS (Intelligent Printer Data Stream) printers. Output can be routed to these printers by various means, including the GDDM processing option PRINTDST. When processing GDDM print requests (or files destined for IPDS printers), JES/328X invokes the GDDM print utility, ADMOPUJ, to process the print request.

PMF and PSF are companion programs that support the advanced-function printing capabilities of printers such as the IBM 3800 Models 3 and 8, the 3820, the 3827, and the 3900. PMF provides several utility programs and 66 character sets in source form, while PSF provides the device support. PMF requires GDDM for its operation; PSF can process data streams created by GDDM.

Lotus/1-2-3M

Lotus 1-2-3M, the System/370 version of Lotus 1-2-3 Release 3, has been developed by Lotus Development Corporation to be exclusively marketed by IBM in the VM/CMS and MVS/TSO/E environments.

It is the host-based component of a 1-2-3 based Enterprise Spreadsheet System, allowing users to work together in both the host and workstation environments to solve business application problems. A 1-2-3 menu-driven interface for file transfer from within 1-2-3 on the personal computer to and from the mainframe is delivered with the host product.

Lotus 1-2-3M provides worksheet consolidation, multiple open files in memory, three-dimensional worksheets, integrated spreadsheet data and graphics, and menu-driven access to Structured Query Language/Data System (SQL/DS) and

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DATABASE 2 (DB2) relational data. It complements other decision support products by providing access to Query Management Facility (QMF) and Application System (AS). Presentation quality graphics are provided using GDDM and GDDM's Interactive Chart Utility (ICU).

MVS Hardware Configuration Definition (HCD)

Hardware Configuration Definition (HCD) is an interactive interface that enables an installation to define I/O configurations to both the software and hardware from one interface. To define configurations to the hardware and software, you use HCD to create an input/output definition file (IODF).

You can use HCD to perform the following major tasks:

- Define new configuration data (an IODF or parts of an IODF)
- Activate configuration data
- View and modify existing configuration data
- Maintain IODFs (such as, copy, import, and export)
- Query and print configuration data
- Migrate configuration data

HCD uses GDDM to produce a graphical representation of the defined configuration, allowing display and printing on graphics capable devices.

OfficeVision: PROFS, DISOSS, and DW/370

The Professional Office System (PROFS), Distributed Office Support System (DISOSS), and DisplayWrite/370 (DW/370) programs together provide office facilities on System/370 machines under various operating systems. GDDM is required to support the DW/370 image and graphics features, and for display of GDDM graphics stapled to PROFS documents.

Operations Planning and Control/ESA (OPC/ESA)

IBM Operations Planning and Control/ESA (OPC/ESA), a SystemView client/server product, is IBM's licensed program for managing systems production workload. OPC/ESA contributes to automating batch production workload and has function for scheduling and tracking:

- MVS batch workload, including special and manually submitted jobs
- MVS Started Tasks, in sequence with batch work
- Workload on OS/2 systems
- Workload on networked RISC System/6000 and AS/400 processors
- Workload on HP-UX, SunOS, and Sun Solaris systems
- Workload on UNIX systems using LoadLeveler for workload balancing
- Manual activities

OPC/ESA, through the OPC Tracker Agents for the various client systems, provides centralized full function workload management. This reduces the need for skilled personnel at remote locations and helps manage distributed systems in a cost effective way.

GDDM is used to generate and print graphic representation of the operation planning flow diagrams.

Performance Reporter for MVS

IBM Performance Reporter for MVS, part of SystemView for MVS, is a product for collecting performance data, summarizing it, and saving it in a DB2 data base. Performance Reporter for MVS is the follow on product to Service Level Reporter (SLR).

Performance Reporter for MVS supports the IBM SystemView performance management discipline with a set of performance data collection and reporting functions: A base, seven application features, and an OS/2 reporting dialog feature.

The Performance Reporter for MVS features control selection and collection of the measurement data, provide predefined reports to present the data, and include documentation to help do performance analysis. The Performance Reporter for MVS features are:

- System Performance
- IMS Performance
- CICS Performance
- Network Performance
- AS/400 System Performance (SP400)
- UNIX Performance
- Capacity Planner
- Reporting Dialog/2

GDDM and GDDM-PGF are used to generate and print graphical reports.

Print Management Facility (PMF) and Print Services Facility (PSF)

PMF and PSF are companion programs that support the advanced-function printing capabilities of printers such as the IBM 3800 Models 3 and 8, the 3820, the 3827, and the 3900. PMF provides several utility programs and 66 character sets in source form, while PSF provides the device support. PMF requires GDDM for its operation; PSF can process data streams created by GDDM.

Print Services Facility (PSF) is the cornerstone product in the family of Advanced Function Printing (AFP) program products. PSF is used to print both line mode and Advanced Function Presentation Data Stream (AFPDS) format, composite documents containing text, graphics, and images. Printing is supported on IBM Advanced Function Printers such as 3112, 3116, 3912, 3916, 3825, and 3827 Page Printers, the 3835 and 3900 Advanced Function Printers, and other various page and line printers.

GDDM-based applications can be used to create image and graphic page segments that can be included in composite documents with text formatting products such as BookMaster, which are then printed using PSF. GDDM thus provides indirect support for PSF.

The ProcessMaster program

The ProcessMaster program provides a panel-driven interface to a variety of computer tools that support document creation, formatting, and printing. This frees the user from having to know how to invoke each of the tools individually. The ProcessMaster program uses GDDM from its various “graphics” panels. For example, the GDDM-PGF ICU is accessed from the business-graphics panel. GDDM is also used in the conversion of ADMGDF files to page segments.

ProductManager: Engineering Management Edition

The IBM ProductManager: Engineering Management Edition licensed programs are an integral part of IBM's Computer Integrated Manufacturing (CIM) for providing enterprise-wide CIM solutions. The ProductManager applications are major components of IBM's Product Information Management solutions.

These licensed programs include:

- Application Services Manager/MVS - provides common user services and system services.
- Product Change Manager/MVS - to manage the design and release process within an enterprise.
- Product Structure Manager/MVS - to define and maintain product definition and product structure data.

The ProductManager applications are designed in conformance with the text subset of the Common User Access (CUA) graphical model, as defined in SAA CUA guidelines. User interaction with ProductManager is enhanced through the exploitation of the windowing capability of GDDM.

Query Management Facility

The Query Management Facility (QMF) program allows end users to query a relational database and use the resulting information to create reports and charts. The QMF program runs with Database 2 (DB2) data in an MVS environment, and with Structured Query Language/Data System (SQL/DS) data in a VM environment. It uses GDDM for all terminal handling, and uses GDDM-PGF for producing charts.

Resource Measurement Facility (RMF)

Resource Measurement Facility (RMF) measures and reports on the performance and availability of the system. Many RMF reports are available online as well as in printed form.

RMF issues reports about performance problems as they occur, so the installation can take action before the problems become critical. As well, the installation can also obtain long-term measurements of system performance that can be used for system tuning and capacity planning.

RMF reports provide information about the activity of individual jobs, specified groups of jobs, or all jobs in the system.

RMF measures and reports on the activity and availability of system hardware and software resources, such as processors, channel paths, devices, real storage, address spaces, serially reusable resources, and JES.

RMF uses GDDM to produce graphical representations of the measurement data for display and printing on graphics capable devices.

SearchManager/370

IBM SearchManager/370 is a general-purpose information-retrieval program for the CICS/MVS environment that is designed to search for and retrieve information stored in text databases.

Information in the databases accessed by IBM SearchManager/370 is organized in units called documents. Documents can contain references to images or graphics contained in another database. The documents can be searched by specifying a word or phrase or combination of words and phrases as search arguments, or by additionally specifying document attributes, such as author name.

An image processing product is needed to store and administer the images and graphics either stored in the document or in the GDDM data base. GDDM/MVS is required for the image and graphics functions and for printing on various GDDM-driven printers.

Service Level Reporter (SLR)

The Service Level Reporter (SLR) program is a tool that provides management information for Information Systems installations. It uses GDDM to show processor usage and other relevant figures in graphic form.

System Display and Search Facility (SDSF)

System Display and Search Facility/MVS (SDSF/MVS) provides an easy and efficient way to monitor, manage, and control the MVS/ESA JES2 system. SDSF/MVS does this with an interactive panel interface that provides immediate, up-to-date information about jobs, output, printers, initiators, and other system resources.

In particular printer output queues can be monitored and controlled, including viewing printer output using SDSF commands. In order to display composite documents (text, graphics and image) in AFPDS format GDDM Composite Document Print Utility (GDDM-CDPU) is required.

GDDM/MVS Base is required to support the viewing of composite documents.

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Chapter 3. New function delivered in Service updates

This chapter describes the new function that has been delivered in Program Temporary Fix (PTF) updates since the general availability of GDDM 3.2.

GDDM support for the euro symbol

GDDM provides support for the euro symbol for the Latin 1 and Latin 9 code pages. Latin 1 is the set of current CECP code pages and Latin 9 is a new code page (924). Support for other code pages will be added when definitions have been finalized. Updates to CDPU functions will only be on an as-required basis.

A new set of Latin 1 Extended CECP code pages has been defined with the euro symbol replacing the international currency symbol. These code pages are:

CECP	ECECP
37	1140
273	1141
277	1142
278	1143
280	1144
284	1145
285	1146
297	1147
500	1148
871	1149

GDDM performs translation between all the above code pages as if the CECP and ECECP character sets were equivalent.

GDDM provides symbol sets to support the new code pages, equivalent to all the existing CECP symbol sets, except for the ADMUWxxx group.

For CGM conversion, GDDM will translate between the ECECP codes pages (1140 through 1149) and PC code page 858, and between EBCDIC code page 924 and PC code page 923.

PostScript output will be to code page 923 if the application code page is 924.

Because of the large number of new symbol sets, the support is shipped in five PTFs. PTF1 is mandatory but PTFs 2 through 5 may be selected according to your symbol set requirements. The APARs for the five PTFs are shown below.

	PTF1	PTF2	PTF3	PTF4	PTF5
GDDM/MVS	PQ17237	PQ17720	PQ17816	PQ18120	PQ18121
GDDM/VSE	PQ17818	PQ18178	PQ18180	PQ18181	PQ18182
GDDM/VM	PQ18168	PQ18169	PQ18170	PQ18171	PQ18172

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The content of the five PTFs is shown below and gives the names of the new symbol sets against the CECP equivalents. PTF1 also contains the code modules required to support the new function.

PTF1 (mandatory for euro support)

<i>Table 1. Content of PTF1</i>		
CECP	ECECP	CP924
ADMDHIlx	ADMDHEIx	ADMDH9Ix
ADMDVECP	ADMDVCPE	ADMDV9CP
ADMDHJVJ	ADMDHEVJ	ADMDH9VJ
ADMDHJVM	ADMDHEVM	ADMDH9VM

PTF2 (optional)

<i>Table 2. Content of PTF2</i>		
CECP	ECECP	CP924
ADMITALx	ADMETALx	
ADMUUxxx	ADMEUxxx	

PTF3 (optional)

<i>Table 3. Content of PTF3</i>		
CECP	ECECP	CP924
ADMITALx		ADM9TALx
ADMUUxxx		ADM9Uxxx

PTF4 (optional)

<i>Table 4. Content of PTF4</i>		
CECP	ECECP	CP924
ADMUVxxx	ADMEVxxx	

PTF5 (optional)

<i>Table 5. Content of PTF5</i>		
CECP	ECECP	CP924
ADMUVxxx		ADM9Vxxx

Using the euro support

The new code page values should be used for the application and installation code page settings, as required.

Display devices

The terminal emulator being used should be configured with the required code page. This value is returned to GDDM when the device is opened.

Family-1 and family-2 printing

When GDDM is used to print pages created by GDDM, the application code page in effect at the time the page was created is used as the device code page for IPDS printers supporting the euro symbol.

Alphanumerics on the page are converted to PTOCA text and are printed using the Courier font, FGID 416. The font is scaled to a size appropriate for the IPDSCPI procopt setting at the time of printing.

Family-4 output

Entries should be added or changed in the ADMLSYS4 table, using the ADMMAFP macro with suitable FONTCHR and CODEPGE parameters.

A font should be used that supports the euro symbol in the printer. In general, the language group code in position 6 of the font name is '0' for all the new code pages.

The new code page names are:

- T1001140
- T1001141
- T1001142
- T1001143
- T1001144
- T1001145
- T1001146
- T1001147
- T1001148
- T1001149
- T1000924

AFPDS Printing

When the GDDM CDPU is used to print AFPDS data sets, the ADMDFNT table will require updating according to your requirements.

Add the code page names, as listed above, to the code page section of the table.

GDDM has been changed such that if an entry is not found for a supported IBM Network Printer or IBM InfoPrint printer, the 'model=4028' entry will be selected. To add specific entries for these printers, 'model=4312' must be used for all models. Scalable fonts will require an 'fwidth=' value specified.

Symbol sets

Any programs using symbol sets will require updating by changing the names to one of the equivalent euro symbol sets. These are defined in the PTF content tables.

Default symbol sets

GDDM will select default symbol sets appropriate for the code page of the device being used.

CGM output

The CGLOAD and CGSAVE calls support the 858 (ECECP) and 923 (924) code pages. The new code pages may, alternatively, be specified in the CGM conversion profile.

PostScript output

If the application code page is 924, the output is to code page 923; otherwise, it is to code page 819.

IBM Network Printer and IBM InfoPrint printer

GDDM now supports the IBM Network Printer models 12, 17, and 24 and the IBM InfoPrint printer models 20 and 32. For the IBM InfoPrint printer, you also require the euro support PTF (PTF1).

GDDM support for the network printers consists of being able to run in native mode, and the addition of support for output stacker selection by means of a new processing option (procopt). Other functions, such as Bar Code support, are at the 4028 level. Support is provided for family-1 (IPDS), family-2, and family-4. Output stacker selection is not applicable to family-4.

The new procopt is IPDSSTAK and is group code 52. The format is (IPDSSTAK,n) where n is the stacker number and has a default of 1.

You should check for the valid media destination values for the printer that you are using. For example, for the 4324 printer:

- Output tray 1 (Face down) is value 1
- Output tray 2 (Face up) is value 2

The output trays may also be Mailbox output or Finisher Trays.

The same device tokens apply to all the Network Printer and InfoPrint printers.

The following device tokens are provided for family-1 and family-2:

SNWPRQ SNA Letter
XNWPRQ Non-SNA Letter
SNWPRA4 SNA A4
XNWPRA4 Non-SNA A4

The family-4 device tokens are:

ANWPRQ Letter 8 LPI
ANWPRA4 A4 8 LPI
BNWPRQ Letter 6 LPI
BNWPRA4 A4 6 LPI

All tokens have the 4mm no print border.

The following is the description of the new procopt.

52

Output stacker selection

Nickname syntax:

(IPDSSTAK,n)

This option specifies the media destination (the output stacker or tray) to be used for the printed output. You should check what media destination values are valid for the printer that you are using (for example: for the 4324).

- Output tray 1 (Face down) is value 1
- Output tray 2 (Face up) is value 2
- Subsystems: Not IMS
- Devices: 4312, 4317, and 4324, family-1 and family-2 IPDS Network Printers, and InfoPrint printer models 20 and 32.
- Length: 2 fullwords:
 - 1 The option group code: 52
 - 2 The output tray number. Any value supported by the printer. The default is 1.

The APAR numbers are PQ07344 (GDDM/MVS), PQ07619 (GDDM/VSE), and PQ07582 (GDDM/VM).

PostScript level 3

GDDM supports family-4 output files in PostScript Level 1 and Level 2 formats, and several suitable device tokens are supplied. The support has been improved so that the level-1 and level-2 PostScript files produced by GDDM are usable on level-3 PostScript devices. GDDM does not, however, create level-3 PostScript output.

The APAR numbers are PQ17609 (GDDM/MVS), PQ17952 (GDDM/VSE), and PQ17953 (GDDM/VM).

Device tokens for the 4247 IPDS printer

GDDM provides family-1 and family-2 device tokens required to support the 4247 IPDS printer.

Six tokens are provided for Standard, Quarto and A4 paper size, and for SNA or NON-SNA protocol. These are:

X4247S	Standard non-SNA
S4247S	Standard SNA
X4247Q	Quarto non-SNA
S4247Q	Quarto SNA
X4247A4	A4 non-SNA
S4247A4	A4 SNA

GDDM supports input bin selection for all available paper sources.

The IPDSBIN procopt values for the 4247 are:

0	Default, as specified on the operator panel
1	Front continuous form
2	Rear continuous form

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5	ASF bin 1 (if paper)
6	ASF bin 2
7	ASF bin 3
65	ASF bin 1 (if envelopes)
97 - 100	Manual bin

The supplied device tokens only include 100 for manual bin selection.

For family-4 output, the existing tokens for 4224 should be used.

The APAR numbers are PQ01129 (GDDM/MVS), PQ01131 (GDDM/VSE), and PQ01130 (GDDM/VM).

Support for process color printers

GDDM supports process color printing via family-4 AFPDS output for printers, such as the IBM Infoprint 4000 HC Highlight Color Postprocessor, that support the Set Process Color GDF order. Process color is only supported in GOCA output.

The GSPCTB function call is added to the GDDM application programming interface:

GSPCTB

Function: To add elements to the Process Color Table.

GSPCTB (control, element-no, count, array)

APL Code 599

GDDM RCP code X'0C0C0710' (202114832)

Parameters

control (specified by user) (fullword integer)

Reserved, and should be set to zero.

element-no (specified by user) (fullword integer)

First element in the table to be loaded. Valid values are 1 to 255.

count (specified by user) (fullword integer)

The number of attributes to be loaded, contained in the array. Must be a multiple of 5. The value must not extend to element numbers beyond 255. The maximum value is 5 x 255 (1275) if element-no = 1.

array (specified by user) (an array of fullword integers)

The process color attribute values to be loaded into the process color table. Each element has five attributes that represent color space and color values 1 through 4.

A process color table is used only for family-4 GOCA output and must only be used for AFP printers that support Process Color. The table is ignored for family-1, -2, and -3 output. When a table has been defined, GSCOL calls that have been issued result in the color value in the calls being used as an index into the process

color table. The process color attributes at that position in the table will replace the GSCOL values.

The values output will be those in effect at the time the FSFRCE or ASREAD is issued. All GSCOL calls will be replaced except for those with values -2, -1, 0, 7, and 8. These will retain their original meanings. Elements 7 and 8 in the table are ignored. There is one process color table for each GDDM page. GSCOL values that reference elements in the table that have not been loaded result in the device default being used. The first call to GSPCTB creates the table and loads elements. Any further calls load and/or replace elements. The color numbers used in GDDM-PGF charts will result in the corresponding process color being used.

Saved GDF files will contain only the original GSCOL orders and must be loaded into a GDDM instance that includes a call to set up the required process color table.

The Process Color Space values are:

- 1** RGB color space. Color values 1, 2, and 3 set the R, G, B components in the range 0 to 255. Color value 4 is reserved and should be set to 0.
- 4** CMYK color space. Color values 1, 2, 3, and 4 set the C, M, Y, K components in the range 0 to 255.
- 6** Highlight color space. Color value 1 specifies the highlight color number in the range 0 to 65535. Values are device dependent. Value 0 results in the device default. Color value 2 specifies the percentage coverage for the specified color, in the range 0 to 100. Color value 3 specifies the percentage shading to be added and is in the range 0 to 100. Shading is added with black. The total of coverage and shading must not exceed 100%. Color value 4 is reserved and should be set to 0.
- 8** CIELAB color space. Color value 1 specifies the luminance in the range 0 to 255. Color values 2 and 3 specify the a and b components in the range -127 to +127. Color value 4 is reserved and should be set to 0.
- 64** Standard OCA color space. Color value 1 specifies the OCA color value. Valid values are:
 - 0 through 6, or X'FF00' through X'FF06' (65280 - 65286)**
Same as GSCOL values 0 through 6
 - 8**
Black
 - 16**
Brown
 - X'FF07' (65287)**
Device default
 - X'FF08' (65288)**
Color of medium
 Color values 2, 3, and 4 are reserved and should be set to 0.

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All non-reserved values are checked for validity. Any invalid values result in error message ADM0152E.

The APAR numbers are PQ10833 (GDDM/MVS), PQ10871 (GDDM/VSE), and PQ10872 (GDDM/VM).

Allow PostScript output to be generated in EBCDIC

GDDM allows the user to output PostScript in EBCDIC as an alternative to ASCII, for use by host-connected PostScript processors.

The choice of output is by extension to the OFDSTYPE procopt. The new values are:

PSE

A primary PS datastream with output in EBCDIC. The encoded value for this is 3.

EPSE

Encapsulated PS output in EBCDIC. The encoded value for this is 4.

EBCDIC output is in the application code page. This may need setting to the required value.

The APAR numbers are PQ05609 (GDDM/MVS) and PQ05610 (GDDM/VM).

Improvements to pie charts

GDDM-PGF provides the following improvements to pie charts:

- When spider text is used, the occurrence of the message ADM0561 will be greatly reduced by making more efficient use of the vertical space at the sides of the chart.
- For exploded pie slices, a new option allows the grouping together of adjacent exploded slices. This function is available only via the CHPEXP call. A new value of 2 in the list means that this slice will be exploded, joined with any adjacent slices that have the value of 2. If there are no adjacent slices with the value of 2, it will have the same effect as value 1. The first and last segments of a pie chart cannot be grouped together.

The GDDM-PGF APAR number is PN91548.

CGM enhancements

GDDM's CGM support has been improved in several respects:

- Improved alignment of "half-aligned" text, on CGM import.

The APAR numbers are PN92217 (GDDM/MVS), PQ02496 (GDDM/VSE), and PQ02505 (GDDM/VM).

- CGM import allowed where the second VDC point is less than the first VDC point.

The APAR numbers are PN92327 (GDDM/MVS), PQ02529 (GDDM/VSE), and PQ02530 (GDDM/VM).

- Improved font-name matching on CGM import by (a) being insensitive to case, (b) treating the "-" and "_" separators in font names as equivalent, and (c) treating ":" and "/" in font names as equivalent.
The APAR numbers are PN92817 (GDDM/MVS), PQ02539 (GDDM/VSE), and PQ02540 (GDDM/VM).
- Improved handling of the various character orientations on GGM import.
The APAR numbers are PQ00463 (GDDM/MVS), PQ02537 (GDDM/VSE), and PQ02538 (GDDM/VM).
- CGMs with an empty Metafile Element List can be imported.
The APAR numbers are PQ00500 (GDDM/MVS), PQ02535 (GDDM/VSE), and PQ02536 (GDDM/VM).
- CGM import is allowed where the VDC extent is specified with the top-right corner first.
The APAR numbers are PQ00528 (GDDM/MVS), PQ02587 (GDDM/VSE), and PQ02588 (GDDM/VM).
- Improved smoothness of the supplied symbol sets ADMUUH, ADMUUHI, ADMUUHB, and ADMUUHBI.
The APAR numbers are PQ01239 (GDDM/MVS), PQ03016 (GDDM/VSE), and PQ03017 (GDDM/VM).
- The marker aspect ratio on CGM import is maintained.
The APAR numbers are PQ02121 (GDDM/MVS), PQ02589 (GDDM/VSE), and PQ02590 (GDDM/VM).
- Improved handling of vertical restricted text on CGM import.
The APAR numbers are PQ05705 (GDDM/MVS), PQ15314 (GDDM/VSE), and PQ15316 (GDDM/VM).
- CGM import is allowed with the y-coordinate increasing downwards.
The APAR numbers are PQ06193 (GDDM/MVS), PQ15407 (GDDM/VSE), and PQ15408 (GDDM/VM).
- GDDM external default NUMBFPM (number convention) values of 2 (comma decimal convention) and 3 (French decimal convention) can be used. This also means that the comma can no longer be used as a parameter separator in the conversion profile. Note that a space is always used as a parameter separator in the conversion profile, and so cannot be used (in the conversion profile) as a thousands separator (write "32727" not "32 767", for example, even when using French decimal convention).
The APAR numbers are PQ13321 (GDDM/MVS), PQ13396 (GDDM/VSE), and PQ13397 (GDDM/VM).
- Invisible segments do not become visible on CGM import.
The APAR numbers are PQ14675 (GDDM/MVS), PQ15645 (GDDM/VSE), and PQ15646 (GDDM/VM).

Other enhancements

- The use of a dummy name-list is allowed for the family-4 name on MVS/TSO.
The APAR number is PQ05707 (GDDM/MVS).
- The appearance of shallow arcs (for example, in small segments of pie charts) is improved.
The APAR numbers are PQ05664 (GDDM/MVS), PQ15185 (GDDM/VSE), and PQ15186 (GDDM/VM).

Chapter 4. What's new for GDDM Version 3 Release 2

This chapter provides an overview of the new function and the improvements supplied in GDDM 3.2.

Support for GIF output

GDDM now allows you, on MVS/TSO and VM/CMS, to exploit your host-based graphical data in the network computing environment by providing a tool to convert ADMGDF files to the popular GIF (Graphics Interchange Format) file format. (See the *GDDM Base Application Programming Reference* for details of how to convert an ADMGDF file into a GIF file.) This format has become a de facto standard for image transmission on the Internet.



Figure 10. The "Daily Hours of Sun" chart as a GIF file

The GDDM-PGF OPS utility

GDDM-PGF has incorporated the IBM Online Presentation System program to enhance its presentation-producing capability.

The GDDM-PGF OPS (Online Presentation System) utility, on MVS/TSO and VM/CMS, provides a DCF-like command interface that is simple and easy to use, yet which is also powerful enough to allow you to create high-quality presentations. These can then be used from displays (perhaps using the built-in automatic scrolling feature), or can be saved for printing or plotting on overhead projection transparencies or paper in one of the many output formats supported by GDDM, such as ADMGDF, PSEG, IPDS, AFPDS, PostScript, and others.

Host GDDM users can now create presentations with full GDDM output capabilities (for example, PostScript, IPDS, AFPDS, and plotter support) without having to

GDDM 3.2 enhancements

transfer files to and from the workstation and without having to use workstation programs. They can also use host GDDM files and symbols without having to worry about host-to-workstation conversion.

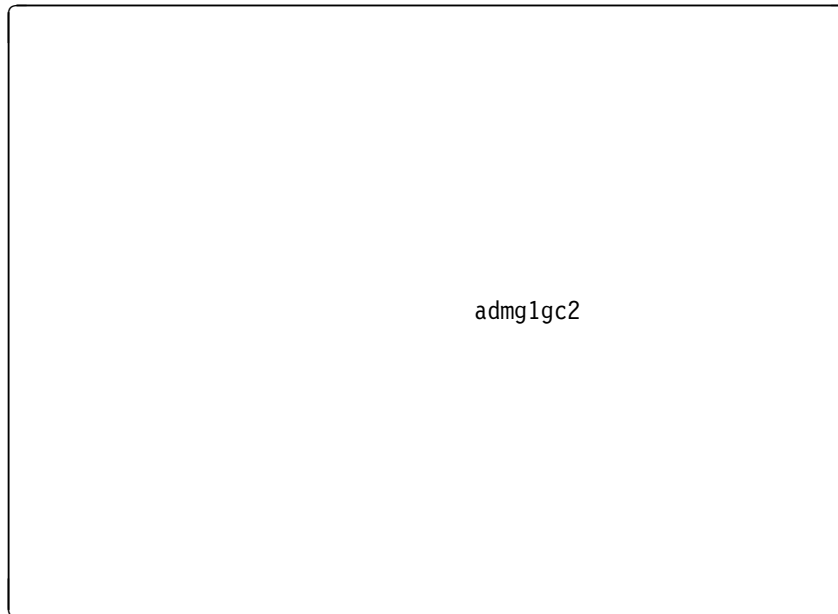


Figure 11. The GDDM-PGF OPS front-end screen

Typical applications of GDDM-PGF OPS are:

- Public presentations using a video monitor or projector
- Educational sessions for private or public display
- Scrollable and/or interactive presentations of business charts
- Production of high-quality foils

Features of GDDM-PGF OPS are:

- A “presentation-by-example” front-end facility.
- Extensive help facilities.
- A powerful command language, which allows quick and concise picture creation.
- Interactive, interpreted commands: no formatting step required.
- High-quality line art, supporting lines and arrows of varying thickness and curvature, boxes with 3-D effects, shadows, and more.
- Scrollable or mouse-controlled presentations.
- Automatic scrolling supported and saving in ADMGDF and PSEG formats is possible during auto-scroll.
- Combines text, line art, Interactive Chart Utility charts, ADMGDF files, and images on the same page.
- Extensive color palette.

See the *GDDM-PGF OPS User's Guide* for a full description of this utility.

Print Queue Manager

The Print Queue Manager (ADMPQM) allows system operators to manage the GDDM master print queue on TSO dynamically, without having to stop the TSO print utility. This represents a considerable productivity enhancement for an installation with many printers. Until now, GDDM did not provide a way of managing the GDDM print queue without stopping the print utility. In a large installation, with perhaps hundreds of printers spread over many sites, stopping the print utility can be extremely inconvenient.

This new addition to GDDM is a menu-driven application, which allows the system operator to:

- Add new printers
- Delete requests for a particular printer
- Move requests from one printer to another
- View requests for a printer

See the *GDDM System Customization and Administration* book for full details of the Print Queue Manager.

CGM enhancements

GDDM's Computer Graphics Metafile (CGM) generation and interpretation has been improved considerably. The enhancements include:

Improved handling of backgrounds

The color of CGM backgrounds can now be controlled.

Color and defaults handling

GDDM creates GCM files that by default use the workstation norms of black lines on a white background (not GDDM's usual green on black display or white printer background).

Improved profiles

The profiles have been updated for the new facilities and defaults.

Improved support for metric mode

Users can create CGM files that specify the use of metric scaling mode, allowing the size of the picture to be specified (in millimeters), where necessary.

Support for Restricted Text and Append Text

CGM Restricted Text and Append Text commands, previously unsupported and ignored by GDDM, are now supported.

Improved pattern handling

The mapping of CGM hatch patterns 5 (vertical or horizontal crosshatch) and 6 (positive or negative slope crosshatch) to similar GDDM shading patterns is made easier, and the profile can now be used to choose the GDDM shading pattern to use for defaulted CGM hatches.

Font mapping improvements

CGM fonts can now be mapped to GDDM symbol sets by CGM font name, rather than just CGM font index.

Improved code page support

The ISO/ANSI 8-bit multilingual code page 819 is now supported in addition to the currently supported ASCII code pages 437 and 850.

CALS conformance

A new profile keyword can be used to ensure that CGMs created by GDDM do not exceed the constraints imposed by US Military specification MIL-D-28003A.

See the *GDDM Base Application Programming Reference* for full details of Computer Graphics Metafile (CGM) support.

New and enhanced output support

GDDM continues to provide support for the newest printers, as well as enhancing its support in existing areas. Items include:

New printer support

The IBM 3112, 3116, 3912, and 3916 printers are now supported.

Support for partitioned data sets for family-4 files

A major improvement is that, on MVS/TSO, family-4 files can now be members of a partitioned data set, for both input and output. This means that GDDM family-4 data sets can now be saved as members of a partitioned data set from within an application. These data sets can be written without the overhead of allocating the partitioned data set for each save, which otherwise would have a significant impact on system resource. The new DSFRCE call and FRCETYPE processing option provide this support.

On MVS/TSO and MVS/Batch, the DSFRCE call enables the current graphics page to be saved in page segment or overlay format, as a member of a partitioned data set.

PRINTDST for family-4

The use of the PRINTDST processing option is extended to family-4, such that output may be sent to the JES spool instead of to a data set.

Enhancements to PostScript support

A linewidth option is added, which allows line widths varying from 1 through 9 on a PostScript device token. New PostScript device tokens are provided specifying a line width of 3, and also for the LEXMARK 4079PLUS PostScript level-2 printer, for paper sizes A3 and B.

64x64 pel pattern sets for family-4 image

In response to the increasing use of higher pels-per-inch printers (for example, 600dpi and 1200dpsi), GDDM supports 64 x 64 pel ADMSYMBL pattern sets for family-4 image output to provide enhanced graphics area fill support. This is in addition to the 32 x 32 pel support already provided by GDDM.

POSTPROC extensions

The POSTPROC processing option is now enabled for all family-4 output and GL plotter output. This allows further processing of an output file after it has been created (for example, to route the output to a specific printer).

NLS enhancements

GDDM now supports the Japanese DBCS PC/3270 V4 emulator's maximum requirement for alphanumeric symbol sets. To support graphics, the emulator must be configured for vector graphics, with or without programmed symbol set (PSS) support.

Simplified Chinese symbols sets are now provided in the Base product. There is new code page and symbol set support for Latvia, Lithuania, Estonia, and Turkey, and for those countries using the Cyrillic and Latin II character sets. Code page support is also provided for Greece.

See the *GDDM System Customization and Administration* book for details of code pages and symbol sets.

TCP/IP GDDMXD support

GDDM now supports family-1 output to IBM Xstation devices in X-Windows sessions on VM and TSO. This is an IBM TCP/IP function. For full details, see:

- *IBM TCP/IP for VM User's Guide*, SC31-6081
- *IBM TCP/IP for MVS User's Guide*, SC31-7136

Performance

The storage constraint in the GDDM/MVS print utilities with large lists of defaults, which restricted the possible number of concurrent printers, has been removed by loading the defaults list above the 16M line.

Enhancements to the sample program, ADMUSP4

With the GDDM-provided ADMUSP4 sample graphics editor, you can now save an edited ADMGDF file and retain all the file's information.

GDDM-IVU

GDDM-IVU allows you to import and export an image as a member of a partitioned data set on MVS/TSO.

See the *GDDM Image View Utility* book.

The GDDM 3.2 library

The GDDM manuals have not been published, in printed form, since GDDM 3.1. The GDDM 3.1.1 function was documented in the *GDDM 3.1.1 Guide to New Function*. The information in that guide has now been placed in the appropriate GDDM 3.2 manual. The new information provided for GDDM 3.1.1 and GDDM 3.2 is shown with a vertical bar in the left-hand margin.

The *Installation: Planning, Testing, and Servicing* manuals for GDDM/MVS, GDDM/VM, and GDDM/VSE have been discontinued. The information has been moved into other books:

- Installation, testing, and servicing information has been moved into the appropriate *GDDM Program Directory*.
- Other information (for example, setting up GDDM-PCLK and GDDM-OS/2 Link) has been moved into the *GDDM System Customization and Administration* book.

The *GDDM-PGF OPS User's Guide* has been added to describe how to use the GDDM-PGF OPS utility for preparing online presentations.

OS/390

OS/390 (program number 5645-001) is a software package that integrates selected MVS platform software products and features to create a fully enabled and functionally rich MVS/ESA operating system platform.

This new System/390 server operating system is a network-ready integrated operational environment. The base operating system functions of key products in the MVS environment are installed and tested as one product prior to customer delivery. Installation of OS/390 provides the base operating system, an open communications server, and distributed data and file services. Other integrated functions include parallel sysplex support, object-oriented programming, OSF Distributed Computing Environment (DCE), multimedia, open application interfaces, and online publications.

GDDM/MVS 3.2 is a base element of OS/390 Base. GDDM-REXX/MVS and GDDM-PGF are optional features.

GDDM's excellence as a graphics program and device driver is recognized worldwide. As a result, it is used extensively as a graphics enabler by other licensed programs, including other elements of OS/390 such as BookManager.

Chapter 5. What's new in GDDM Version 3 Release 1

GDDM Version 3 Release 1 provides a variety of enhancements and new function of interest to all classes of GDDM user. These are summarized here, and described in more detail in the rest of this chapter. The major benefits of GDDM 3.1 are:

Simplified ordering, installation, and maintenance of the GDDM programs

GDDM-OS/2 Link, GDDM-PCLK, and GDDM-REXX have been combined with GDDM Base to provide a single package, so that GDDM is easier to install and maintain.

A streamlined installation process

Improvements have been made to the way in which GDDM is installed in all environments.

Faster application response

Changes have been made to GDDM's screen-redrawing functions to improve application-response time. Also, better windowing performance is provided by GDDM-OS/2 Link.

Improved printing and plotting support

GDDM 3.1 provides many improvements, including:

- Enhanced page-printer support for all types of data
- A greater degree of control over the layout of both printed and plotted output
- Support for more devices
- The ability to store plotter output in IBM-GL files that can be directed to a wider range of non-IBM plotters
- Support for plots up to 11.862 m (38.91 ft.) in length

Improved usability

Many usability enhancements have been made to the GDDM-OS/2 Link and GDDM-PCLK components of GDDM Base, and to the printing interfaces of User Control and the GDDM-PGF Interactive Chart Utility.

Better picture-display function

GDDM's User Control interface now allows both image and graphics to be panned and zoomed.

Support for more programming languages

GDDM 3.1 now includes support for C/370, and extends support for GDDM-REXX to the MVS/TSO environment.

Improved support for Chinese, Japanese, and other double-byte languages

GDDM 3.1 supplies a new, Mincho double-byte character set, and allows multiple double-byte character sets to be installed and used.

Improved documentation

The GDDM 3.1 library is smaller, has been restructured, contains new information (including "how to" examples), and is available in softcopy format for use with IBM BookManager.

GDDM has been repackaged

For simplified ordering, installation, and maintenance of the GDDM programs, GDDM 3.1 has been repackaged. There are three GDDM Version 3 Release 1 Base programs. These are:

<i>GDDM Base program</i>	<i>Level</i>	<i>Program number</i>
GDDM/MVS	3.1.0	5695-167
GDDM/VM	3.1.0	5684-168
GDDM/VSE	3.1.0	5686-057

GDDM/VM 3.1 runs in both the VM and VM/XA environments.

Each of these Base programs now incorporates the code of the GDDM-OS/2 Link and GDDM-PCLK programs, which provide workstation connectivity in the OS/2 and DOS environments respectively. Use of the GDDM-OS/2 Link and GDDM-PCLK code continues to be separately licensed. Ordering and installation of the code, however, is much simplified.

Similarly, the GDDM-REXX program has been incorporated in the GDDM/MVS 3.1 and GDDM/VM 3.1 Base programs. (There is no support for GDDM-REXX in the VSE environment.) Installation of GDDM-REXX is much simplified. **On installation, the GDDM-REXX code is disabled.** In order to receive instructions for enabling the code, you must order the GDDM-REXX feature.

There are now only four GDDM licensed programs in addition to the GDDM 3.1 Base programs:

<i>Licensed program</i>	<i>Level</i>	<i>Program number</i>
GDDM-PGF	2.1.2	5668-812
GDDM Interactive Map Definition	2.1.2	5668-801
GDDM-GKS	1.1.2	5668-802
GDDM-IVU	1.1.2	5668-723

The modification level of each of these programs has been incremented and each is reshipped with GDDM 3.1.

GDDM-CSPF (Central Slide and Plot Facility) is not supported by GDDM 3.1. (Customers with a requirement for GDDM-CSPF function might want to evaluate products such as CMA-CONNECTION from CMA SOFTWARE A/S, Copenhagen, Denmark.)

Machine-readable information (MRI) is shipped separately from the product tapes. There is a national-language support tape for GDDM/MVS, one for GDDM/VM, and one for GDDM/VSE. The tape includes all MRI in all supported languages (including U.S. English) for all GDDM licensed programs.

An improved installation process

GDDM's repackaging for Version 3 Release 1 has brought with it a simplified installation process. In addition to these packaging-related improvements, many other improvements have been made to the way in which GDDM is installed, some applicable to all supported systems and some specific to particular environments.

GDDM/MVS installation

Some installation enhancements that are specific to GDDM/MVS 3.1 are described below.

Removal of installation error messages

Prior to GDDM 3.1, the SMP/E APPLY steps for the GDDM products generated redundant error messages. These error messages did not report errors that had to be fixed, and tended to obscure actual errors. For GDDM 3.1, all avoidable error messages have been removed from the SMP/E APPLY step of GDDM installation.

This change improves feedback to the installer during the installation process, allows real errors to be apparent, reduces the amount of output that has to be checked, and means that the return code from all installation jobs should be zero.

Improvements to GDDM's installation with CICS

A number of improvements have been made to the way in which GDDM is installed with CICS:

- Linkage of GDDM with CICS has been simplified as GDDM 3.1 includes its own copies of the CICS stubs. This effectively removes any confusion about which consolidated software inventory (CSI) GDDM 3.1 should be installed in, and removes manual link-edit processes for installing GDDM 3.1 and applying service. The potential for causing GDDM to fail when a new release of CICS is installed has also been removed.
- Sample DCTs (Device Control Tables) and FCTs (File Control Tables) are provided for use with CICS Versions 1 and 2 to simplify the process of defining GDDM to CICS.
- New installation instructions and samples (including sample CSDs, (CICS System Definitions)) are provided for use with CICS Version 3. Instructions for using the CICS RDO (Resource Definition Online) facility for updating GDDM-related information are provided. This simplifies the process of defining GDDM to CICS, and exploits the latest CICS resource-definition techniques.

New sample installation material

GDDM 3.1 supplies all jobs required to establish the SMP/E and GDDM environments as samples on the GDDM 3.1 installation tapes. The jobs are:

SMP/E environment creation
 SMP/E DDDEF load
 GDDM Data-set allocation
 GDDM Receive
 GDDM Apply
 GDDM Accept

By removing the requirement to type in long job streams, the provision of these sample jobs speeds up the installation process and reduces the potential for error.

GDDM 3.1 enhancements

GDDM objects are repackaged

GDDM 3.1 allows installation of GDDM objects (such as symbol sets, maps, and GDF files) into data sets defined with LRECL=400, BLKSIZE=400*n. This change removes an earlier restriction on the block size of GDDM objects, and is in line with new data-type support provided by SMP/E V1.5.0. It allows faster access to GDDM objects, simplifies the application of service to GDDM objects, and reduces DASD requirements.

Concatenated objects have been removed

The JCL supplied with the GDDM program to load objects into VSAM clusters has been amended to load individual objects rather than concatenated objects. The concatenated versions of the GDDM objects are therefore redundant and are not shipped with GDDM 3.1. This enhancement saves DASD space and simplifies the servicing of GDDM objects.

Changes to GDDM data-set names

In line with changes being made to all MVS products, the names of the GDDM data sets have been altered. The new names more accurately reflect the contents of each data set. A sample job for allocation of the new data sets has been provided.

GDDM/VM installation

GDDM/VM 3.1 allows an enterprise to set up saved segments with names other than those usually allocated to the GDDM programs, and to access them ahead of the normal discontinuous saved segment (DCSS) or named saved system (NSS). This change allows easier testing of migration to later levels of GDDM and of service updates.

GDDM/VSE installation

Installation enhancements specific to GDDM/VSE 3.1 are described below.

Concatenated objects have been removed

All GDDM/VSE 3.1 objects and symbol sets are shipped as individual items rather than as concatenated files. The load method for these objects has been changed accordingly and sample JCL is provided. This enhancement saves DASD space and simplifies the servicing of GDDM objects.

Support for CICS Resource Definition Online (RDO)

Instructions for using the CICS RDO (Resource Definition Online) facility to define GDDM to CICS/VSE and CICS/DOS/VS, including the necessary CSD entries, are provided. This simplifies the process of defining GDDM to CICS, and exploits the latest CICS resource-definition techniques. Also, RDO can be used to define a new level of GDDM temporarily (for testing purposes, for example) without bringing down the CICS system.

Installation of GDDM-OS/2 Link on the workstation

The GDDM-OS/2 Link component of GDDM 3.1, which is an enhanced version of GDDM-OS/2 Link V1.0, is automatically downloaded to existing GDDM-OS/2 Link users when GDDM 3.1 has been installed. Subsequent service updates applied to GDDM-OS/2 Link on the host are also downloaded automatically to the workstation. Existing users of GDDM-OS/2 Link are not required to take any action to download the GDDM-OS/2 Link component of GDDM 3.1. GDDM-OS/2 Link V1.0 is not supported by GDDM 3.1.

First-time users of GDDM-OS/2 Link can install OS/2 support by starting HGINST from an OS/2 session when attached to a host system running GDDM 3.1. This installation method is unchanged from that employed by GDDM-OS/2 Link V1.0.

A new “GDDM-OS/2 Link” group is created when GDDM-OS/2 Link has been successfully installed. From this group you can access both the new GDDM-OS/2 Link online *User’s Guide* and GDDM-OS/2 Link’s service utilities.

Use of the GDDM-OS/2 Link component of GDDM 3.1 is licensed separately from use of the GDDM Base programs.

Installation of GDDM-PCLK on the workstation

The GDDM-PCLK code for GDDM 3.1 is shipped on the Base program’s NLS (national-language support) tape and is installed on the host along with the program’s machine-readable information (MRI). The new user of GDDM-PCLK downloads the GDDM-PCLK code using the terminal emulator’s standard file-transfer commands. For existing users, the GDDM-PCLK code is downloaded automatically to the workstation when GDDM 3.1 has been installed. The GDDM-PCLK code is serviced automatically from the host. In removing the need to install GDDM-PCLK from diskette, this change simplifies the installation of GDDM-PCLK for both new and existing users.

Use of the GDDM-PCLK component of GDDM 3.1 is licensed separately from use of the GDDM Base programs.

Optional installation of DBCS symbol sets

All double-byte character-set (DBCS) symbol sets are shipped on the national-language tape that accompanies the GDDM Base program. This makes their installation optional, thereby saving DASD space and making a small installation-performance improvement for those customers who choose not to install DBCS symbol sets.

The documentation of the GDDM installation process

The way in which the installation of the GDDM program is documented has changed. For GDDM 3.1, all installation instructions are included in the program directory of the GDDM Base program, which is shipped with the program tape. This change allows the installation instructions to be as up-to-date as possible. A new book (*General Information* manual) describes what you have to do before installing GDDM 3.1, how to test the installation, and how to apply service.

Response-time improvements for interactive applications

Several improvements have been made to GDDM’s screen-redraw process. These improvements reduce the circumstances in which a change to the screen contents causes the entire screen to be redrawn, thereby improving the response time of interactive applications. The benefits of these changes will be noticed particularly when running applications over remote lines, because many of them involve a reduction in data-stream size. Improvements include:

- GDDM’s clipping of areas, lines, and mode-1 characters has been refined.
- Whenever alphanumeric text has to be removed from the screen, GDDM erases and redraws the affected parts of the text only.

GDDM 3.1 enhancements

- GDDM's partial erasure and redraw of graphics has been refined.
- Circumstances in which unnecessary screen redraw occurs have been identified and removed. For example, modifying a partition more than once no longer causes GDDM to redraw the screen.
- GDDM redraws only the immediate area surrounding a modified, detectable or transformable graphics segment rather than redrawing the entire graphics field. This change is not applicable to ASCII displays, the IBM 3279, or the IBM 3290.
- When a partition containing graphics is altered, GDDM no longer redraws any area of those graphics that is overlapped by other partitions. This means that the overlapping partitions themselves are no longer redrawn.

The effect of these improvements is likely to vary, depending on the display device being used. In particular, users of single-plane devices (such as DEC ASCII displays, the 5550 family, and displays accessed via GDDM-OS/2 Link or GDDM-PCLK) will notice less improvement than users of other displays.

Printing and plotting enhancements

GDDM 3.1 provides:

- Extensions to support for printing on page printers
- A query facility for available output destinations
- Enhancements to the GDDM print utility in the MVS environment
- Improved plotter support

Extensions to GDDM's support for page printers

Support for page printers by GDDM is enhanced as follows:

- Applications that currently print via the GDDM Print Utility (such as the GDDM-PGF ICU) can now send output to page printers. This makes an enterprise's page printers, which provide high quality output, accessible by a wider audience. Furthermore, page printers can be added to the list of devices accessible by ICU users, for example, without those users having to do anything extra.

This change is effected by the use of a nickname statement with a "TOFAM=4" parameter, together with one of the cell-based, page-printer device tokens provided by GDDM 3.1.

- Page printers can now be used as alternate devices if one of the new, cell-based, page-printer device tokens is used. This enhancement allows data displayed on the user's display device to be copied to a page printer.
- Alphanumeric data, including double-byte characters, can be directed to page printers if one of the new, cell-based page-printer device tokens is used. Any GDDM data can now be directed to page printers, which relieves users from having to know anything about the contents of the files they are printing.
- For users of GDDM/VM, the processing option (PROCOPT) CPSPPOOL has been extended to allow page-printer output to be directed automatically to a server machine running PSF/VM or some other AFPDS processor. In removing the requirement for the user to intervene to send the file to the AFPDS processor, GDDM makes it possible to shield users from the mechanics of printing and to speed up the printing process.

- A multipage document directed to a page printer is printed as a single document, rather than as multiple, single-page documents. This removes an anomaly in GDDM's handling of page printers and satisfies users' expectations of multipage documents.
- Each page of GDDM page-printer output can be rotated by 90, 180, or 270 degrees. The IPDSROT processing option (PROCOPT) has been extended in support of this enhancement, which gives finer control over positioning of output to make best use of the page. (Note that some printers, such as the IBM 4224, do not support rotated text.)

The GDDM utilities ADMCHART, ADMOPUV, ADMOPRT, ADMUCDSO, and ADMUIMPx take advantage of these enhancements to GDDM's page-printer support.

Additional device tokens are provided to support these new functions on a variety of printers. A new macro (ADMMAFP) processes these tokens.

Existing user-written applications are unaffected by these changes, though they might require modification in order to take full advantage of them.

A query facility for available output destinations

Display of print destinations using locally defined terms (such as "Printer in room 17") is now possible. End users printing or plotting from GDDM's User-Control facility or from the GDDM-PGF ICU can enter a "?" to request a list of print destinations. Applications can also be written locally (or existing applications can be updated) to take advantage of this function. In support of this enhancement to the usability of GDDM's printing interface:

- The ADMMNICK (nickname) statement has been extended to include a description parameter (DESC=). Data provided on this parameter is presented to the user.
- Two new GDDM base API calls have been created. These are ESQUNS ("To query user-defined nickname information") and ESQUNL ("To query the length of user-defined nickname information").

Enhancements to the print utility in the MVS environment

When a print job is submitted via the MVS/TSO print utility ADMOPUT to a printer that is inactive or offline, GDDM 3.1 now polls the device at specified polling intervals until either:

- The printer becomes active again
- The job is removed from the Master Print Queue

The need to restart the print utility in these circumstances has been removed.

Also, a new GDDM external default has been provided to allow use of the MVS macros RESERVE/DEQ within the print utility ADMOPUT. When RESERVE is specified, the DASD device upon which the Master-Print-Queue data set resides is reserved, thus preventing other tasks from accessing the data set until a corresponding DEQ request is issued. This enhancement to GDDM 3.1 improves data integrity for shared print queues in the MVS/TSO and MVS/BATCH environments.

IBM-GL files for IBM and non-IBM plotters

Output destined for a plotter can be saved in a file or data set that can be processed by a user-supplied plotter driver. This gives access to a wider range of non-IBM plotters: the file contents can be directed to IBM and non-IBM (for example, Hewlett-Packard or Hewlett-Packard-compatible) plotters. GDDM 3.1 provides this support in the VM/CMS, MVS/TSO, and MVS/BATCH environments by means of a new processing option (TOFILE).

The output is saved in IBM-GL (Graphics Language) format, which is defined in the publication *IBM-GL Programming Manual (Graphics Language) for the IBM 6182, 6184, 6185, 6186, and 6187 Color Plotters*, SH23-0092. There is no GDDM support for GL/2.

Long plots on roll-feed plotters

Roll-feed plotters driven directly by GDDM 3.1 can produce “long” plots. The maximum length of the plot depends on the width of the paper loaded in the plotter:

<i>Paper width</i>	<i>Maximum length of output</i>
914.4 mm (36 in.)	11.862 m (38.91 ft.)
609.6 mm (24 in.)	10.582 m (34.71 ft.)
279.4 mm (11 in.)	4.389 m (14.40 ft.)

This allows GDDM to plot data such as large project schedules produced by the IBM Application System (AS) licensed program.

The processing option PLTPAPSZ (plotter paper size) is used to specify a paper size. GDDM 3.1 supports roll-feed paper on IBM 6186-2 and IBM 6187-2 plotters.

In support of this enhancement:

- The FSQUERY base API call has been enhanced to allow applications to determine whether roll-feed paper has been loaded on a particular plotter.
- Applications can use the FSPCRT call to specify the size of the output when the target device is a roll-feed plotter.
- A new processing option (PLTDELAY) allows a delay to be specified between the output of successive frames to allow for media stabilization. The delay interval is specified in seconds.
- New device tokens are supplied for roll-feed plotters.

Long plots are not supported on plotters attached via GDDM-OS/2 Link. Output intended for roll-feed plotters can be saved in IBM-GL format files.

Control of plotting margins

GDDM 3.1 honors plot-margin values specified on the PRINTCTL processing option for output directed to a plotter via the GDDM Print Utility. That is, values specified for the depth of the top margin and the width of the left margin are used. This change removes a difference in the treatment of printed and plotted output, so that the user does not need to be aware of the target device. If a value for the PLTAREA (plotting area) processing option has also been specified, the PRINTCTL margin values take effect first.

Support for additional devices

GDDM 3.1 supports:

- The IBM 4230 printer
- Enhancements to the IBM 3816 printer
- The IBM 6187 plotter
- All screen sizes of the IBM 5081 and IBM 6091 displays

In addition, the ability to save plotter output in IBM-GL files (which is described on page 56) makes a wide range of non-IBM plotters accessible by GDDM applications.

The IBM 4230 printer

GDDM 3.1 supports the IBM 4230 IPDS printer, both as a directly attached printer and via the GDDM Print Utility. In addition, the IBM 4230 printer can be used:

- To print bar codes, including POSTNET (U.S. Mail) bar codes, via the GDDM Composite Document Print Utility (CDPU). (GDDM can process bar codes, but cannot create them.)
- In fast-draft mode, which allows printing at up to 480 characters per second. Fast-draft mode is controlled by printer switch.

New device tokens are provided.

The IBM 3816 printer

GDDM 3.1 supports the printing of POSTNET (U.S. Mail) and Code 128 bar codes on the 3816 IPDS printer. This enhancement is available via the GDDM CDPU (Composite Document Print Utility).

The IBM 6187 plotter

GDDM 3.1 supports the IBM 6187 plotter to the same extent that it supports the IBM 6186 plotter.

The IBM 6187 plotter can be attached to

- A display
- A personal computer running GDDM-PCLK
- A personal computer running GDDM-OS/2 Link
- A PC/G
- A PC/GX

New device tokens are provided.

Support for all IBM 5081 and IBM 6091 display-screen sizes

GDDM Version 2 Release 3 supports the IBM 5081 high-function graphics display with a 19-inch screen only. GDDM 3.1 extends support of high-function graphics displays to include *all* screen sizes of both the 5081 and 6091 displays.

Improvements to GDDM-OS/2 Link

The GDDM-OS/2 Link component of GDDM 3.1 includes a number of function, usability, and performance enhancements, which are described in the remainder of this section. Also, an earlier restriction on the running of CICS applications in transaction-dependent pseudoconversational mode with GDDM-OS/2 Link has been lifted.

Cut and paste GDDM pictures into an OS/2 application

A part or the whole of a GDDM picture can now be passed to an OS/2 application in metafile format via the clipboard. This enhancement, which is enabled via a new option on the “Host Graphics” dialog, allows the copied picture to be transformed without loss of integrity.

Selective enabling of host graphics

The GDDM-OS/2 Link component of GDDM 3.1 allows host-graphics support to be enabled at the host-session level. That is, you can have host graphics enabled for some host sessions and disabled for others, so that the use of system resources can be more finely controlled. Host-graphics support is enabled by default for every host session.

Improvements to the user interface

Several improvements have been made to GDDM-OS/2 Link’s user interface.

As a result, the GDDM-OS/2 Link component of GDDM 3.1 is fully compliant with the graphical model of the CUA 89 (Common User Access 89) guidelines, which are described in the *SAA CUA Advanced Interface Design Guide*, SC26-4582. The improvements to GDDM-OS/2 Link’s user interface include:

- Improved recovery from error conditions.
- The saving of user preferences in OS2.INI between invocations of GDDM-OS/2 Link.
- Prefixing dialog titles and messages with the short session name of the owning session.
- A new “automatic system update” dialog. This dialog is displayed whenever GDDM-OS/2 Link service updates are downloaded from the host. Also, service update itself requires less manual intervention.
- Consistency between operation and dialog titles.

Improvements to GDDM-OS/2 Link’s online information

The online information provided with the GDDM-OS/2 Link component of GDDM 3.1 includes many enhancements and additions:

- A comprehensive online-help system, including overviews of all GDDM-OS/2 Link functions, is provided.
- Contextual help for dialogs and messages has been improved.
- A new, online GDDM-OS/2 Link *User’s Guide* is installed with the GDDM-OS/2 Link code on the workstation. This guide can be browsed using OS/2’s “View” program, or accessed from GDDM-OS/2 Link’s help system via hypertext links.

Removal of the “automatic naming of print jobs” option

The “automatic naming of print jobs” option, which could be disabled so that all print jobs had to be explicitly named by the user, has been removed from the GDDM-OS/2 Link component of GDDM 3.1. To improve the usability of GDDM-OS/2 Link, all print jobs are now named automatically. The name of any print job now comprises the characters “GDDM,” followed by the short session ID for the logical terminal (such as “A” or “C”), followed by a job number in the range 1 through 999. For example, “GDDM A24” is the 24th print job submitted from host session “A” to an OS/2-attached hardcopy device.

Better performance

Several enhancements have been made to GDDM-OS/2 Link to improve its windowing performance. Chief among these are:

- Much improved speed of picture redraw: GDDM-OS/2 Link can now create a bit map for each host session and restore the screen when necessary by redisplaying the bit map. Though the initial drawing of the bit map can add to the performance overhead, subsequent screen-redraw operations are instantaneous. This method of creating and maintaining the screen contents is optional.
- Reduced memory and disk requirements for running GDDM-OS/2 Link. The run-time size of GDDM-OS/2 Link has been reduced by approximately 120KB.
- Reduced initialization time.
- Reduced service-update time.

Improvements to GDDM-PCLK

The GDDM-PCLK component of GDDM 3.1 provides:

- Improved support for alphanumeric function with Version 2 of the Personal Communications/3270 (PC/3270), DOS-based terminal-emulator program. These changes have provided general performance improvements for GDDM-PCLK.
- An improved user interface.
- Improved support for service trace.

In addition, the range of IBM devices supported by GDDM-PCLK has been increased, and CICS applications can now run in transaction-dependent pseudoconversational mode with GDDM-PCLK.

Improved support for alphanumeric function with the PC/3270 emulator

Enhancements have been made to the way in which the GDDM-PCLK component of GDDM works in conjunction with Version 2 of the PC/3270 terminal-emulator program. These are:

- GDDM-PCLK displays the complete CECP character set, including PC-APL characters, exactly as it is displayed in the PC/3270 host session.
- GDDM-PCLK displays alphanumerics with the same color mapping as the PC/3270 host session.

GDDM 3.1 enhancements

- GDDM-PCLK displays the alphanumeric cursor with the same shape as that used by the PC/3270 host session.
- The performance of the alphanumeric cursor has been improved.

These improvements give GDDM-PCLK greater conformance with the PC/3270 emulator, which in turn improves the usability of the GDDM-PCLK interface.

Devices supported by GDDM-PCLK

The following devices are now supported by the GDDM-PCLK component of GDDM 3.1:

- The XGA adapter
- Image Adapter/A adapter
- IBM 9600 BPS plotter
- Plotters connected to COM3 and COM4 ports
- PS/2 models 25, 35, 40, 55, 57, 60, 70, 80, 90, and 95
- Host-connected keyboard
- IBM 4019 printer in 5202-emulation mode

Improvements to GDDM-PCLK's user interface

Several improvements have been made to the usability of the GDDM-PCLK component of GDDM:

- The non-merged mode function has been deactivated because it has been found to cause performance problems.
- The maximum number of logical terminals from which attachment can be made has been increased from 4 to 8.
- When Personal Communications/3270 is in use, it is no longer necessary to stop and restart GDDM-PCLK in order to use a logical terminal that comes online after GDDM-PCLK is started.
- With Entry-Level emulator, "RESET" is assigned to the left Ctrl key and "ENTER" to the right Ctrl key.
- When the graphics cursor is attached to cursor-move keys, a "+CR" indicator is displayed in the operator information area. This provides a visual indication of whether the alphanumeric or graphics cursor is moved by the cursor-move keys.
- Provided that GDDM-PCLK is started with the /Q option, GDDM-PCLK now exits directly to DOS without redisplaying the selection panels when Ctrl + F3 are pressed to exit GDDM application support.
- A setup option has been provided to allow the user to specify whether underscore attributes are to be supported. When character underscore is not used, less memory is required.
- Only valid selections are enabled on the GDDM-PCLK setup panels. Invalid selections are disabled to make installation of GDDM-PCLK easier.

Improvements to service trace

GDDM-PCLK now allows the size of the trace-cache buffer to be defined when tracing to file is selected. The buffer can be set to zero, to 10KB, or to 20KB from the service (trace) panel. In allowing the user or IBM service personnel to specify the size of this buffer, GDDM 3.1 provides a more flexible trace function. For example, a greater number of trace points to be selected at one time if required. Trace can also be used in low-storage configurations.

Additional programming languages

GDDM 3.1 provides support for the C/370 programming language. It also extends support for GDDM-REXX to the MVS (TSO/E) environment.

Support for C/370

IBM C/370 language is explicitly supported for the first time by GDDM 3.1. That is, GDDM applications can be written in C/370 and can run in all MVS, VM, and VSE environments under which GDDM 3.1 runs².

This change increases programmer flexibility by allowing a language widely used for personal-computer applications to be used on the host. All GDDM Base, all GDDM-PGF, and all GDDM-IVU API calls can be coded in C/370.

Nonreentrant, reentrant, and System Programmer (SPI) application-programming interfaces are provided. The nonreentrant and reentrant interfaces between GDDM and C/370 are provided in (C) header files containing function declarations for all C/370-supported API calls. The System Programmer Interface to C/370 is provided via the GDDM ADMASP function.

Three new sample programs written in C/370, together with some sample JCL for translating, compiling, and link-editing a C/370 application, are provided with GDDM 3.1. The GDDM application-programming documentation (the *GDDM Base Application Programming Reference* book and the *GDDM Base Application Programming Guide*) has been updated accordingly.

Support for GDDM-REXX in the MVS environment

GDDM 3.1 extends support for GDDM-REXX to the TSO/E subsystem of MVS/XA and MVS/ESA. GDDM-REXX is an excellent productivity tool: it enables programmers to prototype GDDM applications, and to create small routines and utility programs quickly and easily.

All GDDM-REXX functions have the same syntax and semantics under VM/CMS and MVS, except where environment-specific differences are unavoidable. Any such differences (typically relating to the use of partitioned data sets rather than CMS files) are defined in the *GDDM Base Application Programming Reference* book.

² For support of C/370, releases of VSE/ESA prior to VSE/ESA 1.1.2 require PTFs UD90262, UD90264, UD90265, and UD90266 for the production system, and PTF UD90263 for the generation feature.

In general, GDDM-REXX execs are not portable between the VM and MVS environments because of the environment-specific nature of some mandatory code. The GDDM calls themselves, however, are portable.

Enhancements to GDDM's User Control

As a result of the changes described in "Printing and plotting enhancements" on page 54, printing on page printers is possible from User Control, and a list of output destinations can be presented to the user so that a printer can be selected. The second of these two enhancements means that the user no longer has to keep a note of the printers that can be accessed from User Control.

Other enhancements to User Control in GDDM 3.1 are:

- Control over the position, size, and orientation of graphics and image objects in printed output.
- The ability to pan and zoom pictures containing images.

Size, position, and orientation of graphics and image objects in printed output

GDDM's User-Control interface has been extended to allow the user to specify the size, position, and orientation of graphics and image objects in printed output. This enhancement, which provides finer control of printed output without loss of picture integrity, applies to graphics primitives and image only; it does not apply to alphanumerics.

The user can define:

- The area of the output page in which graphics and images are to be printed. This value is specified as a percentage of the paper size, and is therefore device independent. Either a width or a depth (but not both) of up to 1000% can be specified to allow for output to roll-feed plotters, for example. The default picture size is 80% of the output area.
- Whether the picture should be scaled to fit the output area, maintain its aspect ratio, or continue with the existing (cell-to-cell) implementation. (The cell-to-cell implementation does allow the output of alphanumerics, but does not support the scaling, rotation, or positioning of graphics and image objects.)
- A rotation for the picture in multiples of 90 degrees. Processing options that specify equivalent values for the document are also honored and the effect is cumulative. For example, if a 90-degree rotation is requested from the user-control interface, and a PLTROTAT processing option specifying 90-degree rotation is also in effect, the output is rotated by 180 degrees.

GDDM 3.1 provides a new base API call to allow application control of the size, position, and orientation of graphics and image objects. The call is DSCOPY ("Copy picture to alternate device, specifying a transform if required").

Panning and zooming of images

Pictures containing images can be panned and zoomed from the GDDM 3.1 User-Control panels:

- User control's "Graphics" function is now titled "Picture."
- The "center," "zoom in," "zoom out," and "reset" functions now work for both graphics and image fields.
- A new function ("pixel retention") has been added to allow the user to specify which pixels are to be deleted when an image is scaled down.

The main benefit of this enhancement is that it reduces the need for the user to understand what type of data is being displayed. The resultant image can be printed, though it cannot be saved in a GDF or PIF file.

Improvements to DBCS and SBCS support

GDDM 3.1 supports the installation and use of *multiple* double-byte character-set (DBCS) graphics symbol sets. For example, multiple Kanji symbol sets can be installed, as can symbol sets for multiple double-byte languages, such as Kanji and Hangeul. Data streams containing double-byte characters can be browsed for the first time using the CDPU. GDDM 3.1 also supplies a new, high-quality, Mincho DBCS vector symbol set.

Improvements in SBCS support include the provision of new, single-byte character sets for code page 1027 (Japanese (Latin) Extended), and CDPU support for data streams that use the new code page.

These enhancements constitute a major improvement to GDDM's usability, particularly in the double-byte languages.

Support for multiple DBCS graphics symbol sets

GDDM 3.1 allows installation of, and selection from, multiple DBCS graphics symbol sets. Furthermore, *any* DBCS graphics symbol set can be installed as the default set. Applications can load a graphics symbol set from auxiliary storage (using the GSLSS call) and set the current symbol set (using the GSCS call), such that more than one symbol set can be used by a single application and within a single page of output.

All double-byte character set (DBCS) symbol sets are shipped on the national-language tape that accompanies the GDDM Base program. This makes their installation optional, thereby saving DASD space and making a small installation-performance improvement for those customers who choose not to install DBCS symbol sets.

The GDDM Image Symbol Editor and the GDDM-PGF Vector Symbol Editor also support multiple DBCS graphics symbol sets.

Support for high-quality DBCS font

A new, Mincho DBCS Kanji vector symbol set is available with GDDM 3.1. In order to use this symbol set, you must install the Japanese national-language-support feature. The symbol set can be installed as the installation default set using the new external default, DBCSDNM. Applications can switch between the installation's default vector symbol set (whether the existing set or the new Mincho set) and the alternative set using either the ESSUDS call or the ESEUDS call, which update the external-default settings.

The size of the symbol set's data block is increased to a maximum of 65 527 bytes. Applications that have defined storage exit routines cannot use the new symbol set, as GDDM requests for storage are restricted to a maximum of 32KB (where KB equals 1024 bytes).

Support for DBCS by the Composite Document Print Utility (CDPU)

GDDM's Composite Document Print Utility (CDPU) supports both browsing and printing of composite documents containing double-byte characters. The characters can be either text or graphics characters. If graphics, they must be either mode-2 or mode-3 characters. GDDM's installed DBCS font is used by the CDPU when printing or displaying composite documents containing DBCS characters.

Support for new single-byte character sets

Some new single-byte character-set (SBCS) symbol sets are provided by GDDM 3.1 in support of code page 1027 (Japanese (Latin) Extended). The national language of the code page is Kanji. The symbol sets are:

<i>Symbol Set</i>		<i>Pixels</i>
ADMDVSSJ	Vector symbol set	
ADMDISJR	Image symbol set	12 x 24
ADMDISJN	Image symbol set	8 x 16

Any of these symbol sets can be defined as the default SBCS at installation time. The sets are also selectable from an application program using the GSLSS and GSCS calls.

Support for Japanese SBCS code page 1027 by the CDPU

GDDM 3.1 allows the CDPU (composite document print utility) to be used for browsing and printing composite documents that use the Japanese SBCS code page 1027. This support is for mode-3 characters only.

I/O synchronization enhancements

GDDM's synchronization of screen I/O has been improved, an addition of particular interest to users of IBM's QMF (Query Management Facility) program. This item improves on an earlier solution (setting the external default IOSYNCH=YES), which had a performance impact.

The GDDM 3.1 library

A number of changes have been made to the GDDM library. In particular, the library has been restructured using task-orientation techniques. That is, the information required to perform a task is in the books provided in support of that task only. This improves retrievability of information, and removes unnecessary duplication. This restructure has brought with it a reduction in the size of the library.

Improvements have been made to the information itself: emphasis has been given to providing more examples, particularly in support of the system-setup and device-definition tasks. Also, the books of the GDDM Base programs are available as BOOK files on both tape and CD-ROM, so that they can be accessed online using the IBM BookManager program. Online access to the GDDM documentation enhances its retrievability, and reduces or removes altogether the need to purchase multiple printed copies of books.

What's new in GDDM Version 3 Release 1.1

This section provides an overview of the new function and the improvements supplied in GDDM 3.1.1.

Support for PostScript printing

Developed by Adobe systems in 1985, PostScript has, in recent years, become a *de facto* standard for printing quality output. PostScript is a language that describes to printers exactly how a page is to be printed. PostScript printers usually have a ROM or plug-in cartridge to enable them to interpret the PostScript language. The majority of PostScript printers are monochrome laser or LED technology printers printing at 300 or 600 pixels per inch. Now more and more printers are exploiting PostScript's color capabilities.

The original PostScript language is known as level-1 PostScript and provides a wide range of text and graphics primitives for use in describing a page to be printed. Level 1 has limited support of color and some color PostScript printers, such as the IBM 4079 Color Jetprinter use level 1 of the language with only minor modifications. The newer level-2 PostScript has better color support and is therefore the level used by most current color PostScript printers. Level 2 also allows for compression of image data.

GDDM 3.1.1 supports PostScript printing on the MVS/TSO, MVS/Batch and VM/CMS subsystems as family-4 output. This means that the PostScript output is placed in a file, which can then be routed to a printer by some other software, such as

- TCP/IP (transmission control protocol/internet protocol)
- PC download to DOS, Windows, and OS/2
- PSF/2 for printing level-1 PostScript output on PCL, AFP, or PPDS printers

The PostScript output sent to the file can be primary (PS) or secondary, "encapsulated" (EPS) output. Most of the GDDM processing options that apply to family-4 output can be used when creating PostScript output. Some of the benefits of GDDM's support of PostScript printing are:

GDDM 3.1.1 enhancements

- Upward compatibility

The new support is upwardly compatible, which implies the following benefits:

- Existing GDDM applications can continue to work unchanged.
- New user default specifications, PostScript device tokens and procopts can be used by new or modified applications to create PostScript output.
- Existing applications can use the new facilities by appropriate customization of GDDM user-default modules or files.

- User exits

A user exit is provided to enable your GDDM applications to run programs that print the PostScript files generated.

- Color selection

GDDM provides a special color table that you can customize to specify which shade of each color is to be used by the generated PostScript output. In this way, your programs can produce acceptable results on a wide range of color printers.

- Font mapping

GDDM also provides a table that can be customized by end users, applications, or for the whole system, to specify how GDDM symbol sets (graphic text) or fonts (presentation text) are mapped to PostScript printer fonts. This enables you to use the large variety of Adobe fonts available for PostScript printers.

- “Core Interchange” symbol sets

GDDM now provides the SAA Core Interchange font families, Helvetica, Times New Roman, and Courier, in vector symbol set form. This widens the choice of symbol sets available to all GDDM applications. Applications exploiting the new PostScript support can use these symbol sets to obtain a closer match between screen display and printed output.

Hardware requirements for GDDM PostScript output

You can send GDDM PostScript output to any generic level-1 or level-2 monochrome or color printers. Some commonly used printers supported are:

- IBM 4019 LaserPrinter with PostScript option
- IBM 4029 LaserPrinter with PostScript option
- IBM 4079 Color JetPrinter
- HP PaintJet XL 300 with PS level 2 option

Device tokens for PostScript printers

Device tokens defining the following printers are supplied by GDDM:

- Generic level 1 Monochrome printer with A4 paper
- Generic level 1 Monochrome printer with Quarto (Letter) paper
- Generic level 2 Monochrome printer with A4 paper
- Generic level 2 Monochrome printer with Quarto (Letter) paper
- Generic level 1 Color printer with A4 paper
- Generic level 1 Color printer with Quarto (Letter) paper
- Generic level 2 Color printer with A4 paper
- Generic level 2 Color printer with Quarto (Letter) paper
- IBM 4029 with A4 paper
- IBM 4029 with Quarto paper

- IBM 4079 with A3 paper
- IBM 4079 with B size paper

Enhanced support for JES spool printing on MVS/TSO

The PRINTDST processing option, which you can use to pass GDDM data to the JES printer support system, can now be used to specify JES WRITER and FORMS values for the spool file.

Changing the FORMS name enables end users to send their output to print queues that are printed on a specific type of paper. Changing the WRITER name enables an IBM or user-written program to process the data set rather than JES. See the *GDDM System Customization and Administration* book for more information.

Retrieval of family-4 AFPDS output by the application

Three new API calls, issued in the proper order, enable application programs to retrieve family-4 AFPDS output, which is normally spooled or written to a data set or file.

For applications that call GDDM to create graphics for inclusion in text documents, these API calls bypass the creation of a family-4 output file on disk and load GDDM's output straight into the application.

The retrieval of family-4 output is initiated by an FSGETS call. This is then followed by a number of FSGET calls, which cause GDDM to retrieve the datastream records until it reaches a record that contains no data. Retrieval can be prematurely terminated using the FSGETE call but this call is not required if an FSGET call reaches the end of the data.

Note: It is not possible to retrieve family-4 PostScript output.

Enhancements to GDDM's CGM support

Applications that use GDDM's support for Computer Graphics Metafile (CGM) can take advantage of the following enhancements:

- Control of color mapping between the GDDM and CGM formats. The application programmer can specify the range of colors to be used when storing GDDM graphics in CGM format or interpreting CGM data in GDDM. Colors can be mapped using a 16-element color table or a 255-element color table.

The 255-element color table enables the broad range of colors available to GDDM-OS/2 Link users to be captured in a generated CGM and enables GDDM to perform better color matching when it interprets data loaded in CGM format.

- Better generation and interpretation of text strings.

ADMGDF to CGM conversion has been extended so that the width and height of text characters can be controlled during both the generation and interpretation of CGM format data. This gives improved control over the shape and size of characters on some CGM interpreters.

GDDM 3.1.1 enhancements

Note: Many CGM interpreters do not fully implement the controls that determine character shape.

GDDM text strings that contain *New Line* characters are now positioned consistently when stored in CGM format and loaded into most other CGM interpreters.

- GDDM now interprets a CGM that uses any CGM standard integer precision. This allows GDDM to interpret CGM format data generated by a broader range of products.
- The ADM ADMCGM conversion profile has been changed extensively. It now includes comprehensive help and explanatory texts.

Enhanced support for Japanese devices

The following enhancements have been made principally for the benefit of Japanese users:

- The FSQUERY API call can now return more information about the characteristics of the current device. The call can now return the code page and character set used by the device for single-byte characters and, if the device supports DBCS, for double-byte characters.
- An extended version of the Japanese (Katakana) code page 290 is now supported using the character set 1172. This character set, which is the same as that used by the Japanese (Latin) Extended code page 1027, contains both lowercase and uppercase Latin characters. New tables provided in the module ADMDATRn enable the translation of alphanumeric and graphic characters between these two extended code pages.

Enhancements to workstation support

In addition to several improvements to the performance of GDDM-OS/2 Link, the following new functions have been added:

- Rubber-band/rubber-box support.

Users of applications that make use of these locator echoes, such as the GDDM Interactive Chart Utility (part of the GDDM-PGF product), can benefit from improved usability.

- Data-key choice device

Users of applications that enable data-key input can now exploit these functions on their workstations.

- Local segment transforms

GDDM-OS/2 Link now enables users to move, scale, rotate, and shear segments on the workstation. No other GDDM device supports the interactive scale, rotate, and shear transformations.

Note: The new functions described above are available only if the host machine is running GDDM 3.1.1 with the latest functional increment, together with Communications Manager/2 1.1 (with APAR PJ07845) or later. Even if you are using the latest release of GDDM-OS/2 Link, these functions are not available unless GDDM 3.1.1 is running on the host to which your workstation is connected.

Enhancements to the sample program, ADMUSP4

The sample program, ADMUSP4, which is supplied with GDDM, has been changed to provide an example of a more modern style of interface. It also demonstrates how application programmers can exploit the latest improvements to GDDM-OS/2 Link for end users. The new version of ADMUSP4 enables end users to draw and transform graphics and text objects using the rubber band and rubber box features provided with GDDM-OS/2 Link.

The menu of actions has been condensed into an action bar at the top of the screen, so more room is provided for drawing on the GDDM page.

GDDM/VM installation with VMSES/E

GDDM/VM is shipped on a tape that is formatted so that the product can be installed using the VMSES/E installation tool.

Enhancements to GDDM-REXX/VM

The GDDM-REXX/VM product has been enhanced to support 31-bit addressing.

As with other GDDM saved segments, the GDDM-REXX saved segment can now be placed in a segment space at an address higher than 16MB.

Chapter 6. Software, hardware, data streams, and standards

This chapter provides all the environmental details you need in order to decide whether GDDM Version 3 Release 2 (GDDM 3.2) can be installed at your enterprise. It identifies:

- Minimum release levels of the operating systems and subsystems that support GDDM 3.2. These are *minimum* levels only: later levels (if any) can be used.
- Programming languages and compilers that you can use to write GDDM application programs.
- The hardware you can use, including processors, control units, display devices, printers, plotters, workstations, scanners, and personal-computer systems.
- The data streams that GDDM can accept as input and produce as output.
- The object and interchange architectures that GDDM implements.

Note that later levels of software than those listed here might be required for support of new hardware facilities. The specifications of such software should be consulted for more information.

Operating-system and subsystem release levels

GDDM 3.2 runs in the MVS, VM, and VSE environments. The minimum release levels of the MVS, VM, and VSE operating systems that GDDM 3.2 runs under, and of their associated subsystems, are defined in Table 6. Note that there are some variations in GDDM's operation with these subsystems. These are defined, by subsystem, following Table 6. Unless otherwise stated, access-method levels are as required by the subsystem.

Table 6. Minimum system and subsystem levels

System	Subsystem	Level	Notes
MVS/ESA		SP 3.1	
	TSO	(As for MVS/ESA)	1
	CICS/ESA	3.1.1	
	IMS	2.2	
	MVS/BATCH		
VM/ESA	CMS	V1.2.1	
VM/ESA 370 Feature	CMS	V1.1.5 370 Feature	
VSE/ESA		V1.1	2, 3
	CICS/VSE	2.1	
	VSE/BATCH		4

Notes:

1. GDDM-REXX under MVS/ESA requires TSO/E 2.1.0 (or later) to be installed.
2. VSE/Power Version 2 Release 2 is a prerequisite for composite document printing.
3. For support of C/370, versions of VSE/ESA prior to VSE/ESA 1.1.2 require PTFs UD90262, UD90264, UD90265, and UD90266 for the production system, and UD90263 for the generation feature.
4. Report Controller Feature of CICS/VSE is a prerequisite for the VSE batch utility.

GDDM under the TSO subsystem

GDDM support under TSO is subject to the following restriction and consideration:

- GDDM-REXX is supported, but requires TSO/E Version 2.1.0 (or later) to be installed.

GDDM under the CICS subsystems

GDDM support under the CICS subsystems (CICS/VSE and CICS/ESA) is subject to the following restrictions and considerations:

- There is no support for the IBM 5080 or 6090 Graphics Systems.
- There is no support for GDDM-REXX.
- There is no support for GDDM-GKS.
- The GDDM-PGF Interactive Chart Utility (ICU) data-import function is not supported.
- ADMGDF interchange with CGM (Computer Graphics Metafile) is not supported. Consequently, the CGLOAD (“load a picture from a CGM”) and CGSAVE (“save segments in a CGM”) base API calls are not supported.
- ADMGDF conversion to GIF (Graphics Interchange Format) is not supported.
- The GDDM PC File Transfer PIF/GGXC File Conversion facilities are not available.
- There is no support for the direct production of files containing graphics or images in formats suitable for use by page printers, such as the IBM 3820 or 3900
- There is no support for IBM-GL files.
- Operator-windowing API functions are supported, but cannot be used to coordinate multiple instances of GDDM.
- GDDM-PCLK and GDDM-OS/2 Link are supported by the CICS subsystems. However, GDDM applications cannot run in “coordination mode” with GDDM-PCLK or GDDM-OS/2 Link. (Coordination mode allows use of Basic Mapping Support (BMS) for the alphanumeric portion of the screen while GDDM builds and displays the graphics portions of the screen.)

GDDM under the IMS subsystem

Unlike the other subsystems under which GDDM operates, IMS does not provide a direct interface to a terminal, but uses message queues instead. This imposes some restrictions on GDDM's operations under IMS.

Device support under IMS

GDDM under the IMS subsystem does not support:

- IPDS printers
- IBM 5080 or 6090 Graphics Systems
- Plotters
- Scanners
- VTAM-attached remote non-SNA devices

These devices are supported in SNA configurations only: 3179-G, 3192-G, 3193, 3472-M, 3270-PC/G, 3270-PC/GX, AT/G, AT/GX, 5550-Multistation, and ASCII terminals.

ASCII devices are supported for alphanumeric applications only.

GDDM licensed programs under IMS

GDDM under the IMS subsystem does not support:

- GDDM-GKS
- GDDM-IVU
- GDDM Interactive Map Definition

(Note, however, that run-time mapping *is* supported under IMS. That is, maps generated by GDDM Interactive Map Definition operating on other subsystems, such as TSO, can be imported and used for output-only operations.)

The GDDM-PGF Interactive Chart Utility (ICU) can be used interactively in stand-alone mode only. A user transaction can call the ICU to display a chart to the terminal user, but no interaction is possible. The ICU's data-import function is not supported.

The GDDM-PGF Vector Symbol Editor can be used interactively in stand-alone mode only.

GDDM Base function under IMS

GDDM under the IMS subsystem does not support:

- GDDM-REXX.
- GDDM-PCLK.
- GDDM-OS/2 Link.
- Operator-windowing API functions.
- Interactive graphics and control-mode functions.
- Composite document printing.
- The GDDM PC File Transfer and PIF/GGXC File Conversion facilities.
- ADMGDF interchange with CGM (Computer Graphics Metafile). Consequently, the CGLOAD ("load a picture from a CGM") and CGSAVE ("save segments in a CGM") base API calls are not supported.

- ADMGDF conversion to GIF (Graphics Interchange Format) is not supported.
- The direct production of files containing graphics or images in formats suitable for use by page printers, such as the IBM 3820 or 3900.
- IBM-GL files.

Input is not allowed in alphanumeric fields, except to specify the name of the next transaction to be executed.

Terminal characteristics cannot be determined at run time. They must be obtained from a preallocated table.

The Image Symbol Editor can be used interactively in stand-alone mode only.

GDDM under the MVS/Batch and TSO/Batch subsystems

The TSO Extensions program (TSO/E) provides batch support, which is referred to here as “TSO/Batch.” The following notes apply to both MVS/Batch and TSO/Batch:

- There is no support for directly connected 3270 and 5550 devices. Specifically, the GDDM DSOPEN function supports directly attached devices as dummy devices only.

GDDM supports the production of queued printer files for printing via the GDDM TSO Print Utility. GDDM also supports the direct production of files containing graphics or images in formats suitable for use by page printers, such as the IBM 3820 or 3900.

- There is no support for GDDM-IVU.
- GDDM-REXX is supported under both the MVS/Batch and the TSO/Batch subsystems. TSO/E 2.1.0 (or later) must be installed.
- There is no support for GDDM-PCLK or GDDM-OS/2 Link.

GDDM under the CMS subsystem

There is no support for GDDM in any CMS DOS environment.

GDDM under the VSE/BATCH subsystem

ADMGDF interchange with CGM is not supported under the VSE/BATCH subsystem. Consequently, the CGLOAD (“load a picture from a CGM”) and CGSAVE (“save segments in a CGM”) base API calls are not supported.

ADMGDF conversion to GIF (Graphics Interchange Format) is not supported.

PostScript and Graphics Interchange Format output are also not supported.

Programming languages and compilers

GDDM function can be invoked by application programs that use standard OS/370 call interfaces. These include application programs written using the programming languages and compilers shown in Table 7 on page 75.

Table 7. Programming languages and compilers

Language	Compiler / Interpreter	Notes
Assembler	H Assembler or High Level Assembler	
APL2		1, 2, 3
BASIC	IBM BASIC	1, 2, 4
COBOL	DOS/VSE OS/VS VS COBOL II	
C	C/C++ Compiler	
C/370	C/370 Compiler	1
FORTTRAN	VS FORTRAN	1, 5
PL/I	DOS Optimizing Compiler OS Optimizing Compiler Checkout Compiler	
REXX	TSO/E 2.1.0	1, 6

Notes:

1. GDDM Interactive Map Definition (GDDM-IMD) does not generate application data structures in FORTRAN, IBM BASIC, APL2, C/370, or REXX. However, application data structures generated by GDDM-IMD can be converted for use in C/370 and REXX applications. Also, mapping techniques can be used in FORTRAN and IBM BASIC applications for which programmers create their own data structures.
2. High-performance alphanumerics is not supported in BASIC and APL2 applications.
3. The GDDM auxiliary processor (AP126) gives full-screen control and allows access by APL programs to the functional capabilities of GDDM Base and GDDM-PGF.
4. IBM BASIC/VM and IBM BASIC/MVS each provide a CALL statement that can be used to call GDDM.
5. GDDM application programs written in FORTRAN cannot run under the CICS and IMS subsystems.
6. GDDM-REXX is supported in the VM and MVS environments. There is no support for GDDM-REXX in the VSE environment. In the MVS environment, TSO/E 2.1.0 is required. The GDDM-REXX component of GDDM 3.2 must be both licensed and enabled.

Hardware supported by GDDM Version 3 Release 2

This section identifies the hardware that can be used with GDDM 3.2. "Hardware" includes processors, control units, displays, printers, plotters, workstations, scanners, and personal-computer systems. All applicable models of a listed device are supported unless a specific model is given in the tables below. Support of some devices is subject to system or subsystem restrictions. These are defined in the notes to each table.

All GDDM functions are supported on all devices, unless the device-variations information in the *GDDM Base Application Programming Reference* book states otherwise.

Explanation of the Function column

The “Function” columns of Table 8 on page 77 through Table 12 on page 88 contain varying combinations of the letters “C,” “A,” “G,” and “I.” Their meaning is as follows:

- C:** Supported for display or printing of composite documents.
- A:** Supported as an alphanumeric device. The GDDM alphanumeric functions (the “Axxxxx” and “Mxxxxx” functions) work on the device.
- G:** Supported as a graphics device. The GDDM graphics functions (the “Gxxxxx” and similar functions) work on the device. Graphics is implemented via Programmed Symbols (PS), vector graphics, or some other method. In some cases, a particular model or feature may be required in order to support graphics.
- I:** Supported as an image device. The GDDM image functions (the “Ixxxxx” functions) work on the device.

Processors

GDDM 3.2 runs on all IBM processors that support the System/370 architecture (or extended architecture) and have the Floating Point feature installed. Any processor from the following processor families can meet these requirements:

- 308x
- 309x
- 43xx
- 937x
- ES/9000
- S/88

The GDDM-PCLK component of GDDM 3.2 runs on a variety of IBM personal-computer systems. These are defined in Table 12 on page 88. IBM PC DOS 2.1 (or later) is required.

The GDDM-OS/2 Link component of GDDM 3.2 runs on any programmable workstation supported by OS/2 Extended Edition 1.2 (or later version of OS/2).

Control units

Supported IBM control units are:

- 3174
- 3271
- 3272
- 3274
- 3276
- 5088

Control-unit microcode-level and fix requirements for specific devices are defined in the notes to Table 8 on page 77, Table 9 on page 81, and Table 10 on page 86.

Other supported hardware-connection methods include:

- 3708 Network Conversion Unit.
- The 7171, which provides ASCII-to-3270 protocol conversion. The 7171 appears to the host processor as a 3274 Model 1D control unit. The attached ASCII display terminals and printers appear as nonqueriable, alphanumeric-only 3278 or 3277 terminals and 3286 printers. Graphics support is not provided.
- 8100 (via the 3270 Data Stream Compatibility Licensed Program).
- Direct TP line.

Other than requiring that a device be attached to the correct controller type and model, GDDM is generally insensitive to the precise attachment of any device. However, some operating systems and subsystems might not support all models of these controllers. You should consult the relevant system and subsystem manuals for further information about supported controllers. Similarly, not all devices attach to all controllers. You should consult the relevant device specification to determine the controller, model, and microcode level for any particular device.

Displays supported by GDDM Version 3 Release 2

Table 8 identifies the display devices supported by GDDM 3.2. These include:

- 3270 displays
- PS/55 and 5550 displays
- High-function graphics displays
- ASCII display terminals

Any restrictions on their use with GDDM 3.2 are included in the notes to Table 8.

The meanings of the values in the “Function” column are explained in “Explanation of the Function column” on page 76.

Table 8 (Page 1 of 2). Display devices supported by GDDM 3.2

Device	Function	Description	Notes
3270 displays			1
3104 Models B1, B2	. A . .	Display	
3178	. A . .	Display	
3179 Model 1	. A . .	Color Display	
3179-G	C A G I	Color Graphics Display	2, 3, 4
3180 Model 1	. A . .	Display	5
3191	. A . .	Display	
3192-C	. A . .	Color Display	
3192-D	. A . .	Display	5
3192-G	C A G I	Color Graphics Display	2, 3, 4
3193	. A . I	Display	2, 6
3194	. A . .	Display	
3275 Models 2, 12	. A . .	Display	
3276	. A . .	Control Unit Display	

Table 8 (Page 2 of 2). Display devices supported by GDDM 3.2

Device	Function	Description	Notes
3277 Models 1, 2	. A . .	Display	
3278	C A G I	Display	7
3278 Model 52	. A . .	Display	
3279	C A G I	Color Display	8
3290	C A G I	Information Panel	9
3472	. A . .	Color Display	
3472-M	C A G I	Color Graphics Display	2, 3, 10
8775	C A G I	Display	11
IBM Personal System/55 and 5550-family displays			
Displays	. A G I	DBCS Displays	12, 13, 14, 15
High-function graphics displays			16
5081	C A G I	Graphics Display	
6091	C A G I	Graphics Display	
ASCII display terminals			17
3151	. A . .	ASCII Display	
3161	. A . .	ASCII Display	
3163	. A . .	ASCII Display	
3164	. A . .	ASCII Display	
DEC VT 240	C A G I	ASCII Graphics Display	
DEC VT 241	C A G I	ASCII Graphics Display	
DEC VT 330	C A G I	ASCII Graphics Display	18
DEC VT 340	C A G I	ASCII Graphics Display	18
Tektronix 4105	C A G I	ASCII Graphics Display	18, 19
Tektronix 4205	C A G I	ASCII Graphics Display	20
Tektronix 4207	C A G I	ASCII Graphics Display	18, 20
Tektronix 4208	C A G I	ASCII Graphics Display	18, 20
Tektronix 4209	C A G I	ASCII Graphics Display	18, 20

Notes:

1. Any terminal that emulates the IBM 3270 architecture can be used, provided it is fully compatible with one of the listed 3270 devices.

Some devices, such as the IBM 3179 and 319x, support a keyboard definition utility that allows the user to define code-points associated with keys when the keyboard is in native mode. Because the default GDDM character set may cause translation of some incoming non-EBCDIC code points, native mode is supported by GDDM only for those applications that specify ASTYPE(1) to suppress translations. Such devices are supported normally by GDDM when they are in keyboard-emulation mode (emulating the 3278/3279).

2. When using remote non-SNA (BSC) attachment, 3274 WACK support must be configured. To configure WACK support, specify "1" in reply to 3274

customization question 176 (BSC Enhanced Communication Option for Distributed Function Terminals).

Under IMS, this device is supported through SNA attachment only.

3. Support for graphics and image requires 3274 Configuration Support D, level 64 or higher.
4. The IBM 3192-G is functionally equivalent to the 3179-G.
5. This display can be dynamically configured in any one of 8 modes (Model 2 through 9). GDDM support of Model 6 through 9 provides no extra function above that provided for Model 2 through 5.

The IBM 3192-D is functionally equivalent to the 3180 Model 1.

6. This display requires IBM 3174 models 1L, 1R, 2R, 3R, 11L, 11R, 12R, 13R, 21L, 21R, 51R, 52R, 53R, 61R, 62R, or 63R with microcode release level 1.0 or higher. Alternatively, the IBM 3274 models 31A, 31C, 31D, 41A, 41C, 41D, 51C, or 61C with configuration support D and microcode of release level 65.0 or higher can be used.
7. Support for graphics and image additionally requires the following features:
 - 5790 Programmed Symbols
 - 3620 Character Set Extension

These features are not available on IBM 3278 Models 1 and 5.

8. Graphics and image are supported on IBM 3279 Models 3B, S3B, S3G, and 03X only. Except for 3279 Model S3G, this support additionally requires the following features:
 - 5790 Programmed Symbols
 - 3850 Extended Function

The 3279 Model 03X also supports the 8750 video-output feature, which allows graphics to be copied from the terminal to another device, such as a camera or TV screen.

9. The 3290 requires 3274 Configuration Support D.
10. This workstation supports multiple sessions. "CAGI" support is for the graphics session only; other sessions are "alpha" only.
11. Support for graphics and image requires the 5790 Programmed Symbols feature.

The 8775 requires downstream loading to support Enhanced Function, Enhanced Function with Magnetics, or Multiple Partitions and Scrolling. This loading can be performed by DPPX or DPCX (if attached via 8100), or by the Downstream Load Utility (DSLUI) licensed program (5668-006) which is supported under VSE and MVS. Consult the specifications of this program for further details.

12. For GDDM's purposes, the IBM Personal System/55 in 3270-emulation mode is functionally equivalent to the IBM 5550 Multistation in 3270-emulation mode.

A 5550 Multistation typically consists of:

- A monitor (for example, 5555).
- A system unit (for example, 5541, 5551, 5561).
- A keyboard (for example, 5556).

- Microcode, being any DBCS country version 3270-PC that is equivalent to Japanese 3270-PC or 3270-PC/G in DBCS support.
 - A printer (for example, 5557, 5563, 5575, 5577).
13. GDDM supports alphanumeric fields containing mixed data (that is, containing both EBCDIC and double-byte character-set data). Support for mixed DBCS data without SO/SI separators taking positions requires “Japanese 3270-PC” microcode Version 6 (or later) or “Japanese 3270-PC/G” microcode Version 5 (or later), or DBCS country equivalent.

Support for graphics and image requires “Japanese 3270-PC/G” microcode, or DBCS country equivalent.

Support for outboard DBCS Vector Symbol Sets requires “Japanese 3270-PC/G” microcode Version 6 (or later), or DBCS country equivalent.

14. When using non-SNA attachment:

- Support for SLHA (local non-SNA) attachment requires “Japanese 3270-PC/G” microcode Version 4 (or later), or DBCS country equivalent.
- Support for BSC (remote non-SNA) attachment requires “Japanese 3270-PC/G” microcode Version 5 (or later), or DBCS country equivalent. Also, 3274 WACK support must be configured. To configure WACK support, specify “1” in reply to 3274 Customization question 176 (BSC Enhanced Communication Option for Distributed Function Terminals).

Under IMS, “Japanese 3270-PC/G” microcode, or DBCS country equivalent, is supported through SNA attachment only.

15. On 5550 systems, “program checks” can result from data-stream changes in fields that include a mixture of single-byte and double-byte character sets (SBCS/DBCS). If the subsystem and communications functions permit it, this problem can be avoided by using a sufficiently large transmission buffer.
16. The 5081 and 6091 displays are supported as components of the IBM 5080 and IBM 6090 Graphics Systems respectively. GDDM supports the 5081 and 6091 high-function graphics displays in two modes. These are:
- Standard mode, which is supported for graphics and image only. Standard mode is supported only through GDDM/graPHIGS (5668-792), and is subject to any configuration requirements imposed by that program.
 - 3270 mode, which is supported only for alphanumeric functions. The 3270 mode is supported through standard subsystem and system mechanisms.

GDDM supports applications that use both alphanumeric and graphic data by combining standard-mode operation with either a separate 3270 device or the 3270 mode of the high-function graphics display, such that the two appear as one logical device to the program.

When standard mode is combined with 3270 mode, the alphanumeric data (in 3270 mode) and the graphic data (in standard mode) cannot be viewed simultaneously.

When standard mode is combined with a separate 3270 device, the terminal user should be aware that prompting messages (for example **PF=...**) appearing in the alphanumeric (3270) data may refer to the graphic data.

GDDM/graPHIGS and Graphics Access Method (GAM/SP) Release 2 are required for the support of the 5080 and 6090 Graphics Systems.

17. ASCII displays are supported when attached via an IBM 3174 with Asynchronous Emulation Adapter (AEA) feature with licensed internal code (LIC) at Configuration Support Release B2 or later.
Tektronix terminals require use of flow control (for example, XON/XOFF flagging) to avoid loss of data when displaying graphics.
18. User defined terminal tables (UDTs) are required in the 3174 AEA to support these terminals.
19. Tektronix microcode Version 4.1 or later is required for display of image or image characters on the Tektronix 4105 graphics terminal.
20. Microcode Version 11 or later is recommended for improved graphics on the Tektronix 42xx series terminals.

Printers and plotters supported by GDDM Version 3 Release 2

Table 9 identifies the printers and plotters supported by GDDM 3.2. These include:

- 3270 printers
- Plotters
- 5550 family printers
- System printers
- Page printers
- Printers and plotters used in conjunction with the GDDM-PCLK and GDDM-OS/2 Link components of GDDM 3.2.

Any restrictions on the use of these devices are included in the notes to Table 9.

The meanings of the values in the “Function” column are explained in “Explanation of the Function column” on page 76.

Table 9 (Page 1 of 4). Printers and plotters supported by GDDM 3.2

Device	Function	Description	Notes
3270 printers			
3230 Models 1, 2	. A . .	Printer	1
3232 Models 1, 11	. A . .	Keyboard printer	2
3262 Models 3, 13	. A . .	Line printer	
3268	. A . .	Printer	
3268 Model 2C	C A G I	Color printer	
3283 Model 52	. A . .	Printer	
3284 Models 2, 3	. A . .	Printer	
3286 Model 2	. A . .	Printer	
3287	C A G I	Color printer	3
3288	. A . .	Line printer	
3812 Model 2	C A G I	IPDS printer	4
3816	C A G I	IPDS printer	4, 5
3112	C A G I	IPDS printer	
3116	C A G I	IPDS printer	
3912	C A G I	IPDS printer	

Table 9 (Page 2 of 4). Printers and plotters supported by GDDM 3.2

Device	Function	Description	Notes
3916	C A G I	IPDS printer	
4028	C A G I	IPDS printer	
4224 Model 2xx	C A G I	IPDS printer	4, 7
4230 Model 201	. A G .	Printer	6, 7
4230 Model 202	C A G I	IPDS printer	6, 7
4234 Model 1	. A . .	IPDS printer	7
4234 Model 7	C A G I	IPDS printer	4, 7
4234 Model 11	C A G I	IPDS printer	4, 7
Plotters			8
6180	. . G .	Plotter (8-pen)	
6182	. . G .	Plotter (8-pen)	
6184	. . G .	Plotter (8-pen)	
6185	. . G .	Plotter (8-pen)	
6186	. . G .	Plotter (8-pen)	9
6187	. . G .	Plotter (8-pen)	9, 10
7371	. . G .	Plotter (2-pen)	
7372	. . G .	Plotter (6-pen)	
7374	. . G .	Plotter (8-pen)	
7375	. . G .	Plotter (8-pen)	
IBM Personal System/55 and 5550-family printers			11
Printers	. A . .	DBCS printers	
System printers			12
1403	. A . .	Printer	
3203 Model 5	. A . .	Printer	
3211	. A . .	Printer	
3262 Models 1, 5, 11	. A . .	Line printer	
3800 Models 1, 2, 3, 6	. A . .	Printing subsystem	
4245	. A . .	Line printer	
4248	. A . .	Printer	
Page printers			13
3800 Models 3, 6, 8	C A G I	Printing subsystem	
3812	C A G I	Page printer	
3816	C A G I	Page printer	
3820	C A G I	Page printer	
3825	C A G I	Page printer	
3827	C A G I	Page printer	
3828	C A G I	Page printer	
3835	C A G I	Page printer	

Table 9 (Page 3 of 4). Printers and plotters supported by GDDM 3.2

Device	Function	Description	Notes
3900	C A G I	Page printer	
3112	C A G I	Page printer	
3116	C A G I	Page printer	
3912	C A G I	Page printer	
3916	C A G I	Page printer	
4028	C A G I	Page printer	
4224	C A G I	Printer	
4230	C A G I	Printer	
4234	C A G I	Printer	
4250	. . G I	Printer	
Printers and plotters with GDDM-PCLK			14
3852 Models 1, 2	. A G I	Color Jetprinter	
4019	. A G .	Laser printer	15
4201 Models 1, 2, 3	. A G I	Proprinter	
4202 Models 1, 2, 3	. A G I	Proprinter XL	
4207 Models 1, 2	. A G I	Proprinter X24	
4208 Models 1, 2	. A G I	Proprinter XL24	
5152	. A G I	Graphics printer	
5182	. A G I	Color printer	
5201	. A G I	Quietwriter printer	
5202	. A G I	Quietwriter III printer	
6180	. . G .	Plotter (8-pen)	
6182	. . G .	Plotter (8-pen)	
6184	. . G .	Plotter (8-pen)	
6186	. . G .	Plotter (8-pen)	9
6187	. . G .	Plotter (8-pen)	9, 10
7371	. . G .	Plotter (2-pen)	
7372	. . G .	Plotter (6-pen)	
7374	. . G .	Plotter (8-pen)	
7375	. . G .	Plotter (8-pen)	
Printers and plotters with GDDM-OS/2 Link			16
3812	. A G I	Page printer	17
3852 Models 1, 2	. A G I	Color Jetprinter	
4019	. A G .	Laser printer	
4201 Models 1, 2, 3	. A G I	Proprinter	
4202 Models 1, 2, 3	. A G I	Proprinter XL	
4207 Models 1, 2	. A G I	Proprinter X24	
4208 Models 1, 2	. A G I	Proprinter XL24	

Table 9 (Page 4 of 4). Printers and plotters supported by GDDM 3.2

Device	Function	Description	Notes
5152	. A G I	Graphics printer	
5182	. A G I	Color printer	18
5201	. A G I	Quietwriter printer	
5202	. A G I	Quietwriter III printer	
5204	. A G I	Quickwriter Model 1	19
6180	. A G .	Plotter (8-pen)	
6182	. A G .	Plotter (8-pen)	
6184	. A G .	Plotter (8-pen)	
6186	. A G .	Plotter (8-pen)	
6187	. A G .	Plotter (8-pen)	
7371	. A G .	Plotter (2-pen)	
7372	. A G .	Plotter (6-pen)	
7374	. A G .	Plotter (8-pen)	
7375	. A G .	Plotter (8-pen)	

Notes:

1. This printer is supported as an IBM 3287 printer.
2. Supported for output only.
3. Support for graphics and image on the 3287 Printer requires the following additional features:
 - Models 1, 2 5781 Programmed Symbols (2) and, optionally, 5782 Programmed Symbols (4)
 - Models 1C, 2C 5783 Programmed Symbols (4A)

Features 3610, 3880, and 9661 are prerequisites to the above.
4. GDDM communicates with IPDS printers using the Intelligent Printer Data Stream (IPDS).
 - IPDS-mode operation using an IBM 3174 Control Unit requires a 3174 with Release 2 or higher.
 - IPDS-mode operation using an IBM 3274 Control Unit requires a 3274 with configuration support level D and Release 65.1.
 - IPDS-mode operation using an IBM 4300 workstation adapter requires a 4361 WSA specify code 9261, Engineering Change (EC) 364436 and Request for Engineering Action (REA) 6421544.

GDDM can print on IPDS printers attached as follows:

 - In the VM environment:
 - LU-0 (non-SNA) locally attached printer attached to a single-user virtual machine
 - LU-0 (non-SNA) attached printer via RSCS
 - LU-1 (SNA) attached printer via RSCS

- In the MVS environment:
 - LU-0 (non-SNA) attached printer accessed via VTAM
 - LU-1 (SNA) attached printer accessed via VTAM
- In the CICS environment:
 - LU-1 (SNA) attached printer accessed via CICS (and VTAM)

The 3812-2 and 3816 printers are supported as IPDS printers when they have the 3270 Attachment Feature (number 3190).

5. The IBM 3816-D duplex printer is supported by GDDM for duplex printing.
6. The IBM 4230 Model 201 and Model 202, in non-IPDS mode, provide text and graphics output in DP quality only.
7. Some graphics applications might not run satisfactorily on 4224 and 4230 printers without expanded storage. For printing complex graphics and composite documents, the expanded storage models (4224-2E2 and 4224-2C2) or the 4234 are recommended.
8. Plotters are supported by GDDM 3.2 when connected via an IEEE-488 attachment to one of the following devices:
 - 3270-PC/G or 3270-PC/GX workstation. Support is through the IBM 3270-PC Graphics Control Program, when attached to an IEEE-488 Adapter in the 5371 system unit or a general-purpose interface bus (GPIB) card in the 5170 or 5373 system units.
 - 3179-G or 3192-G through a 3979 Expansion Unit.
 - Graphics members of the 5550 Multistation.

Plotters are supported when connected via an RS232 attachment to the 3472-M display.

9. The IBM 6186-2 and the IBM 6187-2 support roll-feed plotting.
10. GDDM does not exploit the additional function provided with GL/2 (Graphical Language/2) on this plotter.
11. The IBM Personal System/55 in 3270-emulation mode is fully compatible with the IBM 5550 Multistation in 3270-emulation mode.

A 5550 Multistation typically consists of:

- A monitor (for example, 5555).
- A system unit (for example, 5541, 5551, 5561).
- A keyboard (for example, 5556).
- Microcode, being any DBCS country version 3270-PC that is equivalent to Japanese 3270-PC or 3270-PC/G in the DBCS support.
- A printer (for example, 5557, 5563, 5575, 5577).

GDDM supports alphanumeric fields containing mixed data (that is, containing both EBCDIC and double-byte character-set data). Support for mixed DBCS data without SO/SI separators taking positions requires “Japanese 3270-PC” microcode Version 6 (or later), or “Japanese 3270-PC/G” microcode Version 5 (or later), or DBCS country equivalent.

12. System printers are supported for alphanumerics via system or subsystem spooling support.

13. Page printers are supported via system or subsystem spooling support, such as that provided by the Print Services Facility (PSF) device-access method. Users should check the level of PSF required for support of specific printers. Users should also check whether the AFPDS enhancements for GOCA graphics orders and IO compressed image are supported for specific printers.
14. These printers and plotters are supported under GDDM-PCLK when attached to one of the IBM personal-computer systems listed on page 87.
 Under MVS/TSO, the personal computer system must be defined to the host as a queriable device.
 Plotters are supported via RS232 attachment.
15. The IBM 4019 printer is supported in 5202-emulation mode only.
16. The devices supported by GDDM through GDDM-OS/2 Link include, but are not limited to, those listed. Any graphics device supported by OS/2 Extended Edition Version 1.2 or later can be used with GDDM-OS/2 Link.
 No new device-characteristics tokens are supplied for these devices. If you need to specify new tokens, they must be added to ADMLSYS1. (See the *GDDM System Customization and Administration* book for further guidance on the need for device tokens.)
17. This printer is supported in 5152 compatibility mode.
18. This printer is supported as a monochrome printer only.
19. This printer is supported in Quietwriter III compatibility mode.

3270 workstations supported by GDDM Version 3 Release 2

Table 10 identifies the 3270 workstations supported by GDDM 3.2. Any restrictions on the use of these devices are included in the notes to Table 10.

The meanings of the values in the "Function" column are explained in "Explanation of the Function column."

Table 10. 3270 workstations supported by GDDM 3.2

Device	Function	Description	Notes
3270 workstations			1
3270-PC	C A G I	Workstation	2, 3,4
3270-PC/G	C A G I	Workstation	2, 4
3270-PC/GX	C A G I	Workstation	2, 4

Notes:

1. Any terminal emulating the IBM 3270 architecture can be used, provided that it is fully compatible with one of the listed devices.
2. The AT version of this device is also supported.
3. Support for graphics and image requires the 5790 Programmed Symbols feature.

GDDM-PCLK supports the 3270-PC (with or without Programmed Symbols) but support is limited to CGA-emulation display mode.

4. The IBM 3270-PC Graphics Control Program (GCP) is also required. The following fixes to GCP APARs (according to the GCP Release) should be installed for correct operation of GDDM:

- GCP Release 1.12 – IR67978 and IR67982
- GCP Release 2.10 – IR67980 and IR67985
- GCP Release 3.10 and 3.20 – IR67981 and IR67986

3270-PC AT/G and AT/GX require GCP Release 2.0 (or later).

When using remote non-SNA (BSC) attachment, 3274 WACK support must be configured. To configure WACK support, specify “1” in reply to 3274 Customization question 176 (BSC Enhanced Communication Option for Distributed Function Terminals).

Under IMS, this device is supported through SNA attachment only.

Support for graphics and image requires:

- That the 5371/5373 be attached to the 3274 in Distributed Function Terminal (DFT) mode.
- 3274 Configuration Support D at not less than level 61. The 3274 requires patch number 3537 for level 61.1, and patch numbers 3537 and 3538 for level 63. For level 64, the 3274 requires that you turn on bit 3 (B'xxx1xxx') in reply to 3274 Customization question 125 (Miscellaneous Feature Option).
- DOS workstations require an emulator and GDDM-PCLK to be downloaded. The X3270 emulator provides only graphics viewing for UNIX systems and AIX. Windows NT (TCP/IP only) workstations are supported via IBM PC/3270 V4.1 for Windows 95 or Windows.

Scanners supported by GDDM Version 3 Release 2

Table 11 identifies scanners supported by GDDM 3.2. Scanners must be attached to a 3193 Display.

The meanings of the values in the “Function” column are explained in “Explanation of the Function column” on page 76.

Table 11. Scanners supported by GDDM 3.2

Device	Function	Description	Notes
3117	. . .	Scanner and Extension Unit	
3118	. . .	Scanner	

IBM personal-computer systems supported by GDDM Version 3 Release 2

With the exception of the PC and PC/XT, the personal-computer systems listed in Table 12 on page 88 are supported by the GDDM-OS/2 Link component of GDDM 3.2. OS/2 Extended Edition Version 1.2 or later and 375KB of storage are required.

The personal-computer systems listed in Table 12 on page 88 are also supported by the GDDM-PCLK component of GDDM 3.2 with one of the display adapters

listed in Table 13. The personal-computer system unit requires IBM PC-DOS 2.1 or later, 512KB of storage, and a suitable terminal emulator.

The meanings of the values in the “Function” column are explained in “Explanation of the Function column” on page 76.

Table 12. IBM personal-computer systems supported by GDDM 3.2

Device	Function	Description	Note
PC	C A G I	IBM Personal Computer	1
PC/XT	C A G I	IBM Personal Computer	1
PC/XT-286	C A G I	IBM Personal Computer	
PC/AT	C A G I	IBM Personal Computer	
3270-PC	C A G I	IBM Personal Computer	
3270-PC AT	C A G I	IBM Personal Computer	
PS/2 Models 25, 30, 35, 40, 43, 50, 55, 57, 60, 65, 70, 80, 90, 95	C A G I	IBM Personal System/2	

Notes:

1. Not supported by the GDDM-OS/2 Link component of GDDM Base.

Table 13. IBM display adapters supported by GDDM-PCLK

Name	Resolution	Colors	Notes
Color/Graphics Adapter (CGA)	640 x 200	2	
Enhanced Graphics Adapter (64KB) (EGA)	640 x 200	16	1
Enhanced Graphics Adapter (128KB+) (EGA)	640 x 350	16	2
Multi Color Graphics Array (MCGA)	640 x 480	2	3
Video Graphics Array (VGA)	640 x 480	16	4
Personal System/2 Display Adapter	640 x 480	16	
8514/A Display Adapter	640 x 480	16	5
8514/A Display Adapter	1024 x 768	16	6
Extended Graphics Array (XGA)	640 x 480	16	5, 7
Extended Graphics Array (XGA)	1024 x 768	16	6, 7
XGA Display Adapter	640 x 480	16	5
XGA Display Adapter	1024 x 768	16	6
Image Adapter/A (IAA)	640 x 480	16	5
Image Adapter/A (IAA)	1024 x 768	16	8

Notes:

1. Attached to a Color Display or an Enhanced Color Display
2. Attached to an Enhanced Color Display
3. In some versions of IBM Personal System/2 model 30
4. In some versions of IBM Personal System/2 models 30 and 57, and all versions of IBM Personal System/2 models 25, 35, 40, 43, 50, 55, 60, 65, 70 73, and 80
5. Attached to an IBM 8503, 8504, 8512, 8513, 8516, or 8518 display
6. Attached to an IBM 8507, 8514, or 8515 display
7. In some versions of IBM Personal System/2 model 57, and all versions of IBM Personal System/2 models 90 and 95
8. Attached to an IBM 8506, 8507, 8508, 8514, 8515, or 6091 display

Data streams supported by GDDM Version 3 Release 2

AFPDS	Advanced Function Printing Data Stream
AFPDS-E	Advanced Function Printing Data Stream-Extended
CDPDS	Composite Document Presentation Data Stream
CDPF data stream	Composed Document Printing Facility data stream
DEC ReGIS	DEC Remote Graphics Instruction Set
GL	Graphical Language
IPDS	Intelligent Printer Data Stream
PS	PostScript
Tek	Tektronix 4200 Series Data Stream
3270 data stream	

Object and interchange architectures used by GDDM Version 3 Release 2

BCOCA	Bar Code Object Content Architecture
CGM	Computer Graphics Metafile
GIF	Graphics Interchange Format (output only)
GKS	Graphical Kernel System
GOCA	Graphics Object Content Architecture
IOCA	Image Object Content Architecture
MODCA	Mixed Object Document Content Architecture
PIF	Picture Interchange Format
PTOCA	Presentation Text Object Content Architecture

Installation requirements

For installation in the MVS environment (under TSO, CICS, IMS, or MVS/BATCH) GDDM/MVS (program number 5695-167) is required. SMP/E 1.5.0 or later is required to install GDDM/MVS, which can be ordered as a stand-alone product or as part of a system package such as Custom-Built Installation Program Offering (CBIPO), Custom-Built Product Delivery Offering (CBPDO), or CustomPac.

For installation in the VM environment under CMS, GDDM/VM (program number 5684-168) is required. GDDM/VM can be ordered as a stand-alone product or as

part of a system package such as System Delivery Option (SDO) or CustomPac/VM.

For installation in the VSE environment (under CICS or VSE/BATCH), GDDM/VSE (program number 5686-057) is required. To install GDDM/VSE, the installation dialogs "Install Programs" of VSE/ESA can be used. Alternatively, the installation process can be carried out using the Maintain System History Program (MSHP) component of VSE/ESA.

When GDDM is ordered as a stand-alone product, each GDDM licensed program and each national-language-support feature occupies one or more tapes (1600- or 6250-bpi) or one or more 3480 cartridges.

The storage requirements of GDDM are dependent on configuration, workload, device type, screen size, storage available at the device (where applicable), message rates, and the general processing environment. Some estimates are given in the appropriate *Program Directory* for the MVS, VM, and VSE environments.

Appendix. The GDDM Version 3 library

This appendix describes:

- The structure of the GDDM licensed-program libraries. Because the structure and content of the GDDM 3.2 Base library are different from those of the GDDM Version 2 library, this information will be of particular interest to users migrating to GDDM 3.2 from an earlier release of GDDM.
- The tasks supported by each book in the GDDM program libraries.
- Your entitlement to GDDM publications.
- How to send your comments on the GDDM publications to IBM.
- Which GDDM publications are available in softcopy format for use with the IBM BookManager/READ programs.

The GDDM Version 3 books and the tasks they support

Each of the five GDDM licensed programs (GDDM Base, GDDM-PGF, GDDM-IVU, GDDM-GKS, and GDDM Interactive Map Definition) has its own library. Titles and order numbers for all GDDM publications can be found in “Preface” on page ix. The next section of this appendix provides a short description of the purpose of each GDDM book. Table 14 on page 95 indicates, for each book, which of these tasks it supports:

- Evaluation
- Installation
- Application programming
- System support
- End use

The GDDM Base library

GDDM General Information

This book introduces the GDDM series of licensed programs in general, and identifies function new in GDDM Version 3. One of its main purposes is to provide a comprehensive source of information about GDDM’s hardware and software support.

GDDM Program Directory

For each of the GDDM Base programs (GDDM/MVS, GDDM/VM, and GDDM/VSE) there is a *Program Directory*. The installation instructions for all GDDM programs are supplied only in the Program Directory that accompanies the GDDM Base program tapes. That is, installation instructions for GDDM-PGF, for example, are provided in the Program Directory of the GDDM Base program. It is suggested that the program directory be filed with the *GDDM System Customization and Administration* book for future reference.

GDDM System Customization and Administration

The *GDDM System Customization and Administration* book supports all tasks involved in establishing and maintaining a working GDDM system. These tasks are related primarily to setting up devices and making them available to all or some of an enterprise's users. The book also includes information on performance monitoring and tuning, on running GDDM with other IBM products (many of which name GDDM as a prerequisite), and on tailoring system default values. This was a new book for GDDM 3.1.

GDDM Base Application Programming Guide

Application programmers learning to use the GDDM Base API will need to refer to the *GDDM Base Application Programming Guide*, which provides both introductory and guidance material. It supports all application-programming tasks, from design through coding, compilation, testing, and debugging. Programming examples in all supported programming languages are provided in the book. In addition, the executable sample programs provided with the GDDM Base program are described in the *GDDM Base Application Programming Guide*. The book is intended for application programmers experienced in at least one of the programming languages supported by GDDM.

GDDM Base Application Programming Reference

The *GDDM Base Application Programming Reference* book provides all reference material needed to support the application-programming task, in particular the syntax and function descriptions of all GDDM Base API calls. The *GDDM Base Application Programming Guide* and the *GDDM Base Application Programming Reference* book are companion volumes.

GDDM Messages

The *GDDM Messages* book documents, in alphanumeric order, all diagnostic messages that can be issued by the GDDM Base programs, GDDM-PGF, GDDM-IVU, GDDM-GKS and GDDM Interactive Map Definition. It is intended for anyone who receives a GDDM message.

GDDM Diagnosis

The *GDDM Diagnosis* book describes how to diagnose GDDM problems (particularly by running a trace) and how to report such problems to IBM. It is intended for system-support personnel and for IBM service personnel.

GDDM User's Guide

The *GDDM User's Guide* describes some GDDM functions that are directly available to the terminal or workstation user, such as printing, plotting, and transferring files to and from the host computer. It also describes GDDM's User-Control facility.

GDDM Using the Image Symbol Editor

The *GDDM Using the Image Symbol Editor* book describes the Image Symbol Editor, which is used for creating and editing image symbols for inclusion in charts and graphics display programs. The book, in combination with the Image Symbol Editor's own help panels, is suitable for both new and experienced users of the Image Symbol Editor.

GDDM Series Licensed Program Specifications

The *GDDM Series Licensed Program Specifications* document defines the terms and conditions under which the GDDM licensed programs can be used. It also specifies the operating environment for each GDDM program.

GDDM-OS/2 Link User's Guide

The GDDM-OS/2 Link component of GDDM Base includes an online *User's Guide*. This is intended for all users of GDDM-OS/2 Link. It is not available as a hardcopy or softcopy publication.

The GDDM-PGF library

GDDM-PGF Application Programming Guide

The *GDDM-PGF Application Programming Guide* provides guidance on the use of the GDDM-PGF programming interfaces. It describes how to use both the ICU API and the presentation-graphics routines, and example programs are included. Like the *GDDM Base Application Programming Guide*, it is intended for application programmers experienced in one of the GDDM-supported programming languages. (In earlier releases of GDDM, this book was issued as Volume 2 of the *GDDM Application Programming Guide*, SC33-0337.)

GDDM-PGF Application Programming Reference

The *GDDM-PGF Programming Reference* book provides reference information in support of the application-programming task documented in the *GDDM-PGF Application Programming Guide*. It is intended primarily for application programmers.

GDDM-PGF Application Programming Reference Summary

This pocket-sized booklet provides a summary of some of the GDDM-PGF reference information. It is intended as a companion to the *GDDM-PGF Programming Reference* book.

GDDM-PGF Interactive Chart Utility

The *GDDM-PGF Interactive Chart Utility* book is intended for end users. It assumes no experience of chart creation, and assumes very little knowledge of computers in general. It describes how to use the ICU, beginning with the simplest of charts and progressing to the most complicated. It is complementary to the ICU's own help panels.

GDDM-PGF Vector Symbol Editor

The *GDDM-PGF Vector Symbol Editor* book introduces the GDDM-PGF Vector Symbol Editor, which is used for creating vector symbols, logos, and so on for inclusion in charts and graphics display programs. This manual, together with the help panels of the Vector Symbol Editor, provides all information needed by both new and experienced users.

GDDM-PGF OPS User's Guide

The *GDDM-PGF OPS User's Guide* book tells you all you need to know about using the Online Presentation System. It's divided into three parts:

1. An introduction, which includes hands-on exercises

GDDM publications

2. A “user’s guide,” giving comprehensive guidance on creating and displaying online presentations
3. A complete reference to all the commands that you use in online presentations

GDDM-PGF ICU poster

This poster is complementary to the *GDDM-PGF Interactive Chart Utility* book.

The GDDM-IVU library

GDDM Image View Utility

The *GDDM Image View Utility* book describes the end-user and application-programming interfaces of GDDM-IVU. It is intended for end users, application programmers, and system programmers.

The GDDM-GKS library

GDDM-GKS Programming Guide and Reference

The *GDDM-GKS Programming Guide and Reference* book provides information about writing and running application programs that use the GDDM-GKS (Graphical Kernel System) licensed program. It is intended primarily for application programmers, although some of the information is also applicable to system programmers. The first four chapters give an overview of GKS. The remainder of the book is reference material.

The GDDM Interactive Map Definition library

GDDM Interactive Map Definition

The *GDDM Interactive Map Definition* book, together with GDDM-IMD’s online tutorial, provides all the information needed to use GDDM-IMD to define panel layouts interactively. It is intended primarily for application programmers.

Which books for which tasks?

Table 14 on page 95 identifies the main tasks supported by each of the books in each of the GDDM licensed-program libraries.

Table 14. Which books for which tasks?

Book	Evaluation	Installation	System support	Programming	End use
GDDM Base (GDDM/MVS, GDDM/VM, GDDM/VSE) library:					
<i>GDDM General Information</i>	X				
<i>GDDM/MVS Program Directory</i>		X			
<i>GDDM/VM Program Directory</i>		X			
<i>GDDM/VSE Program Directory</i>		X			
<i>GDDM System Customization and Administration</i>			X		
<i>GDDM Base Application Programming Guide</i>				X	
<i>GDDM Base Application Programming Reference</i>				X	
<i>GDDM Messages</i>		X	X	X	X
<i>GDDM Diagnosis</i>			X		
<i>GDDM User's Guide</i>					X
<i>GDDM Using the Image Symbol Editor</i>					X
GDDM-PGF library:					
<i>GDDM-PGF Programming Reference</i>				X	
<i>GDDM-PGF Application Programming Guide</i>				X	
<i>GDDM-PGF Application Programming Reference Summary</i>				X	
<i>GDDM-PGF Interactive Chart Utility</i>					X
<i>GDDM-PGF Vector Symbol Editor</i>					X
<i>GDDM-PGF OPS User's Guide</i>					X
<i>GDDM-PGF Interactive Chart Utility poster</i>					X
GDDM-IVU library:					
<i>GDDM Image View Utility</i>				X	X
GDDM-GKS library:					
<i>GDDM-GKS Programming Guide and Reference</i>				X	
GDDM Interactive Map Definition library:					
<i>GDDM Interactive Map Definition</i>				X	

Entitlement to books

All GDDM books are issued as entitlement with the appropriate GDDM licensed program. That is, one copy of each book is provided at no additional cost with the program it supports. All GDDM-PGF books, for example, are provided with the GDDM-PGF licensed program. Additional copies can be ordered through your IBM marketing representative or via the System Library Subscription Service (SLSS).

Sending your comments to IBM

You are encouraged to send your comments on the GDDM library to IBM. At the back of each book, you'll find a readers' comment form, which you can complete and send to IBM. Alternatively, you can contact IBM by FAX machine or via the IBMMAIL system. Instructions for both methods are provided at the back of each GDDM Base book (including this one).

GDDM 3.2 books available in softcopy format

All GDDM 3.2 Base books, and the GDDM-IVU book, are available in both hardcopy and softcopy (IBM BookManager) formats. For GDDM 3.2, the GDDM-PGF, GDDM Interactive Map Definition, and GDDM-GKS books are also available in softcopy format.

The softcopy versions of these books are available on the *IBM Printing and Publishing Collection* CD-ROM (order number SK2T-2921), provided as an optional, no-charge feature.

Acronyms and abbreviations

AEA	Asynchronous Emulator Adapter	GL	Graphical Language
AFPDS	Advanced Function Printing Data Stream	GML	Generalized Markup Language
ANSI	American National Standards Institute	HPA	High Performance Alphanumerics
AP	Auxiliary Processor	IBM-GL	IBM Graphics Language
API	Application Program Interface	ICU	Interactive Chart Utility
APE	Application Prototype Environment	IMD	Interactive Map Definition
APL	"A Programming Language"	IMS	Information Management System
AS	Application System	IPDS	Intelligent Printer Data Stream
ASCII	American National Standard Code for Information Interchange	ISO	International Organization for Standardization
bpi	bits per inch	IVU	Image View Utility
CAD	Computer-Aided Design	JES	Job Entry Subsystem
CADAM	Computer-Aided Design and Manufacture	MVS	Multiple Virtual Storage
CAM	Computer-Aided Manufacture	NLS	National Language Support
CATIA	Computer-Graphics Aided Three-Dimensional Interactive Application	OPS	Online Presentation System
CBDS	Circuit Board Design System	OS	Operating System
CCITT	Consultative Committee on International Telegraph and Telephone	PA	Program Access
CDPF	Composed Document Print Facility	PC/AT	Personal Computer (Advanced Technology)
CDPU	Composite Document Print Utility	PC/G	Personal Computer (Graphics)
CDPDS	Composite Document Presentation Data Stream	PC/GX	Personal Computer (Graphics Extended)
CECP	Country Extended Code Page	PF	Program Function
CGM	Computer Graphics Metafile	PG	Presentation Graphics
CICS	Customer Information Control System	PGF	Presentation Graphics Facility
CMS	Conversational Monitor System	PHIGS	Programmer's Hierarchical Interactive Graphics System
CSPF	Central Slide and Plot Facility	PIF	Picture Interchange Format
DBCS	Double-Byte Character Set	PMF	Print Management Facility
DB2	Database 2	PROFS	Professional Office System
DCF	Document Composition Facility	PS	(1) Personal Services (2) Personal System
DEC	Digital Equipment Corporation	PSEG	Page Segment
DISOSS	Distributed Office Support System	PSF	Print Services Facility
DISPF	Decision and Information Support Productivity Facility	PTF	Program Temporary Fix
DOS	Disk Operating System	QMF	Query Management Facility
DP	Data Processing	REXX	Restructured Extended Executor Language
DPPX	Distributed Processing Programming Execution	RJE	Remote Job Entry
DS	(1) Data System (2) Decision Support	SLR	Service Level Reporter
DW	DisplayWrite	SP	Systems Product
EBCDIC	Extended binary-coded decimal interchange code	SQL	Structured Query Language
ESA	Enterprise Systems Architecture	TIF	The Information Facility
GDDM	Graphical Data Display Manager	TIFF	Tag Image File Format
GDF	Graphics Data Format	TSO	Time Sharing Option
GDQF	Graphical Display and Query Facility	VM	Virtual Machine
GGXC	IBM 3270 PC /G /GX color graphics charting	VS	Virtual Storage
GIF	Graphics Interchange Format	VSAM	Virtual Storage Access Method
GKS	Graphical Kernel System	VSE	Virtual Storage Extended
		VTAM	Virtual Telecommunications Access Method
		XA	Extended Architecture

acronyms and abbreviations

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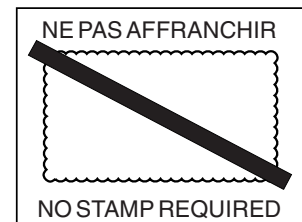
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