DIGITAL RESEARCH™

GSX-86™
Graphics Extension

User's Guide
for the
IBM® Personal Computer

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Foreword

ABOUT THIS BOOK This guide explains the features and operating procedures of GSX-86™, the Graphics System Extension for the CP/M-86® operating system family. The CP/M-86 family includes two operating systems:

- CP/M-86, a single user, single task operating system

- Concurrent CP/M-86™, a single user, multitask operating system

If you plan to use GSX-86 with Concurrent CP/M-86, refer to Appendix B for additional information.

WHO IT IS FOR This guide is for you if you are a new user of GSX-86 on an IBM® Personal Computer. It will help you set-up your system to run your GSX-86 graphic application programs on any printer, plotter, or monitor you select.

If you are a systems or an applications programmer familiar with the CP/M-86 operating system family, this guide provides you with a list of device drivers.

WHAT GSX-86 DOES GSX-86 is a program that adds graphic capability to your CP/M-86 or Concurrent CP/M-86 operating system. With GSX-86 installed, the following features are added to your system.

- GSX-86 provides a device-independent software interface for application programs written for GSX-86. This means that all graphic output devices look the same to your GSX-86 application program. Thus, if you decide to use a printer instead of a plotter, you do not need to alter your GSX-86 application program.

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- GSX-86 promotes software portability. By using the same architecture as the CP/M-86 operating system family, GSX-86 allows you to easily transfer GSX-86 graphic application programs from one computer to another.

- GSX-86 supports DR Graph™ and DR Draw™ . DR Graph allows you to graph and plot data by making simple menu selections. DR Draw allows you to draw complex graphics with your computer.

HOW IT IS ORGANIZED

This guide is divided into four sections.

Section 1 is an overview of GSX-86 that describes GSX-86 and how your system uses it.

Section 2 explains set-up procedures for the first time you use GSX-86, and for changing the graphic devices on your system.

Section 3 describes how to install GSX-86 before you use a graphic application program. It also contains an operation checklist.

Section 4 lists device-dependent information for all the graphic devices supported by this release of GSX-86.

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Section 1
OVERVIEW

INTRODUCTION

This section describes GSX-86 and how it operates with your computer system. The concepts in this section provide background information for the operating procedures in the next two sections.

GSX-86 FUNCTIONS

All graphic devices (monitors, printers, and plotters) draw lines, fill in areas, and produce text differently. GSX-86, the Graphic System Extension to CP/M-86 and Concurrent CP/M-86, manages these device differences and ensures that your GSX-86 graphic application programs can communicate with a variety of graphic output devices.

Coordinate Transformation

When you communicate to your graphic device through GSX-86, all graphic images are represented in a two-dimensional, cartesian coordinate system. GSX-86 transforms the coordinates of lines and text from the GSX-86 application program into the coordinates used by the selected output device. With GSX-86, your application program produces the same graphic image on your printer that appears on your monitor; the linestyles, characters, and so forth appear the same on both devices.
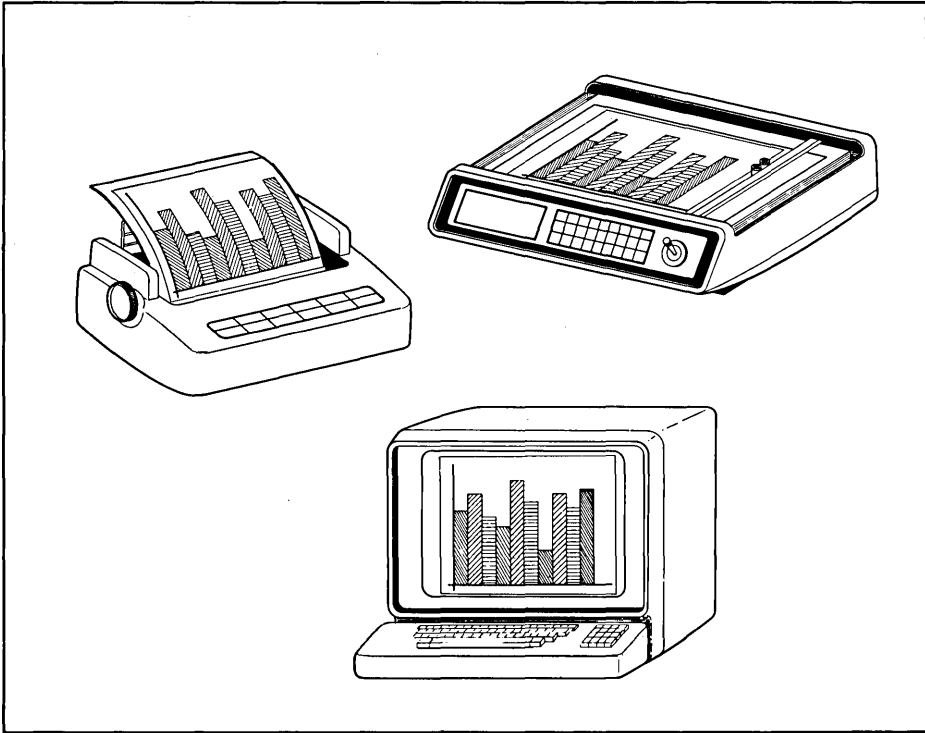
Figure 1-1.   GSX-86 Provides Device-independent Graphics

Servicing   Application programs written for GSX-86 work
Graphic   with GSX-86 through a standard graphic
Requests   interface.   GSX-86 translates the calls
                       generated by the application program to fit the
                       peculiarities of each output device.   This
                       means that GSX-86 graphic application programs
                       can run on a wide range of monitors, plotters,
                       and printers.

**Device
Drivers**

Because each graphic device is mechanically and electronically different, each device requires a special program to establish communication between it and GSX-86. This program is called a device driver.

The device drivers define the types of graphic output devices your computer can operate. The GSX-86 ASSIGN.SYS file, described in Section 2, contains the device driver filename for each output device attached to your computer. If you decide to connect another type of printer to your system, simply change the printer device driver in your ASSIGN.SYS file. Section 4 lists the device drivers that you receive with GSX-86.

End of Section 1

Section 2
SET-UP PROCEDURES

INTRODUCTION   This section describes the procedures for the following:

- installing GSX-86 the first time you use GSX-86 with your system

- modifying the ASSIGN.SYS file when you change the type of devices attached to your computer

STARTING   Set up the printer, plotter, monitor, and any
YOUR SYSTEM other hardware for your system. Your IBM Guide to Operations manual explains how to install and start your system.

CHECKING YOUR   Insert the GSX-86 distribution disk into one
GSX-86   of your computer's disk drives. Use the DIR
DISTRIBUTION DISK command documented in your CP/M-86 Operating System User's Guide to list the contents of the disk.

Your disk should contain the following files:

- ASSIGN.SYS

- GRAPHICS.CMD

- at least one device driver file for each monitor, printer, or plotter connected to your computer

ASSIGN.SYS File   ASSIGN.SYS is the device driver assignment file. It contains the list of device drivers that operate your computer's graphic output devices.

GRAPHICS.CMD File   GRAPHICS.CMD is the file containing GSX-86.

Device Driver   As explained in Section 1, device drivers are
Files   programs that allow your computer to operate
                        with the specific graphic output devices
                        connected to it.   Ensure that all of the
                        following device driver files are on your
                        distribution disk:

- DDIDSM.SYS
- DDOKI84.SYS
- DDPMVP.SYS
- DDFXLR8.SYS
- DDFXHR8.SYS
- DDCNTXM.SYS
- DDLA100.SYS
- DDLA50.SYS
- DDCITOLR.SYS
- DDDS180.SYS
- DDANADXM.SYS
- DDHP7470.SYS
- DDIBM.SYS
- DDIBMC.SYS

If any files are missing, ask your distributor for a new disk.

DUPLICATING YOUR   If all of the device driver files are
DISTRIBUTION DISK   present, use the Disk Maintenance command,
DSKMAINT, to make a duplicate copy of your
distribution disk. See your CP/M-86 or
Concurrent CP/M-86 Operating System User's
Guide for instructions on the use of DSKMAINT.

After making a duplicate disk, store your
distribution disk in a safe place, away from
extreme heat, temperature changes, humidity,
and dust.

CREATING A   Turn to the Device Driver Quick Reference
WORKING DISK   Table in Section 4 and look up the device driver
filename for each graphic output device
connected to your computer. Use the PIP
utility in your CP/M-86 Operating System User's
Guide to copy these specific device driver
files, along with ASSIGN.SYS and GRAPHICS.CMD,
from your duplicate disk to a working disk.

For example, if you have a Centronics 351
printer and an IBM color monitor, you would
copy the following files from your duplicate
disk to your working disk:

- DDCNTXM.SYS
- DDIBMC.SYS
- ASSIGN.SYS
- GRAPHICS.CMD

If your computer is equipped with a fixed disk
drive (hard disk), copy the necessary device
driver files, GRAPHICS.CMD, ASSIGN.SYS, CP/M-86
and your application programs onto the fixed
disk.

Note: Always use your duplicate disk to make
copies of GSX-86 files. Do not use the
distribution disk for routine operations.
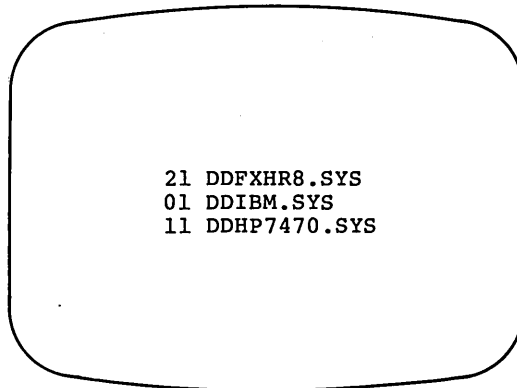
LISTING THE   Insert your working disk into your computer's
ASSIGN.SYS FILE   currently logged disk drive and list the
                          ASSIGN.SYS file by entering

                          A>**TYPE ASSIGN.SYS**

                          The letter preceding the system prompt denotes
                          the currently logged disk drive. In the
                          example above, drive A is the currently logged
                          drive.

                          A list similar to the following appears on the
                          screen.

```
21 DDFXHR8.SYS
01 DDIBM.SYS
11 DDHP7470.SYS
```

Figure 2-1. Display of ASSIGN.SYS File in Drive A

Logical Device   Look   at   the   specific   entries   in   your
Number   ASSIGN.SYS file. The number at the beginning of
                          each line is the logical device number; it must
                          contain two digits. The range of logical
                          device numbers is fixed for various types of
                          devices as shown in the following table.

Table 2-1.   Logical Device Number Assignments

Output Device	Logical Device Number Range
Monitor	01-10
Plotter	11-20
Printer	21-30

The device numbers you assign to the device drivers in your ASSIGN.SYS file must match those used in your GSX-86 graphics application program. As a general rule, assign 01 to your monitor, 11 to your plotter and 21 to your printer. However, this may vary depending on the GSX-86 application program you have.

Device Driver Filename

Following the logical device number is the filename of the device driver. See Section 4 for a list of device drivers and their filenames.

Syntax Rule

Each ASSIGN.SYS entry consists of a two-digit logical device number, a blank space, and a device driver filename.   If no filetype extension is specified after the device driver filename, GSX-86 assumes the filetype is SYS.

MODIFYING THE
ASSIGN.SYS FILE

Before GSX-86 can be used, you must ensure that the device drivers listed in the ASSIGN.SYS file are the correct ones for your computer system. Turn to the Device Driver Quick Reference Table in Section 4 and look up the device driver filename for each graphic output device connected to your computer. If the device driver filenames listed in the ASSIGN.SYS file do not match those listed in Section 4, you must modify the ASSIGN.SYS file before you use GSX-86.

To alter logical device numbers or device driver filenames in the ASSIGN.SYS file, use a text editor to edit the ASSIGN.SYS file. For editing instructions, see the user's guide for the editor you are using.

Follow these guidelines when you edit your ASSIGN.SYS file.
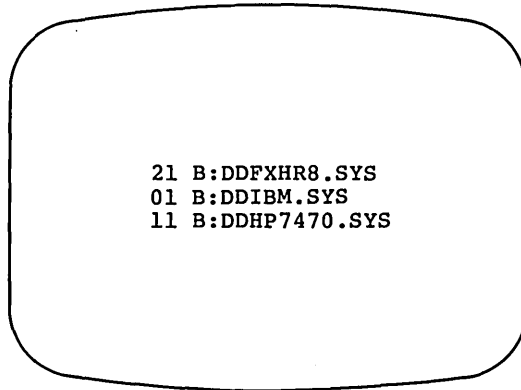
☐ Ensure that the largest device driver is listed first in your ASSIGN.SYS file. The device drivers are loaded into memory in the order listed in the ASSIGN.SYS file. Loading the largest device driver first ensures enough room is reserved for any of the other drivers in the ASSIGN.SYS file.

Typically, the device driver file used for your printer is the largest; the driver file for your plotter is the next largest; and the driver file for your monitor is the smallest. If in doubt, see your CP/M-86 Operating System User's Guide for the command used to determine the size of your files.

☐ If your disk does not have sufficient storage space for the ASSIGN.SYS file and the device driver files, you can put them on separate disks. If you do put your device driver files on a different disk than your ASSIGN.SYS file, you must modify the ASSIGN.SYS file to specify which drive contains the disk with the device driver files. This is done using the following format:

<Device Number> <Disk Drive>:<Filename>

For example, if the disk containing the ASSIGN.SYS file is in drive A and the disk containing the device driver files is in drive B, your ASSIGN.SYS file would look like the following:

```
21 B:DDFXHR8.SYS
01 B:DDIBM.SYS
11 B:DDHP7470.SYS
```

Figure 2-2.   Display of ASSIGN.SYS File in Drive B.

☐   You can include up to five device drivers in your ASSIGN.SYS file.

End of Section 2

Section 3
GSX-86 GRAPHICS MODE

INTRODUCTION

This section explains how to install GSX-86 before you use a graphic application program.

INSTALLING GSX-86

The GRAPHICS command installs GSX-86. Before you can use a graphic application program, you must load GSX-86 and the first device driver from your ASSIGN.SYS file into your computer's memory. Typing GRAPHICS loads both into memory.

After you start your system and receive the system prompt, type a command of the form:

<d>:GRAPHICS

The <d> symbol represents the letter of the drive in which the GSX-86 working disk is located.

For example, if you type

A>A:GRAPHICS

the computer searches drive A for the disk containing GRAPHICS.CMD and the ASSIGN.SYS file.

If you type

A>B:GRAPHICS

the system searches drive B for the disk containing GRAPHICS.CMD and the ASSIGN.SYS file.

If you type

B>GRAPHICS

without specifying a drive, the system searches the disk in the currently logged-in drive. The letter before the ">" prompt indicates which disk drive is currently logged in and being accessed. The B>GRAPHICS command tells the system to search drive B for the disk containing GRAPHICS.CMD and the ASSIGN.SYS file.

When you install GSX-86 correctly, you receive the message:

GSX-86 installed; <filename> is dddd bytes long at XXXX.0000

Here, <filename> is the filename of the first device driver in the ASSIGN.SYS file and dddd is its size, which you should note for making any changes to the ASSIGN.SYS file. For details on the ASSIGN.SYS file, see Section 2, Modifying The ASSIGN.SYS File.

DISABLING GSX-86   When you are not using graphics, you can disable GSX-86 by typing:

A>GRAPHICS NO

This command frees the memory space formerly used by GSX-86 and the device driver.

When you disable GSX-86 correctly, you receive
the message:

GSX-86 not installed

You might also receive this message if
something prevents you from installing GSX-86.

**WARM AND
COLD STARTS**

If you are running an application program and
you decide to terminate the run, you can
exit the program by

● Pressing both the CTRL key and C key at the
  same time. This is called a warm start of
  your computer and it will not disturb the
  GSX-86 installation.

● Restarting your computer by either turning it
  off and back on again, or pressing its reset
  button. This is called a cold start, which
  disables both CP/M-86 and GSX-86.   To
  reinstall GSX-86, you must reboot CP/M-86 or
  Concurrent CP/M-86 and reenter the GRAPHICS
  command.

ERROR MESSAGES

If you type the GRAPHICS command incorrectly,
what you originally typed appears on the screen
followed by a question mark (?).   If you
receive such a message, check the exact
command syntax and type the command again. If
you continue to receive this error message, use
the DIR command to list the contents of your
currently logged disk.   If the GRAPHICS.CMD
file is not on the disk, locate the correct
disk, insert it into the currently logged
drive, and reenter the GRAPHICS command.

If you make an error after entering GSX-86, an
error message appears on your screen. Refer to
Appendix A for a definition of the error
messages and the recommended action for
recovery.

OPERATION   ☐   Are the hardware components properly
CHECKLIST   attached to your computer?

                       ☐   Does the distribution disk contain the
                            files you need?

                       ☐   Did you duplicate the distribution disk
                            and store it safely away from heat,
                            extreme temperature changes, dust, and
                            humidity?

                       ☐   Is the disk containing GRAPHICS.CMD,
                            ASSIGN.SYS, and the correct device drivers
                            on the drive you specify in the GRAPHICS
                            command?

                       ☐   If you have your device drivers and your
                            ASSIGN.SYS file on a separate disk, does
                            your ASSIGN.SYS file specify which drive
                            contains the disk with your device
                            drivers?

                       ☐   Is the logical device number 01 assigned
                            to your monitor, 11 to the plotter, and 21
                            to the printer?

                       ☐   Is the largest device driver listed first
                            in the ASSIGN.SYS file?

                       ☐   Have you typed the GRAPHICS command to
                            load GSX-86 and the first driver into
                            memory?

                            End of Section 3

Section 4
DEVICE-SPECIFIC INFORMATION

INTRODUCTION   This section describes the graphics device
                       drivers available for GSX-86.

                       The first part of this section discusses the
                       printer drivers, the second part discusses the
                       HP 7470A plotter driver, and the third part
                       discusses the monitor drivers.

                       For quick reference of the device driver types
                       and the filenames associated with them, see the
                       table below.

Table 4-1. Device Driver Quick Reference Table

Printers	Filename	Device Number Range
Anadex ® DP-9501 and DP-9001A	DDANADXM.SYS	
Centronics 351, 352 and 353	DDCNTXM.SYS	
C.ITOH 8510A Low Resolution	DDCITOLR.SYS	
Datasouth DS180	DDDS180.SYS	
DEC ® LA50	DDLA50.SYS	
DEC LA100	DDLA100.SYS	21-30
Epson ® Low Resolution (8 bit)	DDFXLR8.SYS	
Epson High Resolution (8 bit)	DDFXHR8.SYS	
IDS Monochrome	DDIDSM.SYS	
OKIDATA Microline	DDOKI84.SYS	
Printronix ® MVP ™	DDPMVP.SYS	

Plotter	Filename	Device Number Range
HP 7470A	DDHP7470.SYS	11-20

Monitors	Filename	Device Number Range
IBM Color	DDIBMC.SYS	01-10
IBM Monochrome	DDIBM.SYS	

PRINTER DRIVERS

Introduction   The following information applies to all of the printer drivers listed in this section.

Device Number   The logical device numbers for printers range from 21 to 30. When you use only one printer, assign it device number 21.

Linestyle   The printers support six linestyles. Each linestyle is identified by an index number (see the following table). The driver uses linestyle 1, a solid line, when you specify a linestyle index number outside the 1-6 range.

Table 4-2. Printer Linestyles

Index	Linestyle
1	Solid
2	Short Dash
3	Dot
4	Dash-Dot
5	Long Dash
6	Dash-Dot-Dot

Markers   The printers support 12 marker sizes and 5 marker types.

● Marker sizes range from 7 to 84 pixels in height, in 7-pixel increments.

● Each marker type is identified by an index number (see the following table). The driver uses marker type 3 (*) when you specify a marker index number outside the 1-5 range.

Table 4-3. Printer Marker Sizes

Number	Marker
1	.
2	+
3	*
4	O
5	X

4-2

Text   The printers support 12 character sizes, from 7
                         to 84 pixels in height, in 7-pixel increments.
                         Text can be rotated in 90-degree increments.

Fill Area   The area in a polygon can be filled with a hatch
                         or halftone pattern.

Fill Styles   The printers support the following two fill
                         patterns.

Table 4-4. Printer Hatch Pattern

Index	Hatch Patterns
1	Vertical lines
2	Horizontal lines
3	+45 degree lines
4	-45 degree lines
5	Both vertical and horizontal crosshatch
6	Both 45 and -45 degree crosshatch
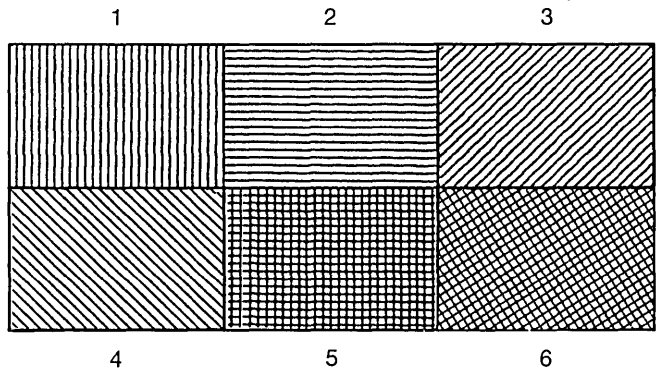
Figure 4-1. Printer Hatch Patterns

Halftone Patterns:

The printer drivers have six halftone fill
patterns that simulate six different levels of
the gray scale.
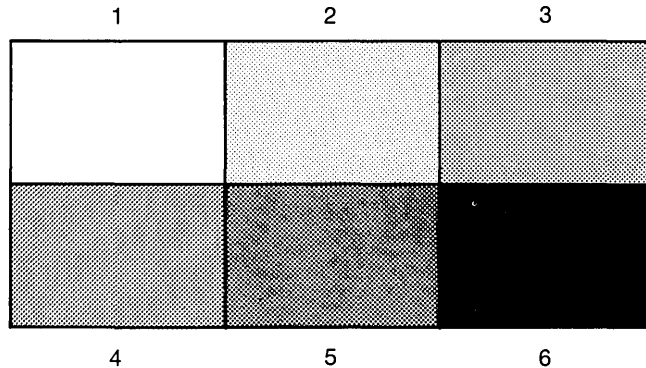
Figure 4-2.   Printer Halftone Patterns

Cell Array

Printers outline the cell array in the current
line color with a solid line.

**Generalized
Drawing
Primitives (GDPS)**

Printer Drivers support only the GSX-86 BAR GDP;
its identifier is 1.

Color

The MONOCHROME printers support two colors:

0 = White (background color)
1 = Black

All color indexes other than 0 are displayed as
index 1 (black).   You cannot redefine the
printer's color indexes with the GSX-86 Set
Color Representation function.

Escapes   The only escape function available on the
                               printer is the GSX-86 Inquire Addressable
                               Character Cells function; its identifier is 1.

Word Length   Computers communicate with printers using either
                               7 or 8 data bits for each transmitted
                               character. The number of data bits used for
                               each character is called the "word length."

                               If your computer is connected through a
                               parallel port to your printer, the word length
                               your printer uses is not important. However,
                               if your computer is connected to your printer
                               through a serial RS-232C port, you must
                               determine the word length used by both your
                               computer and your printer. The CONFIG command,
                               documented in your CP/M-86 or Concurrent CP/M-
                               86 for the IBM Personal Computer Operating
                               System manual, allows you to determine the
                               current word length used by your computer and,
                               if necessary, allows you to change it.   The
                               word length used by your printer should be
                               documented in your printer's hardware manual.
                               If your printer uses a word length of 7, your
                               computer and the printer driver you select must
                               also use a word length of 7.   If your printer
                               uses a word length of 8, your computer and the
                               selected printer driver must also use a word
                               length of 8.

Graphic Input   Printers do not support graphic input.

ANADEX PRINTERS:
       MODEL DP-9501
       MODEL DP-9001A

Filename   DDANADXM.SYS

Resolution   Horizontal: 75 dots per inch
                        Vertical: 72 dots per inch

Maximum Plot Size   8 x 9.5 inches (600 x 672 dots)

Word Length   7 bits per byte from the computer

CENTRONICS PRINTERS
          MODEL 351
          MODEL 352
          MODEL 353

Filename   DDCNTXM.SYS

Resolution   Horizontal: 66 dots per inch
                          Vertical: 72 dots per inch

Maximum Plot Size   8 x 9.5 inches (528 x 672 dots)

Word Length   7 bits per byte from the computer

C.ITOH MODEL 8510A PRINTER

Filename   DDCITOLR.SYS

Resolution   Horizontal: 136 dots per inch (17 cpi pitch)
                        Vertical: 72 dots per inch

Maximum Plot Size   8 x 9.5 inches (1088 x 672 dots)

Word Length   8 bits per byte from the computer.

DATASOUTH DS-180 PRINTER

Filename   DDDS180.SYS

Resolution   Horizontal: 75 dots per inch
                          Vertical: 72 dots per inch

Maximum Plot Size   8 x 9.5 inches (600 x 672 dots)

Word Length   7 bits per byte from the computer

DIGITAL EQUIPMENT CORPORATION LA50 PRINTER

Filename   DDLA50.SYS

Resolution   Horizontal: 144 dots per inch
                       Vertical: 72 dots per inch

Maximum Plot Size 8 x 9.5 inches (1152 x 672 dots)

Word Length   7 bits per byte from the computer

DIGITAL EQUIPMENT CORPORATION LA100 PRINTER

Filename   DDLA100.SYS

Resolution   Horizontal: 132 dots per inch
                        Vertical: 72 dots per inch

Maximum Plot Size   8 x 9.5 inches (1056 x 672 dots)

Word Length   7 bits per byte from the computer

EPSON PRINTERS:
    MX-80™ WITH GRAFTRAX PLUS™
    MX-100™
    FX-80™
    FX-100™

Introduction   Two drivers exist for the Epson printers. The
                          first supports low resolution graphics and the
                          second supports high resolution graphics.

                          The low resolution driver prints at over twice
                          the speed of the high resolution driver.
                          Generally, the low resolution driver is best
                          suited for draft output and the high resolution
                          driver for final copy.

Epson Low Resolution

Filename   DDFXLR8.SYS

Resolution   Horizontal: 60 dots per inch
                          Vertical: 72 dots per inch

Maximum Plot Size   8 x 9.5 inches (480 x 672 dots)

Word Length   8 bits per byte from the computer.

                          Note: When this driver is used for the FX-100
                          or the MX-100 printer, only the left eight
                          inches of the printer are used.

Epson High Resolution

Filename   DDFXHR8.SYS

Resolution   Horizontal: 120 dots per inch
                         Vertical: 144 dots per inch

Maximum Plot Size   8 x 9.5 inches (960 x 1368 dots)

Word Length   8 bits per byte from the computer.

                         Note: When this driver is used for the FX-100
                         or the MX-100 printer, only the left eight
                         inches of the printer are used.

INTEGRAL DATA SYSTEMS MONOCHROME PRINTERS:
        MICRO PRISM™ MODEL 480
        PRISM 80
        PRISM 132

Filename   DDIDSM.SYS

Resolution   Horizontal: 84 dots per inch
                        Vertical: 84 dots per inch

Maximum Plot Size   8 x 9.5 inches (672 x 800 dots)

Word Length   7 bits per byte from the computer

OKIDATA PRINTERS:
      MICROLINE 92
      MICROLINE 84 STEP 2

Filename   DDOKI84.SYS

Resolution   Horizontal: 103 dots per inch (17 cpi pitch)
                    Vertical: 72 dots per inch

Maximum Plot Size   8 x 9.5 inches (824 x 672 dots)

Word Length   7 bits per byte from the computer

PRINTRONIX MVP PRINTER

Filename   DDPMVP.SYS

Resolution   Horizontal: 60 dots per inch
                          Vertical: 75 dots per inch

Maximum Plot Size   8 x 8 inches (480 x 600 dots)

Word Length   7 bits per byte from the computer

PLOTTER DRIVER

HEWLETT-PACKARD ® 7470A GRAPHICS PLOTTER

Filename   DDHP7470.SYS

Device Number   Logical device numbers for plotters range from
                      11 to 20.   When you use only one plotter,
                      assign it device number 11.

Graphic Input   The pen holder is the graphic input device. The
                      initial position of the pen holder indicates to
                      your applications program the starting position
                      for the graphic image to be drawn. To move the
                      pen holder, press the arrow keys on the front
                      panel. When the pen holder is at the desired
                      location, press the ENTER button.   The
                      coordinates of the pen holder are then
                      transmitted to your applications program.

Text   The HP 7470A has continuous scaling of character
                      sizes.   Text can be rotated in one-degree
                      increments.

Linestyle   The plotter supports six linestyles.   Each
                      linestyle is identified by an index number (see
                      the following table).   The driver uses
                      linestyle 1, a solid line, when you specify a
                      linestyle index number outside the 1-6 range.

Table 4-5.   Plotter Linestyles

Index	Linestyle
1	Solid
2	Dot
3	Short Dash
4	Long Dash
5	Dash-Dot
6	Dash-Dot-Dot

Markers

The plotter supports five marker types.   Each marker type is identified by an index number (see the following table).   The driver uses marker 3 (*) when you specify a marker index number outside the 1-5 range.

Table 4-6.   Plotter Marker Sizes

Number	Marker
1	.
2	+
3	*
4	O
5	X

Color

The number of the pen, not the number of the pen holder, indicates the color.   This allows you to use more than two colors on the plotter.   By default, index 1 is held in pen holder 1 and index 2 is held in pen holder 2.   If you are using more than these two colors, your applications program will prompt you to insert the third colored pen in a pen holder and enter the pen holder number.   No limit exists for the number of pen indexes available on the plotter.

MONITOR DRIVERS

Introduction   The following information applies to all monitor
                      drivers listed in this section.

Device Number   The logical device numbers for monitors range
                      from 01 to 10. If you use only one monitor,
                      assign it device number 01.

Linestyle   The monitors support six linestyles. Each
                      linestyle is identified by an index number (see
                      the following table). The driver will use
                      linestyle 1, a solid line, when you specify a
                      linestyle index number outside the 1-6 range.

                      Table 4-7. Monitor Linestyles

Index	Linestyle
1	Solid
2	Short Dash
3	Dot
4	Dash-Dot
5	Long Dash
6	Dash-Dot-Dot

Markers   The monitors support 182 marker sizes and 5
                      marker types.

                      ● Marker sizes range from 8 to 190 pixels, in 1
                        pixel increments.

                      ● Each marker type is identified by an index
                        number (see list below). The driver will use
                        marker 3 (*) when you specify a marker index
                        number outside the 1-5 range.

Table 4-8. Monitor Marker Sizes

Number	Marker
1	.
2	+
3	*
4	O
5	X

Text   The IBM PC supports 182 character sizes from 8
                      to 190 pixels, in 1 pixel increments. Text can
                      be rotated in 90 degree increments.

Fill Area   The area within a polygon can be filled with a
                      hatch or halftone pattern.

Fill Styles   The monitors support the following two fill
                      patterns.

Table 4-9. Monitor Hatch Patterns

Index	Hatch Patterns
1	Vertical lines
2	Horizontal lines
3	+45 degree lines
4	-45 degree lines
5	Both vertical and horizontal crosshatch
6	Both 45 and -45 degree crosshatch

1   2   3

4   5   6
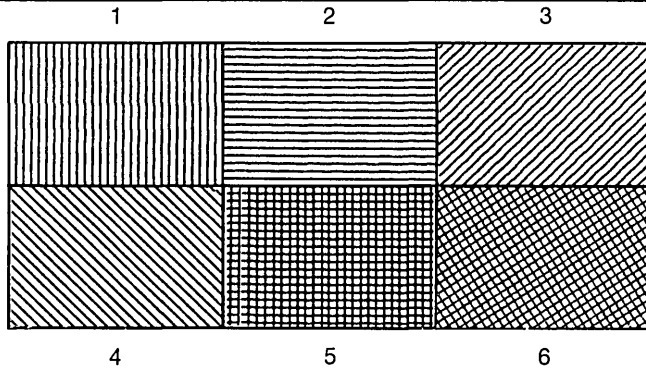
Figure 4-3.   Monitor Hatch Patterns

Halftone Patterns:

The monitor drivers have six halftone fill
patterns that simulate six different levels of
the gray scale.

1   2   3

4   5   6
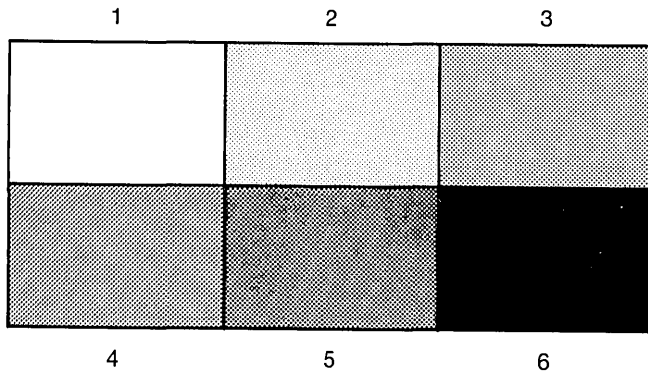
Figure 4-4.   Monitor Halftone Patterns

4-21

Generalized   Monitor drivers support the   GSX-86   BAR   GDP
Drawing   only; its identifier is 1.
Primitives (GDPS)

Escapes   All standard GSX-86 escapes are supported by the
                           monitor drivers.

Graphic Input   Some GSX-86 application programs require you to
                           select specific coordinates on your monitor
                           screen. GSX-86 allows you to move the graphic
                           cursor on the screen to a desired location and
                           input its coordinates to the application
                           program. When GSX-86 Graphic Input (GIN) is
                           invoked on the IBM PC, a graphic cursor
                           resembling a plus sign (+) appears on the
                           screen. You can move the graphic cursor up,
                           down, left, and right by pressing one of the 4
                           arrow keys on the numeric keypad at the right-
                           hand side of the keyboard. You can also move
                           the graphic cursor in 45 degree angles by
                           pressing the 7, 9, 1, and 3 keys on the numeric
                           keypad. Initially, the cursor moves in large
                           increments. Pressing the INS key changes the
                           distance between large and small movements.
                           When the cursor is at the desired location, you
                           can select the point by pressing any
                           alphanumeric key (other than return) on the
                           keyboard. This transmits the coordinates of
                           the point to the current program.

IBM PC (Medium Resolution Color)

Filename   DDIBMC.SYS

Resolution   Horizontal: 320 dots
                      Vertical: 200 dots

Color   The IBM PC in medium resolution color mode
                      supports four colors. The color indexes cannot
                      be redefined to other colors.   The default
                      association of color indexes with color is
                      listed in the following table.

Table 4-10.   IBM PC Color Index

Index	Color
0	Black
1	Red
2	Green
3	Yellow

IBM PC (High Resolution Monochrome)

Filename   DDIBM.SYS

Resolution   Horizontal: 640 dots
                          Vertical: 200 dots

Color   In high resolution monochrome mode, the IBM PC
                          supports only two colors: black and white.
                          Color indexes cannot be redefined. The default
                          association of color indexes with monochrome
                          intensity is listed in the following table.

                    Table 4-11.   IBM PC Monochrome Index

Index	Intensity	Color
0	0%	Black
1	100%	White

                    End of Section 4

Appendix A
GSX-86 ERROR MESSAGES

The following error messages might appear when you use GSX-86.

Table A-1. GSX-86 Error Messages

Message	Meaning
d:ASSIGN.SYS not found	The ASSIGN.SYS file cannot be found on the disk in the currently logged drive. Use the DIR command to list the contents of the disk. If the ASSIGN.SYS file is not on the disk, locate the disk containing the ASSIGN.SYS file; insert it into the drive; and type the GRAPHICS command.
d:ASSIGN.SYS syntax error	An entry in the ASSIGN.SYS file does not follow the syntax rule. The entry does not contain a two digit logical device number, a blank space, and a device driver filename. Edit the ASSIGN.SYS file and make the necessary corrections. Type the GRAPHICS command again.
d:ASSIGN.SYS close error	The system cannot find the file to close it. This sometimes happens when you exchange the disk that was previously in the drive with another disk. Insert the correct disk in the drive and try again.
d:ffffffff.SYS not found	One of the device driver files listed in the ASSIGN.SYS file is not on the working disk. Use the DIR command to list the contents of the working disk. Ensure that

Table A-1.   (continued)

Message	Meaning
	all of the device driver files listed in the ASSIGN.SYS file are present on the disk. If a device driver file listed in the ASSIGN.SYS file is on the working disk, copy the missing device driver file onto it.
d:ffffffff.SYS empty	
	The system found the specified device driver, but it contains no data. Delete the empty file from your working disk and recopy the original file from your duplicate disk to your working disk. For details, see Creating a Working Disk in Section 2.
d:ffffffff.SYS contains absolute segment	
	The specified device driver file attempted to address an absolute segment and it cannot be loaded. This is probably the result of a corrupted driver file. Recopy the original file from your duplicate disk to your working disk.
d:ffffffff.SYS close error	
	An error occurred when the system closed the specified file. This probably happened because you exchanged the disk that was previously in the drive with another disk. Insert the correct disk in the drive and try again.
d:ffffffff.SYS load error	
	An error occurred while the system was reading the device driver file. This occurs if you fail to list the largest device driver first in the ASSIGN.SYS file. Reedit the ASSIGN.SYS file and list the largest driver first.

Table A-1.   (continued)

Message	Meaning
Not enough memory for GSX-86	
	Your computer does not have enough memory for GSX-86 and the default device driver. Disable unnecessary programs to free memory or add more RAM memory to your system.

End of Appendix A

Appendix B
OPERATING GSX-86 WITH CONCURRENT CP/M-86

INTRODUCTION

Concurrent CP/M-86 allows you to simultaneously run multiple programs from four separate virtual consoles. However, when you use Concurrent CP/M-86 with GSX-86, the following restrictions exist.

USE OF RUN COMMAND

Note the version number on the label of your Concurrent CP/M disk.

● If you use GSX-86 with the 2.0 version of Concurrent CP/M, do not use the RUN command when you initiate your GSX-86 application programs. For example, to initiate DR GRAPH, type the command:

A>GRAPH

● If you use GSX-86 under the 1.0 or 1.1 version of Concurrent CP/M, use the RUN command when you initiate your GSX-86 application programs. For example, to initiate DR GRAPH, type the command:

A>RUN GRAPH

PLOTTER SUPPORT

When your computer is running the Concurrent CP/M-86 operating system, GSX-86 does not support the HP 7470A Plotter.

MONITOR CONNECTIONS

Before running your graphics application program on your IBM computer, you must have both the standard IBM PC monochrome monitor and a graphics monitor connected to your computer.

● Connect your graphics monitor to the output port of the Color/Graphics Monitor Adapter at the rear of your computer.

● Connect your monochrome monitor to the output port of the Monochrome Display/Printer Adapter at the rear of your computer.

USE WITH DR GRAPH   Although Concurrent CP/M-86 allows you to run multiple programs simultaneously, you can run only one DR Graph program at a time.

UNLOADING   GSX-86 is a system extension of the CP/M-86
OPERATING   and Concurrent CP/M-86 operating systems. If
SYSTEM   another system extension and GSX-86 are both
EXTENSIONS   loaded for concurrent operation, they must be
                     unloaded (or disabled) in the reverse order
                     that they were loaded. For example, if GSX-86
                     was loaded before the other system extension,
                     you would unload that system extension before
                     GSX-86.

End of Appendix B

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Date _____ First Edition: July 1983

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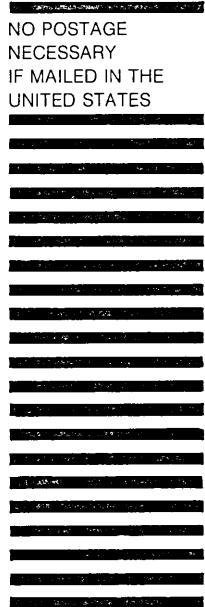
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