F. VAN GRICKEN

HEWLETT PACKARD

HP 7550 Plus Plotter

Computer Information

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HP 7550 Plus Plotter
Computer Information

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Many product updates and fixes do not require manual changes and, conversely, manual corrections may be done without accompanying product changes. Therefore, do not expect a one to one correspondence between product updates and manual revisions.

First Edition — April 1990

How to Use This Manual

This *Computer Information* manual contains all the information you should need to connect your plotter to a computer and plot graphics and text using a software package. The first three chapters contain the information needed to connect your plotter to most computers and configure your software package. Chapter 4 gives information on using buffers, spoolers, and peripheral sharing devices. Chapters 5, 6, and 7 contain technical specifications for the Centronics, RS-232-C, and HP-IB interfaces—including cable schematics.

You don't need to read this manual from cover-to-cover! Follow the steps in Chapters 1 or 2 to connect your plotter to the computer. Browse through Chapter 3 if you will be using a software package. Use Chapters 4 through 7 if you need further technical information. Here's what you'll find:

Chapter 1 **Establishing a Computer Interconnection** gives you general instructions on connecting your plotter to a computer with a Centronics, RS-232-C, or HP-IB interface.

Chapter 2 **Connecting Your Plotter to These Computers** gives you specific interconnection instructions for 17 popular computers.

Chapter 3 **Using Software with Your Plotter** explains what a plotter driver is and how to get one. It also gives hints for specific applications and what to do if you don't have a 7550 Plus driver.

Chapter 4 **Using Your Plotter with Peripheral Sharing Devices, Buffers, and Spoolers** tells you about these popular devices including how to decide if you need one and which one to buy. It also includes lists of devices tested by Hewlett-Packard.

Chapter 5 **Centronics Technical Information** includes pin assignments, handshake timing, and cable schematics.

Chapter 6 **RS-232-C Technical Information** includes an overview of the RS-232-C interface. It describes handshaking and selecting a handshake as well as providing pin allocations and cable schematics.

Chapter 7 **HP-IB Technical Information** explains normal and secondary command support. It also gives the supported bus commands and explains the addressing sequences.

Manual Terms and Conventions

Before reading this manual, you should understand the type styles and number representation used in the text.

BOLDFACE TYPE	Denotes buttons on the plotter's control panel, such as **Form Feed**. Also denotes an ASCII control character, such as **ESC**, or an escape command, such as **ESC&k3W**.
Numbers—12 345	Numbers are typed using SI (International System of Units) standards. Numbers with more than four digits are placed in groups of three—separated by a space instead of a comma—counting both to the left and right of the decimal point (e.g., 54 321.123 45).
RS-232-C	A serial interface. All references to RS-232-C interface in this manual apply equally to RS-232-C and CCITT V.24 interfaces. The term RS-232-C is used for simplicity.

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Chapter 3: Using Software with Your Plotter

1

Establishing a Computer Interconnection

This chapter deals with generic configurations and interface conditions and outlines the steps necessary to establish communication between a computer and the plotter. It describes the different ways equipment can be connected and discusses RS-232-C, Centronics, and HP-IB interface conditions.

Before You Begin

If you find your computer in the following list, skip to chapter 2 and follow the interconnection instructions for your computer.

Personal Computers (Compatible)
- Compaq Deskpro
- HP Vectra/Vectra ES/12
- HP RS/20
- IBM PC/PC-XT/AT
- IBM PS/2
- Olivetti M24

Apple Macintosh
Apple Macintosh Plus/SE/II
DEC VAX
HP 3000
HP 9000, Series 300 Technical Computer
HP 9000, Series 800 Technical Computer

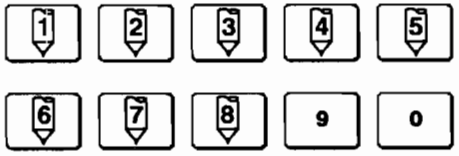
If your computer isn't listed, and it supports an RS-232-C, Centronics, or HP-IB interface, follow the interface instructions in this chapter, depending on which interface you are using. Additional technical RS-232-C, Centronics, and HP-IB interface information (including cable schematics) is contained in chapters 5, 6, and 7. Additionally, you can contact your HP Sales and Support Office to see if there is a *Set-Up Instruction* available for your particular computer.

Using the Menus

After selecting your interface and connecting the plotter to the computer, you must use the front panel to establish the interface parameters. The following is a quick review of using the front panel. If you need more detailed instructions, refer to the User's Guide.

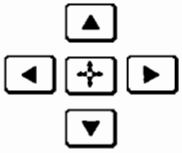
Pen Select Buttons

The **Pen Select** buttons retrieve pens from the carousel, and they designate the number of copies. Software normally selects pens for you, but sometimes you may want to use the **Pen Select** buttons.



Cursor Control Buttons

The **Cursor Control** buttons are used to move a pen after you select it. The pen moves in the direction of the arrow on the button.

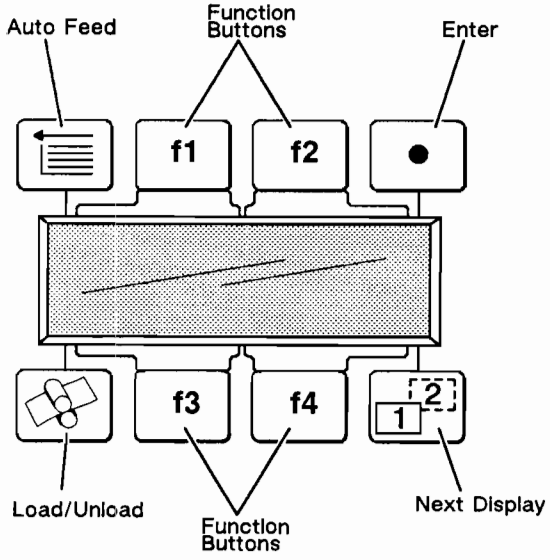


- Press one button to move in the direction of the arrow on the button.
- Press two adjacent buttons to move the pen at a 45-degree angle.
- Press the center button and an arrow button to move at maximum speed.

Menu Control Buttons

Plotter functions are usually controlled by software. However, you can use the menu control buttons to control these features yourself.

- **Auto Feed** — Selects the method of loading media: either manual or automatic.
- **Load/Unload** — In manual mode, loads and unloads media. In automatic mode, loads individual sheets from the loading tray.
- **Enter** — Stores menu selections.
- **Next Display** — Displays the next menu. To go to the previous menu, press **Enter** and then **Next Display**.
- **Function buttons** — Select menu options. Although not labeled on the plotter, they are numbered (**f1** through **f4**) in this book for clarity.

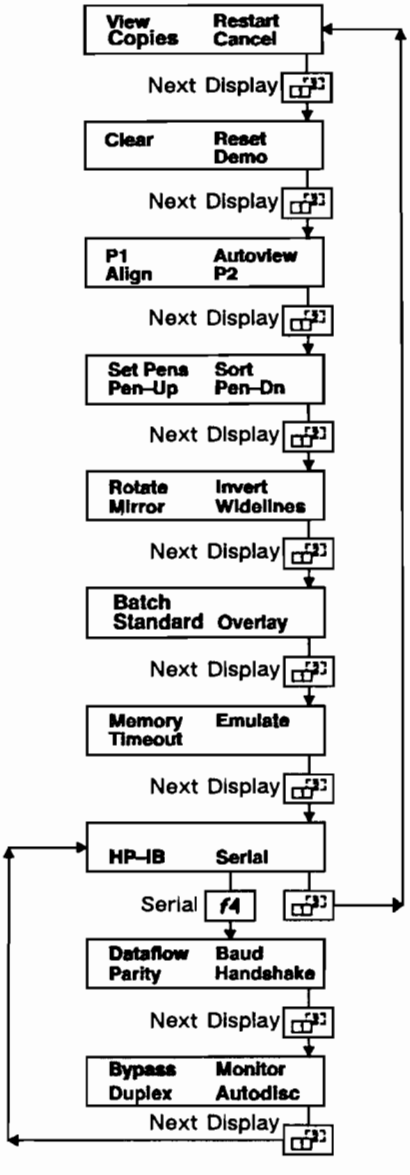


Moving Forward and Backward in the Menus

To go forward to the next menu, press **Next Display**. To go back to the previous menu, press **Enter** and then **Next Display**.

The Primary Menus

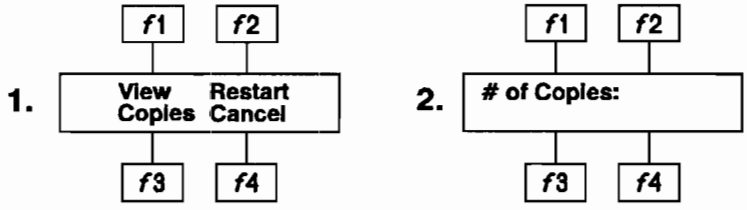
The diagram below shows the primary menus. Press **Next Display** to go to the next menu. Press **Enter (●)** and then **Next Display** to go to the previous menu.



NOTE: Highlighted options display only on the HP-IB/RS-232-C version.■

An Example of a Submenu

Pressing **Copies (f3)** displays a submenu that asks for the number of copies. Use the **Pen Select** buttons to enter the number of copies, then press **Enter (●)**.



Storing a Menu Selection

When you make a menu selection, the **Enter** symbol (●) flashes in the upper-right corner of the display. Press the **Enter (●)** button to store your selection.

NOTE: Although you can change menu settings while a plot is in progress, the plotter may not respond immediately.■

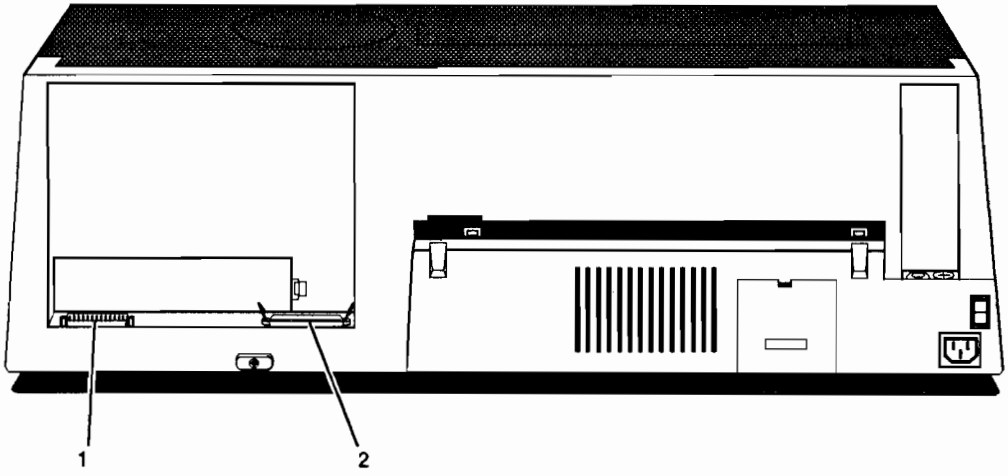
Identifying Your Interface

The 7550 Plus plotter has two versions: an RS-232-C and Centronics option and an RS-232-C and HP-IB option (including eavesdrop and RS-422-C capability). Use the following illustrations to determine what interface connector to use.

RS-232-C and Centronics Version

Your HP 7550 Plus plotter has a parallel (Centronics) and an RS-232-C (serial) interface. For the optimum data transmission speed, use the Centronics instead of the RS-232-C. Plug your interface cable into the appropriate connector.

NOTE: You cannot connect this plotter in an eavesdrop configuration or use RS-422-C.■

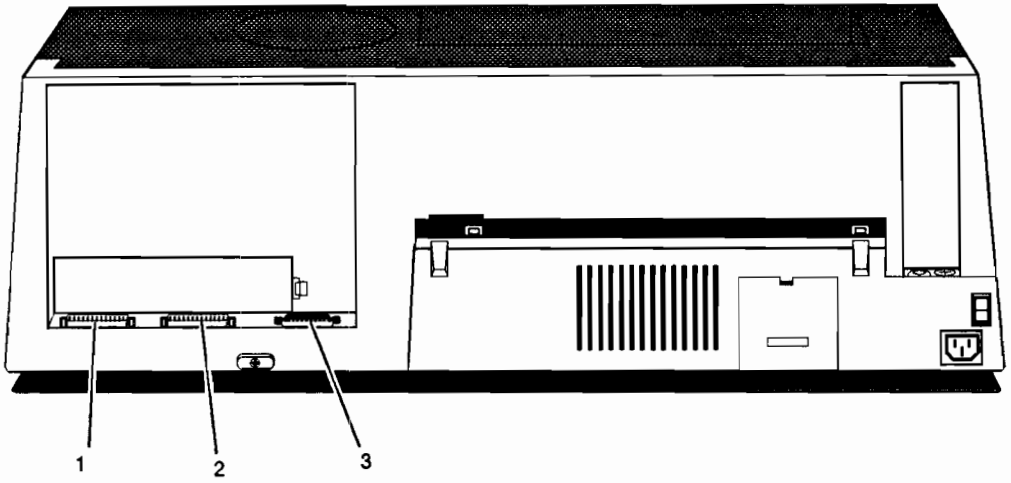


1 **Computer/Modem Port** — Accepts the RS-232-C/CCITT V.24 cable used to connect the plotter to a computer or modem (RS-232-C DCE I/F).

2 **Centronics (Parallel) Port** — Accepts the parallel interface cable used to connect the plotter to a computer.

RS-232-C and HP-IB Version

Your HP 7550 Plus plotter has a parallel (HP-IB), and two RS-232-C (serial) connectors. The two serial connectors allow you to connect your 7550 Plus in an eavesdrop configuration. For the optimum data transmission speed, use the HP-IB instead of the the RS-232-C. Plug your interface cable into the appropriate connector.



1 **Terminal Port** — Accepts the RS-232-C/CCITT V.24 cable used to connect the plotter to a terminal (RS-232-C DTE I/F).

2 **Computer/Modem Port** — Accepts the RS-232-C/CCITT V.24 cable used to connect the plotter to a computer or modem (RS-232-C DCE I/F). Also accepts RS-422-C cable.

3 **HP-IB Port** — Accepts the HP-IB (IEEE-488) interface cable used to connect the plotter to a computer.

Setting Up a Centronics Interconnection

Use this section to help you establish a Centronics interconnection between the plotter and your computer. Centronics is a type of *parallel* interfacing. This interface is the most widely used interface on personal computers because, unlike the RS-232-C serial interface, it usually does not require setup commands or special configurations on either the computer or plotter.

Setting up the Centronics interface is the easiest of the interfaces. You simply:

- Connect the equipment.
- Verify communication.

For Centronics pin allocations, cable schematics, and technical information, refer to chapter 5.

Connecting the Equipment

Once you have decided how to configure your equipment, connect the plotter to your computer.

With the plotter, your computer, and all of its components turned off, connect the end of the Centronics cable to the computer's Centronics port and tighten the screws. (To select a Centronics cable appropriate for your computer, refer to chapter 5.) Connect the other end of the cable to the plotter's Centronics connector. Latch the clips into place and turn your equipment on.

CAUTION

Many computer systems will have both Centronics and RS-232-C ports. These ports frequently appear identical. Make sure you plug your cable into the Centronics port (it should be labeled), or you might damage your plotter.

NOTE: In some cases, you may need to install a Centronics (parallel) interface card in the computer. If this is the case, your computer documentation should provide details.■

Verifying Communication

Verify that the plotter is turned on, pens and media are loaded, and **Auto Feed** is on. Then follow the instructions below.

RS-232-C Interface

Type the following at the DOS prompt and press **ENTER** (substitute COM2 for COM1 if necessary).

```
MODE COM1:9600,N,8,1,P          ENTER

MODE LPT1:=COM1                 ENTER
```

The first command sets the serial port to 9600 baud, no parity, 8 data bits, 1 stop bit, and continuous retry on all timeouts. The second command directs the primary plotter communication to the first serial port.

All Interfaces

Type the following and press **ENTER**. (For a parallel interface, substitute LPT1 or LPT2 for COM1; for an RS-232-C, substitute COM2 for COM1 when necessary.)

```
ECHO IN;SP1;PS5000,5000;PD0,1500,1500,1500,0,0;PG;>COM1

ECHO IN;SP1;PU0,0;PD1500,2000,3000,0,0,0;PG;>COM1
```

The plotter should draw a triangle and eject the media.

Setting Up an HP-IB (IEEE-488) Interconnection

The HP-IB is a parallel interface, also known as IEEE-488. The following steps outline the process used to connect the plotter to your computer. For more detailed information about how the plotter's HP-IB interface functions, refer to chapter 7.

1. **Connect the equipment.** With both computer and plotter turned off, connect one end of the HP-IB cable to the plotter's HP-IB port. Insert the other end of the cable into your computer's HP-IB port. Tighten the screws on both ends of the cable. Turn your equipment on.

2. **If you need a plotter address other than 05**, use the plotter's HP-IB menu to select a new address. (The plotter is set to an address of 05 at the factory.) If you need to change the address to work with your particular hardware or software, complete the steps described in the next section.

3. **Verify communication.** Use the appropriate read and write statements for your computer language to run the following program. This program instructs the plotter to print 7550B PLOTTER OK. If the program runs successfully, it means that the plotter and your computer are communicating.

```
"IN;OI;"
ID$
"SP1;PA500,500"
"LB"+ID$+" PLOTTER OK"+CHR(3)
"PA0,0;SP0;"
```

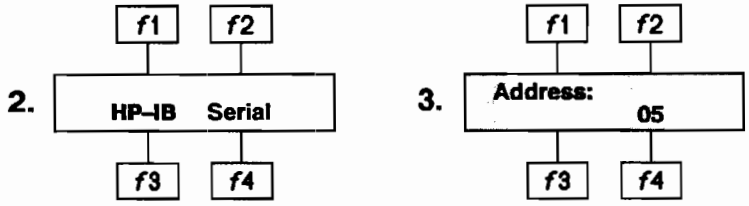
   The following example shows the same program, with BASIC read and write statements included. The first line of the program establishes interface conditions, and may vary based on your computer's requirements. If you are not sure how your computer reads data, check your computer documentation. For further examples of read and write statements for various computers, refer to the sample programs in Chapter 8.

```
10 OUTPUT 705;"IN;OI;"
20 ENTER 705;ID$
30 OUTPUT 705;"SP1;PA500,500;"
40 OUTPUT 705; "LB"+ID$+" PLOTTER OK"+CHR(3)
50 OUTPUT 705; "PA0,0;SP0;"
60 END
```

NOTE: The BASIC *CHR$(3)* string function returns the decimal code (3) for the ASCII character **ETX** Check your computer documentation for the proper string function to use.■

Selecting an Address

If you are using more than one peripheral with your computer, each must have a separate HP-IB address. Most systems use address 5 for the plotter; this is the plotter's factory-set address. To use an address other than 5, proceed as follows.



1. Press the **Next Display** button until **HP-IB** displays. Then, press **HP-IB** (**f3**) to view the address submenu.

2. Use **f3** and **f4** to cycle through the address options—**f4** increases the number and **f3** decreases the number. You can use any one of 31 different addresses, ranging from 0 through 30 plus **LISTEN ONLY**. Choose an address that is compatible with your computer and software. When the address you need displays, press the **Enter** button to store the setting in the plotter's continuous memory. (The setting will stay in memory until you change it, even if you turn the plotter off.)

   To exit without changing the setting, press the **Next Display** button.

If you select **LISTEN ONLY**, the plotter will listen to all data transmitted on the interface but cannot respond to computer inquiries. This mode is useful in a system that has no controller but, instead, has a dedicated talker (such as a magnetic tape driver or other mass storage unit) transmitting information to the plotter.

If your computer system uses languages such as BASIC, FORTRAN, or COBOL, with high-level input/output (I/O) statements, the addressing procedure is taken care of by the computer's internal operating system—all you need to do is select an address. If, however, your computer uses low-level I/O statements, you must directly control the addressing. If your computer systems fits this latter description, refer to "HP-IB Addressing Protocol", in chapter 7, for help.

Setting Up an RS-232-C Interconnection

Use this section to help you establish RS-232-C communication between the plotter and your computer. RS-232-C is also known as *serial* interfacing.

The following steps outline the process to connect the plotter to your computer.

- Identify system configuration.
- Connect the equipment.
- Set serial interface conditions from the front panel.
- Verify communication.

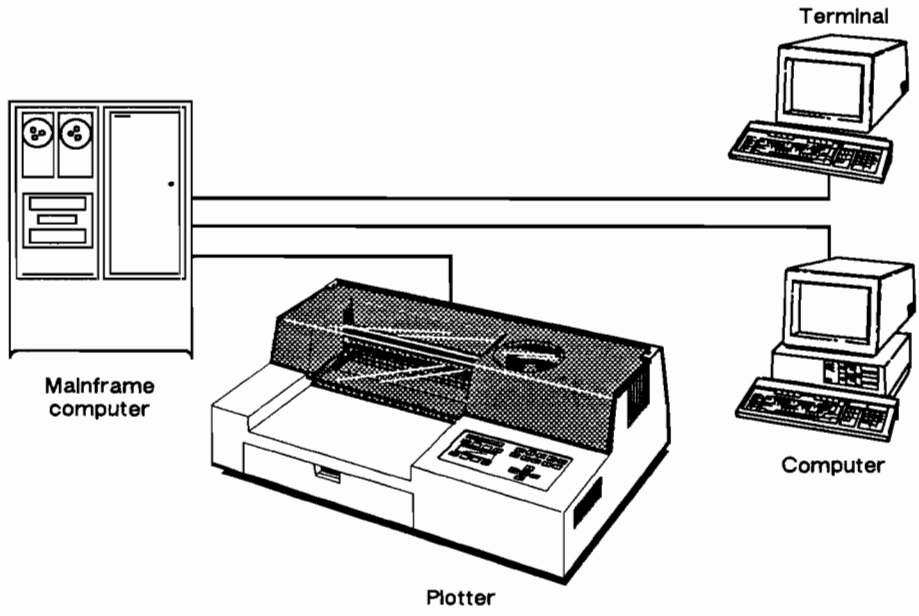
For RS-232-C pin allocations, cable schematics, and technical information, refer to chapter 6.

Identifying Your System Configuration

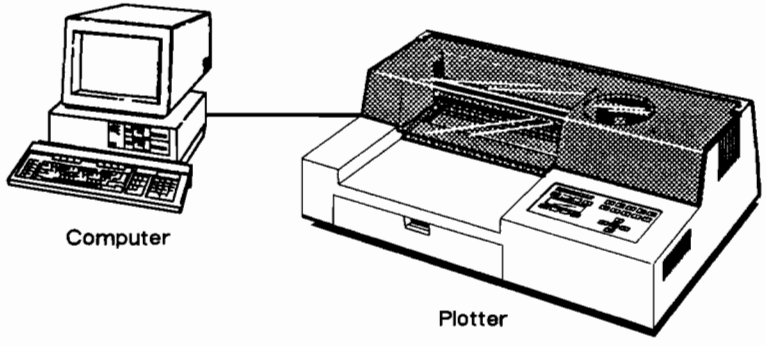
The term "system configuration" refers to the way the plotter is connected to the computer and other equipment. The plotter can be operated in a standalone or eavesdrop configuration. Read the following descriptions to identify your configuration, then read the section called "Connecting the Equipment" to learn how to connect the plotter to your computer.

Standalone Configuration

In a standalone configuration, the plotter is connected to the computer via a separate (not shared) interface cable. The following illustrations show this arrangement for mainframe computers and personal computers.



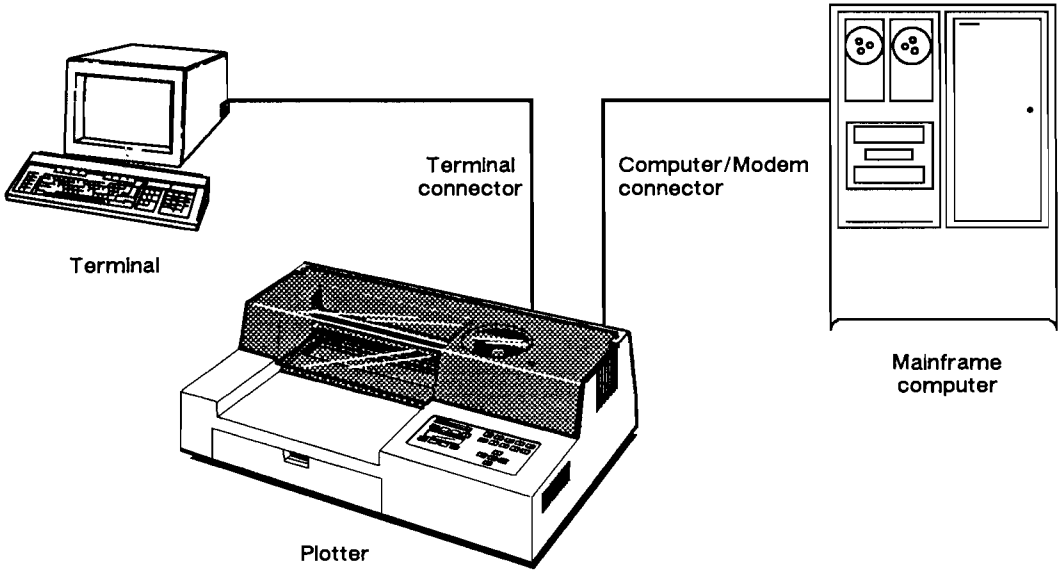
Standalone Configuration with Mainframe



Standalone Configuration with Personal Computer

Eavesdrop Configuration
(RS-232-C and HP-IB Version Only)

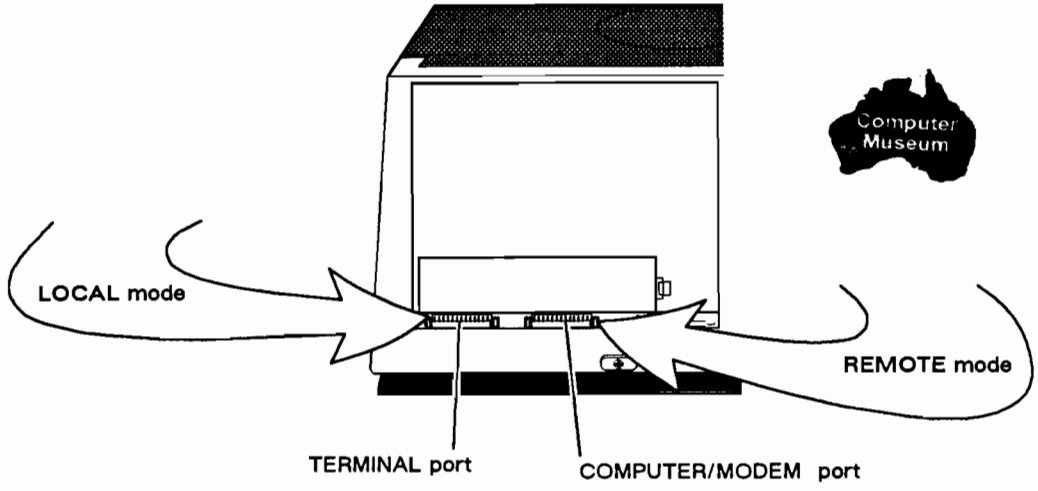
In an eavesdrop configuration, the plotter is connected between a mainframe computer and a terminal. All communications between the mainframe computer and the terminal actually pass through the plotter.



Eavesdrop Configuration

Remote and Local Operating Mode
(RS-232-C and HP-IB Version Only)

When you select an operating mode from the front panel, you are telling the plotter which of its RS-232-C ports will receive instructions from the computer or terminal. Refer to the following illustration.



When a terminal or any device emulating a terminal is connected to the **TERMINAL** port, set the plotter to **Local**.

Local is used primarily as an annotation and debugging tool, when using the plotter directly with a terminal. If you use **Local** and the **TERMINAL** port, you cannot use the hardwire handshake.

When a computer or modem is connected to the **COMPUTER/MODEM** port, set the plotter to **Remote**.

Use **Remote** and the **COMPUTER/MODEM** port if you need to use a hardwire handshake (most personal computers and software packages use hardwire handshake). **Remote** is also recommended for mainframe computers in a standalone or an eavesdrop configuration.

The following table summarizes the typical uses of each configuration.

	Eavesdrop	Standalone
Remote	Recommended for mainframe computers serving many terminals and peripherals connected in series. Conserves computer port usage. Modem or simulated modem applications.	Recommended for mainframe computers where the plotter is a shared resource connected to separate computer port. Also recommended for single-users, personal computer connection. Direct connections not using RS-232-C modem protocol.
Local	Sometimes used by mainframe computers serving many terminals and peripherals connected in series. Allows terminal to communicate with the plotter as if it were the modem.	Sometimes used by individual personal computer users.

Connecting the Equipment

Once you have decided how to configure your equipment, connect the plotter to your computer.

NOTE: If you have the RS-232-C/HP-IB version plotter and your computer can use the RS-422-A interface, you may want to use an RS-422-A cable. The advantage of the RS-422-A interface is that information can be transmitted over longer distances than with the RS-232-C interface.■

With the plotter, your computer, and all of its components turned off, connect one end of the RS-232-C cable to the computer's RS-232-C port. (To select an RS-232-C cable appropriate for your computer, refer to chapter 6.) Connect the other end of the cable to the plotter's RS-232-C connector. Tighten the screws on both ends of the cable and turn your equipment on.

NOTE: In some cases, you may need to install an RS-232-C (serial) interface card in the computer. If this is the case, your computer documentation should provide details.■

Determining RS-232-C Interface Conditions

After correctly connecting your plotter and computer, use the plotter's front panel to tell it which configuration you are using. Additionally, you must set the plotter to match your computer's baud rate and parity. *To work together, your plotter and computer must use the same settings.*

Check your system's documentation to determine which baud rate, parity, and handshake your computer uses. Then, write your computer's requirements in the table below, in the *Computer Requirement* column. This should help you determine if you need to change plotter settings. If you are using a software package, you may need to make adjustments later, according to the requirements of the software.

RS-232-C Interface Condition Checklist

Condition	Plotter Factory Settings	Computer Requirement
configuration*	REMOTE/STANDALONE**	**
baud rate	9600	_____
parity	0***	_____
handshake	Hardwire: ON	_____
	XON/XOFF: ON	_____

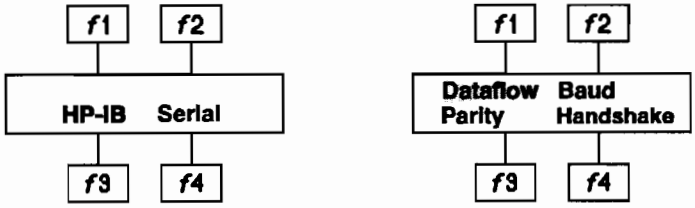
* The name for the plotter's configuration menu is **Dataflow.**
** This condition is not something you'll need to set on the computer, but your potter's **Dataflow** menu setting must reflect the way you have configured your equipment.
*** This sets parity to off, the parity bit set to 0. (Also known as space parity.)

NOTE: The plotter generates 1 stop bit when set to a baud rate of 150 or greater; it generates 2 stop bits when set to a baud rate less than 150. Most computers also use 1 stop bit as a default or at high baud rates and will not need to be reset.■

The following section explains how to use the plotter's menus to change interface settings. The subsequent sections list the full range of plotter capabilities for each menu item.

Using the Serial Menus to Set Interface Conditions

Complete the following steps to use the plotter's serial menus.



NOTE: Highlighted options display only on the HP-IB/RS-232-C version.■

1. Press the **Next Display** button until the **Serial** menu displays. Then, press **Serial (f4)** to display the **Dataflow** menu.

2. To access each of the four features—**Dataflow** (for configuration options), **Baud, Parity,** and **Handshake**—press the associated function button.

3. Press the **Enter** button when the setting you need displays, to store the selection. All settings except **REMOTE, LOCAL,** and **STANDBY** are stored in continuous memory.

   To exit, press the **Next Display** button *twice.*

The full range of the serial options is discussed on the following pages. Read the sections pertaining to the settings you need to change.

Setting Your Plotter's Configuration—Dataflow

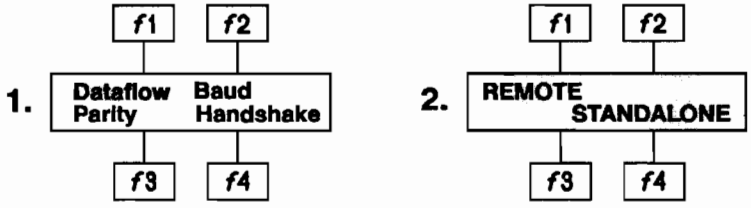
USE: Use **Dataflow** to tell your plotter what configuration you are using.

DEFAULT: REMOTE/STANDALONE

OPTIONS:

Configuration Options	Operating Modes
REMOTE LOCAL STANDBY	STANDALONE EAVESDROP

EXPLANATION: Complete the following steps to set configuration.



NOTE: Highlighted options display only on the HP-IB/RS-232-C version.■

1. Press **Dataflow** (**f1**) to display the **Dataflow** submenu.

2. Use the **Dataflow** menu to set two options; configuration and operating mode. Press **f1** to view each of the configuration options (**REMOTE, LOCAL,** and **STANDBY**). Then, press **f4** to view each of the operating mode options (**STANDALONE** and **EAVESDROP**).

3. Press the **Enter** button when both the desired configuration and operating mode are displayed, to store the selection. All selections except **REMOTE, LOCAL** and **STANDBY** are stored in the plotter's continuous memory.

   To exit without changing the values, press the **Next Display** button.

Refer to the preceding section for an explanation of remote, local, eavesdrop, and standalone. Standby mode is a useful tool for locating data communication or interfacing problems when in an eavesdrop configuration. In standby mode, the plotter ignores all information received from both the **COMPUTER/MODEM** and **TERMINAL** ports. If you suspect that the plotter is interfering with the information you are sending between the computer and terminal, standby mode lets you "unhook" the plotter temporarily—without disconnecting cables or interfering with data transmission between the computer and terminal. Since standby is a temporary tool, it cannot be stored in the plotter's continuous memory.

Setting the Baud Rate

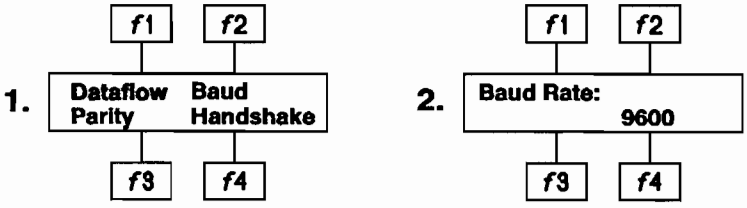
USE: Use **Baud** to set your plotter to the same baud rate that your computer uses.

DEFAULT: 9600

OPTIONS:

Baud Rate Settings
75
150
300
600
1200
2400
4800
9600
19200
External

EXPLANATION: Complete the following steps to select a baud rate.



NOTE: Highlighted options display only on the HP-IB/RS-232-C version.■

1. Press **Baud**, (**f2**) to display the baud rate submenu.
2. Use **f3** and **f4** to cycle through the baud options—**f4** increases the number and **f3** decreases the number.
3. Press the **Enter** button when the option you want displays, to store the setting in continuous memory. (The setting will remain in memory until you change it, even if you turn the plotter off.)

   To exit without changing the baud rate, press the **Next Display** button.

Setting the Parity

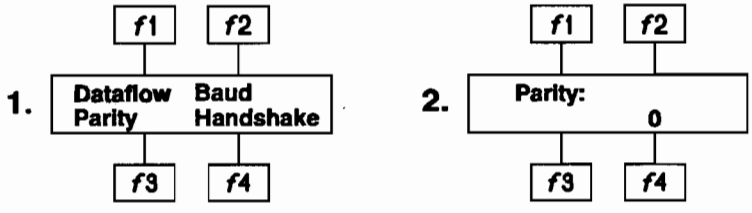
USE: Use **Parity** to set your plotter to the same parity that your computer uses.

DEFAULT: 0 (Off, parity bit 0)

OPTIONS: 0, 1, EVEN, ODD

NOTE: If your software uses higher bits from the symbol sets or 8-bit character sets (e.g., ISO sets), it will require NO (0 or space) parity as the 8th bit must be available for data.■

EXPLANATION: Complete the following steps to select a parity.



NOTE: Highlighted options display only on the HP-IB/RS-232-C version.■

1. Press **Parity** (**f3**) to display the **Parity** submenu.
2. Press **f4** to cycle through the parity options. Press **f2** to view the previous option.
3. Press the **Enter** button when the option you want displays, to store the setting in continuous memory. (The setting will be stored in memory until you change it, even if you turn the plotter off.)

   To exit without changing the setting, press the **Next Display** button.

Setting parity to 0 sets the parity to off, parity bit 0 (also known as space parity). Setting parity to 1 sets the parity to off, parity bit 1 (also known as mark parity). If your computer requires parity, set the parity to ODD or EVEN, according to your computer's requirements.

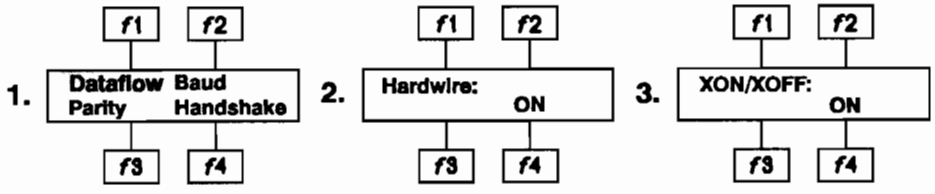
Selecting a Handshake

USE: Use **Handshake** to select a handshake. Select a handshake setting that is compatible with your computer and software package.

DEFAULT: ON

OPTIONS: ON, OFF

EXPLANATION: Complete the following steps to turn hardwire and Xon/Xoff handshake on or off.



NOTE: Highlighted options display only on the HP-IB/RS-232-C version.■

1. Press **Handshake** (**f4**) to display the **Handshake** submenu.
2. Press **f4** to toggle **Hardwire** on and off. Press the **Enter** button when the option you want is displayed, to store the setting in continuous memory.

   To exit without changing the setting, press the **Next Display** button. The **XON/XOFF** submenu displays when you exit the **Hardwire** submenu.
3. Press **f4** to toggle **XON/XOFF** on and off.
4. Press the **Enter** button when the option you want is displayed, to store the setting in continuous memory. (The setting will be stored in memory until you change it, even if you turn the plotter off.)

Since the plotter's handshake must be compatible with the computer's handshake, check your system documentation for a handshake recommendation. (Most personal computers use hardwire handshake.) To use hardwire handshake, set the plotter to **Hardwire: ON**.

In addition to hardwire and Xon/Xoff handshakes, the plotter can use the enquire/acknowledge handshake, and a software checking handshake. If your computer supports one of these handshakes, set the plotter to **Hardwire: OFF**. Use **Hardwire: OFF** if your software controls the handshake or if you are using a modem. To set up an Enquire-Acknowledge or software checking handshake programmatically, refer to appendix A for the programming instructions you'll need.

Verifying Communication

Verify that the plotter is turned on, pens and media are loaded, and **Auto Feed** is on. Then follow the instructions below.

Using DOS

Type the following at the DOS prompt and press **ENTER** (substitute COM2 for COM1 if necessary).

```
MODE COM1:9600,N,8,1,P          ENTER

MODE LPT1:=COM1                 ENTER
```

The first command sets the serial port to 9600 baud, no parity, 8 data bits, 1 stop bit, and continuous retry on all timeouts. The second command directs the primary plotter communication to the first serial port.

Type the following and press **ENTER**.

```
ECHO IN;SP1;PS5000,5000;PD0,1500,1500,1500,0,0;PG;>COM1
```

The plotter should draw a triangle and eject the media.

Using BASIC

This program instructs the plotter to print 7550B PLOTTER OK (or 7550A PLOTTER OK, depending on the emulation mode setting). The first line of the program establishes interface conditions and may vary based on your computer's requirements. If you are not sure how your computer reads in data, check your computer documentation.

```
10 OPEN "COM1:9600,N,8,1,RS,CS65535,DS,CD" AS #1
20 PRINT #1, "IN;OI;"
30 INPUT #1, ID$
40 PRINT #1, "SP1;PA500,500;"
50 PRINT #1, "LB"+ID$+" PLOTTER OK"+CHR$(3)
60 PRINT #1, "PA0,0;SP0;"
70 END
```

In Eavesdrop mode add the following two lines.

```
15 PRINT #1, CHR$(27)+".("
16 PRINT #1, CHR$(27)+".M;;;"+CHR$(13)+";"+CHR$(10)=":"
```

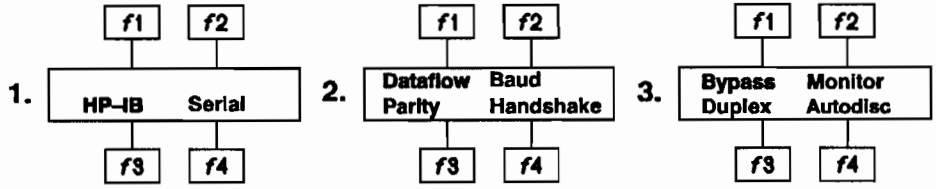
NOTE: The BASIC CHR$(3) string function sends the decimal code 3 for the ASCII character ETX. Check your computer documentation for the proper string function to use.■

Using Advanced Features

The remainder of this chapter is designed to help you perform the following tasks.

- use debugging tools to diagnose communication problems between the plotter and your computer
- select a duplex setting
- use a modem with the plotter

In order to perform these tasks, you'll need to use the appropriate menus, as explained below.



NOTE: Highlighted options display only on the HP-IB/RS-232-C version.■

1. Press the **Next Display** button until **Serial** displays. Then, press **Serial (f4)**.
2. Press the **Next Display** button.
3. The advanced menu has four options: **Bypass, Monitor, Duplex,** and **Autodisc.** Press the function button associated with the menu you want to view.

   To leave the menu completely and display menu 1, press the **Next Display** button two times.

Each of the advanced features is discussed on the following pages. Read the sections pertaining to the settings you need to change.

Controlling Data Transfer
(RS-232-C and HP-IB Version Only)

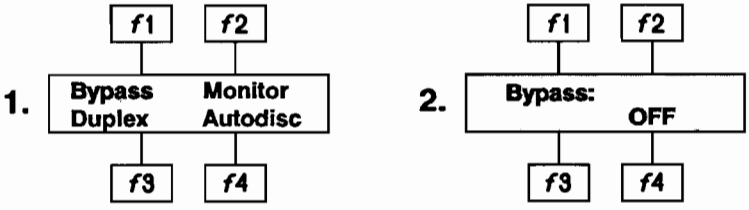
USE: In an RS-232-C *eavesdrop* configuration, you can use **Bypass** to control when the plotter receives data.

DEFAULT: OFF

OPTIONS: OFF, ON

EXPLANATION: When you set **EAVESDROP**, **Bypass** is automatically set on. In most cases, you can use **EAVESDROP** without changing the setting of **Bypass.**

Complete the following steps to use Bypass.



NOTE: Highlighted options display only on the HP-IB/RS-232-C version.■

1. Press **Bypass** (**f1**) to display the **Bypass** submenu.
2. Press **f4** to view each of the **Bypass** options.
3. Press the **Enter** button when the options you want display. Since bypass is used as a temporary tool, you cannot store a bypass setting in continuous memory.

   To exit without changing the setting, press the **Next Display** button.

When you activate **EAVESDROP**, **Bypass** is automatically set on. When **Bypass** is on, the computer and terminal can communicate. When **Bypass** is off, the computer and plotter can communicate. When you turn **EAVESDROP** off (by activating **STANDALONE**), **Bypass** is automatically turned off.

For normal plotting in an eavesdrop configuration, leave bypass on. The computer and terminal will communicate until the plotter receives a plotter-on instruction, **ESC.**(or **ESC.**Y. If you are writing your own programs, they must contain the plotter-on instruction. (If you are using a software package designed for use with plotters, the plotter-on instruction will be taken care of by the software.) The plotter-on instruction turns bypass off, allowing the computer to send plotting instructions to the plotter.

When the computer is finished sending data to the plotter, bypass should be set on again by a plotter-off instruction, **ESC.**) or **ESC.Z**. (Software packages will do this automatically.) Refer to appendix C in the User's Guide for an explanation of plotter-on and plotter-off instructions (device control instructions) and their syntax.

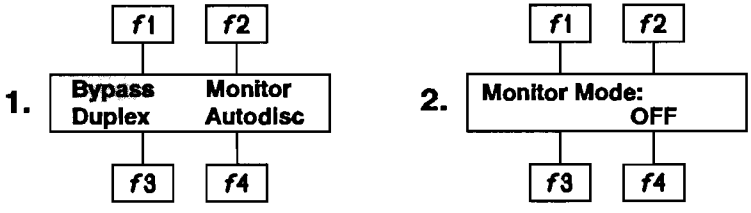
Detecting Communication Problems

USE: Use **Monitor** to evaluate plot files.

DEFAULT: OFF

OPTIONS: OFF, PARSE MODE, RECEIVE MODE

EXPLANATION: Complete the following steps to use **Monitor.**



NOTE: Highlighted options display only on the HP-IB/RS-232-C version.■

1. Press **Monitor** (**f2**) to display the **Monitor** submenu.
2. Press **f4** to display each of the **Monitor** options.
3. Press the **Enter** button when the option you want displays, to activate the mode. Since monitor is used as a temporary tool, you cannot store **PARSE MODE** or **RECEIVE MODE** in continuous memory.

   To exit without changing the setting, press the **Next Display** button.

Leave monitor mode off for normal plotting. If you are writing your own programs, set monitor mode to **PARSE MODE** or **RECEIVE MODE** for debugging. Both modes are explained below.

In both parse mode and receive mode, HP-GL (or HP-GL/2) and device-control instructions sent to the plotter are retransmitted to the terminal and displayed on the CRT screen.

In parse mode, instructions are displayed *as they are executed*. Device-control instructions are always executed immediately whereas HP-GL (or HP-GL/2) instructions go into the plotter's buffer before being executed. Therefore, device-control instructions may be displayed on the terminal before HP-GL (or HP-GL/2) instructions *even if they were sent after the HP-GL* (or HP-GL/2) *instructions*.

In receive mode instructions are displayed as they are received, allowing you to confirm that the plotter is receiving the instructions you send it intact.

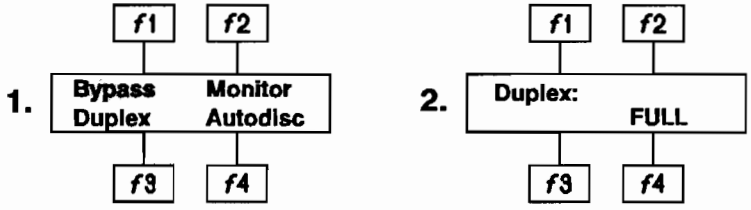
Setting Duplex

USE: If you are using the plotter in **LOCAL** mode with a terminal or have **Monitor on,** use **Duplex** to have your plotter use the duplex needed by your terminal.

DEFAULT: FULL

OPTIONS: FULL, HALF

EXPLANATION: Complete the following steps to select a duplex.



NOTE: Highlighted options display only on the HP-IB/RS-232-C version.■

1. Press **Duplex** (**f3**) to display the **Duplex** submenu.
2. Press **f4** to display each **Duplex** option.
3. Press the **Enter** button when the option you want displays, to store the setting in continuous memory. (The setting will be stored in until you change it, even if you turn the plotter off.)

   To exit without changing the setting, press the **Next Display** button.

If you are using the plotter in **LOCAL** mode, set the plotter's duplex to match the requirements of your terminal.

Set the plotter to **Duplex: FULL** if your terminal's local echo is off. This will cause the plotter to echo all data it receives from the terminal back to the terminal.

Set the plotter to **Duplex: HALF** if your terminal's local echo is on. This will prevent the plotter from echoing data it receives from the terminal back to the terminal.

If you set the duplex incorrectly, you will either see two characters displayed on your terminal for every one typed, or none. Correct the problem by resetting the duplex.

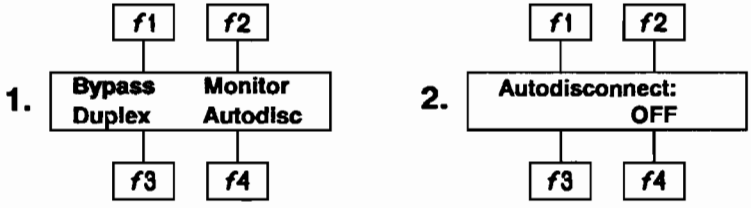
Using a Modem with the Plotter

USE: If you are using a modem with the plotter, use **Autodisc** (automatic disconnect) to access several modem features.

DEFAULT: OFF

OPTIONS: OFF, SWITCHED DATEX, LEASED LINE

EXPLANATION: Complete the following steps to access the **Autodisc** submenu.



NOTE: Highlighted options display only on the HP-IB/RS-232-C version.■

1. Press **Autodisc (f4)** to display the **Autodisconnect** submenu.
2. Press **f4** to view each **Autodisconnect** option.
3. Press the **Enter** button when the option you want displays, to store the setting in continuous memory. (The setting will be stored in memory until you change it, even if you turn the plotter off.)

   To exit without changing the setting, press the **Next Display** button.

NOTE: When using a modem with the plotter, confirm that the baud rate reflects the requirements of the computer, modem, plotter, and terminal. ■

The **SWITCHED DATEX** and **LEASED LINE** settings allow you to automatically disconnect the modem at the end of any session conducted over phone lines. They are useful when no one is present to manually hang up the phone. These settings are most frequently used in Europe. Leave **Autodisconnect** off if you do not need this feature.

When set to **SWITCHED DATEX**, the plotter uses the CTS and DSR lines to control the DTR line and bypass function. As long as the control lines are high, the DTR line is high and the plotter is able to receive information (is set to **Bypass: OFF**). If any of the controlling lines goes low, the DTR line is also low; the plotter cannot receive information (switches to **Bypass: ON**), and the modem is automatically disconnected.

When set to **LEASED LINE**, the plotter uses the CTS, DSR, and DCD lines to control the DTR line and bypass. As long as the control lines are high, the DTR line is high, and the plotter is able to receive information (is set to **Bypass: OFF**). If any of the controlling lines goes low, the DTR line is set low, the plotter cannot receive information (switches to **Bypass: ON**), and the modem is automatically disconnected.

2

Connecting Your Plotter to These Computers

Your plotter will work with most computers. This chapter tells you how to connect it to one of the computers in the following list. If your computer is not in this list, refer to chapter 1.

- Personal Computers (Compatible)
  - Compaq Deskpro
  - HP Vectra/Vectra ES/12
  - HP Vectra RS/20
  - IBM PC/PC-XT/AT
  - IBM PS/2
  - Olivetti M24
- Apple Macintosh
- Apple Macintosh Plus/SE/II
- DEC VAX
- HP 3000
- HP 9000, Series 300 Technical Computer
- HP 9000, Series 800 Technical Computer

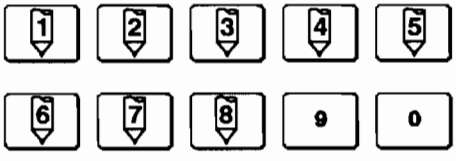
Refer to appendix B of the User's Guide for cable ordering information. Additional technical RS-232-C, Centronics, and HP-IB interface information (including cable schematics) is contained in chapters 5, 6, and 7.

Using the Menus

After selecting your interface and connecting the plotter to the computer, you must use the front panel to establish the interface parameters. The following is a quick review of using the front panel. If you need more detailed instructions, refer to the User's Guide.

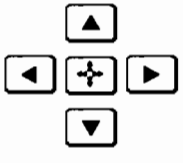
Pen Select Buttons

The **Pen Select** buttons retrieve pens from the carousel, and they designate the number of copies. Software normally selects pens for you, but sometimes you may want to use the **Pen Select** buttons.



Cursor Control Buttons

The **Cursor Control** buttons are used to move a pen after you select it. The pen moves in the direction of the arrow on the button.

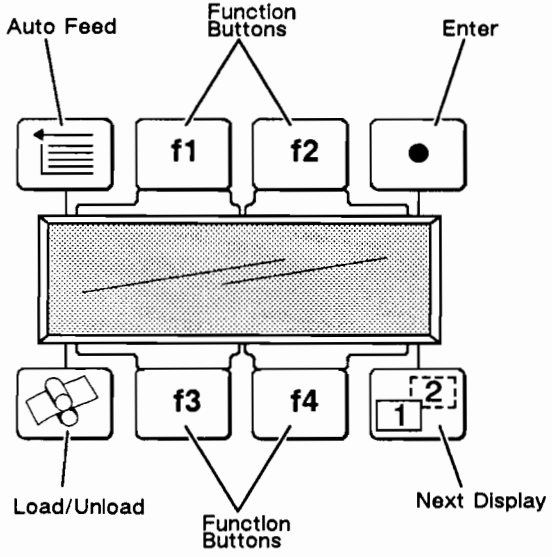


- Press one button to move in the direction of the arrow on the button.
- Press two adjacent buttons to move the pen at a 45-degree angle.
- Press the center button and an arrow button to move at maximum speed.

Menu Control Buttons

Plotter functions are usually controlled by software. However, you can use the menu control buttons to control features yourself.

- **Auto Feed** — Selects the method of loading media: either manual or automatic.
- **Load/Unload** — In manual mode, loads and unloads media. In automatic mode, loads individual sheets from the loading tray.
- **Enter** — Stores menu selections.
- **Next Display** — Displays the next menu. To go to the previous menu, press **Enter** and then **Next Display**.
- **Function buttons** — Select menu options. Although not labeled on the plotter, they are numbered (**f1** through **f4**) in this book for clarity.

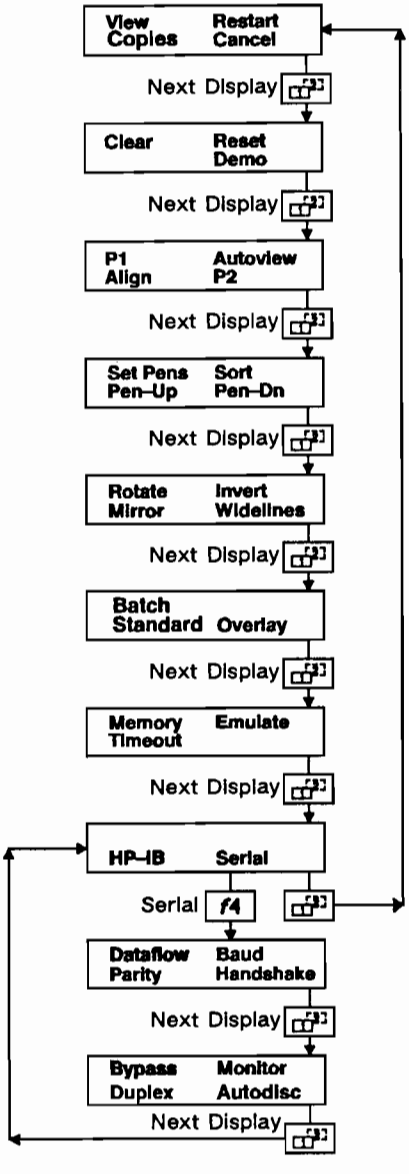


Moving Forward and Backward in the Menus

To go forward to the next menu, press **Next Display**. To go back to the previous menu, press **Enter** and then **Next Display**.

The Primary Menus

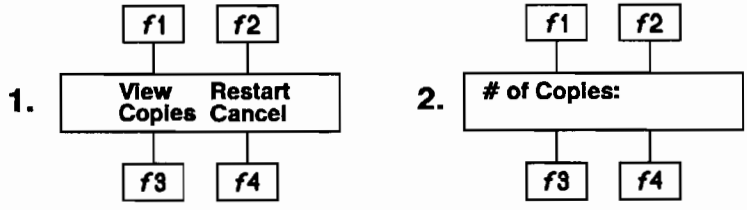
The diagram below shows the primary menus. Press **Next Display** to go to the next menu. Press **Enter** (●) and then **Next Display** to go to the previous menu.



NOTE: Highlighted options display only on the HP-IB/RS-232-C version.■

An Example of a Submenu

Pressing **Copies (f3)** displays a submenu that asks for the number of copies. Use the **Pen Select** buttons to enter the number of copies, then press **Enter** (●).



Storing a Menu Selection

When you make a menu selection, the **Enter** symbol (●) flashes in the upper-right corner of the display. Press the **Enter** (●) button to store your selection.

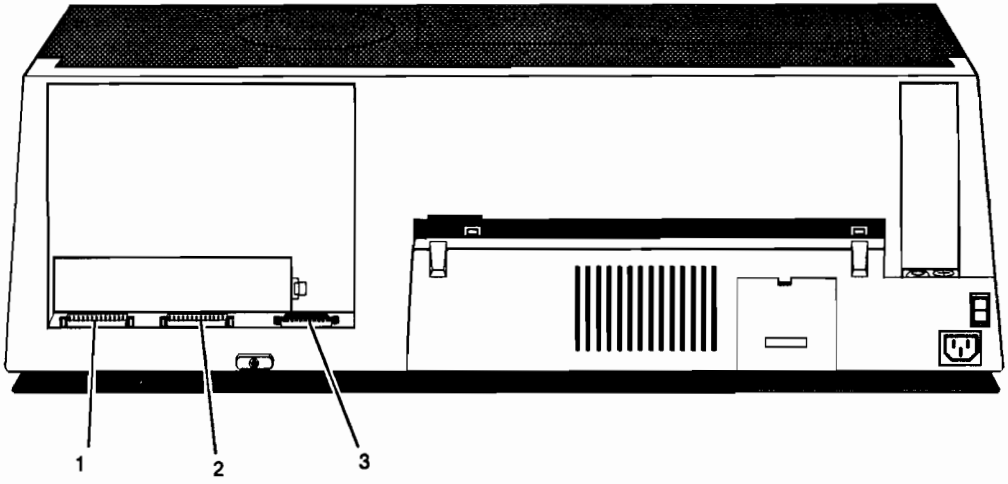
NOTE: Although you can change menu settings while a plot is in progress, the plotter may not respond immediately.■

Identifying Your Interface

Use the following illustrations to determine what interface connector to use.

RS-232-C and HP-IB

Your HP 7550 Plus plotter has a parallel (HP-IB), and two RS-232-C (serial) connectors. The two serial connectors allow you to connect your 7550 Plus in an eavesdrop configuration. For the optimum data transmission speed, use the HP-IB instead of the the RS-232-C. Plug your interface cable into the appropriate connector.



1 **Terminal Port** — Accepts the RS-232-C/CCITT V.24 cable used to connect the plotter to a terminal or RS-232-C DTE I/F.

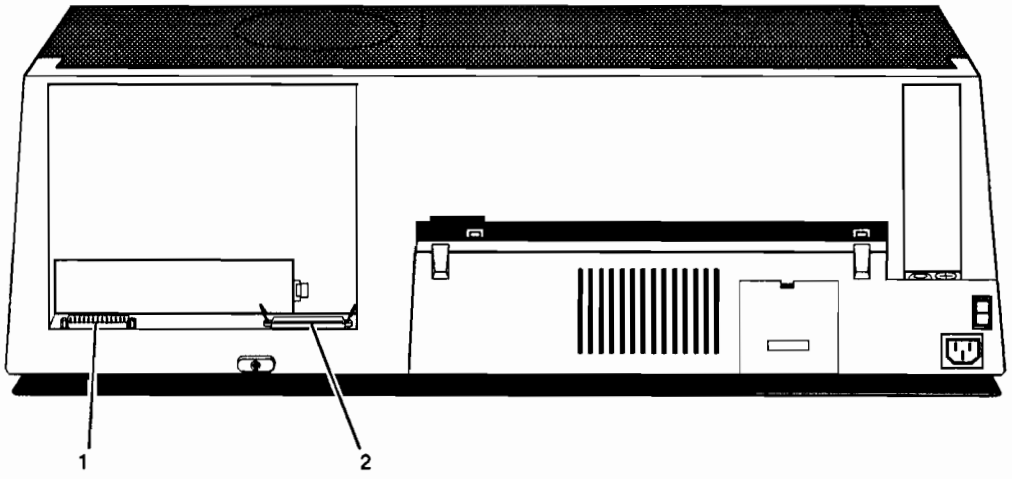
2 **Computer/Modem Port** — Accepts the RS-232-C/CCITT V.24 cable used to connect the plotter to a computer, modem, or RS-232-C DCE I/F.

3 **HP-IB Port** — Accepts the HP-IB (IEEE-488) interface cable used to connect the plotter to a computer.

RS-232-C and Centronics

Your HP 7550 Plus plotter has a parallel (Centronics) and an RS-232-C (serial) interface. For the optimum data transmission speed, use the Centronics instead of the RS-232-C. Plug your interface cable into the appropriate connector.

NOTE: You cannot connect this plotter in an eavesdrop configuration.■



1 **Computer/Modem Port** — Accepts the RS-232-C/CCITT V.24 cable used to connect the plotter to a computer, modem, or RS-232-C DCE I/F.

2 **Centronics (Parallel) Port** — Accepts the parallel interface cable used to connect the plotter to a computer.

Using the Interconnection Instructions

The following instructions are designed to help you get your plotter and computer connected and communicating as soon as possible. Be aware that the listed computer and plotter equipment includes the *minimum* necessary to establish communication. Please verify that your computer and plotter work individually before attempting to connect them.

Note that using an interface cable other than the one listed may prevent communication. If you want to make your own cable refer to the schematics in the appropriate technical information chapter for your interface.

If you'll be using graphics software, check your software documentation (or software supplier) for specific computer hardware and memory requirements. When you install your software, you may have to "configure" the software. After your computer and plotter are communicating, refer to chapter 3 for information on configuring your software.

Testing Communication Using MS®-DOS

Many of the instructions for the computers in this chapter include a program written in GW-BASIC for testing the communication between your computer and plotter. If you are using an MS-DOS computer, but are not using GW-BASIC you may want to use these steps to test your computer/plotter communication. Verify that pens and media are loaded. Then follow the instructions below.

RS-232-C Interface

Type the following at the DOS prompt and press **ENTER** (substitute COM2 for COM1 if necessary).

```
MODE COM1:9600,N,8,1,P          ENTER

MODE LPT1:=COM1                 ENTER
```

The first command sets the serial port to 9600 baud, no parity, 8 data bits, 1 stop bit, and continuous retry on all timeouts. The second command directs the primary plotter communication to the first serial port.

All Interfaces

Type the following and press **ENTER**. (For a parallel interface, substitute LPT1 or LPT2 for COM1; for an RS-232-C, substitute COM2 for COM1 when necessary.)

```
ECHO IN;SP1;PS5000,5000;PD0,1500,1500,1500,0,0;PG;>COM1
```

The plotter should draw a triangle and advance the media.

Personal Computers

(Compatibles using RS-232-C Interface)

These instructions tell you how to connect your HP 7550 Plus plotter to the following compatible computers.

- Compaq DeskPro
- HP Vectra/ES/12 Personal Computers
- HP Vectra RS/20
- IBM PC/PC-XT/AT Computer
- IBM PS/2

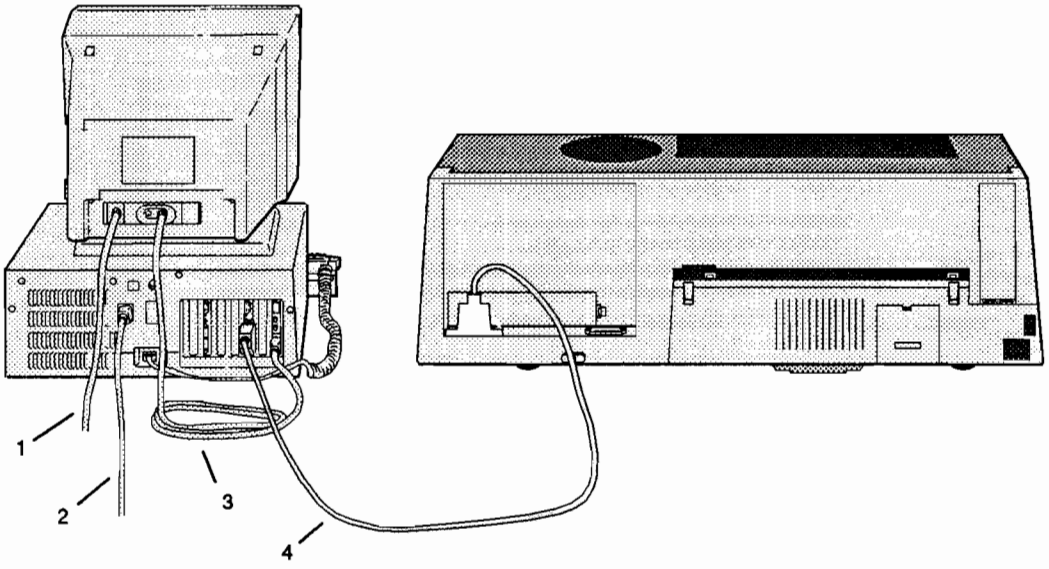
Computer	Cable
HP Vectra, ES/12, or RS/20 with HP 24540A or HP 24541A card using the 9-pin connector	HP 24542H
with the 24541A card using the 25-pin connector	HP 17255D
IBM PC, PC-XT, or PS/2 using the 25-pin connector	HP 17255D
IBM AT or PS/2; COMPAQ 286 or 386 using the 9-pin connector	HP 24542H

Interconnection Instructions

1. Turn off your plotter and computer equipment.
2. If necessary, install the serial interface card. (Refer to your computer documentation for details.) If you have already installed a serial card, go to step 3.

   NOTE: If you have more than one serial port installed, you will need to know whether you're connecting the plotter to COM1 or COM2 (most software will not run on COM3). You will need this information for testing communications and for configuring your software. If you are using COM2, be sure to substitute COM2 for COM1 in the instructions.■

4. Connect the plotter to the computer. The following illustration shows an HP Vectra PC with an RS-232-C/Centronics plotter.



1. Monitor power cord
2. Computer power cord
3. Video cable
4. RS-232-C cable

The plotter has a 25-pin connector. If you have a 25-pin connector on the serial card on your computer, you can use the HP 17255D, attaching the male end to the computer and the female to the plotter. If you have a 9-pin connector on the serial card on your computer, you can use the HP 24542H cable, attaching the 9-pin connector to the computer and the 25-pin connector to the plotter.

4. Use the front panel to store the following settings.

Data Flow:	Remote, Standalone
Handshake:	Hardwire
Duplex:	Full
Parity:	0
Baud:	9600

NOTE: If your software uses higher bits from the symbol sets or 8-bit character sets (e.g., £, ©, and ISO sets), it will require NO (0) parity as the 8th bit must be available for data.■

Verifying Communication

Load pens and media. Then follow the instructions below.

Setting the Mode Command

Place the Mode command(s) appropriate for your interface into your AUTOEXEC.BAT file. Consult your DOS documentation if you need assistance.

From the DOS prompt enter the following commands (substitute COM2 for COM1 if necessary):

```
MODE COM1:9600,N,8,1,P    ENTER

MODE LPT1:=COM1           ENTER
```

The first command sets the serial port to 9600 baud, no parity, 8 data bits, 1 stop bit, and continuous retry on all timeouts. The second command directs the primary plotter communication to the first serial port.

Running the Test Program

To test the computer/plotter interface, turn on your computer and plotter, load pens and media, then enter and run the following GW-BASIC program. (If you need help entering and running the program, refer to your computer documentation.)

```
10 OPEN "COM1:9600,N,8,1,RS,CS65535,DS,CD" AS #1
20 PRINT #1, "IN;OI;"
30 INPUT #1, ID$
40 PRINT #1, "SP1;PS5000,5000;PA500,500;"
50 PRINT #1, "LB"+ID$+" PLOTTER OK"+CHR$(3)
60 PRINT #1, "PA0,0;PG;"
70 END
```

NOTE: If your plotter is connected to a different serial port than specified in line 10, replace COM1 with the appropriate COM port identifier. Be sure the baud rate you specify in line 10 matches the plotter settings.■

Your plotter prints '7550B PLOTTER OK.' (If 7550A emulation mode is on, the number 7550A prints.)

Personal Computers

(Compatibles using Centronics (parallel) Interface)

These instructions tell you how to connect your HP 7550 Plus plotter to the following compatible computers.

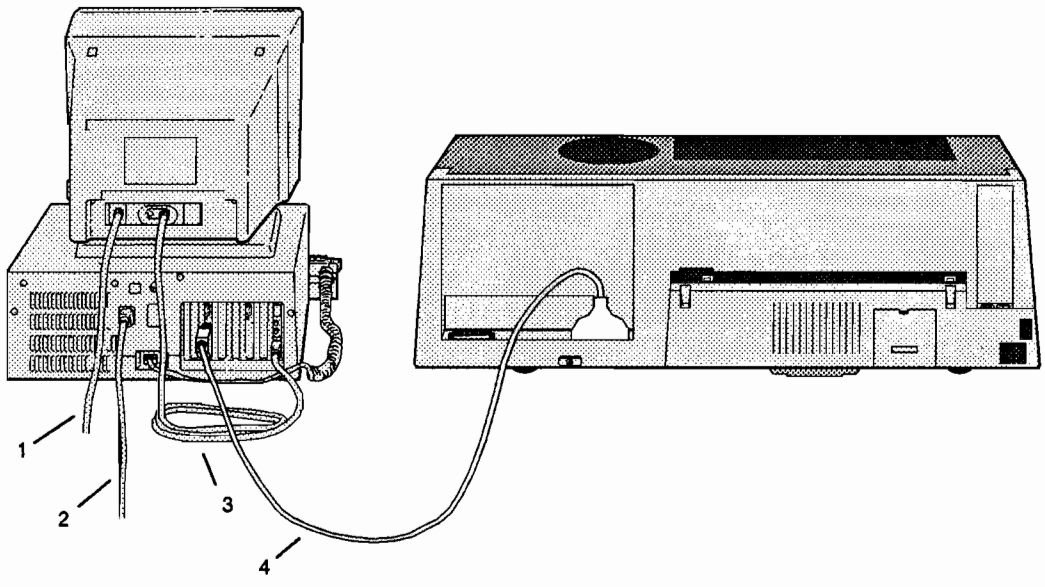
- Compaq DeskPro
- HP Vectra/ES/12 Personal Computers
- HP Vectra RS/20
- IBM PC/PC-XT/AT Computer
- IBM PS/2
- Olivetti M24

Computer	Cable
HP Vectra, ES/12, or RS/20 IBM PC, PC-XT, or PS/2 COMPAQ 286 or 386 Olivetti M24	HP 92284A

Interconnection Instructions

1. Turn off your plotter and computer equipment.
2. If necessary, install the Centronics interface card. (Refer to your computer documentation for details.) If you have already installed a Centronics card, go to step 3.

3. Connect the plotter to the computer. The following illustration shows an HP Vectra PC.



1. Monitor power cord
2. Computer power cord
3. Video cable
4. Centronics cable

CAUTION

Many computer systems will have both Centronics and RS-232-C ports. These ports frequently appear identical. Make sure you plug your cable into the Centronics port (it should be labeled), or damage could occur to your plotter.

Verifying Communication

1. Verify that the plotter is on and pens and media are loaded.
2. Type the following and press ENTER. (Substitute LPT2 for LPT1 when necessary.)

   ```
   ECHO IN;SP1;PS5000,5000;PD0,1500,1500,1500,0,0;PG;>LPT1
   ```

   The plotter should draw a triangle and advance the media.

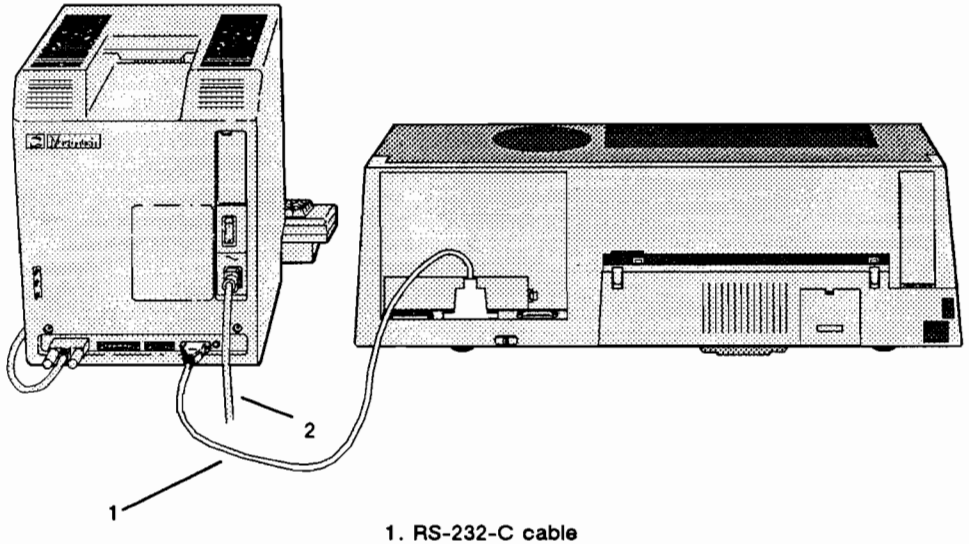
Apple Macintosh, Macintosh Plus/SE/II Computers
(RS-232-C Interface)

Computer	Cable
Apple Macintosh	HP 92219M*
Apple Macintosh Plus/SE/II	HP 17302A*

* Plus a female to female gender converter (HP 92224F).

Interconnection Instructions

1. Turn off your plotter and computer equipment.
2. Connect the small end of the cable to the computer's modem port. The following shows the Apple Macintosh and the RS-232-C/HP-IB plotter.



1. RS-232-C cable
2. Computer power cord

3. Use the front panel to store the following settings.

Data Flow: Remote, Standalone
Handshake: Hardwire
Duplex: Full
Parity: 0
Baud: 19 200

NOTE: If your software uses higher bits from the symbol sets or 8-bit character sets (e.g., £, ©, and ISO sets), it will require NO (0) parity as the 8th bit must be available for data.■

4. Configure your computer system as follows. (Refer to your computer documentation if you have difficulty with this step.)

   a. Insert the System Disk (or the System Tools disk if purchased after 1 January 1986) in the disk drive and turn on the computer.

   b. Select the "apple" icon from the menu bar, then select **CHOOSE Plotter** from the "apple" icon menu.

   c. Under **PORT**, choose the Plotter icon, then select **OK** to exit the system disk menu.

   d. Select **FILE** from the menu bar, then select **EJECT** from the file menu.

Verifying Communication

To test the computer/plotter interface, turn on your computer and plotter, load pens and media, then enter and run the following program. (If you need help entering and running the program, refer to your computer documentation.)

1. Insert BASIC 2.0 or higher into the disk drive.

2. Select **FILE** from the menu bar, then select **OPEN** from the file menu. If prompted to do so, correct the date and time and press **ENTER**.

3. Choose the Microsoft® BASIC icon in the window.

4. Select **FILE** from the menu bar, and **OPEN** from the file menu. You should have a window, headed by LIST on your screen.

5. Enter the following BASIC program.

```
10 OPEN "COM1:19200,N,8,1,RS,CS65535,DS,CD" AS #1
20 PRINT #1, "IN;OI;"
30 INPUT #1, ID$
40 PRINT #1, "SP1;PS5000,5000;PA500,500;"
50 PRINT #1, "LB"+ID$+" PLOTTER OK"+CHR$(3)
60 PRINT #1, "PA0,0;PG;"
70 END
```

6. Select **RUN** from the menu bar, and select **START** from the run menu. Your plotter prints '7550B PLOTTER OK.' (If 7550A emulation mode is on, the number 7550A prints.)

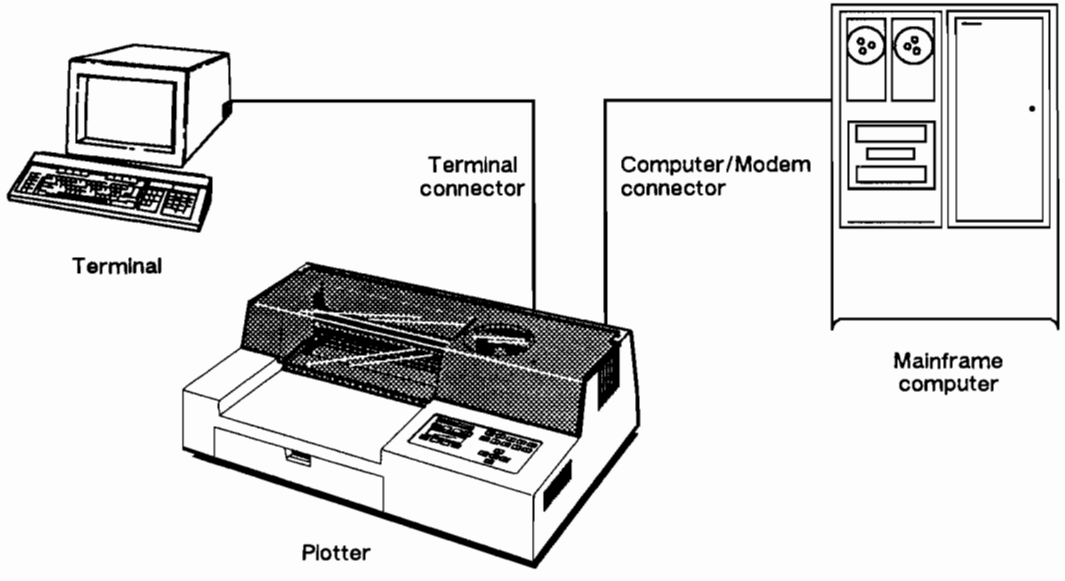
DEC VAX Computer (RS-232-C Interface)

Computer	Cable
DEC VAX	HP 17255D* or DEC null modem cables BC22D* or BC03M*

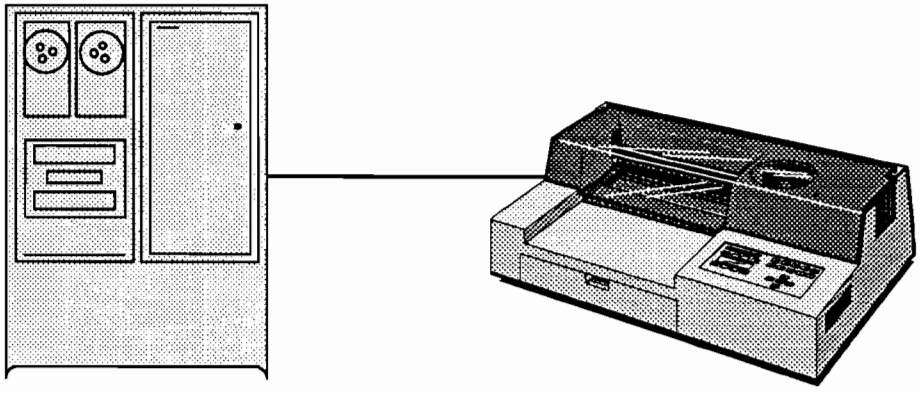
* With any of these cables, you may need a gender converter or a straight through extension cable.

Interconnection Instructions

1. Turn off your plotter and terminal.
2. **EAVESDROP** (RS-232-C/HP-IB Version Only)**:** Connect the terminal to the plotter using the Terminal connector. Connect the computer to the plotter using the Computer/Modem connector. Refer to the following illustration.



STANDALONE: Connect the plotter to the computer using the Computer/ Modem connector



3. Use the front panel to store the following settings.

EAVESDROP: If your terminal is communicating successfully with the computer, try setting the plotter to the same baud rate and parity as the terminal.

Data Flow:	Remote, Eavesdrop
Handshake:	Xon-Xoff
Duplex:	Full
Parity:	0
Baud:	19 200

STANDALONE:

Data Flow:	Remote, Standalone
Handshake:	Hardwire
Duplex:	Full
Parity:	0
Baud:	19 200

NOTE: If your software uses higher bits from the symbol sets or 8-bit character sets (e.g., £, ©, and ISO sets), it will require NO (0) parity as the 8th bit must be available for data.■

Running the Test Program

To test the computer/plotter interface, turn on your computer and plotter, load pens and media, then enter and run the following FORTRAN program. (If you need help entering and running the program, refer to your computer documentation.)

```
          PROGRAM INTERCONNECT
          CHARACTER*5 ID
          INTEGER ESCAPE,ETX
          ESCAPE = 155
          ETX = 3
          WRITE (6,10) ESCAPE,ESCAPE,ESCAPE
10        FORMAT (1X,A1,".Y",A1,".I80;0;17:",A1,".N10;19:")
          WRITE (6,20) ESCAPE
20        FORMAT (1X,A1,".M;;10:IN;SP1;PA500,500;OI;")
          READ (5,30) ID
30        FORMAT (A5)
          WRITE (6,40) ID,ETX
40        FORMAT (1X,"LB",A5," PLOTTER OK",A1)
          WRITE (6,50) ESCAPE
50        FORMAT (1X,"PA0,0;SP0;",A1,".Z")
          STOP
          END
```

NOTE: This program establishes an Xon-Xoff handshake with predefined values. If the program does not run on your system, refer to the *HP-GL/2 Reference Guide* for information on changing these values.■

Your plotter prints '7550B PLOTTER OK.' (If 7550A emulation mode is on, the number 7550A prints.)

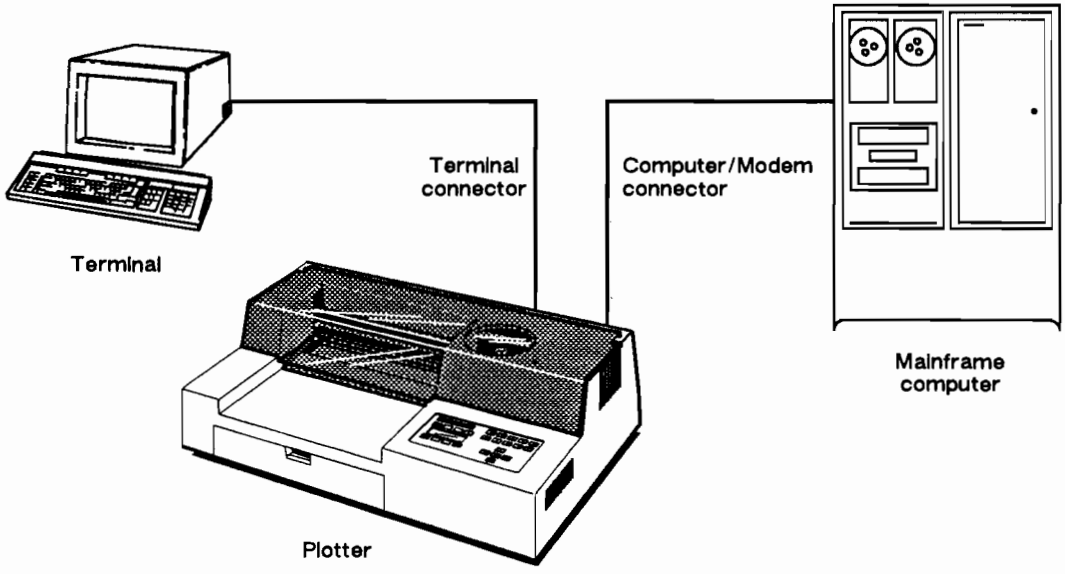
HP 3000 Computer (RS-232-C Interface)

Computer	Cable
HP 3000	HP 17255D*

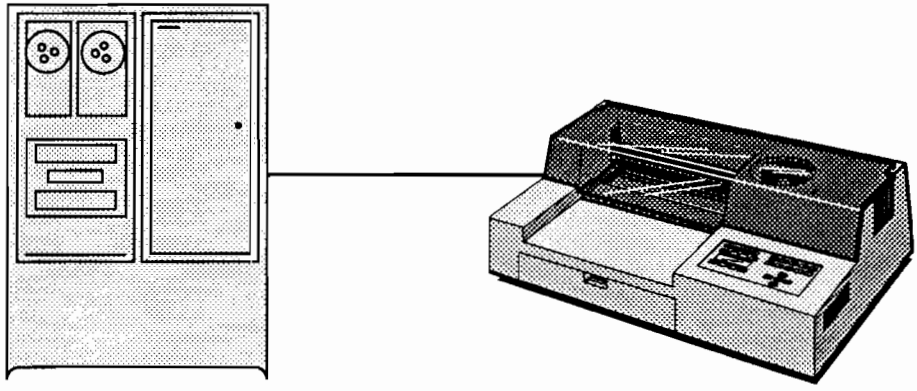
* The RS-232-C cable connects the plotter to the computer's ATC or ADCC interface. (The ATP interface requires the adapter cable HP 30152A.) You need another cable to connect the terminal to the computer. Refer to your computer documentation for the part number of this second cable.

Interconnection Instructions

1. Turn off your plotter and terminal.
2. **EAVESDROP** (RS-232-C/HP-IB Version Only)**:** Connect the terminal to the plotter using the Terminal connector. Connect the computer to the plotter using the Computer/Modem connector. Refer to the following illustration.



STANDALONE: Connect the plotter to the computer using the Computer/ Modem connector



3. Use the front panel to store the following settings.

EAVESDROP: If your terminal is communicating successfully with the computer, try setting the plotter to the same baud rate and parity as the terminal.

Data Flow:	Remote, Eavesdrop
Handshake:	Xon-Xoff
Duplex:	Full
Parity:	0
Baud:	19 200

STANDALONE:

Data Flow:	Remote, Standalone
Handshake:	Hardwire
Duplex:	Full
Parity:	0
Baud:	19 200

NOTE: If your software uses higher bits from the symbol sets or 8-bit character sets (e.g., £, ©, and ISO sets), it will require NO (0) parity as the 8th bit must be available for data.■

Running the Test Program

To test the computer/plotter interface, turn on your computer and plotter, load pens and media, then enter and run the following FORTRAN program. (If you need help entering and running the program, refer to your computer documentation.)

```
            PROGRAM INTERCONNECT
            CHARACTER*5 ID
            INTEGER ESCAPE,ETX
            ESCAPE = 155
            ETX = 3
            WRITE (6,1Ø) ESCAPE,ESCAPE,ESCAPE
1Ø          FORMAT (1X,A1,".Y",A1,".I8Ø;Ø;17:",A1,".N1Ø;19:")
            WRITE (6,2Ø) ESCAPE
2Ø          FORMAT (1X,A1,".M;;1Ø:IN;SP1;PA5ØØ,5ØØ;OI;")
            READ (5,3Ø) ID
3Ø          FORMAT (A5)
            WRITE (6,4Ø) ID,ETX
4Ø          FORMAT (1X,"LB",A5," PLOTTER OK",A1)
            WRITE (6,5Ø) ESCAPE
5Ø          FORMAT (1X,"PAØ,Ø;SPØ;",A1,".Z")
            STOP
            END
```

NOTE: This program establishes an ENQ/ACK handshake with predefined values. The handshake setting on the front panel can be set to either Xon-Xoff or Hardwire; this program will override the setting to establish ENQ/ACK. If the program does not run on your system, refer to the *HP-GL/2 Reference Guide* for information on changing these values.■

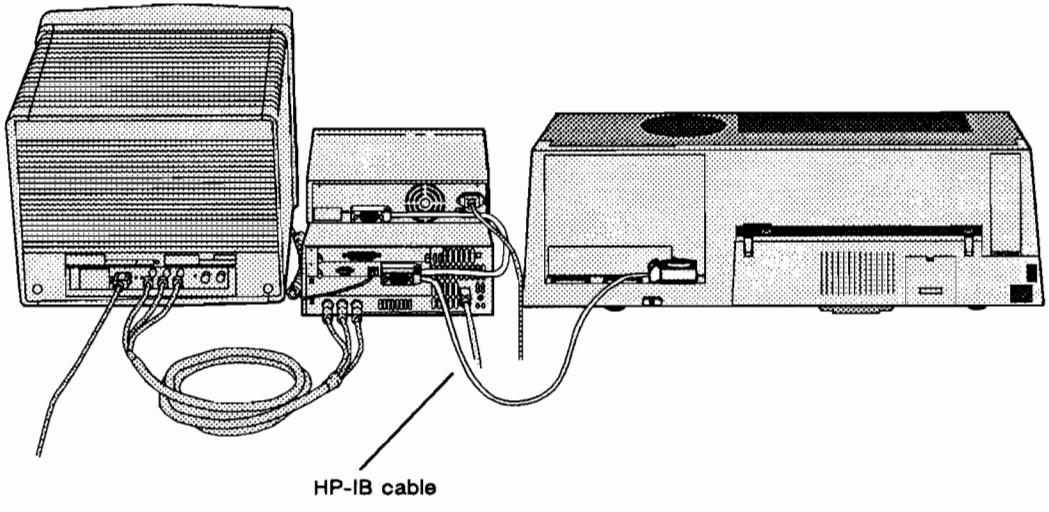
Your plotter prints '7550B PLOTTER OK.' (If 7550A emulation mode is on, the number 7550A prints.)

HP 9000 Series 300 Technical Computer
(HP-IB Interface)

Computer	Cable
HP Model 310 or 320 computer	HP 10833A, B, C, or D

Interconnection Instructions

1. Turn off your plotter and computer equipment.
2. Connect the HP-IB cable to the computer.



3. Use the Plotter Setup menu to store the following setting.

   Address: 05

Verifying Communication

To test the computer/plotter interface, turn on your computer and plotter, load pens and media, then enter and run the following program. (If you need help entering and running the program, refer to your computer documentation.)

```
10 OUTPUT 705 ;"IN;OI;"
20 ENTER 705 ; Id$
30 OUTPUT 705 ;"SP1;PS5000,5000;PA500,500;"
40 OUTPUT 705 ;"LB"&Id$&" PLOTTER OK"&CHR$(3)
50 OUTPUT 705 ;"PA0,0;PG;"
60 END
```

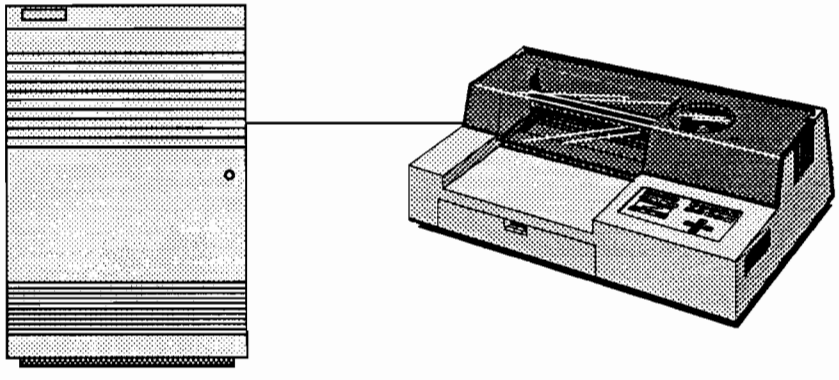
Your plotter prints '7550B PLOTTER OK.' (If 7550A emulation mode is on, the number 7550A prints.)

HP 9000 Series 800 Technical Computer
(HP-IB Interface)

Computer	Cable
HP 9000 Series 800 computer	HP 10833A, B, C, or D

Interconnection Instructions

1. Turn off your plotter and computer equipment.
2. Connect the plotter to the computer using the HP-IB cable. Either end of the cable can be connected to the plotter or computer.



3. Use the front panel to store the following setting.

   Address: 05

Verifying Communication

To test the computer/plotter interface, turn on your computer and plotter, load pens and media, then enter and run the following program. (If you need help entering and running the program, refer to your computer documentation.)

```
10 OUTPUT 705 ;"IN;OI;"
20 ENTER 705 ; Id$
30 OUTPUT 705 ;"SP1;PS5000,5000;PA500,500;"
40 OUTPUT 705 ;"LB"&Id$&" PLOTTER OK"&CHR$(3)
50 OUTPUT 705 ;"PA0,0;PG;"
60 END
```

Your plotter prints '7550B PLOTTER OK.' (If 7550A emulation mode is on, the number 7550A prints.)

3

Using Software with Your Plotter

This chapter provides important information on using graphics software packages or programs to create color graphics on your plotter. Be sure to read it before attempting to use your graphics software package. This chapter includes the following information.

- Before using your software.
- Using graphics software packages.
- Understanding plotter drivers.
- Using the HP 7550A emulation mode.
- Writing your own graphics programs.

Before You Begin

Before using a software package, check the following.

- Is your plotter in good working condition? If the demo plot works, it is a good indication that the plotter is working correctly.
- Is your computer system working correctly?
- Are your plotter and computer communicating effectively? If the test program (described in chapters 1 and 2) runs, communication is established.
- Does your software package support your plotter and computer? (Your software documentation should tell you.) If your software tells you that the software works with HP-GL/2, set `Emulation Mode` to `HP-GL/2` using the front panel. Otherwise, use a 7550A driver with your plotter.

When you are sure the components of your computer system are working properly, and that communication has been established between the computer and plotter, you are ready to use your software package.

Using Graphics Software Packages

Your software documentation is your best source of information about how your software works and the features it supports. Sections of this chapter give you key words to look for in your application's manual for more information.

Many software packages require you to configure the software so that it knows what type of plotter you are using, the plotter interface and settings, and where the plotter is attached to your computer. This configuration is usually done by typing or selecting answers on your computer in response to questions asked by the software. If your software asks you configuration questions, answer them carefully to avoid computer/plotter communication problems. Read your software documentation when installing and configuring the software to avoid communication problems.

For specific directions on installing a driver, *refer to your software documentation.* You may need to key in answers to certain questions asked by the software, such as what type of interface you are using or which port on your computer is connected to the plotter.

If your software documentation recommends specific plotter settings, use them—even if they differ from the settings recommended for your computer in chapter 2. If your software lists possible choices *without* making a recommendation, use the settings recommended in chapters 1 and 2.

The following two sections summarize information you may need when configuring or installing your software package. Read the section pertaining to the interface type you are using.

For HP-IB (Parallel) Interface Users . . .

If you are using the HP-IB interface, the plotter's address setting must match the HP-IB address used by the graphics software package. If your software requires configuring, select an HP-IB address of 05 and be certain your plotter's address is set to 05. If you need to use an address other than 05, set the HP-IB address using the front panel as explained in chapter 1.

For RS-232-C (Serial) Interface Users . . .

If your software or software documentation recommends specific plotter settings, use the front panel to select and store the recommended settings, as explained in chapter 1. Your software package may ask for the following information.

- Baud rate
- Stop bits
- Parity
- Handshake

Many serial devices require that you specify the baud rate of your computer, whether parity is on or off, and whether parity is even or odd. If you are in a MS-DOS environment, we recommend you initialize your computer serial port using the MODE command, as shown below.

```
MODE COM1:9600,N,8,1,P

MODE LPT1:=COM1
```

The first command sets the serial port to 9600 baud, no parity, 8 data bits, 1 stop bit, and continuous retry on all timeouts. The second command directs the primary plotter communication to the first serial port.

If your software doesn't require any configuring, or if no plotter settings are suggested in your software documentation, try setting the interface as advised in chapter 2. *Be certain your software configuration matches the plotter's settings.*

Understanding Plotter Drivers

The plotter driver is a program that works with the software package to transfer information from the computer to the plotter. Just as the cable is the link from the computer to the plotter, the plotter driver is the link from the software package to the plotter.

How Do Plotter Drivers Work?

Plotter drivers control the plotter by carrying information from your software package to the plotter. The plotter driver carries two types of information: the graphics, numbers, or words you want to plot and the instructions on how to plot them (e.g., fill types, line types, and plot location).

Plotter drivers have two limitations: they carry only the information they are given by the software package and only the information they were designed to carry. Because of these limitations, you may be unable to use a feature of your software package or plotter if the driver doesn't support it on your plotter. The features you will be able to use are the ones that have all three components (software, plotter driver, and plotter).

7550A or HP-GL/2

The HP 7550 Plus plotter can run under 7550A emulation mode or HP-GL/2 mode.

Most software packages offer the 7550A plotter as an output option. For this reason, the plotter automatically defaults to 7550A mode, unless you change the setting from the front panel.

HP-GL/2 is an enhanced, standardized language that enables files to be sent from the computer to the plotter in less time. If your software offers a "7550 Plus-HP-GL/2" driver, or an "HP-GL/2 device" driver, then select one of these options. Be sure to select HP-GL/2 mode by setting `Emulation Mode` to `HP-GL/2` on the front panel.

How Do I Get a Plotter Driver?

The plotter driver may come as part of your software package or may have to be obtained separately. In general, if 7550A driver or an HP-GL/2 driver is included, you will see 7550A or HP-GL/2 listed in your software's 'select plotter' screen. (When you 'select a plotter', you are actually selecting a plotter driver.)

If a driver is not included in the installation directions for your application, check your application disk(s). Often software applications have a 'readme' file on the disk that contains information on using your plotter with the software. List the directory of the disk and look for a file called 'readme' or a file name ending in '.DOC' or '.TXT'. To plot the file, type the following at the DOS prompt.

TYPE a:*filename.extension* > LPT1

If you still don't locate a driver, contact your software vendor to see if one is available separately. Typically there is no extra cost.

Writing Your Own Graphics Programs

If you want to write your own graphics programs using the HP-GL/2 programming language, you can purchase an extensive programming document, the *HP-GL/2 Reference Guide* plus the *Comparison Guide* from Hewlett-Packard. Refer to appendix B of the User's Guide for ordering information.

4

Using Your Plotter with Peripheral Sharing Devices, Buffers, and Spoolers

This chapter is an educational section about peripheral sharing devices, buffers, and spoolers. It presents an overview of the functions of buffers, spoolers, and peripheral sharing devices and tells you how to determine if one will be an advantage to your system. Finally, it lists considerations to be aware of when making a purchasing decision. A matrix of Hewlett-Packard tested devices and some of their characteristics is included. For details about specific products, consult your computer dealer.

Because your computer can send data to the plotter faster than the plotter can plot it, your computer is frequently unavailable for use while the plotter is plotting. Buffers and spoolers (and some peripheral sharing devices) allow your computer to send large amounts of data to the buffer to await plotting, thus freeing your computer for other tasks.

The time savings you will realize depends on the type of computer or workstation you are using, the complexity of your drawing, and whether your computer's operating system supports multitasking. For example, using certain buffering/spooling devices with a 32-bit (80386 based) personal computer without multitasking (e.g., HP Vectra RS Personal Computer or IBM PS/2 Model 70), can reduce, by 50 to 70 percent, the time your computer is "tied-up" by the plotter.

What Are Peripheral Sharing Devices, Buffers, and Spoolers?

The terms peripheral sharing device, buffer and spooler are beginning to be used interchangeably in the industry. The following are traditional definitions.

A *peripheral sharing device* allows two or more computers to use the same peripheral (e.g., plotter). The simplest form would be an A/B switch, which allows two computers (A and B) to send output to the same peripheral. The A/B switch must be manually changed for the peripheral to receive data from the other computer.

Today, the technologies of peripheral sharing devices, buffers, and spoolers are beginning to converge. Many peripheral sharing devices have buffering or spooling capability, and many buffers and spoolers allow peripheral sharing.

The *buffer* in any computing device is an area where data is held until it can be processed. A buffer temporarily stores information that is being transmitted between a computer and a peripheral device such as a plotter.

A buffer, then, expands the memory of your plotter. The buffer will accept data from a computer as fast as the computer can send it. The buffer then sends that data to the plotter as fast as the plotter can accept it.

A *spooler* is a data storage and transmission device just as is a buffer. In addition, spoolers usually accept data from more than one computer at a time and send each job to the plotter as the plotter becomes available. Some spoolers also support multiple output devices and (once configured) automatically know that data from computer A goes to plotter C. Additionally, some spoolers allow you to set priorities so that large jobs are held until after all smaller ones have been plotted.

Two additional capabilities that buffers and spoolers may provide are replotting (making multiple copies without resending the data from your computer each time) and peripheral sharing (allowing several computers to share a plotter without having to switch the plotter from computer to computer for plotting).

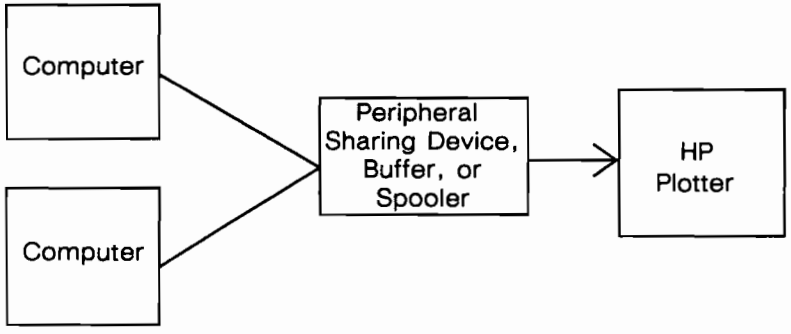
Why Use Peripheral Sharing Devices, Buffers, and Spoolers?

A buffering/spooling/sharing device can help optimize the efficiency of your computer system in four different ways:

1. **Frees the computer.** Freeing your computer for other tasks is the primary purpose of a buffering/spooling/sharing device. Computers can usually send data faster than plotters can plot it. But with a buffering/spooling/sharing device, you won't have to sit and wait impatiently for the plot to finish before you can use your PC again. Once you have sent data to the buffering/spooling/sharing device, it will send the data on to the plotter, so you can work on other tasks.

2. **Provides replot capability.** A buffering/spooling/sharing device with this capability can generate multiple copies of a plot without tying up a PC—a wonderful timesaving feature. The number of copies you can select will vary by manufacturer.

3. **Provides peripheral sharing.** Some devices enable you to connect two or more PCs to one or more plotters. Many of these devices manage the incoming data from different computers without intervention on your part. They automatically store the data and send it to the plotter as it becomes available.



4. **Provides I/O compatibility.** Some external buffering/spooling/sharing devices have several interfaces (e.g., RS-232-C, Centronics, and/or HP-IB). For example, the device could receive data from an RS-232-C interface, and then send it to the plotter over an HP-IB, Centronics, or RS-232-C interface.

What Form Do They Take?

As the technologies come together, we find buffers that spool, spoolers with buffers, and peripheral sharing devices that do both. In addition you will find features called buffers in some plotters that do none of the things we've talked about in this note. What's important is that you find the product that meets your needs. Here are some definitions to help you identify the variety of products that are available and what each offers.

- Internal — Built into the plotter's firmware. These types of buffers can often be adjusted using the plotter's programming language. They are also called configurable graphics memory. Refer to your plotter's programming manual for information on configuring these internal buffers.

- Internal — Optional RAM chips, hard disks, or other memory devices that are internal to the plotter, but usually cannot be configured by the user.

- Cartridge — Optional cartridges that can be "plugged into" the plotter. These buffers usually cannot be configured, but may contain additional features such as spooling or replot capability.

- External Hardware Device — Buffers are sometimes referred to as buffer boxes because they tend to be "little black boxes" that the data goes into. The external buffer is connected between the computer and plotter. A spooler can also be an external hardware device.

- Computer Software Utility — Spoolers can be a software utility resident on a computer's hard disk that either uses the hard disk or RAM for memory space.

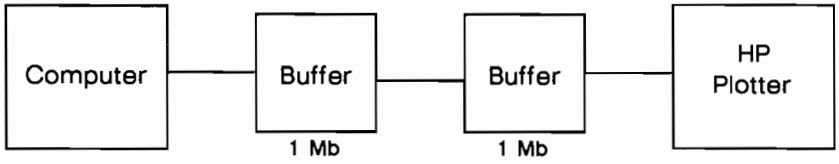
What Additional Features Are Available?

The four basic advantages of sharing/buffering/spooling devices are freeing the computer, replot capability, peripheral sharing, and I/O compatibility. In addition, these devices have other helpful features. Look over the list below to get a general idea of what other features are available. The many buffering devices on the market vary greatly in the number of features they provide.

- **Spooling and/or plot stacking.** Devices that perform these functions are typically called "spoolers." A spooler will take separate files/plots and plot them out in a certain priority (usually the order received). Spooling is discussed in more detail in a following section.

- **Memory upgrades.** Buffers can range in memory from 64KB to 2MB and more. Some buffers have a memory upgrade option that lets you increase the memory size according to your needs. Most business applications require about 256KB of memory. Most CAD applications require at least one megabyte of memory. The PaintJet XL, for example, needs 1 MB to spool an A-size graphics page and 2 MB for a B-size graphics page.

  On some products you can also increase memory by connecting or "daisy-chaining" two or more buffering devices together. This feature is particularly useful for CAD applications that require a lot of memory.



- **Multiple interfaces.** Buffering/spooling/sharing devices can have a serial (RS-232-C), parallel (Centronics), or HP-IB (IEEE-488) interface, or a combination of these. Multiple interfaces are very handy when your equipment has different interfaces. For example, you could output from the computer's serial port to the buffer and then the buffer would output over an HP-IB interface to the plotter.

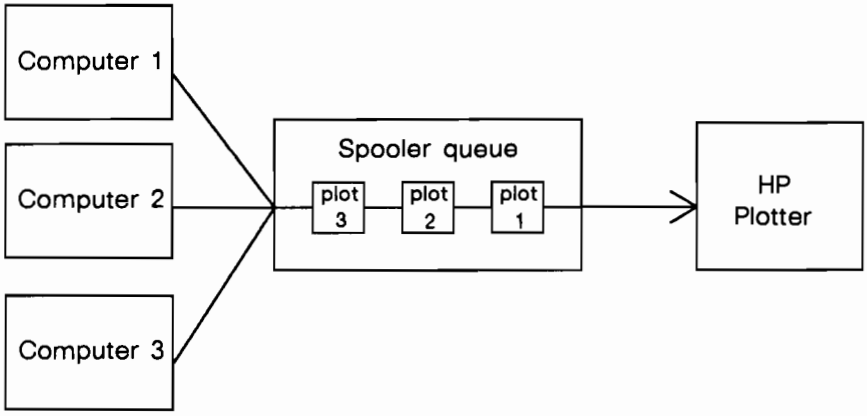
- **Multiple handshaking protocols.** Although some devices offer only Xon-Xoff or hardwire handshake, many devices offer both.

- **File Appendage.** With some devices you can insert a character string at the beginning or end of a plot file. For example, with some peripherals, you could insert the HP-GL/2 *PG;* instruction so that a rollfeed plotter would advance the paper, or an automatic sheetfeed device (like the HP 7550 Plus plotter) would automatically load the next sheet.

Spoolers

When your sole objective is to free up your PC, then a plotter buffering device is probably all you need. But if you want to send plot files from several computers and arrange them in a specific order (queue) to be processed, you will need a spooler. A spooler can be either an independent hardware device or a software utility resident on a computer's hard disk or in random access memory (RAM).

A hardware spooler can take separate plot files from different PCs, put them in a queue, and then direct the plotter to plot them in a given order (usually the order received).



Software Spoolers

A software spooling utility program sends a file from the computer's hard disk to the plotter. The utility uses the hard disk as the buffer instead of needing a separate hardware device. Thus, the size of the buffer is dependent on the available hard disk space.

NOTE: To use a software spooler, your application software must be able to plot to a file and must be using one-way communication (explained later in this chapter).■

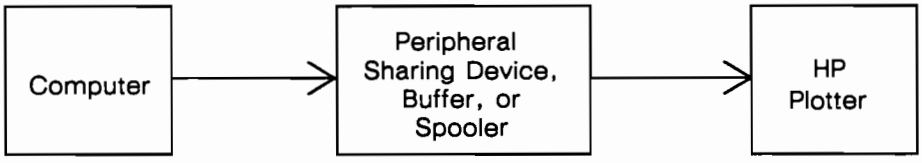
Software spoolers are memory (RAM) resident. They are activated with "hot" keys (usually ALT + another key) and can be invoked anytime. They allow the plotter to plot "in the background" while you continue working on your primary task. With a software spooler you can arrange plot files in a specific order (queue), cancel files, or plot multiple copies.

One-Way or Two-Way Communication?

If you are considering adding a buffering/spooling/sharing device to your system, you must know whether your application software functions with one-way or two-way communication. *Some buffering/spooling/sharing devices will not work with software that requires two-way communication.* Many devices offer both one-way and two-way communication; some devices are limited to one-way communication.

One-Way Communication

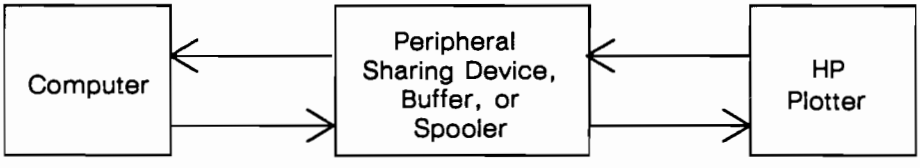
One-way (half-duplex) communication means just that: data goes one way only—from the computer to the buffer to the plotter. A device that performs one-way communication will only work well when the plotter software also uses one-way communication.



NOTE: All software packages for the Apple® Macintosh™ computers use one-way communication.■

Two-Way Communication

Similarly, software that performs two-way communication requires a buffering/spooling/sharing device that can perform two-way, or full-duplex, communication. A device that performs two-way communication not only sends data to the plotter, it can also *receive* data from the plotter and *send it back to the PC*. In this case, a plotter can respond to inquiries from the computer. For example, the software may ask the plotter to identify itself so the software "knows" the plotter's orientation, scaling point coordinates, etc. If the external buffer does not use two-way communication, it cannot respond to a computer inquiry, thus creating an error situation (possibly "hanging" the system).



Be aware. If a software package uses two-way communication extensively, it may defeat the main purpose of a buffering/spooling/sharing device: freeing the computer for other tasks. An inquiry from a PC results in an instruction being queued in the buffer. Now the PC is tied up again because it is waiting for a response from the plotter.

Some two-way devices are preprogrammed to "fake" a standard response (e.g., dummy ENQ-ACK) to any inquiry that has been sent to the plotter. Although this method provides a workable solution for most applications, a standard response will sometimes produce erroneous results.

The communication modes for some popular packages are listed in the table at the end of this note. If you do not know the requirements of your software package, consult your software vendor.

NOTE: All software packages for the Apple® Macintosh™ computers use one-way communication.■

Your Software Is the Key

Buffering/spooling/sharing devices are a solution to slow data transfer resulting from two devices having different data transmission speed. But whether or not a buffering/spooling/sharing device will be advantageous to you *depends primarily on your software*. If the application takes as much time outputting to the plotter as the plotter takes to plot, then a buffering/spooling/sharing device will not necessarily save you any time. It will take just as long to send the program to the buffer and then on to the plotter as it would to send it directly to the plotter.

For example, if your software uses powerful HP-GL/2 commands that instruct the plotter to perform advanced tasks such as labeling or polygon fill, then the plotter is performing the time-consuming calculations. In this case, an external buffer is most advantageous. On the other hand, if the computer is doing most of the calculations, or if the software pauses every time the plotter changes pens, the computer will not be ahead of the plotter by much, if at all. In this case (unless you plan to use the buffer to generate multiple plots), the time saved with a buffering/spooling/sharing device is minimal.

Helpful Hints

However, if you are using one-way communication, you can use your buffering/spooling/sharing device to its best advantage by sending your output to a file instead of the plotter. Typically, the transmission to a file is faster than transmission to the plotter. Once you've done this, then copy the file to the plotter using the DOS COPY command. This method frees your computer and speeds plotting because the plotter doesn't have to wait for data.

Refer to your operating system documentation and the programming manual for your plotter for information on implementing these hints.

Here's a Short Review

It is a good idea to have an understanding of the following questions before purchasing a buffering device. You can use this review as a check list.

1. Does the software function in a way that is conducive to using a plotter buffer?

   Above all, know your applications and your software. Remember, if the plotter has to wait for the computer, then an external buffer may not save you much time. If, on the other hand, the computer has to wait for the plotter, a buffer will offer you a time-saving advantage.

2. Does the application software use one-way or two-way communication?

   You want to purchase a buffering device that functions with the type of communication employed by your application software.

3. What type of computer, and if applicable, how many computers will be used with the device?

4. What additional cables are required?

   Since the plotter buffer is connected between your PC and your plotter, you will need at least one additional cable. Manufacturers will sometimes, but not always, provide a cable or information on cables. Be sure to note whether your computer ports are male or female so you can select the proper cables.

5. What are the handshaking requirements?

   Some of the parameters (requirements) are baud rate, parity, and handshake method. You can configure some devices by pushing buttons on the front panel. On others, you must open the box and set switches and jumpers. On others, you can use a software utility. Some utilities support only one or two handshaking protocols, some support more. Note that if you have two packages that use different handshaking protocols, you may have to reconfigure the buffer whenever you use a different application.

6. Does the device have replot capability?

7. What are the memory requirements of your application?

   Most business applications will require 256KB of memory. Most CAD applications will require 1 MB of memory.

Some Final Considerations

External buffers are intended for a PC environment. Do not try to use them in an eavesdrop mode with a mainframe, a terminal, and a plotter.

Although a buffer/spooler will free up the PC, it will not make your plotter plot faster. A buffering device cannot enable a plotter to go beyond its mechanical limits.

Before making a purchase, contact the buffer's vendor and verify that the product you want will work with your hardware and software configuration.

Plot Buffers, Spoolers, and Peripheral Sharing Devices

In this section you'll find lists of plot buffers, spoolers, and peripheral sharing devices. The information includes the vendor, product name, buffer size, type of communication, and computers supported.

Plot Buffers

This table lists buffers that support the HP ColorPro, HP 7475, HP 7550, HP DraftPro Series, and HP DraftMaster Series plotters. The Printer Optimizer and Systemizer Plus also support the HP PaintJet Series printers.

Vendor	Product[1]	Buffer[1] Size	Input/Output Ports[1]			Data Communication		Replot (copies)	Personal Computers	
			RS-232-C	Parallel	HP-IB	One-way	Two-way		HP Vectra IBM PS/2, AT, PC/XT & Compatibles	Apple Macintosh
Applied Creative Tech. 8333 Douglas Ave., Suite 700 Dallas, TX 75225 (214) 352-2281	Printer Optimizer[2] Systemizer Plus[2]	128KB–1MB 256KB–1MB	X X	X X		X X	X X	99 1	X X	X
Consolink Corp 1275 S. Sherman Dr. Longmont, CO 80501 (303) 651-2014	MicroSpooler 128	64KB–128KB	X			X	X	1	X	
Dickerson Enterprises 8108 N. Milwaukee Ave. Niles, IL 60648 (312) 966-4884	CADDY	256KB	X			X	X	1	X	
Ergotron, Inc. 1631 E. 79th Street Minneapolis, MN 55420 (612) 452-8135	MacBuffer	256KB–1MB	X			X		1		X
Eventide, Inc. One Alsan Way Little Ferry, NJ 07643 (201) 641-1200	Cloverleaf[3] Expressway[3]	256KB–2MB 256KB–2MB			X X	X X	X X			
ICT Technologies, Inc. 301 Galveston Drive Redwood City, CA 94063 (415) 361-1155	PlotStation 1		X			X			X	
Intelligent Interfaces P.O. Box 1486 Stone Mountain, GA 80086 (404) 381-9891	MicroPlot 80A[3]	256KB–2MB			X	X	X	1		
Western Automation 1700 North 55th St. Boulder, CO 80301 (303) 449-6400	Seleris	512KB–2MB	X			X	X	99	X	

[1] Contact vendor for other models and configuration.
[2] Also supports the HP PaintJet Color Graphics Printer.
[3] For the HP 150 and HP 9000 Series 200/300 computers.

Software Plot Spoolers

The following table lists software plot spoolers. These plot spoolers are memory resident and plot in the background. These spoolers support the HP Vectra, IBM PS/2, PC/XT/AT, and compatible computers. Software products listed support HP plotters.

Vendor	Product	Memory Used	Output Ports Supported		Queue/ Spool Plots	Replot (copies)	Comments
			RS-232-C	Parallel			
ACS Telecom 25825 Eshelman Avenue Lomita, CA 90717 (213) 325-3055	10 Plot		X	X	X		Supports AutoCAD, VersaCAD, and other PC-CAD packages capable of outputting to a file.
The Software Machine 2450 East 7000 South, Suite 210 Salt Lake City, UT 84121 (801) 944-9212	AutoPlot II	33KB	X	X	X	9	Supports AutoCAD.
Digital Control Systems Five Cabot Place Stoughton, MA 02072 (617) 344-8100	Concurrent Plot II	78KB	X		X	999	Supports AutoCAD and VersaCAD.
SSC Soft Systems 301 West Holly Bellingham, WA 98225 (206) 676-6175	Plump	8KB	X		X	255	Supports AutoCAD and other PC-CAD packages.

Peripheral Sharing Devices

The following table lists peripheral sharing devices. Devices with serial (RS-232-C) interfaces support HP plotters. All devices listed also support the HP PaintJet Series Color Graphics Printers.

Vendor	Product[1]	Buffer[1] Size	Input/Output Ports[1]		Data Communication		Spool[3] Capability	Replot (copies)	Personal Computers[5]
			RS-232-C	Parallel	One-way	Two-way[2]			HP Vectra IBM PS/2, AT, PC/XT & Compatibles
Bay Technical Association 200 N 2nd Street Bay St. Louis, MS 39520 (800) 523-2702	PrintMaster	512KB–1MB	X	X	X	X	X		X
Bravo Communications 1310 Tully RD., Suite 107 San Jose, CA 95122 (408) 297–8700	CPS/1000	N/A		X	X		X		X
Datacom Technologies 1101 31st Place West Everett, WA 98204 (206) 355-0590	Metro Switch 431	512KB	X	X	X		X	99[4]	X
Digital Products 108 Water Street Watertown, MA 02172 (617) 924-1680	Print Director	256KB–2MB	X	X	X		X		X
Extended Systems 6062 Morris Hill Lane Boise, ID 83704 (208) 322-7163	MultiSpool 2398A	1MB–4MB	X	X	X		X	255[4]	X
Fifth Generation Systems 11200 Industriplex Blvd. Baton Rouge, LA 70809 (504) 291-7221	Logical Connection	256KB–512KB	X	X	X	X	X		X
Integrated Marketing Corp. 1031-H East Duane Ave. Sunnyvale, CA 94086 (408) 730-1112	Data Manager	256KB–1MB	X		X	X	X		X
Rose Electronics P.O. Box 742571 Houston, TX 77274 (713) 933-7673	CareTaker Plus Master Switch	64KB–256KB 256KB–1MB	X X		X X	X X	X X		X X

[1] Contact vendor for other models and configuration.
[2] Two-way communication supported on serial (RS-232-C) port only.
[3] Spools one-way communication plots.
[4] Multiple copies through software utility or control commands.
[5] Apple Macintosh is not supported by any of these peripheral sharing devices.

5

Centronics Technical Information

The 7550 Plus plotter either supports an RS-232-C serial interface and Centronics parallel interface or an HP-IB parallel interface.

The Centronics interface is recommended over RS-232-C for faster throughput with your plotter. The Centronics interface transfers data and commands between the computer and plotter on 15 signal lines. Eight data input lines are reserved for the transfer of data and other messages in a byte-serial, bit parallel manner. Data and message transfer is asynchronous, coordinated by three handshake lines. The remaining four lines are for management of bus activity.

If a cable is attached to the Centronics connector, the plotter automatically uses the Centronics communication protocol.

Pin Assignments

Addressing is not necessary with this interface since it is not a shared bus. The following table lists and describes the Centronics connector pin assignments. (The second Pin Number column refers to a ground wire that is twisted with the signal wire.)

Signal	Pin	Pin	Signal
~Strobe (Input)	1	19	Strobe Return (GND)
Data 1 (Input)	2	20	Data 1 (GND)
Data 2 (Input)	3	21	Data 2 (GND)
Data 3 (Input)	4	22	Data 3 (GND)
Data 4 (Input)	5	23	Data 4 (GND)
Data 5 (Input)	6	24	Data 5 (GND)
Data 6 (Input)	7	25	Data 6 (GND)
Data 7 (Input)	8	26	Data 7 (GND)
Data 8 (Input)	9	27	Data 8 (GND)
~Acknlg (Output)	10	28	Acknlg Return (GND)
Busy (Output)	11	29	Busy Return (GND)
Paper error (Output)	12	30	Signal GND
~Select (Output)	13	31	~INIT (Input)
NC	14	32	~Error (Output)
NC	15	33	Auxout1 (GND)
O VDC	16	34	NC
Chassis GND	17	35	NC
NC	18	36	NC

The "~" in front of the signals indicates that the signal is negative true (active LOW). GND means the connection is a ground. NC indicates that there is no connection for the pin.

Input Signals

Data Strobe (Pin 1)

This line defines when the information on the data lines is to be accepted by the plotter. This line is normally HIGH, and is set LOW when data to be written to the plotter is valid. BUSY is set HIGH after the falling edge of this signal. Refer to the previous table.

Data Lines (Pins 2–9)

Eight lines are used for character transfer from the host CPU to the plotter. Data line 1 is the least significant bit; data line 8 is the most significant bit.

Input Prime (Pin 31)

The plotter will reinitialize on this signal.

Output Signals

Select Line (Pin 13)

The select line is LOW at power-up. It is set HIGH at initialization and remains HIGH.

Fault Line (Pin 32)

–Fault goes LOW if any malfunction or error occurs in the plotter.

Busy Line (Pins 11 & 29)

When Busy is LOW, the plotter can accept another character from the host. Busy goes HIGH after *every* valid HIGH-TO-LOW transition of the = Strobe signal. This allows a host CPU to handshake data with the plotter using the BUSY signal instead of the –Ack signal.

Acknowledge Line (Pins 10 & 28)

-Ack is also used to synchronize the transfer of data from the host CPU to the plotter. The -Ack pulse is a "request for data" signal generated by the plotter, and expects one character in response from the Host CPU. During normal data transfer, the -Ack signal is generated *when or before* the BUSY signal changes from HIGH to LOW (not-BUSY). A -Ack pulse is generated each time the plotter changes from OFF-LINE to ON-LINE.

Paper Error Line (Pin 12)

Normally LOW, this signal changes to HIGH when the plotter runs out of paper. In addition to paper errors, this signal responds to any fault that occurs in the plotter which requires the attention of the operator. When the signal is HIGH, the -Fault signal is always LOW.

O VDC (Pin 16)

Same as logic ground.

Chassis Grounds (Pin 17)

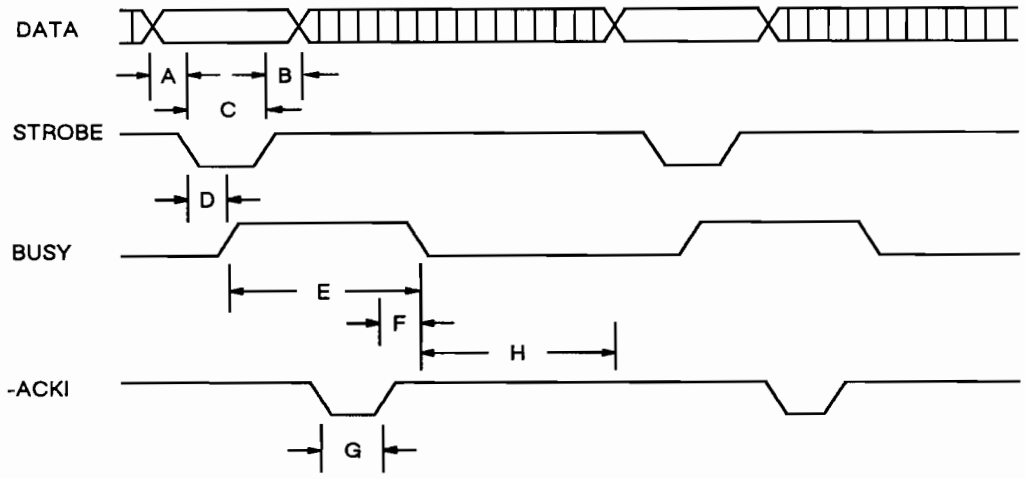
Same as frame ground.

Auxout1 (Pin 33)

This signal is always LOW while the plotter is powered on.

Handshake Timing

The time specifications for parallel plug-compatible interfaces are described in the following figure.



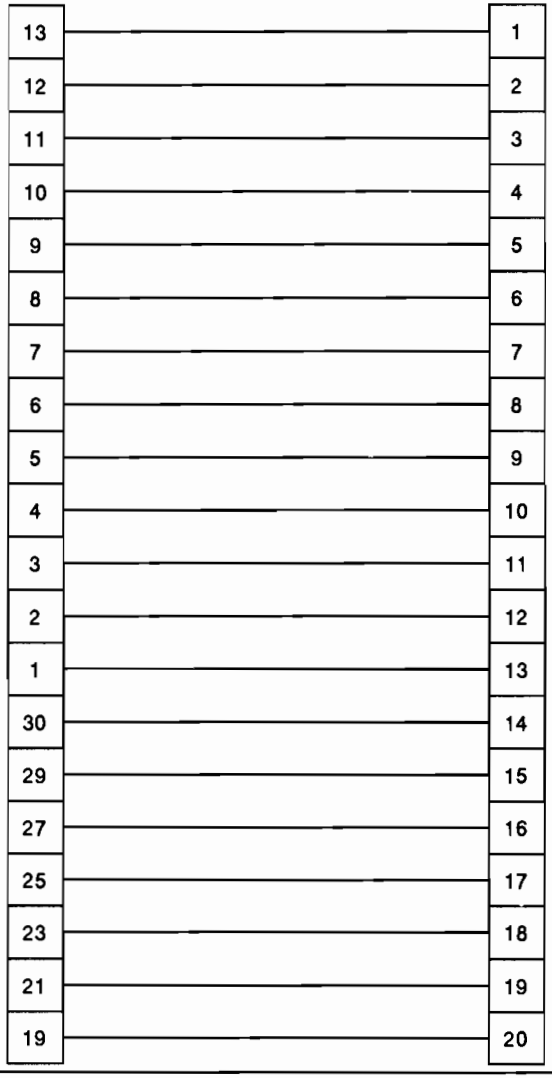
Timing Specification Description	Minimum Value	Typical Value	Maximum Value
A: Data set-up time before -Strobe on	0.5 usec.	–	–
B: Data hold time after -Strobe off	0.5 usec.	–	–
C: -Strobe-on pulse width	0.5 usec.	–	500 usec.
D: -Strobe-on to Busy-on	0.0 usec.	–	0.5 usec.
E: Busy-on duration (plotter-ON-LINE)	10.0 usec.	* 143 usec. **2.0 msec.	10 Sec
F: -Ack-off to Busy-off	0.0 usec.	0.1 usec.	
G: -Ack-on pulse width	4.5 usec.	–	5 usec.
H: Busy-off to start of next cycle	0.0 usec.		

* Image and font download data.
** Text data.

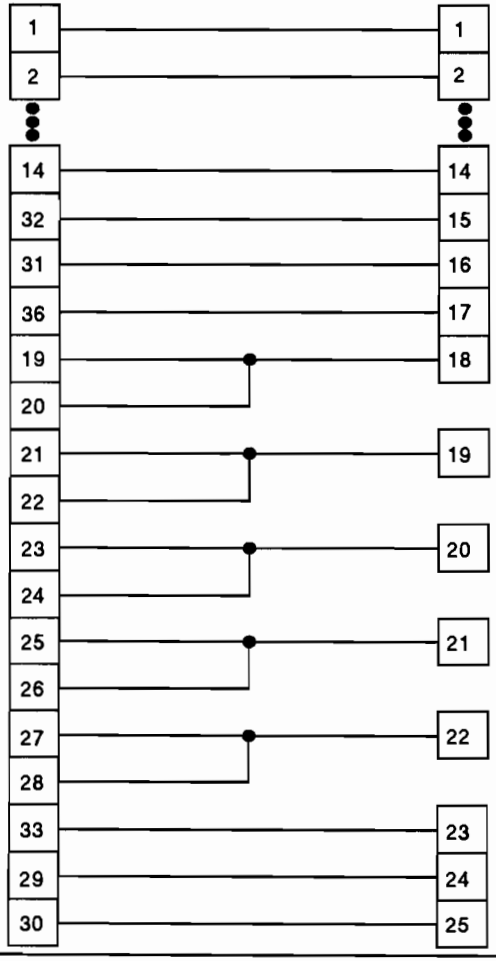
Centronics Cable Schematics

The following cable schematics are for Hewlett-Packard cables.

HP Part Number	Connector Type	
	Plotter End	Computer End
13242D	36-pin male	25-pin male



HP Part Number	Connector Type	
	Plotter End	Computer End
92284A	36-pin male	25-pin female



6

RS-232-C Technical Information

Interfacing is a multistep process that establishes compatibility between a computer and a peripheral device. Handshaking controls the manner in which data is transferred between the two devices, once an interface has been established. This chapter explains the underlying concepts about establishing an interface and initiating a handshake.

The first section of this chapter pertains to interfacing—establishing compatibility between your plotter and computer. The four areas of compatibility: mechanical, electrical, timing, and data, are explained. Communication compatibility (timing and data) is discussed in depth. The rest of the chapter discusses handshaking, the way data is transferred between the plotter and computer, once an interface has been established. Guidelines are provided to help you select a handshake. Once you select a handshake, read the section pertaining to that handshake method for specific instructions and examples of implementation.

An Overview of Interfacing and Handshaking

What is interfacing, and why is it necessary? Ideally, all peripherals and computers would standardize their input/output connections, making them compatible once interconnected. Unfortunately, no such standard exists and, as a result, two RS-232-C devices are not necessarily compatible. In the case of the serial RS-232-C interface, the EIA standards refer only to the mechanical and electrical characteristics and signal functions; other characteristics are not discussed. To communicate successfully, there must be timing and data format (i.e., communication compatibility), and electrical and mechanical compatibility between all devices adhering to the RS-232-C standard. This chapter briefly explains the electrical and mechanical areas of compatibility before dealing in depth with communication (data and timing) compatibility.

Mechanical Compatibility

RS-232-C mechanical compatibility implies the use of a standard 25-pin connector. The EIA standard defines 25 lines and their respective signal functions; in addition to data transfer, these lines are used for interfacing functions. On HP plotters a maximum of 9 of the 25 available lines are connected to the plotter's internal circuitry. The use of these nine lines is very common in the industry, and many computers now have connectors only for those nine lines. If you need more detailed information on signal designation and direction, refer to *RS-232-C Pin Allocations* later in this chapter.

Electrical Compatibility

Data passes between devices over the lines using two voltage levels. These levels represent the two possible states (1 or 0) of a binary digit. The voltage levels must be the same for both devices. RS-232-C standards specify that voltage levels between +3V and +25V on lines used for data transfer be recognized as 0 or "space" and on control lines (such as Data Set Ready and Clear To Send) as ON. Voltage levels between -3V and -25V must be recognized as 1 or "mark" for data transfer lines and as OFF for control lines.

Communication Compatibility

Computers and plotters have a wide range of operating speeds. Plotters may execute instructions slower or faster than computers generate them, necessitating a system that ensures the efficient transmission and receipt of data. You must provide this communication compatibility to interface your plotter with your computer.

Communication compatibility includes both data format and timing compatibility as well as communication protocol. In order to establish communication compatibility, your computer and plotter must be set to use the same:

- Number of data bits
- Parity
- Baud rate
- Number of stop bits

Each of these subjects is discussed in this chapter, with reference to plotters. The requirements of your computer system will dictate the conditions you establish.

Data Format

Once an interface has made a computer and plotter mechanically and electrically compatible, they can exchange messages in the form of electrical signals. In order for these messages to be understood and executed, certain data formatting conventions must be followed. Devices may use any data format for internal communication. However, each device must input and output data in a standard character representation such as Extended Binary Coded Decimal Interchange Code (EBCDIC) or American Standard Code for Information Interchange (ASCII). All HP plotters use standard 8-bit ASCII code; as a result, they are compatible with a wide variety of devices. If data from the computer is not in this format, you need a protocol converter. HP plotters are not compatible with 6-bit or 12-bit ASCII devices.

The following table shows the binary code for the uppercase characters A through C and the decimal code of the their seven low-order bits. The lowercase p in the binary code represents the required eighth bit, the parity bit, which can have the value 0 or 1. You will use the decimal codes of ASCII characters to specify some parameters of the plotter instructions which establish communication between the plotter and computer.

ASCII Character	Binary Code*	Decimal Code of Low-Order Seven Bits
A	p1000001	65
B	p1000010	66
C	p1000011	67

* The lower case 'p' represents the required eighth bit, the parity bit.

Parity – The number of bits per character and the format of those bits is important when transferring data between the computer and plotter. ASCII characters are coded in seven bits, with an eighth bit to be used as a parity, or error-checking, bit. While the parity bit may not be active, it still must be included as the eighth bit of each character. Most devices can be set to odd, even, mark, or space (no) parity. Set your plotter and terminal to the same parity as your computer. On the HP 7550 Plus plotter, you set the parity using the front panel.

Most PC systems use 8-bits and no parity checking. This is because graphics data requires 8 data bits of information; otherwise, part of the image will be missing as well as any extended characters above decimal 127 (e.g., £, ©, or Æ).

Refer to "Setting the RS-232-C Interface" in chapter 1 for detailed instructions on setting parity.

Timing Compatibility

Baud Rate – The baud rate is approximately equal to the number of bits transmitted per second. This can be translated into an approximate number of characters per second, since each character is 10 bits long (eight bit code plus one start and one stop bit). For example, at 300 baud a maximum of 30 characters per second may be transmitted. The device receiving the data must be prepared to interpret the eight-bit characters at the same rate at which they are sent. Failure to do so will result in garbled data.

Match the data transmission speeds of your computer and plotter by setting the baud rates equal. The HP 7550 Plus plotter receives and transmits data at the standard baud rates shown in the following table. Make the baud rate selection using the front panel.

Baud Rates
75
150
300
600
1200
2400
4800
9600
19 200
External

Refer to "Setting the RS-232-C Interface" in chapter 1 for instructions on setting the baud rate.

Stop Bits – Data is transmitted asynchronously across the signal lines by means of the eight-bit characters. Asynchronous transmission means the data transfer may be initiated at any time, and the interval of time between characters may vary. To enable the receiving device to distinguish the starting and ending point of each character, each eight-bit group must be preceded by a "start" bit and followed by one or two "stop" bits.

In most cases, HP plotters verify and generate a single stop bit. Two stop bits are generated and verified by HP plotters with baud rate settings less than or equal to 110. Switches can be used on some plotters to generate two stop bits at settings above 110. You should set your plotter and computer to the same number of stop bits, if possible.

Communication Protocol – The communication protocol for the HP 7550 Plus plotter is set using the ESC.M instruction. Refer to Appendix A of the User's Guide or the *HP-GL/2 Reference Guide* for information on the ESC.M instruction.

Handshaking

Once you've established an interface, you will need to initiate a handshake. Handshaking is a means of assuring correct and complete data transfer between the plotter and computer.

If you know which type of handshake you will use, skip this section and refer to the section about that particular handshake.

Hewlett-Packard plotters use an input/output buffer, called the logical input/output buffer in some plotters, to adjust for the rate at which data is received and processed. To prevent data loss due to I/O buffer overflow, the computer and plotter must communicate about the availability of I/O buffer space in the plotter. This process is called "handshaking." An efficient handshake optimizes computer/peripheral communication while preventing data loss. The computer system's capabilities and requirements dictate which handshake method is appropriate. There are two handshakes you can use with your HP 7550 Plus plotter:

- **Hardwire Handshake** — This method uses a physical wire, pin 20 of the RS-232-C connector, to control handshaking. You can use it if the computer and the plotter are directly connected, without a modem, and the computer system can or does monitor pin 20 (CD, Data Terminal Ready (DTR)). Most personal computers use hardwire handshake.

  NOTE: Using a hardwire handshake in a PC environment is likely to cause device timeouts. Since the DTR line remains low while the plot is rasterized and executed, the PC is likely to time-out while waiting for the DTR to go high. Use the "P" parameter of the MODE command in a DOS environment to prevent this. Refer to "Verifying Communication" in chapter 1 for more information.■

- **Xon-Xoff Handshake** — This method is initiated by the plotter. You can use it if your computer system supports an Xon-Xoff protocol. An Xon-Xoff handshake transmits a control character from the plotter to the computer when the plotter's I/O buffer is full, and another character when the buffer is ready to receive more data.

This guide will help you determine which handshake to use.

Guidelines for Selecting a Handshake

The sections discusses the two handshakes implemented on the HP 7550 Plus plotter and gives guidelines for selecting a handshake. How do you know which handshake is best for your specific configuration? The ideal handshake minimizes I/O transactions while keeping the plotter's I/O buffer supplied with data. The communication characteristics and capabilities of the host computer dictate which handshaking method is possible and will be most efficient. *A thorough understanding of the computer's communication characteristics is necessary in order to make the best decision on the type of handshake.*

If you are not sure which is the best handshake to use, consult the documentation for your computer system and software package. Most software packages designed for use with Hewlett-Packard RS-232-C plotters tell you which handshake to select. You may need to fill in parameters suitable to your system, to be used in subroutine calls. The information you need to do this is found in the installation guides for the software. If you are not using a commercial software package, your system manual may tell you whether your system supports Xon-Xoff protocol or hardwire handshake. If there isn't a recommendation in your documentation, the following information should help you choose an efficient handshake.

Plotters Hardwired to the Computer

If your plotter operates in a hardwire configuration there is no intermediate hardware between the plotter and computer; a cable goes directly from plotter to computer. This is the only configuration in which the hardwire handshake can be used. Hardwire handshake is a very efficient handshake; sometimes the term automatic handshake is used to refer to this type of handshake. Many personal computers use hardwire handshake.

Plotters in a Remote Environment

If your plotter will be in a configuration other than hardwire, you can use the Xon-Xoff handshake. The Xon-Xoff handshake is implemented in the operating system or device driver. The Xon-Xoff handshake is efficient when sending variable or fixed-length records.

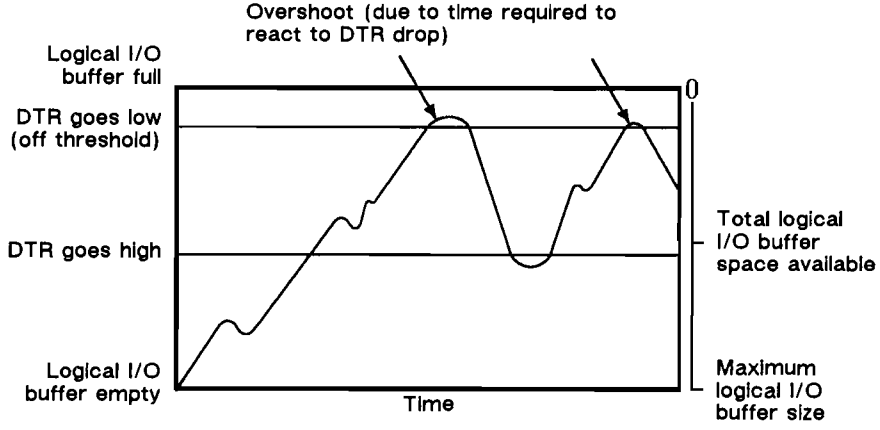
You can test your system for Xon-Xoff support by printing a long program listing (or other text) to a terminal plugged into the RS-232-C connector where you plan to attach to your plotter. While information is printing on your display, send the ASCII character **DC3** (Xoff) to the computer. On many terminals, this is done by pressing and holding the terminal's **CONTROL** key (sometimes labeled "CNTL" or "CTRL") and then pressing the **S** key. If printing immediately stops, send the character **DC1** (Xon), often sent by pressing and holding the **CONTROL** key and then pressing the **Q** key. The printing should resume. If you can stop and start printing in this manner, you can probably use the Xon-Xoff handshake.

Hardwire Handshake

As the name implies, the hardwire handshake takes place in the hardware rather than the firmware or software. Generally speaking, to use hardwire handshake there must not be intermediate hardware between the plotter and computer. You cannot use hardwire handshake in eavesdrop mode, where both a computer and a terminal are connected to the plotter. Many personal computers use hardwire handshake. This handshake uses the plotter's Data Terminal Ready (DTR) control line (pin 20) to control handshaking. You can use this handshake if your computer can monitor pin 20.

In a hardwire handshake, the plotter controls the data exchange sequences by setting the electrical voltage on pin 20 of the computer connector (CD line) to signal the computer when to send another block of data. If there is enough room in the plotter's I/O buffer to store another block of data, the plotter sets the Data Terminal Ready (DTR or CD) line to a high state. You can think of this as turning the line ON. If there is insufficient buffer space, it sets the line low (or OFF). By monitoring this line, the computer knows when it can safely transmit each block of data.

In a hardwire handshake, the computer monitors one of the interface lines from the plotter. If the line is high, it sends data; if the line is low, the computer waits until the line is high again before sending more data. This prevents the computer from overfilling the plotter's input buffer.



Hardwire Handshaking

NOTE: Using a hardwire handshake in a PC environment is likely to cause device timeouts. Since the DTR line remains low while the plot is rasterized and executed, the PC is likely to time-out while waiting for the DTR to go high. You should be sure to set the P parameter of the MODE command when using the hardwire handshake. Refer to "Verifying Communication" in chapter 1 for details on the MODE command.■

Initiating Hardwire Handshake

Hardwire handshake is implemented on the HP 7550 Plus plotter using the front panel.

Output Terminate Character — The output terminate character is a one- or two-character terminator that the computer requires the plotter to send at the end of each response to a data request. The output terminate character tells the computer, "This completes my transmission." The plotter sends a carriage return (**CR**) as the output terminator.

Threshold Level — Threshold level is used to prevent data loss due to buffer overflow. It is a number of bytes in the buffer for the receipt of data. When this portion of the buffer is full of data, the **DTR** line is set low to tell the computer to stop sending data until buffer space is available.

Xon-Xoff Handshake

To understand the way Xon-Xoff handshake works, think of the plotter's buffer as a bucket, which serves to contain water (data). The water source in this discussion is the computer. As water is used (data is processed), it drains out of the bucket.

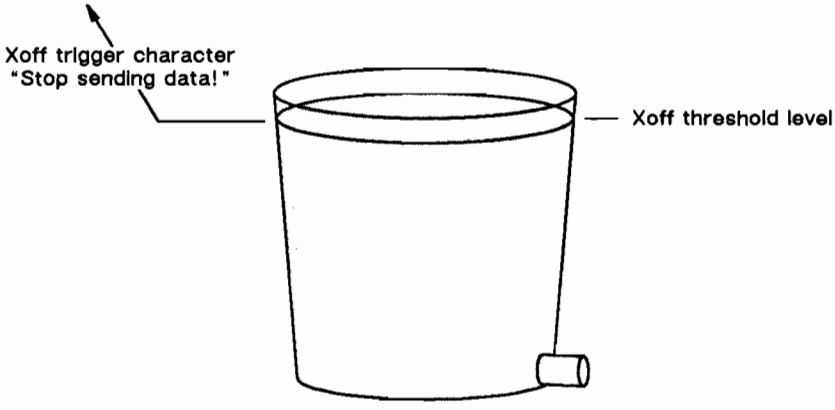
The bucket has two markings. The first marking (Xoff threshold level) indicates when the bucket is so full of water that it is in danger of overflowing. Once the water reaches the danger level, a warning (Xoff trigger character) is sent to the water source, telling it to stop the flow of water.

The second marking (Xon threshold level) is halfway up the bucket. The Xon threshold level is automatically set by the plotter. When enough water has drained out of the bucket, so that the bucket is half full, a signal (Xon trigger character) is sent to the water source. This signal tells the source, "There's enough room in the bucket for more water," and the water is turned on again. This process is repeated until the water source is depleted.

The following diagrams illustrate the way the Xon-Xoff handshake works.

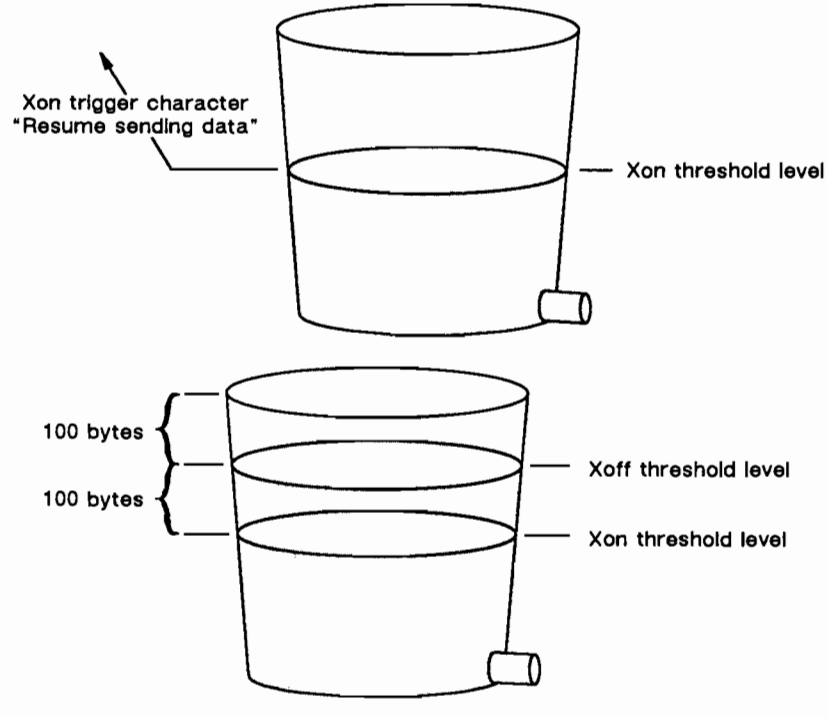
1. Water enters the bucket faster than it can be used, and the bucket starts to fill.

2. The water level reaches the overflow level, and a danger signal is sent to the water source, telling it to turn off the water.



3. There is a delay between the time the warning signal is sent and the time the water is shut off. The plotter automatically allows extra room for overflow (100 bytes), to avoid losing water.

4. Water continually drains out of the bucket. When the water level reaches the Xon threshold level, a signal is sent to the source to turn the water on again.

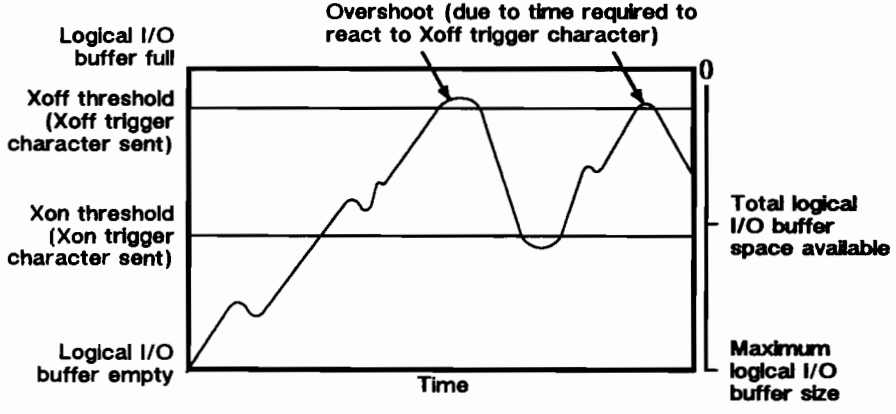


When using the Xon-Xoff handshake method, the plotter controls the data exchange sequence by signaling the computer when it has sufficient room in its I/O buffer for data and when to stop sending data. The plotter uses buffer threshold indicators (an Xon trigger character and an Xoff trigger character) to prevent buffer overflow.

1. Data enters the plotter's buffer faster than it can be processed, and the buffer starts to fill. When the data in the I/O buffer reaches the Xoff threshold level, the plotter sends the Xoff trigger character to the computer.

2. The plotter's buffer empties as data is processed. When the Xon threshold level is reached, the plotter sends the Xon trigger character to the computer, restarting the flow of data.

This process is repeated until all data has been sent. The following is a graphic representation of this process.



Xon-Xoff Handshaking

RS-232-C Pin Allocations

The plotter interfaces to the RS-232-C communications lines through a standard 25-pin female connector. Connector pin allocations are identified and described in the following table.

RS-232-C

Wire/Signal Name	Pin #	RS-232-C	CCITT V.24
Protective Ground	1	AA	101
Transmitted Data	2	BA	103
Received Data	3	BB	104
Signal Ground	7	AB	102
Data Terminal Ready	20	CD	108.2

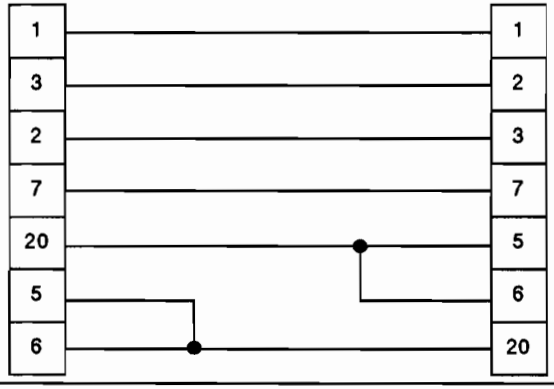
RS-422-A
(RS-232-C and HP-IB Version Only)

Wire/Signal Name	Pin Number	RS-422-A
Send data–	9	SD.A
Send data +	10	SD.B
Receive data +	18	RD.B
Receive data–	3	RD.A
Signal common	7	SG

RS-232-C Cable Schematics

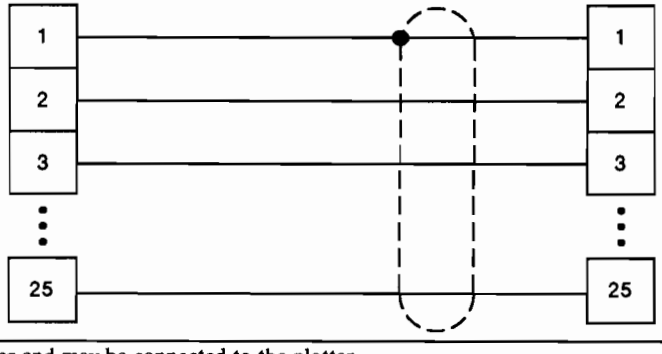
The following cable schematics are for Hewlett-Packard cables.

HP Part Number	Connector Type (25-pin)	
	Plotter End	Computer End
17255D 17255F 17255M or 13242G*	male female male	female female male



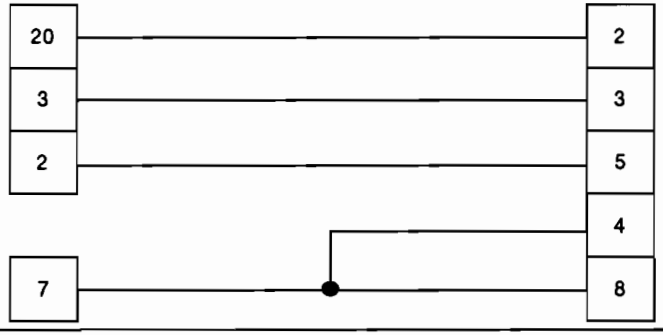
* Symmetrical; either end may be connected to the plotter. Other pins are connected in the 13242G but do not affect plotter operation.

HP Part Number	Connector Type (25-pin)	
	Plotter End	Computer End
17355D 17355F* 17355M*	male female male	female female male

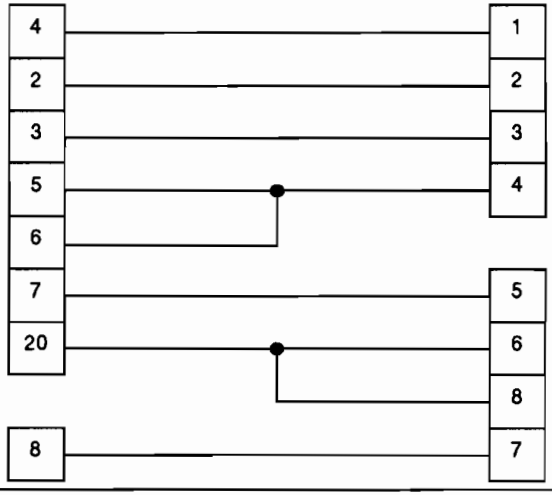


* Symmetrical; either end may be connected to the plotter.

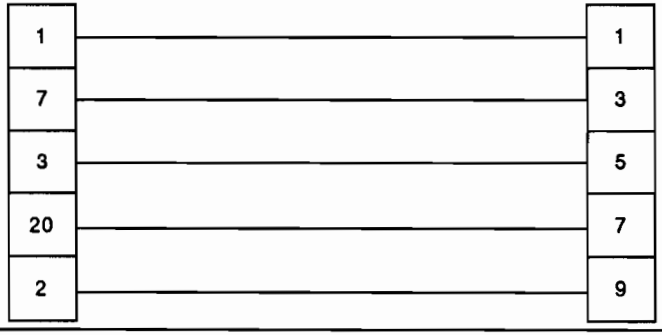
HP Part Number	Connector Type	
	Plotter End	Computer End
17302A	male (25-pin)	male (8-pin mini din)



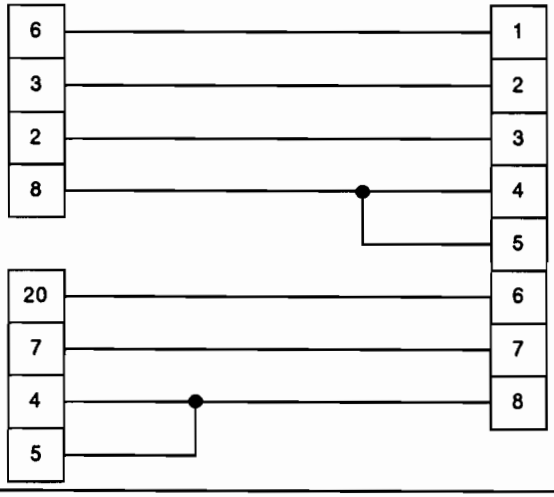
HP Part Number	Connector Type	
	Plotter End	Computer End
24542G 24542H	male (25-pin) female (25-pin)	female (9-pin) female (9-pin)



HP Part Number	Connector Type	
	Plotter End	Computer End
92219M	male (25-pin)	male (9-pin)



HP Part Number	Connector Type	
	Plotter End	Computer End
92219P	male (25-pin)	male (9-pin)



6

7

HP-IB Technical Information

This chapter discusses how to programmatically establish communication compatibility between the plotter and the computer using the HP-IB (IEEE-488) parallel interface, including normal and secondary command support modes.

For most applications, you probably only need to understand how to address your plotter. Setting the plotter address is detailed in chapter 1.

HP-IB (IEEE-488) Information

The Hewlett-Packard Interface Bus (HP-IB) provides for compatibility between all devices adhering to the ANSI/IEEE-488 (1978) standard. HP-IB is the most common interface between Hewlett-Packard computers, peripherals and instruments. HP-IB is recommended over RS-232-C for faster throughput with your plotter.

HP-IB transfers data and commands between the computer and plotter on 16 signal lines. Eight data I/O lines are reserved for the transfer of data and other messages in a byte-serial, bit parallel manner. Data and message transfer is asynchronous, coordinated by three handshake lines. The remaining five lines are for management of bus activity.

Devices connected to the bus can be talkers, listeners, or controllers. The controller dictates the role of each of the other devices by setting the attention (ATN) line true and sending talk or listen addresses on the data lines. Addresses are set into each device at the time of system configuration either by switches built into the device or by jumpers on an internal board. While the ATN line is true, all devices must listen to the data lines. When the ATN line is false, only devices that are addressed actively send or receive data.

Interface Functions

The following table shows the HP-IB interface functions.

HP-IB Interface Functions

Interface Function Name	Normal Implementation
Source Handshake	SH1
Acceptor Handshake	AH1
Talker	T6
Listener	L3
Extended Talker	—
Extended Listener	—
Service Request	SR1
Parallel Poll	PP1,PP2 or PP0*
Device Clear	DC1
No Remote Local	RL0
No Device Trigger	DT0
No Controller	C0

* PP0 is implemented if the plotter is in listen-only mode; PP2 is implemented if the plotter's address is less than 8; PP1 is implemented otherwise.

HP-IB Protocol

This is the standard implementation of HP-IB that establishes mechanical, electrical, timing, and data compatibility between devices. It allows high-speed communication between many peripherals on one computer port. A device on the HP-IB may function in the following ways.

- As a 'listener' that receives data sent over the bus.
- As a 'talker' that transmits data to other devices on the bus.
- As a 'controller' (computer) that regulates interaction of the devices on the HP-IB system.

The plotter functions primarily as a 'listener,' receiving data sent over the bus.

Controlling Addressing Sequences

When you are programmatically controlling the HP-IB, one of the first things you must consider is addressing. Using HP-IB addresses, the controller can identify and individually access various devices on the interface. The following table lists the listen and talk characters for specific addresses. Select the HP-IB address using the front panel as explained in chapter 1.

Address Codes		Address Characters	
Decimal	Octal	Listen	Talk
0	0	SP	@
1	1	!	A
2	2	"	B
3	3	#	C
4	4	$	D
5	5	%	E ← Factory default
6	6	&	F
7	7	'	G
8	10	(	H
9	11	)	I

(Table continues)

HP-IB Address Settings

Address Codes		Address Characters	
Decimal	Octal	Listen	Talk
10	12	*	J
11	13	+	K
12	14	,	L
13	15	-	M
14	16	.	N
15	17	/	O
16	20	0	P
17	21	1	Q
18	22	2	R
19	23	3	S
20	24	4	T

(Table continues)

HP-IB Address Settings

Address Codes		Address Characters		
Decimal	Octal	Listen	Talk	
21	25	5	U	← Reserved for HP desktop computer
22	26	6	V	
23	27	7	W	
24	30	8	X	
25	31	9	Y	
26	32	:	Z	
27	33	;	[	
28	34	<	\	
29	35	=	]	
30	36	>	^	
31	37	?	_	← Sets listen-only mode

An addressing sequence is made up of three major parts, with the ATN (Attention) line true.

<Unlisten Command> <Talk Address> <Listen Addresses>

The purpose of these parts is as follows.

- **Unlisten Command** — A universal bus command; its character is **?** (ASCII decimal code 63). It unaddresses all listeners. After transmitting the unlisten command, no active listeners remain on the bus.

- **Talk Address** — Indicates the device that is to talk, or send data. A new talk address automatically unaddresses the previous talker.

- **Listen Addresses** — Indicate one or more devices that are to listen, or receive data. A listen address adds the designated device as listener along with other addressed listeners.

This addressing sequence directs who talks to whom. You can implement the commands (unlisten, talk, listen) by putting data on the bus and setting the ATN control line true. The unlisten command (**?**) plays a vital role in this sequence. It is important that a device receive only the data that is intended for it.

When a new talk address is transmitted in the addressing sequence, the previous talker is unaddressed. Therefore, only the new talker can send data on the bus and you don't need to use an untalk command in the same manner as the unlisten command.

For example, to tell a computer at address 21 to talk and a plotter at address 05 to listen, the controller (usually the computer) sets the proper control line true and sends the following sequence.

? **U** **%**

where	**?**	—	tells all devices on the bus to unlisten,
	U	—	designates the device at address 21 as the talker,
	%	—	designates the device at address 05 as the listener.

To have the plotter talk and the computer listen, you would set the control lines and send the following, with ATN true.

? **E** **5**

Listen-Only Mode

In listen-only mode, the plotter plots all data transmitted over the bus without being addressed by a computer.

Activate listen-only mode using the front panel. In listen-only mode, the plotter does not have an address, but listens to all data transmitted on the bus. The plotter cannot then be placed in a talker-active state.

Listen-only mode is useful in a system that has no controller but has a dedicated talker (such as a tape drive or other mass storage unit) transmitting information to the plotter.

Bus Commands

Devices on the HP-IB receive special instructions in the form of commands. To send a command over the bus, the controller asserts the ATN line. Once the ATN line is asserted, the devices on the bus understand that what follows is a command, not data.

Listen Address (LAD) X01AAAAA

AAAAA represents the HP-IB address of the device for which the command is intended. This command causes the plotter to become a listener.

Device Clear (DCL) X0010100

Sets all devices on the HP-IB system to a predefined or initialized state. It clears the I/O buffer and resets the parser to begin accepting a new instruction, and disables any current output. (The DCL command does not reset any parameters in the plotter to default values. It is not the same as the PCL instruction **ESC** E or the HP-GL/2 instructions DF or IN.) Partially parsed instructions and/or parameters are lost.

If the plotter is parsing an instruction, DCL aborts it; if the plotter is executing an instruction (processing and storing it internally), it is completed. DCL does not affect instructions already stored in the plotter's buffer.

Selected Device Clear (SDC) X0000100

This command clears only those devices on the bus that are selected to listen. Except for this difference, SDC has the same effect as DCL.

Sent along with the addresses of the devices, SDC sets selected devices to a predefined or initialized state. This command clears only those devices on the bus that are selected to listen. It clears the I/O buffer and resets the parser to begin accepting a new instruction, and disables any current output. (The SDC command does not reset any parameters in the plotter to default values. It is not the same as the PCL instruction **ESC E** or the HP-GL instructions DF or IN.) Partially parsed instructions and/or parameters are lost.

Interface Clear (IFC)

The controller uses the IFC line to override all bus operations and return the bus to a known inactive state. All pending output on the bus is cleared. IFC does not affect data already received by the plotter.

Running 7550A Programs on the 7550 Plus

There are some minor differences in a few HP-GL commands on the 7550A and the 7550A emulation mode on the 7550 Plus. If you are using your HP 7550 Plus with a commercial software package and a 7550A driver, you should notice no differences. If you have written your own programs for your 7550A, in most cases you will probably notice no differences when you run that program using your 7550 Plus. However, you should take note of the differences discussed below.

AP The Automatic Pen Operations Instruction

New parameters have been added as follows.

Parameter	Format	Range	Default
n	integer	1 to 255	95

- **No Parameters** — Turns on all the automatic pen operations except for converting SP instructions to SG instructions. This is the default set.
- **n** — To turn on any subset of the automatic pen operations, add the value of the parameters.

  0 Disables automatic pen operations. Pens not lifted until commanded by PU instruction or front panel. Pens not stored until commanded by SP instruction or front panel. Pens retrieved immediately when selected by SP instruction.

  1 Lifts the pen if it has been down for the allotted time.

  2 Stores the pen if it has not moved in the allotted time. If unable to put the pen away, lifts the pen (if down).

  4 Does not retrieve a pen selected by the SP instruction until the new pen is required to draw.

  8 Merges consecutive pen up moves.

16 Sorts the instructions in the pen sorting buffer according to pen number. The plotter then plots all the instructions for one pen before switching to another one. When pen sorting is off, plots are drawn in the order the instructions are received. Turn pen sorting off to debug a program. If ink smears or bleeds when shapes are outlined, turn pen sorting off.

32 Reserved.

64 Allows bidirectional plotting.

128 Automatically converts all SP instructions to SG instructions so you can group pens with software that does not use the SG instruction.

BF The Buffer Plot Instruction

The BF instruction has been NOP'd on the 7550 Plus. RP will continue to replot everything since the last plot terminator.

CV The Curved Line Generator Instruction

The default state for the curved line generator is now *on*. Pen acceleration and pen speed are no longer reduced, so plot throughput is not decreased by the curved line generator. Also the IN instruction now resets the curved line generator to on.

GM The Graphics Memory Instruction

The GM instruction has been NOP'd on the 7550 Plus. Because of the new larger buffers, programs you have previously written will probably not be affected. You can still change buffer sizes using the ESC.T instruction if you need to.

ESC.T Allocate Configurable Memory

The 7550 Plus has new larger default buffers and an additional buffer used for pen sorting (increases throughput). The physical I/O buffer can no longer be altered. The new default buffer sizes are:

physical I/O	1024
polygon	7168
downloadable character	6144
replot	25976
vector buffer	3000
pen sort	12000

If you install one of the additional memory cards, the plotter will use the card's memory for the physical I/O and replot buffer and reallocate the internal memory as follows.

physical I/O	0
polygon	7168
downloadable character	6144
replot	0
vector buffer	3000
pen sort	38000

B

HP-GL/2 Syntax Summary

This appendix lists the syntax and parameter ranges for HP-GL/2, the graphics language instructions your plotter supports. HP-GL/2, in its entirety, is composed of two parts: the HP-GL/2 kernel instructions and extension instructions. The kernel instructions are supported on all HP plotters, the extensions are dependent on the device. Your plotter supports the HP-GL/2 kernel and the Technical Graphics, Palette, and Digitizing extensions. All of the instructions in these groups are summarized below.

For a more complete description of these instructions and the entire HP-GL/2 language, along with special programming considerations, you can order the *HP-GL/2 Reference Guide* through your HP Sales and Support Office. If you are writing drivers to support more than one HP-GL/2 device, you may also want to order the *HP-GL/2 Comparison Guide*.

This appendix first explains briefly HP-GL/2 syntax conventions, then describes the instructions this plotter supports. The summary lists the instructions from the HP-GL/2 kernel and the Technical Graphics, Palette, and Digitizing extensions in one alphabetical list.

The *HP-GL/2 Reference Guide* explains the HP-GL/2 instructions according to the kernel group or HP-GL/2 extension. For your help in referencing to the *HP-GL/2 Reference Guide,* this summary lists the functional kernel group or extension with which the instruction is associated.

Key to HP-GL/2 Syntax

Optional syntax elements are enclosed in parentheses. The parentheses are not part of the HP-GL/2 instructions.

Individual parameters in each command must be specified using one of the data format types shown in the following table.

Data Type	Range
Integer	-8 388 608 to 8 388 607
Real	-8 388 608.000 0 to 8 388 607.999 9
Clamped Integer	-32 768 to 32 767
Clamped Real	-32 768 to 32 767
Current Unit	*
Character	8-bit character range 0 to 255
Newstring	character sequence within double quotes

* Units are plotter units if scaling is off and user units if scaling is on. Plotter units are in the *integer* format, user units are in the *real* format.

AA, Arc Absolute (Vector Group)

USE: Draws an arc, using absolute coordinates, that starts at the current pen location and pivots around the specified center point (*XCENTER,YCENTER*).

SYNTAX: AA*XCENTER,YCENTER,sweep angle(,chord angle;)*

Parameter	Format	Functional Range	Default
XCENTER,YCENTER	current units	-8 388 608 to 8 388 607	—
sweep angle	clamped real	±360°	—
chord angle*	clamped real	0.5° to 180°	5°

* Chord angle is the default interpretation of chord tolerance. Deviation distance is defined as the distance between the drawn chord and the arc segment it represents. When you use the chord angle mode of chord tolerance, the circle or arc is always drawn with the same number of chords. When deviation distance mode is used, the number or chords changes with the size of the circle or arc. Change chord tolerance mode using the CT instruction.

AC, Anchor Corner (Line and Fill Attribute Group)

USE: Positions the starting point of any fill pattern. Use AC to ensure that the selected fill pattern will be positioned within the figure as expected.

SYNTAX: AC*X,Y(;)*
or
AC*(;)*

Parameter	Format	Functional Range	Default
X,Y coordinates	current units	-8 388 608 to 8 388 607	—

AD, Alternate Font Definition (Character Group)

USE: Defines an alternate character set and its attributes: font spacing, pitch, height, stroke weight, and typeface. Use AD to set up an alternate character set that you can easily access when labeling.

SYNTAX: AD*kind,value...(,kind,value;)*
or
AD*(;)*

Parameter	Format	Functional Range	Default
kind	clamped integer	1 to 7	—
value	clamped real	*kind* dependent	*kind* dependent

Attribute	Kind*	Value	Description
Character set	1	277 (0)	Roman8 (default)
		21	ANSI USASCII
		14	ECMA 94 Latin 1
		6	French v1
		38	French v2
		39	German
		563	HP Drafting
		531	HP-GL/2 Download
		267	HP Kana8
		43	HP Katakana
		5	HP Roman Extensions
		595	HP Special Symbols
		85	Intnl. Ref. Version
		9	Italian
		11	JIS ASCII
		4	Norwegian v1
		36	Norwegian v2
		147	Portuguese
		115	Swedish
		19	Swedish Names
		83	Spanish
		37	United Kingdom
Font spacing	2	0	fixed spacing (default)
		1	variable spacing
Pitch	3	0 to 32 767.9999	characters per inch (default: 5.942)
Height	4	0 to 32 767.9999	font point size (default: 16)
Stroke Weight	6	–7	very light
		–3	light
		0	normal (default)
		3	bold
		7	very bold
Typeface	7	48	Stick (default)
		49	HP-GL Drafting
		50	HP-GL ArcSpline

* Kind 5 is ignored.

AR, Arc Relative (Vector Group)

USE: Draws an arc, using relative coordinates, that starts at the current pen location and pivots around the specified center point (*XINCREMENT,YINCREMENT*).

SYNTAX: AR*XINCREMENT,YINCREMENT,sweep angle(,chord angle;)*

Parameter	Format	Functional Range	Default
XINCREMENT, YINCREMENT	current units	–8 388 608 to 8 388 607	—
sweep angle	clamped real	±360°	—
chord angle*	current units	0.5° to 180°	5°

* Chord angle is the default interpretation of chord tolerance. Deviation distance is defined as the distance between the drawn chord and the arc segment it represents. When you use the chord angle mode of chord tolerance, the circle or arc is always drawn with the same number of chords. When deviation distance mode is used, the number or chords changes with the size of the circle or arc. Change chord tolerance mode using the CT instruction.

AT, Absolute Arc Three Point (Vector Group)

USE: Draws an arc segment, using absolute coordinates, from a starting point through an intermediate point (*XINTER,YINTER*) to an end point (*XEND,YEND*). Use AT when you know these three points of an arc.

SYNTAX: AT*XINTER,YINTER,XEND,YEND(,chord angle;)*

Parameter	Format	Functional Range	Default
XINTER, YINTER	current units	–8 388 608 to 8 388 607	—
XEND, YEND	current units	–8 388 608 to 8 388 607	—
chord angle	clamped real	0.5° to 180°	5°

* Chord angle is the default interpretation of chord tolerance. Deviation distance is defined as the distance between the drawn chord and the arc segment it represents. When you use the chord angle mode of chord tolerance, the circle or arc is always drawn with the same number of chords. When deviation distance mode is used, the number or chords changes with the size of the circle or arc. Change chord tolerance mode using the CT instruction.

BP, Begin Plot

Technical Graphics Extension

USE: Indicates the beginning of a plot. Also lets you name plot files for queuing and spooling.

SYNTAX: BP(*kind,value...(,kind,value);*)
or
BP*(;)*

Parameter	Format	Functional Range	Default
kind	clamped integer	1, 2 , 3, or 4	—
value	*kind* dependent	*kind* dependent	*kind* dependent

The following table describes the values for the corresponding *kind* parameters.

Kind	Value
1	**Picture name:** Defaults to device-dependent sequence number or the time of day if a clock is available. This value can be used to identify the plot for the user.
2	**Number of copies:** Defaults to 1.
3	**File disposition code:** Controls replot capability. **0** Enables replot; saves the file if room exists. **1** Destroys file after printing (does not save in memory or on disk, disables use of RP afterward or retrieval of the file using the control panel).
4	**Render last page if unfinished:** **0** No (Erases the page). **1** Yes (Prints the page and advances the media).
5	**Auto-rotation** **0** Permits automatic rotation of the plot when nesting is on. (Default.) **1** Disables automatic rotation. The "length" parameter of the PS instruction is in the direction of the paper movement.

CI, Circle (Vector Group)

USE: Draws the circumference a circle using the specified radius and chord tolerance. If you want a filled circle, refer to the WG or PM instruction.

SYNTAX: CI*radius(,chord angle;)*

Parameter	Format	Functional Range	Default
radius	current units	-8 388 608 to 8 388 607	—
chord angle	clamped real	0.5° to 180°	5°

* Chord angle is the default interpretation of chord tolerance. Deviation distance is defined as the distance between the drawn chord and the arc segment it represents. When you use the chord angle mode of chord tolerance, the circle or arc is always drawn with the same number of chords. When deviation distance mode is used, the number or chords changes with the size of the circle or arc. Change chord tolerance mode using the CT instruction.

CP, Character Plot (Character Group)

USE: Moves the pen the specified number of character plot cells from the current pen location. Use CP to position a label for indenting centering labels.

SYNTAX: CP*spaces,lines(;)*
or
CP*(;)*

Parameter	Format	Functional Range	Default
spaces	clamped real	-32 767. 999 9 to 32 767. 999 9	—
lines	clamped real	-32 767. 999 9 to 32 767. 999 9	—

CT, Chord Tolerance Mode Technical Graphics Extension

USE: Determines whether the chord tolerance parameter of the AA, AR, AT, CI, EW, RT, and WG instructions is interpreted as a chord angle in degrees or as a deviation distance in current units.

SYNTAX: CT*mode(;)*
or
CT*(;)*

Parameter	Format	Functional Range	Default
mode	clamped integer	0 (chord angle mode) 1 (deviation distance mode)	0

DC, Digitize Clear

Digitizing Extension

USE: Terminates digitize mode.

SYNTAX: DC;

DF, Default Values

(Configuration and Status Group)

USE: The DF command returns the plotter to the default condidtions as follows.

SYNTAX: DF*(;)*

Function	Equivalent Instruction	Default Condition
Anchor Corner	AC	Anchor set to lower-left corner of hard-clip limits.
Alternate Font Definition	AD	Roman8, fixed spacing, fixed vector typeface.
Character Fill Mode	CF	Solid fill, no edging.
Absolute Direction	DI	Character direction parallel to X-axis.
Define Label Terminator	DT	**ETX** and nonprinting mode.
Define Variable Text Path	DV	Text printed left to right with normal line feed.
Extra Space	ES	Turns off extra spacing.
Fill Type	FT	Solid bidirectional fill.
Input Window	IW	Hard-clip limits.
Line Attributes	LA	Butt caps, mitered joins, and miter limit = 5.
Label Origin	LO1	Standard labeling starting at current location.
Line Type	LT	Solid line, relative mode, pattern length = 4% of diagonal distance from P1 to P2.
Plotting Mode	PA	Absolute plotting.
Polygon Mode	PM0PM2	Polygon buffer cleared.
Raster Fill	RF	Solid black.
Scale	SC	User-unit scaling off.
Standard Font Definition	SD	Roman8, fixed spacing, fixed vector typeface.

Function	Equivalent Instruction	Default Condition
Character Size Absolute	SI	Turns off size transformation.
Character Slant	SL	No slant.
Symbol Mode	SM	Off.
Select Font	SS	Standard font selected.
Transparent Data	TD	Normal printing mode.
User-Defined Line Type	UL	Defaults all 8 line types.

DI, Direction Absolute

(Character Group)

USE: Specifies the slope or direction in which labels are drawn, independent of P1 and P2 settings. The ratio of the two parameters *run* and *rise* determine the slope of the line along which labels will be drawn.

SYNTAX: DI*run,rise(;)*
or
DI*(;)*

Parameter	Format	Functional Range	Default
run (or cos θ)	clamped real	-32 767. 999 9 to 32 767. 999 9	1
rise (or sin θ)	clamped real	-32 767. 999 9 to 32 767. 999 9	0

DL, Download Character

Technical Graphics Extension

USE: Allows you to design characters and store them in a buffer for repeated use. Use DL whenever you want to create characters or symbols not included in the plotter's character sets.

SYNTAX: DL*character number(,up),X,Y..,(up),X,Y;)*
or
DL*character number(;)*
or
DL*(;)*

Parameter	Format	Functional Range	Default
character number	clamped integer	33 to 126	—
up	clamped integer	-128	—
X,Y coordinates	clamped integer	-127 to 127 primitive grid units	—

DP, Digitize Point

Digitizing Extension

USE: Places the plotter in digitize mode. Use the OD instruction to obtain the coordinates of a point on a plot.

SYNTAX: DP;

DR, Relative Direction

(Character Group)

USE: Specifies the direction in which labels are drawn, relative to the scaling points P1 and P2. *Label direction is adjusted when P1 and P2 change so that labels maintain the same relationship to the plotted data.* The ratio of the two parameters *run* and *rise* determine the slope of the line along which labels will be drawn.

SYNTAX: DR*run,rise(;)*
or
DR*(;)*

Parameter	Format	Functional Range	Default
run	clamped real	-32 767. 999 9 to 32 767. 999 9	1% of P2x-P1x
rise	clamped real	-32 767. 999 9 to 32 767. 999 9	0% of P2Y-P1Y

DT, Define Label Terminator

(Character Group)

USE: Specifies the character to be used as the label terminator and whether it is printed. Use DT to define a new label terminator if your computer cannot use the default label terminator (**ETX**, decimal code 3).

SYNTAX: DT*label terminator(,mode;)*
or
DT*(;)*

Parameter	Format	Functional Range	Default
label terminator	character	any character except **NULL**, **LF**, **ENQ**, and **;** (decimal codes 0, 5, 27, and 59 respectively)	**ETX** (decimal code 3)
mode	clamped integer	0 or 1	1 (nonprinting)

DV, Define Variable Text Path (Character Group)

USE: Specifies either right, left, up, or down as the text path for subsequent labels and the direction of line feeds. Use DV to 'stack' characters in a column.

SYNTAX: DVpath(,line;)
or
DV(;)

Parameter	Format	Functional Range	Default
path	clamped integer	0, 1, 2, or 3	0 (horizontal)
line	clamped integer	0 or 1	0 (normal line feed)

EA, Edge Rectangle Absolute (Polygon Group)

USE: Defines and outlines a rectangle using absolute coordinates.

SYNTAX: EA*X,Y(;)*

Parameter	Format	Functional Range	Default
X,Y coordinates	current units	-8 388 608 to 8 388 607	—

EP, Edge Polygon (Polygon Group)

USE: Outlines the polygon currently stored in the polygon buffer. Use EP to edge polygons that you defined in polygon mode and with the fill rectangle and wedge instructions (RA, RR, and WG).

SYNTAX: EP(;)

ER, Edge Rectangle Relative (Polygon Group)

USE: Defines and outlines a rectangle using relative coordinates.

SYNTAX: ER*X,Y(;)*

Parameter	Format	Functional Range	Default
X,Y increments	current units	-8 388 608 to 8 388 607	—

ES, Extra Space (Character Group)

USE: Adjusts space between characters and lines of labels without affecting character size.

SYNTAX: ES*width(,height;)*
or
ES*(;)*

Parameter	Format	Functional Range	Default
width	clamped real	-32 767. 999 9 to 32 767. 999 9	0
height	clamped real	-32 767. 999 9 to 32 767. 999 9	0

EW, Edge Wedge (Polygon Group)

USE: Outlines any wedge. Use EW to draw sectors of pie charts.

SYNTAX: EW*radius,start angle,sweep angle,(,chord angle;)*

Parameter	Format	Functional Range	Default
radius	current units	-8 388 608 to 8 388 607	—
start angle	clamped real	±360°	—
sweep angle	clamped real	±360°	—
chord angle*	clamped real	0.5° to 180°	5°

* Chord angle is the default interpretation of chord tolerance. Deviation distance is defined as the distance between the drawn chord and the arc segment it represents. When you use the chord angle mode of chord tolerance, the circle or arc is always drawn with the same number of chords. When deviation distance mode is used, the number or chords changes with the size of the circle or arc. Change chord tolerance mode using the CT instruction.

FP, Fill Polygon (Polygon Group)

USE: Fills the polygon currently in the polygon buffer. Use FP to fill polygons defined in polygon mode and by the edge rectangle and wedge instructions (EA, ER, and EW).

SYNTAX: FP(;)

FT, Fill Type

(Line and Fill Attributes Group)

USE: Selects the shading pattern used to fill polygons (FP), rectangles (RA or RR), characters (CF), or wedges (WG). Use FT to enhance plots with solid fill, parallel lines (hatching), cross-hatching, or patterned (raster) fill.

SYNTAX: FT *fill type(,option1(,option2;))*
or
FT*(;)*

Parameter	Format	Functional Range	Default
fill type	clamped integer	1 to 4, 10, 11	1
option1, option2	clamped real	type dependent	type dependent

The following table shows how to interpret the *option1,option2* parameters according to the *fill type* parameter.

Fill Type	Description	Option1	Option2
1	solid bidirectional*	ignored	ignored
2	solid unidirectional*	ignored	ignored
3	hatched (parallel lines)	spacing of lines	angle of lines
4	cross-hatched	spacing of lines	angle of lines
10	shading	shading level	ignored
11	user-defined	raster-fill index	ignored

IN, Initialize

(Configuration and Status Group)

USE: Resets most plotter functions to their default settings; IN is more powerful than the DF instruction.

SYNTAX: IN *n(;)*
or
IN(;)

Parameter	Format	Functional Range	Default
n	clamped integer	1*	no parameter

* This is the only valid number for this instruction. Use this parameter to return the all plotter features and programmable functions to their factory default settings.

IP, Input P1 and P2 (Configuration and Status Group)

USE: The IP command defines the position of the scaling points P1 and P2.

SYNTAX: IP*P1X,P1Y(,P2X, P2Y;)*
or
IP(;)

Parameter	Format	Functional Range	Default
P1x,P1y(,P2x,P2y)	integer	-8 388 608 to 8 388 607	hard-clip limits

IR, Input Relative P1 and P2 (Configuration and Status Group)

USE: Establishes new or default locations for the scaling points P1 and P2 relative to the hard-clip limits.

SYNTAX: IR*P1X,P1Y(,P2X,P2Y;)*
or
IR*(;)*

Parameter	Format	Functional Range	Default
P1x,P1y(,P2x,P2y)	clamped real	-32 767.999 9 to 32 767.999 9	0,0,100,100%

IW, Input Window (Configuration and Status Group)

USE: Defines a rectangular area, or window, that establishes soft-clip limits. Subsequent programmed pen motion is restricted to this area.

SYNTAX: IW *XLL,YLL,XUR,YUR*(;)
or
IW(;)

Parameter	Format	Functional Range	Default
XLL,YLL,XUR,YUR	current units	-8 388 608 to 8 388 607	hard-clip limits

LA, Line Attributes

(Line and Fill Attributes Group)

USE: Specifies how line ends and joins (corners) are physically shaped. The LA instruction applies to lines drawn by the AA, AR, AT, CI, EA, EP, ER, EW, FP, PA, PD, PE, PR, RA, RR, RT, and WG instructions.

SYNTAX: LA*kind,value(,kind,value(,kind,value;))*
or
LA*(;)*

Parameter	Format	Functional Range	Default
kind	clamped integer	1 through 3	1
value	clamped integer	*kind* dependent*	kind dependent*

* Refer to the following table.

Attribute	Kind	Value	Description
Line Ends*	1	1	Butt (default)
		2	Square
		3	Triangular
		4	Round
Line Joins*	2	1	Mitered (default)
		2	Mitered/beveled
		3	Triangular
		4	Round
		5	Beveled
		6	No join applied
Miter Limit	3	0 to 32 767.999 9**	(Miter Length)/ (Line Width) default = 5

* Lines with a width of 0.80 mm or less always have rounded caps, regardless of the current attribute setting.
** Values less than 1.1 are set to 1.1 and do not cause an error.

LB, Label (Character Group)

USE: Plots text using the currently defined font. Use LB to annotate drawings or create text-only charts.

SYNTAX: LB *c . . . c* label terminator

Parameter	Format	Functional Range	Default
c . . . c	character	any character(s)	—
label terminator	character	(see DT instruction)	**ETX** (ASCII 3)

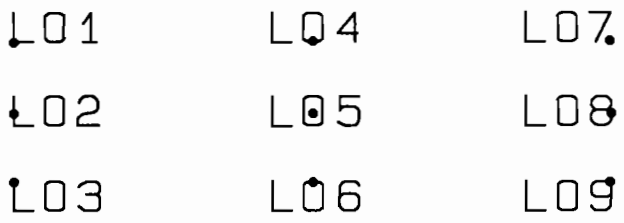
LO, Label Origin (Character Group)

USE: Positions labels relative to current pen location.

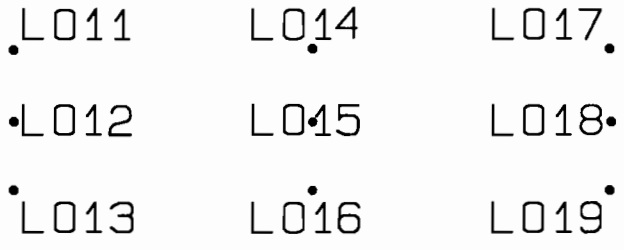
SYNTAX: LO*position(;)*
or
LO*(;)*

Parameter	Format	Functional Range	Default
position	clamped integer	1 to 9 or 11 to 19	1

The following shows how the label position values affect the placement of the label.



The label positions LO 11 through LO 19 differ from LO 1 through LO 9 only in that the labels are offset from the current pen location. (Offset is ¼ the current character width and height—16 grid units for stick fonts.)



LT, Line Type

(Line and Fill Attributes Group)

USE: Specifies the line pattern to be used when drawing lines. Use LT to distinguish lines and enhance your plot. Note that the ends of dashed line segments in a line pattern are affected by current line attributes.

SYNTAX: LT*line type(,pattern length(,mode;))*
or
LT*(;)*
or
LT*99(;)*

Parameter	Format	Functional Range	Default
line type	clamped integer	-8 to 8	solid line
		99	restores previous line type
pattern length	clamped real	>0%	4% of the distance between P1 and P2
mode	clamped integer	0 or 1	0 (relative)

MG, Message

Technical Graphics Extension

USE: Writes a message to the plotter's control panel.

SYNTAX: MG*(message;)*
or
MG*(;)*

Parameter	Format	Functional Range	Default
message	newstring	any character	—

MT, Media Type

Technical Graphics Extension

USE: Indicates the type of media loaded in the plotter.

SYNTAX: MT(*type;*)
or
MT(*;*)

Parameter	Format	Functional Range	Default
type	clamped integer	0, 1, 2, 3, 4, or 5	0 (paper)

The following lists the media type for each parameter value.

0 Paper
1 Transparency
2 Vellum
3 Polyester Film (such as Mylar)
4 Translucent Paper
5 Special Paper

NP, Number of Pens

Palette Extension

USE: Sets the size of the HP-GL/2 palette.

SYNTAX: NP(*n;*)
or
NP;

Parameter	Format	Functional Range	Default
n	clamped integer	2, 4, 8, 16, or 32*	8

* The plotter performs a modulo function when the pen number specified is greater than the number of pens that fits into the carousel.

NR, Not Ready

Technical Graphics Extension

USE: Takes the plotter offline for a specified amount of time. This lets you set control panel conditions before starting your plot.

SYNTAX: NR(*timeout;*)

Parameter	Format	Functional Range	Default
timeout	clamped integer	0 to 600*	0

* This is the practical *and recommended* range. The actual range is 0 to 32 767.

OD, Output Digitized Point and Pen Status — Digitizing Extension

USE: Outputs the X,Y coordinates and up/down pen position associated with the last digitized point. Use this instruction after the DP instruction to return the coordinates of the digitized point to your computer.

SYNTAX: OD;

OE, Output Error — Technical Graphics Extension

USE: Outputs a number corresponding to the type of HP-GL/2 error (if any) received by the plotter after the most recent IN instruction, control-panel reset, or OE instruction. Use OE for debugging programs. (Do *not* use on networks or Centronics interfaces.)

SYNTAX: OE;

NOTE: You *must* use a terminator (;) with output instructions.■

Parameter	Response	Format	Range
none	error number	clamped integer	0 to 7

The following describes each error value.

Error Number	Description
0	No error
1	Instruction not recognized
2	Wrong number of parameters
3	out-of-range or invalid parameter
4	(Reserved)
5	(Reserved)
6	Position overflow (lost)
7	Buffer overflow (out of memory)

OH, Output Hard-Clip Limits

Technical Graphics Extension

USE: Outputs the X,Y coordinates of the current hard-clip limits to the computer. Use OH to determine the plotter unit dimensions of the area in which plotting can occur. (Do *not* use on networks or Centronics interfaces.)

SYNTAX: OH;

NOTE: You *must* use a terminator (;) with output instructions.■

Parameter	Response	Format	Range
none	X_{LL},Y_{LL},X_{UR},Y_{UR}	integer	hard-clip limits

OI, Output Identification

Technical Graphics Extension

USE: Outputs the plotter's identifying number. (Do *not* use on networks or Centronics interfaces.)

SYNTAX: OI;

NOTE: You *must* use a terminator (;) with output instructions.■

Parameter	Response	Format	Range
none	plotter ID	character string	up to 30 characters

The plotter ID string will usually be *7550B*. If you are using the plotter in HP-GL emulation mode, the plotter ID string is *7550A*.

OP, Output P1 and P2

Technical Graphics Extension

USE: Outputs the X,Y coordinates (in plotter units) of the current scaling points P1 and P2 to the computer. (Do *not* use on networks or Centronics interfaces.)

SYNTAX: OP;

NOTE: You *must* use a terminator (;) with output instructions.■

Parameter	Response	Format	Range
none	P1x,P1y,P2x,P2y	integer	–8 388 608 to 8 388 607

* Note that P2 tracks P1 and can be outside this range.

OS, Output Status

Technical Graphics Extension

USE: Outputs the decimal value of the status byte. Use OS when debugging a program. (Do *not* use on networks or Centronics interfaces.)

SYNTAX: OS;

NOTE: You *must* use a terminator (;) with output instructions.■

Parameter	Response	Format	Range
none	status number	clamped integer	0 to 255

The following describes the values of the status byte.

Decimal Value	Meaning	Bit Number
1	Pen is down.	0
2	P1 or P2 newly established; cleared by OP.	1
4	Not used (bit always set to 0).	2
8	Initialized; cleared by OS.	3
16	Ready for data buffer empty (bit always set to 1).	4
32	Error; cleared by OE.	5
64	Not used (bit always set to 0).	6
128	Not used (bit always set to 0).	7

PA, Plot Absolute

(Vector Group)

USE: Establishes absolute plotting and moves the pen to the specified absolute coordinates from the current pen location using the pen's up or down position.

SYNTAX: PA *X,Y (,...;)*
or
PA*(;)*

Parameter	Format	Functional Range	Default
X,Y coordinates	current units	–8 388 608 to 8 388 607	—

PD, Pen Down (Vector Group)

USE: Lowers the plotter's physical or 'logical' pen and draws subsequent graphics instructions.

SYNTAX: PD *X,Y(,...;)*
or
PD*(;)*

Parameter	Format	Functional Range	Default
X,Y coordinates/ increments	current units	-8 388 608 to 8 388 607	—

PE, Polyline Encoded (Vector Group)

USE: Incorporates PA, PR, PU, PD, and SP instructions into an encrypted format that substantially decreases the size of your file and the time required for data transmission. (This instruction is especially useful when using an RS-232-C interface.)

SYNTAX: PE*(flag)(value)...(flag)(value)*;

NOTE: Parameter values are self-terminating; *do not use commas* with this instruction. Also, you *must* use a semicolon to terminate PE.■

Parameter	Format	Functional Range	Default
flag	character	':', '<', '>', '=', or '7'	—
value	character	flag dependent*	

The following tables further describe the flag parameter.

Flag	Meaning	Description
:	Select Pen	Indicates that the subsequent value is the desired pen number. A PE command without pen select defaults to the currently selected pen.
<	Pen Up	Raises the pen and moves to the subsequent coordinate pair value. (All coordinate pair values not preceded by a pen-up flag are considered pen-down moves.)*
>	Fractional Data	Indicates that the subsequent value specifies the number of fractional binary *bit*s contained in the coordinate data. Default is zero.

Flag	Meaning	Description
=	Absolute	Indicates that the subsequent coordinate pair is defined by absolute coordinates.
7	7-bit Mode	Indicates that all subsequent coordinate pair values should be interpreted in 7-bit mode. Once you send a seven-bit flag, base 32 is used and eighth bits are ignored for the remainder of the command.

* We recommend you always follow a pen up flag as a relative move of (0,0). This ensures that the next plotting coordinates will be drawn.

The value parameter specifies data according to the preceding flag. For example, a value following a select-pen flag should be a pen number; values following an absolute flag should be coordinate pairs. Instructions for encoding flag values follow the parameter descriptions.

Value	Format	Range
pen number	integer	0 to 8
number of fractional binary bits	integer	-26 to 26

Encode X,Y coordinates in base 64 (default) or base 32 equivalent.

PG, Advance Page

(Configuration and Status Group)

USE: *Devices with page advance capability:* Terminates the plot being sent and draws it. Refer to the plot size (PS) instruction to specify page length.

Devices without page advance capability: If the media has been printed on, this instruction is equivalent to the Not Ready (NR) instruction.

SYNTAX: PG*(n)*;
or
PG;

NOTE: The PG instruction, with or without parameters, *must* be terminated with a semicolon.■

Parameter	Format	Functional Range	Default
n	clamped integer	-32 767 to 32 767	—

PM, Polygon Mode

(Polygon Mode)

USE: Enters polygon mode for defining shapes, such as block letters or any unique area, and exits for subsequent filling and/or edging. Fill polygons using the fill polygon (FP) instruction and/or outline them using the edge polygon (EP) instruction.

SYNTAX: PM*polygon definition(;)*
or
PM*(;)*

Parameter	Format	Functional Range	Default
polygon definition	clamped integer	0 (enter polygon mode 1 (close current (sub)polygon 2 (exit polygon mode)	0

PR, Plot Relative

(Vector Group)

USE: Establishes relative plotting and moves the pen to specified points with each successive move relative to the current pen location.

SYNTAX: PR *X,Y(,...;)*
or
PR*(;)*

Parameter	Format	Functional Range	Default
X,Y (increments)	current units	-8 388 608 to 8 388 607	—

PS, Plot Size

Technical Graphics Extension

USE: Sets the hard-clip limits to a given size and the X-axis along the longest edge of the plot.

SYNTAX: PS(*length(,width;)*)
or
PS*(;)*

Parameter	Format	Functional Range	Default
length	integer	-8 388 608 to 8 388 607	*
width	integer	-8 388 608 to 8 388 607	*

* Dependent on paper size.

PU, Pen Up

(Vector Group)

USE: Moves to subsequent points without drawing. Use PU to move between points without drawing a connecting line.

SYNTAX: PU*X,Y(,...;)*
or
PU(;)

Parameter	Format	Functional Range	Default
X,Y coordinates/ increments	current units	-8 388 608 to 8 388 607	—

PW, Pen Width

(Line and Fill Attributes Group)

USE: Specifies a new width for the logical pen. Subsequent lines are drawn in this new width. Use PW to distinguish lines and enhance your plots. Pen width can be specified as a fixed metric unit or relative to P1 and P2. The mode is set via the WU instruction (default is metric).

SYNTAX: PW*width(,pen;)*
or
PW*(;)*

Parameter	Format	Functional Range	Default
width	clamped real	-32 768.000 0 to 32 767.999 9	*
pen	integer	0 to 32**	all pens

* Dependent on the mode set by the pen width unit selection (WU) instruction: if mode is metric, default width is 0.35 mm; if mode is relative, default width is 0.1% of the diagonal distance from P1 to P2.
** The plotter performs a modulo function on any pen number greater than 8 to select a pen from the carousel.

QL, Quality Level

Technical Graphics Extension

USE: Sets 'draft' or 'final' mode for your output.

SYNTAX: QL*(quality level;)*
or
QL*(;)*

Parameter	Format	Functional Range	Default
quality level	clamped integer	0 to 100	100

RA, Fill Rectangle Absolute (Polygon Group)

USE: Defines and fills a rectangle using absolute coordinates. Use RA to fill rectangular shapes in plots. To outline a rectangle using absolute coordinates, use the EA instruction.

SYNTAX: RA*X,Y(;)*

Parameter	Format	Functional Range	Default
X,Y coordinates	current units	-8 388 608 to 8 388 607	—

RF, Raster Fill Definition (Line and Fill Attributes Group)

USE: Defines a rectangular pattern that may be used in area fill. Pen plotters effectively NOP this instruction by defaulting the area fill to a hatch pattern approximating the density of the expected raster fill.

SYNTAX: RF*index(,width,height,pen number(,...pen number;))*
or
RF*index(;)*
or
RF*(;)*

Parameter	Format	Functional Range	Default
index	clamped integer	1 to 8	1 (solid)
width	clamped integer	8, 16, 32, or 64	—
height	clamped integer	8, 16, 32, or 64	—
pen number	integer	0 to 32*	—

* This is the practical range. While the plotter only handles eight physical pens, it uses a modulo function to let you specify different thicknesses for pens. The actual range is 0 to 67 108 863.

RO, Rotate Coordinate System (Configuration and Status Group)

USE: Rotates the plotter's coordinate system 90°, 180°, and 270° counterclockwise about the plotter-unit coordinate origin. Use RO to orient your plot vertically or horizontally, or to reverse the orientation.

SYNTAX: RO*angle(;)*
or
RO*(;)*

Parameter	Format	Functional Range	Default
angle	clamped integer	0°, 90°, 180°, or 270°	0°

RP, Replot (Configuration and Status Group)

USE: Draws multiple copies of plots. This is a device-dependent instruction. Your plotter must have an internal hard disk or designated buffer area to store the plotter.

SYNTAX: RP*n(;)*

Parameter	Format	Functional Range	Default
n	clamped integer	1 to 32 767	1

RR, Fill Rectangle Relative (Polygon Group)

USE: Defines and fills a rectangle using relative coordinates. Use RR to fill rectangular shapes in plots. To outline a rectangle using relative coordinates, use the ER instruction.

SYNTAX: RR*X,Y(;)*

Parameter	Format	Functional Range	Default
X,Y increments	current units	–8 388 608 to 8 388 607	—

RT, Relative Arc Three Point (Vector Group)

USE: Draws an arc segment, using relative increments, from a starting point through an intermediate point (*X*INCR INTER,*Y*INCR INTER) to an end point (*X*INCR END,*Y*INCR END). Use RT when you know these three points of an arc.

SYNTAX: RT*X*INCR INTER,*Y*INCR INTER,*X*INCR END,*Y*INCR END*(,chord angle;)*

Parameter	Format	Functional Range	Default
XINCR INTER, YINCR INTER	current units	–8 388 608 to 8 388 607	—
XINCR END, YINCR END	current units	–8 388 608 to 8 388 607	—
chord angle*	clamped real	0.5° to 180°	5°

* Chord angle is the default interpretation of chord tolerance. Deviation distance is defined as the distance between the drawn chord and the arc segment it represents. When you use the chord angle mode of chord tolerance, the circle or arc is always drawn with the same number of chords. When deviation distance mode is used, the number or chords changes with the size of the circle or arc. Change chord tolerance mode using the CT instruction.

SA, Select Alternate Font (Character Group)

USE: Selects the alternate font (already designated by the AD instruction) for subsequent labeling. Use SA to shift from the currently selected standard font to the designated alternate font.

SYNTAX: SA*(;)*

SC, Scale (Configuration and Status Group)

USE: Establishes a user-unit coordinate system by mapping user-defined coordinate values onto the scaling points P1 and P2. Use SC to establish automatic isotropic scaling or to relocate the origin and set a specific ratio of plotter units to user units.

SYNTAX: SC*X*MIN,*X*MAX,*Y*MIN,*Y*MAX *(,type(,left,bottom;))*
or
SC*X*MIN,*X*FACTOR,*Y*MIN,*Y*FACTOR,*type(;)*
or
SC*(;)*

Parameter	Format	Functional Range	Default
XMIN,XMAX, YMIN,YMAX	real	-8 388 608 to 8 388 607	—
type	clamped integer	0 (anisotropic), 1 (isotropic), or 2 (point factor)	0
left	clamped real	0 to 100%	50%
bottom	clamped real	0 to 100%	50%
XFACTOR, YFACTOR	real	-32 767. 999 9 to 32 767.999 9*	—

* Excluding zero and values approaching zero

SD, Standard Font Definition (Character Group)

USE: Defines the standard character set and its attributes: font spacing, pitch, height, stroke weight, and typeface.

SYNTAX: SD*kind,value... (,kind,value;)*
or
SD*(;)*

Parameter	Format	Functional Range	Default
kind	clamped integer	1 to 7	—
value	clamped real	*kind* dependent	*kind* dependent

Attribute	Kind*	Value	Description
Character set	1	277 (0)	Roman8 (default)
		21	ANSI USASCII
		14	ECMA 94 Latin 1
		6	French v1
		38	French v2
		39	German
		563	HP Drafting
		531	HP-GL/2 Download
		267	HP Kana8
		43	HP Katakana
		5	HP Roman Extensions
		595	HP Special Symbols
		85	Intnl. Ref. Version
		9	Italian
		11	JIS ASCII
		4	Norwegian v1
		36	Norwegian v2
		147	Portuguese
		115	Swedish
		19	Swedish Names
		83	Spanish
		37	United Kingdom
Font spacing	2	0	fixed spacing (default)
		1	variable spacing
Pitch	3	0 to 32 767.9999	characters per inch (default: 5.942)
Height	4	0 to 32 767.9999	font point size (default: 16)
Stroke Weight	6	–7	very light
		–3	light
		0	normal (default)
		3	bold
		7	very bold
Typeface	7	48	Stick (default)
		49	HP-GL Drafting
		50	HP-GL ArcSpline

* Kind 5 is ignored.

SI, Absolute Character Size (Character Group)

USE: Specifies the size of labeling characters in centimetres. Use SI to establish character sizing independent of P1 and P2.

SYNTAX: SI*width, height(;)*
or
SI*(;)*

Parameter	Format	Functional Range	Default
width	clamped real	-32 767. 999 9 to 32 767.999 9	*
height	clamped real	-32 767. 999 9 to 32 767.999 9	*

* Dependent on the current pitch and font height set by the AD or SD instructions. If set to default values, the width is 0.285 cm and the height is 0.375 cm.

SL, Character Slant (Character Group)

USE: Specifies the slant at which labels are drawn. Use SL to create slanted text for emphasis, or to reestablish upright labeling after an SL instruction with parameters has been in effect.

SYNTAX: SL*tangent of angle(;)*
or
SL*(;)*

Parameter	Format	Functional Range	Default
tangent-of-angle	clamped real	-32 767. 999 9 to 32 767.999 9	0

SM, Symbol Mode (Line and Fill Attribute Group)

USE: Draws the specified symbol at each X,Y coordinate point with PA, PD, PE, PR, and PU instructions. Use SM to create scattergrams, indicate points on geometric drawings, and differentiate data points on multiline graphs.

SYNTAX: SM*character(;)*
or
SM*(;)*

Parameter	Format	Functional Range	Default
character	label	most printing characters (decimal codes 33–58, 60–126, 161 and 254)*	—

* Decimal code 59 (the semicolon) is an HP-GL/2 terminator and cannot be used as a symbol *in any character set.* Use it only to cancel symbol mode (i.e., (*SM;*)).

SP, Select Pen

(Line and Fill Attribute Group)

USE: Selects the plotter's physical pen for subsequent plotting. An SP instruction *must* be included in each program or the plotter will not draw.

SYNTAX: SP*pen number(;)*
or
SP*(;)*

Parameter	Format	Functional Range	Default
pen number	integer	0 to 32*	0

* This is the practical range. While the plotter only handles eight physical pens, it uses a modulo function to let you specify different thicknesses for pens. The actual range is 0 to 67 108 863.

SR, Relative Character Size

(Character Group)

USE: Specifies the size of characters as a percentage of the distance between P1 and P2.

SYNTAX: SR*width height(;)*
or
SR*(;)*

Parameter	Format	Functional Range	Default
width	clamped real	-32 767. 999 9 to 32 767.999 9	0.75% of P2x-P1x
height	clamped real	-32 767. 999 9 to 32 767.999 9	1.5% of P2y-P1y

SS, Select Standard Font

(Character Group)

USE: Selects the standard font (already designated by the standard font definition (SD) instruction) for subsequent labeling. Use SS to shift from the currently selected alternate font to the designated standard font.

SYNTAX: *SS(;)*

ST, Sort

Technical Graphics Extension

USE: Specifies how the plotter sorts vectors for plotting.

SYNTAX: ST(*switches;)*
or
ST*(;)*

Parameter	Format	Functional Range	Default
switches	clamped integer	-1, 0, 1 and 2	-1 (pen sorting and endpoint swapping)

TD, Transparent Data (Character Group)

USE: Specifies whether control characters perform their associated function or print their character when labeling. Use TD to access printable characters that, in normal mode, function only as control characters.

SYNTAX: TD*mode(;)*
or
TD*(;)*

Parameter	Format	Functional Range	Default
mode	clamped integer	0 or 1	0 (normal)

UL, User-Defined Line Type (Line and Fill Attributes Group)

USE: Creates line types by specifying gap patterns. Use the LT instruction to select the pattern you've defined using UL.

SYNTAX: UL index *(,gap1,...gap20;)*
or
UL*(;)*

Parameter	Format	Functional Range	Default
index	clamped integer	1 through 8	—
gaps	clamped real	0 to 32 767.999 9*	default line types

* Gaps are converted to percentages of the pattern length parameter of the LT instruction.

VS, Velocity Select Technical Graphics Extension

USE: Specifies pen speed. Use VS to optimize line quality and pen life for each pen and media combination. Increase line quality and create a slightly thicker line on any media by slowing the pen speed.

SYNTAX: VS*(pen velocity(,pen number;))*
or
VS;

Parameter	Format	Functional Range	Default
pen velocity	clamped integer	1 to 110 (cm/s)	*
pen number	clamped integer	1 to 8	all pens

* The default pen velocity depends on the type of pen loaded. Refer to Chapter 2 for the table that lists default pen speeds for different pen types.

WG, Fill Wedge (Polygon Group)

USE: Defines and fills any wedge. Use WG to draw filled sectors of a pie chart.

SYNTAX: WG*radius,start angle,sweep angle(,chord angle;)*

Parameter	Format	Functional Range	Default
radius	current units	-8 388 608 to 8 388 607	—
start angle	clamped real	±360°	—
sweep angle	clamped real	±360°	—
chord angle	clamped real	0.5° to 180°	5°

* Chord angle is the default interpretation of chord tolerance. Deviation distance is defined as the distance between the drawn chord and the arc segment it represents. When you use the chord angle mode of chord tolerance, the circle or arc is always drawn with the same number of chords. When deviation distance mode is used, the number or chords changes with the size of the circle or arc. Change chord tolerance mode using the CT instruction.

WU, Pen Width Unit Selection (Line and Fill Attributes Group)

USE: Specifies how the width parameter of the pen width (PW) instruction is interpreted, in metric or relative units.

SYNTAX: WU*type(;)*
or
WU*(;)*

Parameter	Format	Functional Range	Default
type	clamped integer	0 (metric) or 1 (relative)	0

No Operation (NOP) Instructions

Because the following instructions do not logically apply to this plotter, they are NOP'd to provide compatibility. The plotter ignores the instructions and does not generate any errors.

Technical Graphics Extension:

FR, Frame Advance
MC, Merge Control

Palette Extension:

CR, Set Color Range for Relative Color Data
PC, Pen Color Assignment
SV, Screened Vectors
TR, Transparency Mode

Device-Control Instructions

Device-control instructions (DCIs) are part of the I/O language. HP-GL/2 drivers should avoid DCIs if possible because of the following.

- DCI immediate status readback is difficult, if not impossible, in networked environments.
- DCIs cannot be mixed with the transparent data (TD) command in HP-GL/2.

Note, too, that we do not recommend the use of the **ESC**.T instruction when you regularly rely on the spooling feature of the plotter.

All HP-GL/2 devices use the same default Xon/Xoff handshaking, so DCIs will not be necessary in most cases. The default RS-232/422 configuration for all HP-GL/2 plotters is:

Handshake:	Xon/Xoff
Xon character:	decimal 17
Xoff character:	decimal 19
Xoff threshold level:	80 bytes

Output parameters:

Output terminator character:	decimal 13 (carriage return)
Output trigger character:	none
Output initiator character:	none
Turn around delay:	none
Intercharacter delay:	none

In some case, these defaults will not meet the need of a particular system, and DCIs will be necessary for applications running on these systems.

ESC.A, Output Identification

SYNTAX: ESC.A

Parameter	Response	Format	Range
none	plotter ID	character string	up to 30 characters
	firmware revision level	clamped integer	1 to 32 767

The plotter ID string will usually be *7550B*. If you are using the plotter in HP-GL emulation mode, the plotter ID string is *7550A*.

ESC.B, Output Buffer Space

SYNTAX: ESC.B

Parameter	Response	Format	Range
none	available logical input buffer space	clamped integer	0 to 1024 bytes

ESC.E, Output Extended Error

SYNTAX: ESC.E

Parameter	Response	Format	Range
none	error number	clamped integer	0, 10 to 18

ESC.H, Set Handshake Mode 1 (Software Enq/Ack)

SYNTAX: **ESC**.H (data block size);(enquiry character);(acknowledgment string):
or
ESC.H:

Parameter	Format	Range	Default
data block size	clamped integer	0, 10 to 18	80 bytes
enquiry character	ASCII value	0 to 26, 28 to 31 (decimal codes)*	0 (no character)
acknowledge string	ASCII value	0 to 126 (decimal codes)	0 (no character)

* Practical range; printable characters (ASCII codes 32 to 126) should be avoided as they are required to send the HP-GL/2 instructions.

ESC.I, Set Handshake Mode 2 (Operating System)

SYNTAX for Xon-Xoff: **ESC**.I *(Xoff threshold level);(omitted);(Xon trigger character(s))*:

Parameter	Format	Range	Default
Xoff threshold level	clamped integer	0 to 1024	80 bytes
omitted	clamped integer	0*	—
Xon character(s)	ASCII value	0 to 126, 1 to 10 (decimal codes)	0 (no character)

* You can designate the omitted parameter by entering a 0 or by putting the semicolon without a parameter.

SYNTAX for Enquire/Acknowledge: **ESC**.I*(data block size);(enquiry character);(acknowledgment string)*:

Parameter	Format	Range	Default
data block size	clamped integer	0 to 1024 bytes	80 bytes
enquiry character	ASCII value	0 to 26, 28 to 31 (decimal codes)*	0 (no character)
acknowledge string	ASCII value	0 to 126, 1 to 10 (decimal codes)	0 (no character)

* Practical range; printable characters (ASCII codes 32 to 126) should be avoided as they are required to send the HP-GL/2 instructions.

ESC.J, Abort Device-Control

SYNTAX: **ESC**.J

ESC.K, Abort Graphics

SYNTAX: **ESC**.K

ESC.L, Output Buffer Size When Empty

SYNTAX: **ESC**.L

ESC.M, Set Output Mode

SYNTAX: **ESC**.M *(turnaround delay);(output trigger);(echo terminator);(output terminator);(output initiator)*:

Parameter	Format	Range	Default
turnaround delay*	clamped integer	0 to 32 767	0
output trigger	ASCII value	0 to 4, 6 to 26, 28 to 126 (decimal codes)	0 (no character)
echo terminator	ASCII value	0 to 4, 6 to 26, 28 to 126 (decimal codes)	0 (no character)
output terminator	ASCII value	0 to 4, 6 to 26, 28 to 126 (1 or 2 decimal codes)	13 (carriage return)
output initiator	ASCII value	0 to 126 (decimal codes)	0 (no character)

* If the delay is odd, the plotter adds 1 to make it even.

ESC.N, Set Extended Output and Handshake Mode

SYNTAX: **ESC**.N *(intercharacter delay);(handshake dependent parameter)*:

Parameter	Format	Range	Default
intercharacter delay*	clamped integer	0 to 32 767	0
handshake dependent parameter for Xon–Xoff: Xoff trigger character(s)	ASCII value	0 to 126 (up to 10 decimal codes)	0 (no character)
for Enquire/Acknowledge: immediate response string	ASCII value	0 to 126 (up to 10 decimal codes)	0 (no character)

* If the delay is odd, the plotter adds 1 to make it even.

ESC.O, Output Extended Status

SYNTAX: **ESC**.O

ESC.P, Set Handshake Mode

SYNTAX: **ESC**.P *(handshake)*:

Parameter	Format	Range	Default
handshake	clamped integer	0 (none) 1 (Xon–Xoff) 2 (ENQ/ACK) 3 (hardwire)	0

ESC.R, Reset

SYNTAX: **ESC**.R

ESC.S, Output Configurable Memory Size

SYNTAX: **ESC**.S *n*:

Parameter	Format	Range	Default
n	clamped integer	0 to 6	0 (total memory)

Parameter Value	Memory Specification
0	total configuration memory
1	not used; 0 is output
2	polygon buffer
3	downloadable character buffer
4	0 is output
5	vector buffer
6	pen sort buffer

ESC.T, Allocate Configurable Memory

NOTE: Use of this instruction can interfere with spooled plots and is, therefore, not recommended.■

SYNTAX: **ESC**.T *(physical I/O buffer);(polygon buffer);(downloadable character buffer);0;(vector buffer);(pen sort buffer);*

Parameter	Format	Range	Default
physical I/O buffer	clamped integer	1 024 bytes*	1 024
polygon buffer	clamped integer	4 to 40 882 bytes	6 144
downloadable character buffer	clamped integer	0 to 40 878 bytes	6 144
reserved	clamped integer	—	0
vector buffer	clamped integer	66 to 40 944 bytes	3 000
pen sort buffer	clamped integer	12 to 40 890 bytes	25 672

* This buffer is set at 1 024 bytes and cannot be changed.

ESC.U, End Flush Mode

SYNTAX: **ESC.**U

ESC.Y or ESC.(, Plotter On

SYNTAX: **ESC.**Y or **ESC.**(

ESC.Z or ESC.), Plotter Off

ESC.@, Set Plotter Configuration

SYNTAX: **ESC.**Z or **ESC.**)

Parameter	Format	Range	Default
logical input buffer size	clamped integer	0 to 1 024 bytes	1 024
input conditions		0 to 32 767 bytes	1 024

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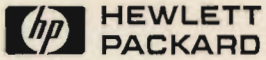

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