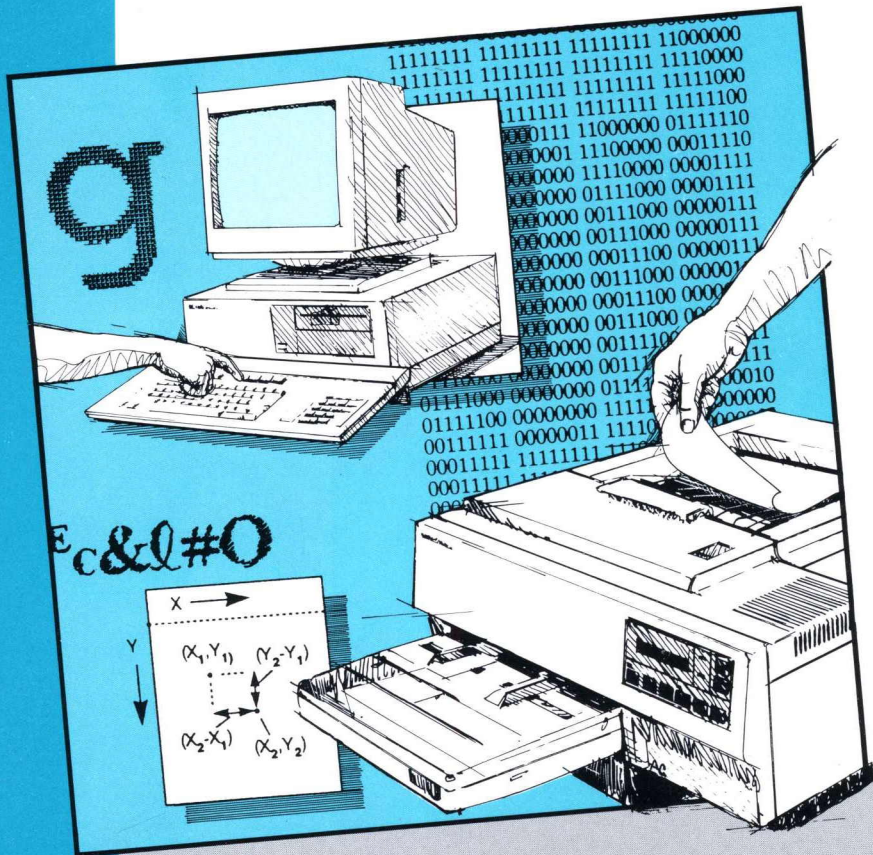


LaserJet series II Technical Reference Manual



LaserJet series II Printer Technical Reference Manual



**HEWLETT
PACKARD**

**Manual Part No.
33440 - 90905**

Notice

The information contained in this document is subject to change without notice.

HEWLETT-PACKARD MAKES NO WARRANTY OF ANY KIND WITH REGARD TO THIS MATERIAL, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. Hewlett-Packard shall not be liable for errors contained herein or for incidental consequential damages in connection with the furnishing, performance, or use of this material.

This document contains proprietary information which is protected by copyright. All rights are reserved. No part of this document may be photocopied, reproduced, or translated without the prior written consent of Hewlett-Packard Company.

Copyright © 1987 by HEWLETT-PACKARD COMPANY.

Centronics is a registered trademark of Centronics Corporation.
HP Vectra Personal Computer is a product of Hewlett-Packard Corporation.
IBM is a registered trademark of International Business Machines Corporation.
scLASERplus is a trademark of Software Channels Incorporated.

Printing History

First Edition - May 1987

This manual was created using *scLASERplus* software on an HP Vectra Personal Computer. The camera ready text was generated on an HP LaserJet series II printer and then reproduced using standard offset printing.

Table of Contents

About This Manual	xiii
Support	xv
Related Documents	xvii

Chapter 1

Introduction to HP PCL

The History of PCL	1-1
PCL Architecture	1-2
What are Printer Commands?	1-4
Syntax of Escape Sequences	1-5
Two Character Escape Sequences	1-5
Parameterized Escape Sequences	1-5

Chapter 2

The Page

Introduction	2-1
Logical Page	2-2
PCL Coordinate System	2-3

Chapter 3

The Print Environment

Introduction	3-1
Factory Default Environment	3-2
User Default Environment	3-3
Modified Print Environment	3-4
Resetting the Print Environment	3-5
LaserJet Family Compatibility	3-6

Chapter 4

Job Control Commands

Introduction	4-1
Printer Reset	4-2
Number of Copies	4-3

Introduction 5-1

Paper Source 5-2

Page Size 5-3

Page Length 5-4

Orientation 5-6

Text Area 5-7

Left Margin 5-9

Right Margin 5-10

Clear Horizontal Margins 5-11

Top margin 5-12

Text Length 5-13

Perforation Region 5-14

Horizontal Motion Index 5-15

Vertical Motion Index 5-16

Line Spacing 5-17

Chapter 6

Cursor Positioning

Introduction	6-1
Absolute/Relative Cursor Positioning	6-2
Cursor Positioning Units	6-3
Horizontal Cursor Positioning (Columns)	6-4
Horizontal Cursor Positioning (Decipoints)	6-5
Horizontal Cursor Positioning (Dots)	6-6
Horizontal Cursor Positioning Control Codes	6-7
Vertical Cursor Positioning (Rows)	6-8
Vertical Cursor Positioning (Decipoints)	6-9
Vertical Cursor Positioning (Dots)	6-10
Half-Line Feed	6-11
Vertical Cursor Positioning Control Codes	6-12
Line Termination	6-13
Push/Pop Cursor Positioning	6-14

Chapter 7

Fonts

Introduction	7-1
Orientation	7-2
Symbol Set	7-3
Spacing	7-4
Pitch	7-5
Height	7-6
Style	7-7
Stroke Weight	7-8
Typeface	7-9

Introduction	8-1
Font Selection by Characteristic	8-2
Primary and Secondary Fonts	8-4
Orientation	8-5
Symbol Set	8-6
ISO Symbol Sets	8-8
Spacing	8-10
Pitch	8-11
Height	8-12
Style	8-13
Stroke Weight	8-14
Typeface	8-16
Internal Fonts	8-18
Font Selection Example	8-19
Summary of Font Selection by Characteristic	8-20
Selection of the Default Font	8-22
Transparent Print Data	8-23
Underline Command	8-24

Chapter 9

Font Management

Introduction	9-1
Downloading Soft Fonts	9-2
Temporary/Permanent Fonts	9-3
Deleting Fonts	9-3
Font ID	9-4
Font Control	9-5
Font Selection by ID	9-6
Font Management Example	9-7

Chapter 10

Soft Font Creation

Introduction	10-1
Coordinate System	10-2
Font Descriptor Format	10-3
Font Descriptor Command	10-13
Character Descriptor and Data Format	10-15
Character Code Command	10-21
Character Descriptor and Data Command	10-22

Chapter 11

Graphics

Introduction	11-1
Raster Graphics	11-2
Raster Graphics Resolution	11-4
Start Raster Graphics	11-5
Transfer Raster Data	11-6
End Raster Graphics	11-8
Raster Graphics Example	11-9
Rectangular Area Fill	11-12
Horizontal Rectangle Size (Decipoints)	11-13
Horizontal Rectangle Size (Dots)	11-13
Vertical Rectangle Size (Decipoints)	11-14
Vertical Rectangle Size (Dots)	11-14
Area Fill ID	11-15
Fill Rectangular Area	11-18
Rectangular Area Fill Examples	11-19

Chapter 12

Macros

Introduction	12-1
Macro Creation	12-2
Macro Invocation	12-3
Temporary/Permanent Macros	12-4
Deleting Macros	12-4
Macro ID	12-5
Macro Control	12-6
Macro Control Example	12-8

Introduction	13-1
PCL Command Parsing	13-2
Job Control	13-2
Printer Reset	13-2
Page Control	13-3
Paper Source	13-3
Page Length	13-3
Text Area/Margins	13-3
HMI	13-4
Cursor Positioning	13-4
Fonts	13-5
Raster Graphics	13-6
Macros	13-7
Performance	13-8
PCL Commands	13-8
Print Data	13-8
Print Overrun	13-9
I/O	13-9
Troubleshooting Commands	13-10
End-of-Line Wrap	13-10
Display Functions Mode	13-11
Auto Continue Mode	13-12
Memory Usage	13-13
Common Errors	13-14
20 Error	13-14
21 Error	13-14
22 Error	13-14
40 Error	13-14

Appendix A

Reference Tables

Roman-8 ASCII Character Set	A-1
Control Codes	A-2
Roman-8 Character Conversion	A-3
Printer Commands	A-11

Appendix B

Reference Interfaces

Introduction	B-1
Parallel Interface	B-2
Serial Interface	B-8

Glossary	G-1
Index	I-1
Sales and Service Offices	S-1

About This Manual

Hewlett-Packard has developed a standard set of printer features (and corresponding commands) for use in its printers. The set of features designed by Hewlett-Packard for all of its printers is called Printer Command Language (PCL). This manual describes the PCL feature/commands available for the **LaserJet series II** printer. In addition to the commands, this manual also describes basic requirements of PCL programming.

This manual is written for people who have some programming experience. Many of the concepts discussed assume some programming knowledge.

When writing a PCL program for the **LaserJet series II** printer the user should be knowledgeable of the PCL concepts presented in this manual.

This manual is divided into 13 chapters. A brief description of each chapter is provided below.

Chapter 1
Introduction to HP PCL

This chapter gives a brief history of the development of PCL, describes PCL levels (architecture), and describes PCL commands (control codes and escape sequences).

Chapter 2
The Page

This chapter introduces the idea of the logical page and identifies the area in which printing can occur. It also describes the PCL coordinate system.

Chapter 3
The Print Environment

This chapter introduces the printer's feature settings, collectively, as the print environment and how it is affected by printer reset functions. Included are descriptions of the factory default environment user default environment, and the modified print environment.

Chapter 4
Job Control Commands

This chapter describes the commands providing job control. Job commands are usually grouped together and sent at the beginning of a job. Job control functionality includes restoration of the user default environment and selection of the number of copies of each page to be printed.

- Chapter 5**
Page Control Commands This chapter describes the commands providing page format control. Page format control functionality provides for selection of the page source, size, orientation, margins, and text spacing.
- Chapter 6**
Cursor Positioning This chapter describes how to position the cursor within the logical page.
- Chapter 7**
Fonts This chapter describes the characteristics of a font.
- Chapter 8**
Font Selection This chapter describes how to select a font for printing using the font characteristics commands. The underline feature is described at the end of this chapter.
- Chapter 9**
Font Management This chapter describes the fonts supplied with the printer; these fonts are referred to as internal fonts. Additional fonts can be added to the printer by inserting font cartridges or downloading soft fonts. Font management provides mechanisms for downloading and manipulating soft fonts.
- Chapter 10**
Soft Font Creation This chapter describes how to design characters for downloading to the printer.
- Chapter 11**
Graphics This chapter describes how to download raster graphics to the printer and how to use rules or predefined patterns and shading.
- Chapter 12**
Macros A typical printer task requires the use of several commands. Applications may perform the same task numerous times. For tasks performed repeatedly, PCL provides macro functionality to reduce the number of commands that must be sent to the printer. A macro is a collection of escape sequences, control codes, and data downloaded to the printer, whose execution can be initiated using a single command.
- Chapter 13**
Programming Aids This chapter provides information for use during the development of PCL software.

Customer Support

Hewlett-Packard has support services available to help you in case you have a problem with your **LaserJet series II** printer. The following are places to turn for this support.

Your Dealer

If you encounter a difficulty, begin by contacting the person who sold you your **LaserJet series II**. Your salesman is familiar with your needs, equipment and software and should be able to provide you with the information you want.

LaserJet series II Customer Assist

If you don't get the answer to your question using the HP Guidelines system, Hewlett-Packard has a **LaserJet series II** Customer Assist service available to you. It is available from 7 am - 4 pm (MST), Monday through Friday. The **LaserJet series II** Assist staff can provide you with help.

(208) 323-2551

Before you call the **LaserJet series II** Customer Assist line, do the following:

1. Check the “In Case of Difficulty” section of the *User's Manual*.
2. Check with your software vendor for help.

When you call the **LaserJet series II** Assist group, please have the following information available to help us answer your questions more quickly:

- Identify which computer you are using.
- Identify any special equipment or software you are using (for example, spoolers, networks, switch boxes, modems or special software drivers).
- Identify which cable you are using and who sold it to you.
- Identify any special interface, I/O or RAM boards installed in your printer.
- Identify the software name and version you are currently using.
- Have a control panel test print available.

Related Documentation

The following is a list of other **LaserJet series II** printer manuals.

*LaserJet series II
User's Manual*
(part number 33440-90901)

This manual is written for operators of the **LaserJet series II** printer. Following an introduction to the printer and its parts, four chapters describe the operation, printing, fonts and maintenance features. A final chapter gives troubleshooting hints.

*Getting Started with
LaserJet series II*
(part number 33440-90908)

Getting Started is a companion to the *User's Manual* and contains set-up and configuration information.

*LaserJet series II
Service Manual*
(part number 33440-90904)

This is a reference document for qualified technicians to use when servicing the printer. Included is all routine preventive maintenance as well as troubleshooting guides and removal and replacement procedures.

*HP LaserJet series II Printer
Paper Specifications Guide*
(part number 5954-7339)

This guide provides information on paper selection to ensure the best print quality production by the printer.

The above documents may be purchased directly from Hewlett-Packard. See your authorized dealer or Hewlett Packard Service Representative for ordering information.

1

Introduction to HP PCL

Contents

The History of PCL	1-1
PCL Architecture	1-2
What are Printer Commands?	1-4
Syntax of Escape Sequences	1-5
Two Character Escape Sequences	1-5
Parameterized Escape Sequences	1-5

The History of PCL

In the past, printers were developed without a computer industry standard for feature access. Printers manufactured during this period were designed with features that differed from device to device. As a result, application programs written for one printer often had to be rewritten or modified to work correctly with another printer, requiring months or even years of software development.

For the user, reluctance to upgrade to new printer technologies stemmed from this need to modify the software applications for each printer. When printers were introduced, current applications required modifications to support them. Rather than providing a smooth upgrade path, the industry was creating chaos as the output capabilities of printers changed.

To minimize this chaotic situation, Hewlett-Packard developed a standard language for printer control called "Printer Command Language" (PCL). Hewlett-Packard's PCL defines a standard for printer features and feature access by software applications. It provides the highest level of communication between the system and the printer. PCL is designed to be independent of the host system, device drivers, I/O interface, and network communications. Its purpose is to bring together all HP printers under a common and consistent control structure that provides feature compatibility from printer to printer. This protects the investment in applications and driver software.

The key to designing PCL was determining the printing features for the various printer markets. Due to the diversity of printing needs from the low-end personal computer market to the high-end computer market, developing a common feature set would have either restricted the advanced printing capabilities of the high-end system printers or added to the cost of the low-end printers. The solution was simple: design PCL by partitioning printer features so they align with the major printer markets.

Print and space, electronic data processing (EDP) and transaction office word processing, and page formatting emerged as the four level hierarchy of PCL. With this structure, the ability to address the diversity of printing needs while protecting the investment in applications and driver software for the printers has become a reality.

PCL Architecture

Printer Command Language provides four levels of printer features: *Print and Space*, *EDP/Transaction*, *Office Word Processing*, and *Page Formatting*. Each level has a specific market for which its feature set has been targeted.

- Level I** *Print and Space* is the base level printer feature set. Printers implementing this feature set are usually inexpensive and provide a convenient means for the user to obtain hard-copy output. This level is typically associated with a single user workstation.
- Level II** The *EDP/Transaction* feature set is a superset of the Print and Space level. Printers implementing this feature set are generally multi-user hard-copy devices which have a wide range of performance. This level is used in the EDP environment or for *Transaction* processing.
- Level III** The *Office Word Processing* feature set is a superset of the EDP/Transaction level. This level is tailored toward the needs of the office: high quality output with additional data formatting capabilities.
- Level IV** The *Page Formatting* feature set is a superset of the Office Word Processing Level. This level gives the user the most flexibility in the formation of hard-copy output. **LaserJet series II** is a PCL Level IV device.

Each level is a proper superset of the previous level, providing upward compatibility. This allows leverage of applications across printers at or above the level for which the application was written. For example, any application written for Level I (*Print and Space*) will run properly on any Hewlett-Packard printer fitting into the PCL level structure. Likewise, a Level IV (*Page Formatting*) printer can run any PCL application written for a PCL level I, II, III, or IV device.

Each level of PCL provides a well-defined set of features which address the needs of a major printer market. Optional features have been defined which are extensions to the PCL level hierarchy; these features provide the flexibility to address special applications, such as paper handling and bar codes.

The PCL model succeeds because the following points are observed:

- All printers implement features identically.
- Each level is a proper superset of the previous level.
- A printer supporting a specific PCL level implements, as a minimum, the defined feature set of that level.
- Each printer is specific as to its application and any exceptions in features that it may have (for example, no raster graphics on daisy wheel printers).
- All PCL printers have the ability to ignore unsupported commands.

What are Printer Commands?

PCL commands provide access to printer features. Once a PCL command sets a parameter, that parameter will remain set until the same PCL command is repeated with a new value or the printer is reset to its user default environment. For example, if you send the printer a command to set landscape page orientation, each page will print in landscape orientation until you send the portrait orientation command or reset the printer.

There are three types of PCL commands:

- control codes,
- two-character escape sequences, and
- parameterized escape sequences.

A control code is a character that initiates a printer function, for example CR, LF, FF, etc.

PCL escape sequences consist of two or more characters. The first character is always the ASCII escape character, identified by the E_c symbol. This character is a control code used specifically by the printer to identify a string of characters as a printer command. As the printer monitors incoming data from a computer, it is "looking" for this character. When this character appears, the printer reads it and its associated characters as a command to be performed and not as data to be printed.

Note



1. PCL printer commands are also referred to as escape sequences. The terms "escape sequence" and "printer command" are used interchangeably throughout this manual.
 2. Some escape sequences shown in this manual contain spaces between characters for clarity. Do not include these spaces when using escape sequences.
-

Syntax of Escape Sequences

There are two forms of PCL escape sequences: two character escape sequences and parameterized escape sequences.

Two Character Escape Sequences

Two-character escape sequences have the following form:

$$^E_C X$$

where "X" is a character which defines the operation to be performed. (Note, "X" may be any character from the ASCII table [see Appendix A] within the range 48-126 decimal ["0" through "~"]). For a list of the two character escape sequences supported by the printer refer to Appendix A.

Example

1. $^E_C E$ - is a two character escape sequence used for resetting the printer.
2. $^E_C 9$ - is a two-character escape sequence used for resetting the left and right margins.

Parameterized Escape Sequences

Parameterized escape sequences have the following form:

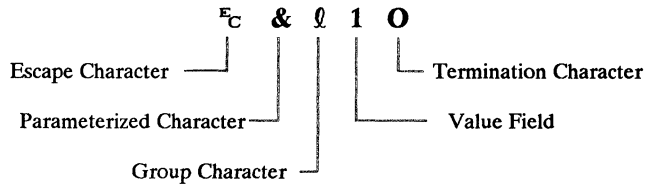
$$^E_C X y \# z1 \# z2 \# z3 \dots \# Zn[\text{data}]$$

where y, #, zi and [data] may be optional, depending on the command.

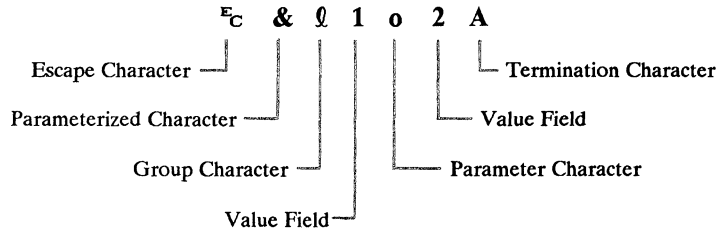
X **Parameterized Character** - A character from the ASCII table within the range 33-47 decimal ("!" through "/") indicating that the escape sequence is parameterized.

- y** **Group Character** - A character from the ASCII table within the range 96-126 decimal ("`" through "~") which specifies the group type of control being performed.
- #** **Value Field** - A group of characters specifying a numeric value. The numeric value is represented as an ASCII string of characters within the range 48-57 decimal ("0" through "9") which may be preceded by a "+" or "-" sign and may contain a fractional portion indicated by the digits after a decimal point("."). If an escape sequence requires a value field and a value is not specified, a value of 0 is assumed.
- zi** **Parameter Character** - Any character from the ASCII table within the range 96-126 decimal ("`" through "~"). This character specifies the parameter to which the previous value field applies. This character is used when combining escape sequences.
- Zn** **Termination Character** - Any character from the ASCII table within the range 64-94 decimal ("@" through "^"). This character specifies the parameter to which the previous value field applies. This character terminates the escape sequence.
- [Data]** **Binary Data** is eight-bit data (for example, graphics data, downloaded fonts, etc.). The number of bytes of binary data is specified by the value field of the escape sequence. Binary data immediately follows the terminating character of the escape sequence.

The following is an example of an escape sequence with a termination character and no parameter character. This escape sequence performs a single function.



The following is an example of an escape sequence with a parameter character and a termination character. This escape sequence performs two functions.



This command is a combination of the following escape sequences:

E_C & l 1 O and E_C & l 2 A

Notice that the " E_C " and the " l " are dropped from the second printer command when they are combined. Also, the upper-case "O" that terminated the first command becomes a lower-case "o" parameter character when these commands are combined.

Use these three rules to combine and shorten printer commands:

1. The first two characters after "**E**" (the parameterized and group character) must be the same in all of the commands that will be combined. In the example above, these are "&" and "Q".
2. All alphabetic characters within the combined printer command will be lower-case, except the final letter which is always upper-case. In the combined example above, "O" becomes "o". The final character in the printer command must always be upper-case to let the printer know that the command is complete.
3. The printer commands will be performed in the order that they are combined (from left to right). Be sure to combine commands in the order that they are to be performed.

Contents

Introduction	2-1
Logical Page	2-2
PCL Coordinate System	2-3

Introduction

This chapter describes the PCL coordinate system. It defines the logical page and the printable area, and identifies the boundaries of each.

Logical Page

The PCL logical page (also referred to as the addressable area) defines the area in which the cursor can be positioned. Although the printer does not actually have a cursor (like the blinking underline character used on most computer terminals), the cursor position refers to the currently active printing position. In other words, the location of the “cursor” is the position on the logical page where the next character will be positioned. The cursor can be moved to different points on the logical page using the cursor positioning commands. The cursor cannot be moved outside of the logical page bounds. The cursor cannot be moved outside of the logical page bounds.

The size of the logical page for the media supported by the printer is defined in Figures 2-2 and 2-3.

PCL Coordinate System

The PCL coordinate system is defined as shown in the following figure:

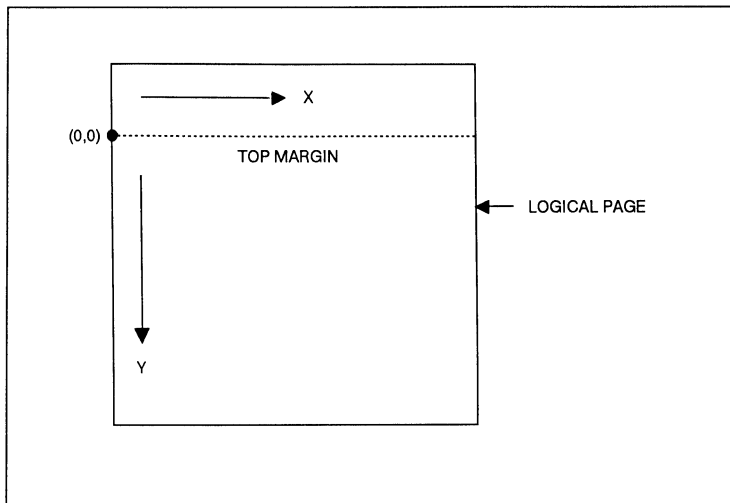


Figure 2-1. X,Y PCL Coordinates

The point (0,0) is at the left edge of the logical page at the current top margin position. Since the top margin may be changed using a printer command, the physical location of the point (0,0) may change.

Units of the PCL Coordinate System

The units of the X-axis of the PCL coordinate system may be dots, decipoints, or columns. The units of the Y-axis may be dots, decipoints, or rows.

The dot is the smallest printable unit. On **LaserJet** family printers, one dot equals $1/300^{\text{th}}$ inch. The number of dots printed per inch is referred to as the printer's resolution.

A decipoint is $1/720^{\text{th}}$ inch or one-tenth of a PCL typographic point.

The width of a column is defined by the current horizontal motion index (HMI). The distance between rows is defined by the current vertical motion index (VMI), or lines-per-inch (lpi). HMI, VMI and lpi are described in Chapter 5, Page Control Commands.

Internally, the printer uses a different unit of measure. It maps dots, decipoints, and columns and rows to this unit of measure. This internal unit is $1/3600^{\text{th}}$ inch. All positioning is kept in internal units and truncated to physical dot positions when data is printed.

Printable Area

The printable area is the area of the physical page in which the printer is able to place a dot. The physical page refers to the size of the media installed in the printer.

The relationship between physical page, logical page, and printable area is defined in Figures 2-2 and 2-3.

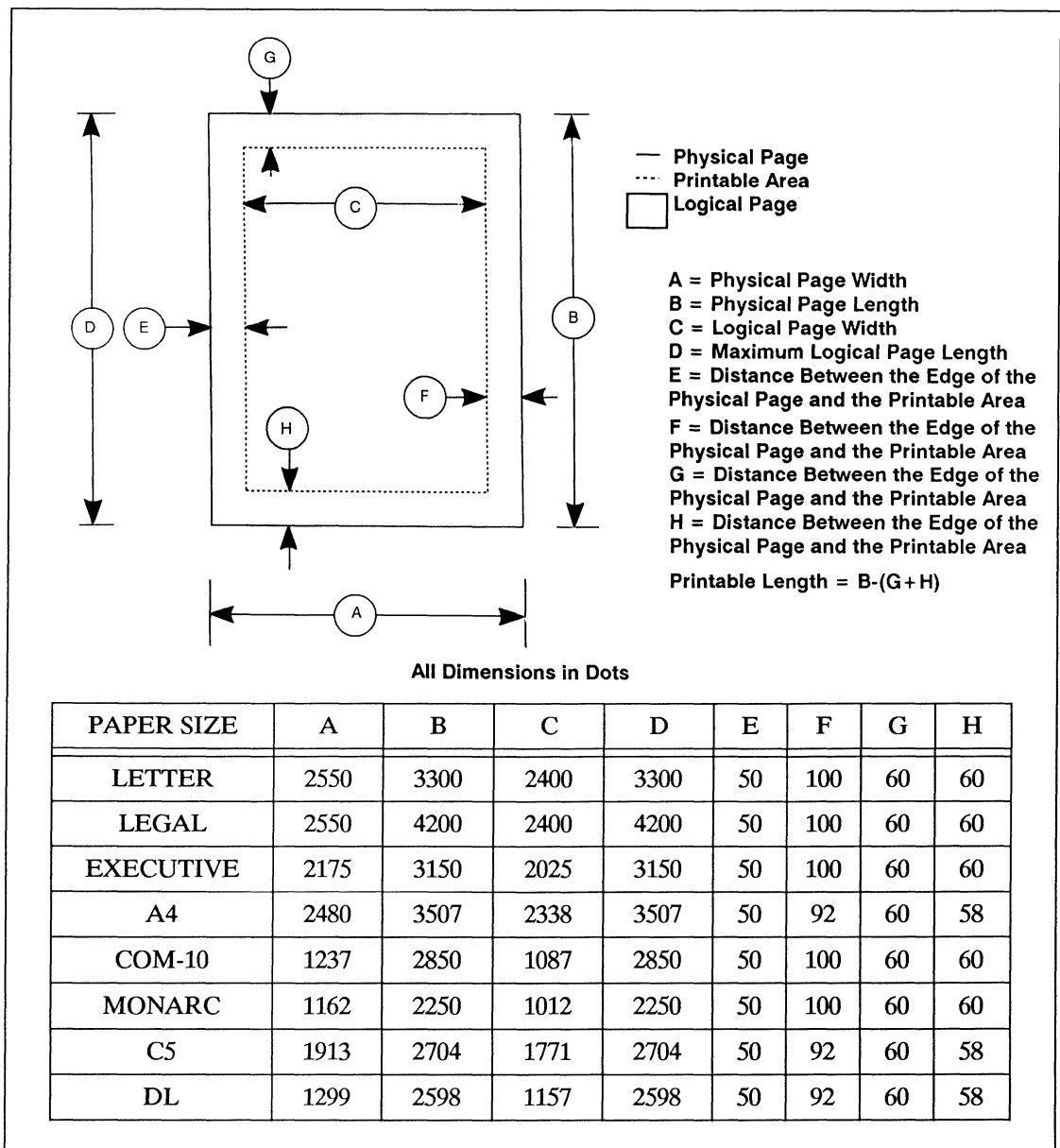


Figure 2-2. Portrait Logical Page and Printable Area Boundaries

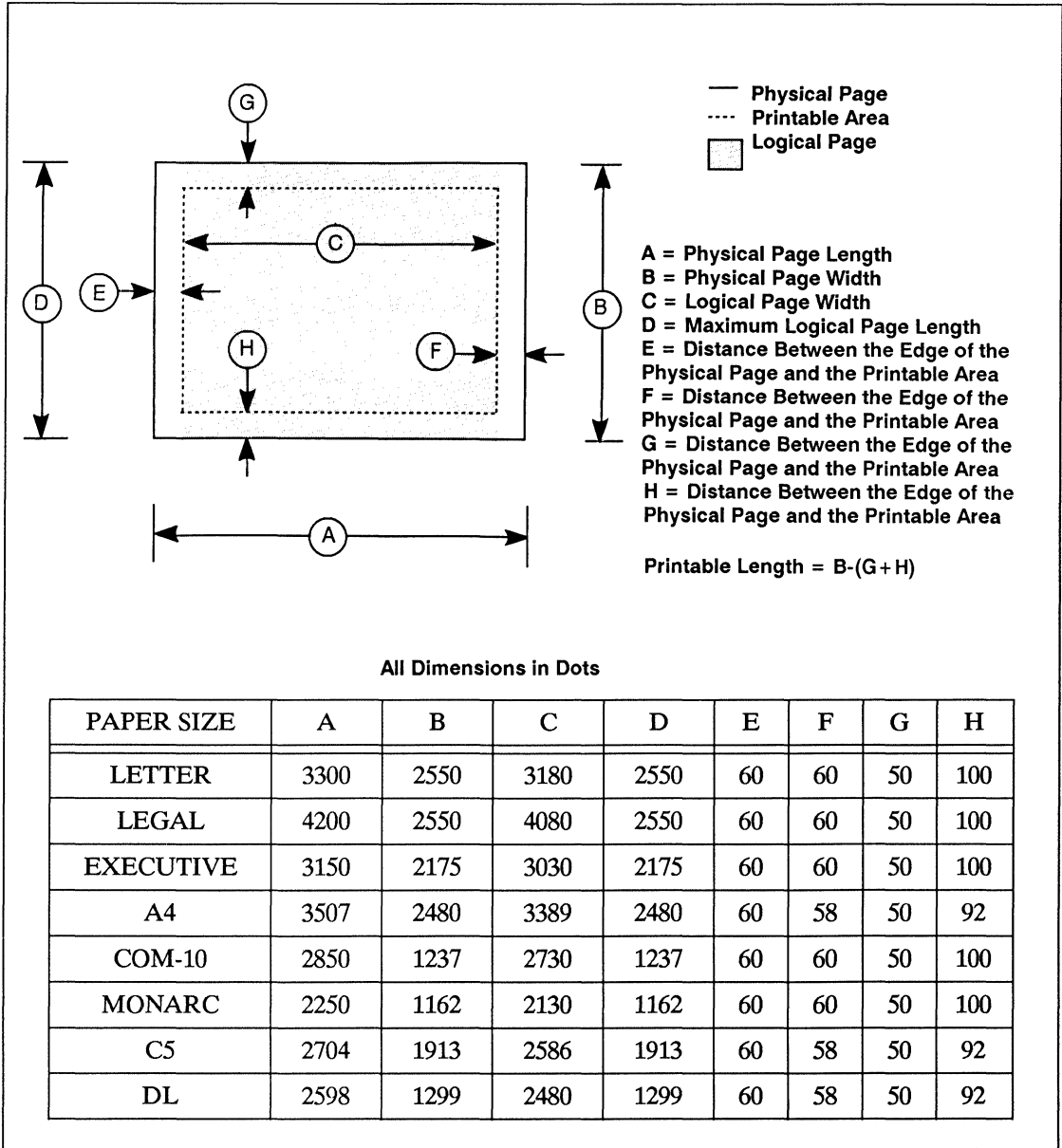


Figure 2-3. Landscape Logical Page and Printable Area Boundaries

When printing characters, if any portion of the character cell falls outside the printable area, the character will not print (see Figure 2-4). The character will not print even if the portion of the character cell that is outside of the printable area does not contain any printable data.

If raster graphics or rules are being printed and the cursor is initially positioned within the printable area, only that portion of the image which is outside the printable area will be clipped.

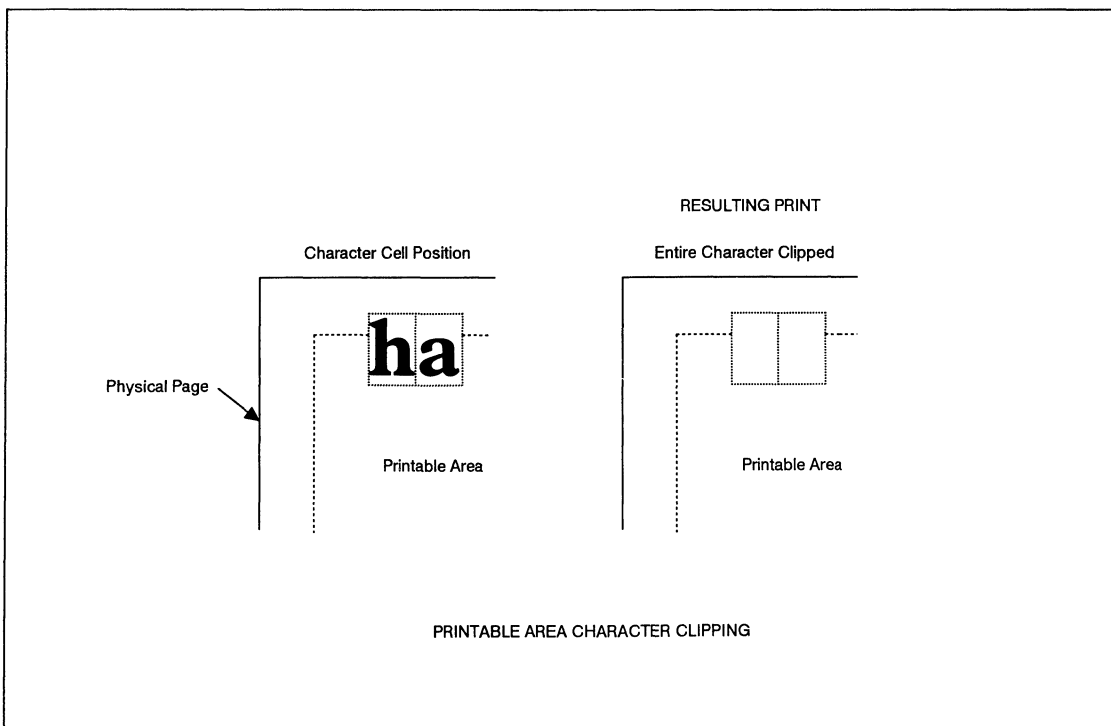


Figure 2-4. Printable Area Character Cell Positioning

3

The Print Environment

Contents

Introduction	3-1
Factory Default Environment	3-2
User Default Environment	3-3
Modified Print Environment	3-4
Resetting the Print Environment	3-5
LaserJet Family Compatibility	3-6

Introduction

The group of all of the printer's current feature settings, collectively, is referred to as the print environment. The printer maintains four print environments: the factory default environment, the user default environment, the modified print environment and the overlay environment. This chapter describes the factory default environment, the user default environment, and the modified print environment (the overlay environment is described in Chapter 12, "Macros").

Default settings refer to the settings programmed into the printer at the factory or settings selected using the control panel. The term default simply refers to the settings the printer uses unless printer commands are used to select other settings.

Each time a job is printed, some of the printer's feature settings may be changed from their default values to produce the desired printed output for that job. After the job has printed, the job specific feature settings will no longer be required, since the next job will likely have different output requirements. The next job should clear all previous job settings by performing a reset. This allows a job to start with the default settings as a base and vary only those settings that are needed. Returning to the default environment at the beginning of each print job eliminates the need for setting every feature each time a job is run.

Factory Default Environment

A factory default is a setting programmed into the printer at the factory. The group of all of the printer's factory settings is referred to as the factory default environment. The factory default symbol set is selectable from the control panel configuration menu (refer to the *LaserJet series II User's Manual*). (Each of these features is described later in this manual.) Table 3-1 lists the printer's factory defaults.

Table 3-1. Print Environment Features with Factory Default Settings

JOB CONTROL

- NUMBER OF COPIES* = 1

PAGE CONTROL

- PAPER FEED* = Installed tray
- ORIENTATION** = Portrait
- PAGE SIZE = Installed paper tray size
- VERTICAL MOTION INDEX * = 8 (6 lpi)
- HORIZ. MOTION INDEX = 12 (10 cpi)
- TOP MARGIN = 1/2" (150 dots)
- TEXT LENGTH = Installed Paper Length - (1/2" top margin + 1/2" bottom margin)
- LEFT MARGIN = Left logical page boundary
- RIGHT MARGIN = Right logical page boundary
- PERFORATION SKIP = ON
- LINE TERMINATION = CR→CR, LF→LF, FF→FF

FONTS**

- ORIENTATION = Portrait
- SYMBOL SET = ROMAN-8
- SPACING = Fixed
- PITCH = 10 cpi
- HEIGHT = 12 point
- STYLE = Upright
- STROKE WEIGHT = Medium
- TYPEFACE = Courier
- UNDERLINING MODE = OFF

FONT MANAGEMENT

- FONT ID = 0
- CHARACTER CODE = 0

RASTER GRAPHICS

- RASTER GRAPHICS RESOLUTION = 75 dpi

RECTANGULAR AREA FILL

- HORIZONTAL RECTANGLE SIZE = 0
- VERTICAL RECTANGLE SIZE = 0
- AREA FILL ID = 0

MACRO

- MACRO ID = 0

TROUBLESHOOTING COMMANDS

- END-OF-LINE WRAP = OFF
- DISPLAY FUNCTIONS = OFF

* - User default values may be selected by the user from the printer's Operator control panel for these items.

** - The font characteristics are determined by the default font. The default font can be the factory default font or the user selected default font from the Operator control panel or from a font cartridge with a default font.

User Default Environment

A user default is a setting selected from the printer's control panel. There are four PCL features on the **LaserJet series II** printer for which user defaults may be selected. These features are as follows:

Number of Copies
Paper Source (manual or tray)
Font (font source and font printout ID number)
Form Length (VMI)

Note



1. Choosing the user default font also results in selection of the user default symbol set and user default page orientation.
 2. Refer to discussion on VMI for the implications of setting this user default.
 3. Changing the installed paper tray and/or the default page orientation will result in a change to the user default VMI setting.
-

For instructions on how to select these user defaults from the control panel refer to the *LaserJet series II User's Manual*.

User default settings are stored in the User Default Environment and are retained even if the printer is turned OFF.

The User Default Environment consists of the user default settings (any user default settings selected from the control panel) with the remainder of the environment features set to their factory default values.

Modified Print Environment

The current printer feature settings constitute the modified print environment. Whenever a feature setting is altered using escape sequences, the new setting is recorded in the modified print environment.

The modified print environment consists of the current settings for the following features:

Number of Copies	Primary Font
Paper Source	Secondary Font
Page Size	Underline Mode
Page Length	Font ID
Orientation	Character Code
Left Margin	Raster Graphics Resolution
Right Margin	Raster Graphics Left Margin
Top Margin	Area Fill ID
Text Length	Horizontal Rectangle Size
Perforation Skip	Vertical Rectangle Size
HMI	Macro ID
VMI/Line Spacing	Line Termination
Primary Font Characteristics	End-of-Line Wrap
Secondary Font Characteristics	

The following items are not part of the modified print environment:

- Current cursor position
- Cursor position stack

Resetting the Print Environment

Resets are used to return the printer to a known environment. Depending on the type of reset performed, the printer returns to either the user default environment or the factory default environment.

A printer reset restores the user default environment and deletes temporary fonts and macros. A printer reset is performed by sending the F_C E command or by pressing the RESET key on the control panel.

The F_C E command prints any partial pages of data which may have been received. The control panel RESET discards any formatted pages which have not yet been printed.

Note



Hewlett-Packard strongly recommends the use of the F_C E command at the beginning and end of each job.

A RESET MENU restores the factory default environment, deletes temporary fonts and macros, and discards any formatted pages which have not yet been printed.

A RESET MENU is performed by pressing the RESET MENU key on the control panel (refer to the *LaserJet series II User's Manual*).

LaserJet Family Compatibility

Control panel functionality has been added to the **LaserJet series II** to permit selecting user defaults for certain features. This permits users to tailor their printer's default environment to their printing requirements. For example, European users may choose to select a font other than the factory default font as their default and EDP users may choose to select 66 lines per letter page rather than 60 lines as their default. To insure compatibility with applications written for **LaserJet** family printers, the user defaults must be set equal to their factory default values. The following table shows the factory default setting for each feature for which a user default setting may be selected.

Table 3-2. LaserJet Family Compatibility

LaserJet series II Control Panel Functionality	Compatibility Mode
Copies	01
Manual Feed	OFF
Font Source	I unless cartridge has a default mark
Font Number	00
Form Length	57 if executive tray is installed 60 if letter tray is installed 64 if A4 tray is installed 78 if legal tray is installed
Symbol Set	Roman-8

4

Job Control Commands

Contents

Introduction	4-1
Printer Reset	4-2
Number of Copies	4-3

Introduction

A job typically consists of three parts:

- commands providing job control,
- commands providing page control, and
- document data.

This chapter describes the commands providing job control. Job control commands are usually grouped together and sent at the beginning of a job. Page control commands and data are associated with each printed page of a job. Job control functionality includes the following:

- restoration of the user default environment, and
- selection of the number of copies of each page.

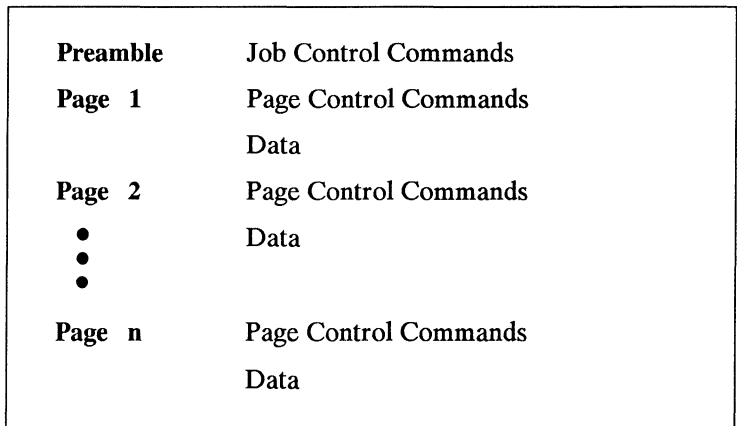


Figure 4-1. Structure of a Job

Note



If a number of pages within a job have the same format, the associated page control commands only need to be sent once for that group of pages.

Printer Reset

Receipt of the printer reset command restores the user default environment, deletes temporary fonts and macros, and prints any partial pages of data which may have been received.

E_c E

Hewlett-Packard strongly recommends the use of the printer reset command at the beginning and end of each job.

Number of Copies

The Number of Copies command designates the number of printed copies of each page.

$\text{E}_c \& \text{q} \# X$

= Number of copies (up to 99 maximum)

This command can be received anywhere within a page and affect the current page as well as subsequent pages. The factory default number of copies is 1.

Example To print 3 copies of a page, send:

$\text{E}_c \& \text{q} 3 X$

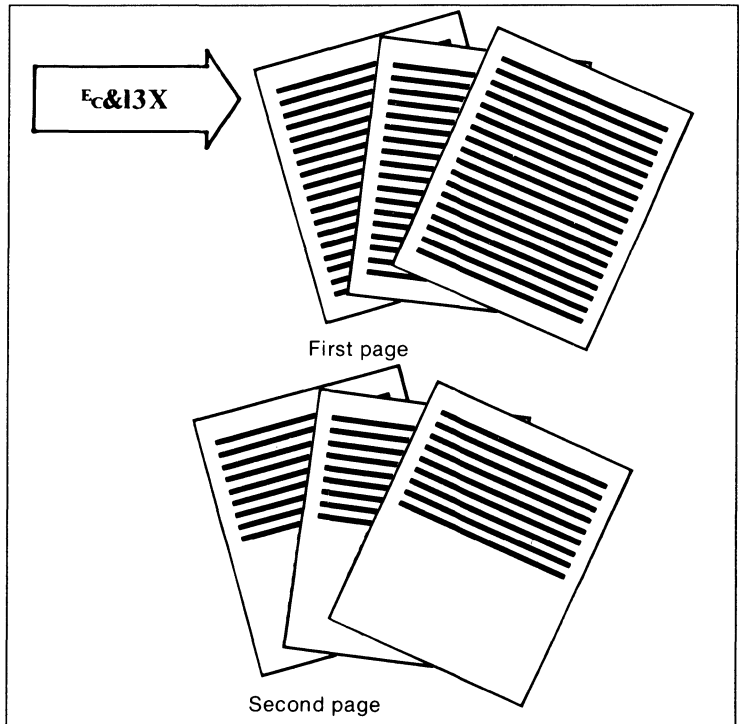


Figure 4-2. Number of Copies

5

Page Control Commands

Contents

Introduction	5-1
Paper Source	5-2
Page Size	5-3
Page Length	5-4
Orientation	5-6
Text Area	5-7
Left Margin	5-9
Right Margin	5-10
Clear Horizontal Margins	5-11
Top Margin	5-12
Text Length	5-13
Perforation Region	5-14
Horizontal Motion Index	5-15
Vertical Motion Index	5-16
Line Spacing	5-17

Introduction

A job typically consists of three parts:

- commands providing job control,
- commands selecting page format, and
- document data.

Job control commands are usually grouped together and sent at the beginning of a job. Page Control commands and data are associated with each printed page of a job. This chapter describes the commands providing page format control. Page format control functionality provides for selection of the page source, size, orientation, margins, and text spacing.

Paper Source

The Paper Source command designates one of the two paper locations as the paper source for printing.

$\text{E}_c \ \& \ l \ \# \ H$

= 0 - Print the current page (paper source remains unchanged)

1 - Feed paper from internal tray

2 - Feed paper from manual input

Receipt of a Paper Source command causes the current page to be printed and the cursor to be moved to the left edge of the logical page at the top margin on the following page.

The factory default paper source is the internal tray.

Example To feed paper from the manual feed slot, send:

$\text{E}_c \ \& \ l \ 2 \ H$

Page Size

The Page Size command designates the physical page size which in turn defines the size of the logical page.

`^C & l # A`

- # = 1 - Executive (7.25" x 10.5")
- 2 - Letter (8.5" x 11")
- 3 - Legal (8.5" x 14")
- 26 - A4 (210mm x 297mm)

ENVELOPES:

- 80 - Letter (Monarch 7 $\frac{3}{4}$) (3 $\frac{7}{8}$ " x 7 $\frac{1}{2}$ ")
- 81 - Business (Commercial 10) (4 $\frac{1}{8}$ " x 9 $\frac{1}{2}$ ")
- 90 - International DL (110mm x 220mm)
- 91 - International C5 (162mm x 229mm)

Upon receipt of this command any unprinted pages will be printed, the top margin, text length, and left and right margins will be set to their user defaults, and the automatic macro overlay will be disabled. The cursor is moved to the left edge of the logical page at the top margin on the following page.

If a page size different from that of the installed paper is specified, a message is displayed on the control panel requesting installation of paper of the specified size.

The factory default logical page length is defined by the size of the media in the installed tray.

Example To select a legal size page, send:

`^C&l3A`

Page Length

The Page Length command designates the length of the logical page which in turn defines the physical page size.

$\text{F}_C \ \& \ l \ \# \ P$

- Number of Lines

The value field (#) identifies the length of the logical page in lines. If a request is received for a page length greater than the maximum supported page size or if the VMI is 0, the Page Length command is ignored.

If a Page Length command is received that designates a page size different from that of the installed paper, a message is displayed on the control panel requesting installation of the appropriate paper size.

Upon receipt of this command any unprinted pages will be printed, the top margin, text length, left and right margins will be set to their user defaults, and the automatic macro overlay will be disabled. The cursor will be moved to the left edge of the logical page at the top margin on the following page.

The Page Length command used with the **LaserJet** and **LaserJet Plus** printers is an alternate way of setting the page size. Either command can be used with the **LaserJet series II** and **LaserJet 2000** printer. The command most recently received will be in effect.

The factory default logical page length is defined by the size of the media in the installed tray.

Note



A change in the control panel FORM setting results in a modification of the VMI (given that the paper tray has not changed). If the Page Length command follows a VMI change, the physical size of the page is recalculated. therefore, depending on the VMI modification made, the printer may request a different paper size.

The following tables list page length values associated with the standard paper sizes.

Table 5-1. Portrait Orientation Page Length Settings.

Page Size	Lines-per-inch Setting:	
	6	8
Letter	66	88
Legal	84	112
A4	70	93
Executive	63	84

Table 5-2. Landscape Orientation Page Length Settings

Page Size	Lines-per-inch Setting:	
	6	8
Letter	51	68
Legal*	---	----
A4	49	66
Executive	43	58

* To print a legal size page in landscape orientation, start out in portrait orientation, set the page length using the `^C&l84P` command, and then set the orientation using the `^C&l10` command.

To determine the number of lines per page, simply multiply the line spacing setting (lines per inch) times the length of the page in inches.

Orientation

Orientation defines the position of the logical page and the direction of print with respect to the physical page as shown in Figure 5-1.

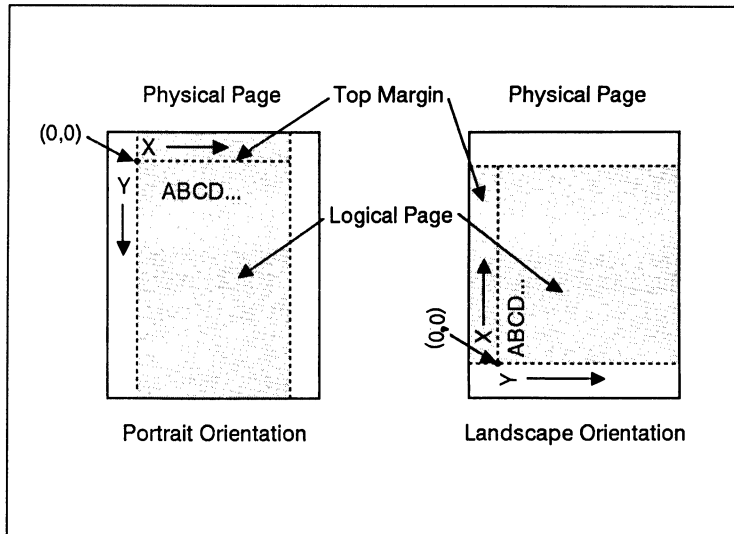


Figure 5-1. Page Orientation

Changing orientation causes any unprinted pages to be printed, the logical page length, top margin, text length, left and right margins, HMI and VMI to be set to their user defaults, and the automatic macro overlay to be disabled. The cursor is moved to the left edge of the logical page at the top margin on the following page. When the orientation is changed, the font in the new orientation whose attributes most closely resemble those of the current font will be selected.

The factory default page orientation is portrait. On the **LaserJet series II** the user default orientation is automatically set when a user default font is selected using the control panel.

Text Area

Text printing may be restricted to a specific area within the logical page using the left margin, right margin, top margin, text length and perforation skip mode commands. This area is known as the text area.

The left margin defines the distance between the left edge of the logical page and the left edge of the text area. The right margin defines the distance between the left edge of the logical page and the right edge of the text area. The width of the text area is the distance between the left and right margins. The top margin defines the distance between the top of the logical page and the top of the text area. The text length defines the length of the text area. The perforation skip region is the distance from the bottom of the text area to the top of the text area on the next page. The text area is shown in Figure 5-2.

In general, characters will be printed when they fall within the text area. Characters will be printed between the bottom of the text area and the top of the text area on the next page only when perforation skip is disabled. Characters will be printed outside the text area if a cursor move escape sequence positions the cursor there.

Note



Attempting to print characters outside the printable area will result in data loss.

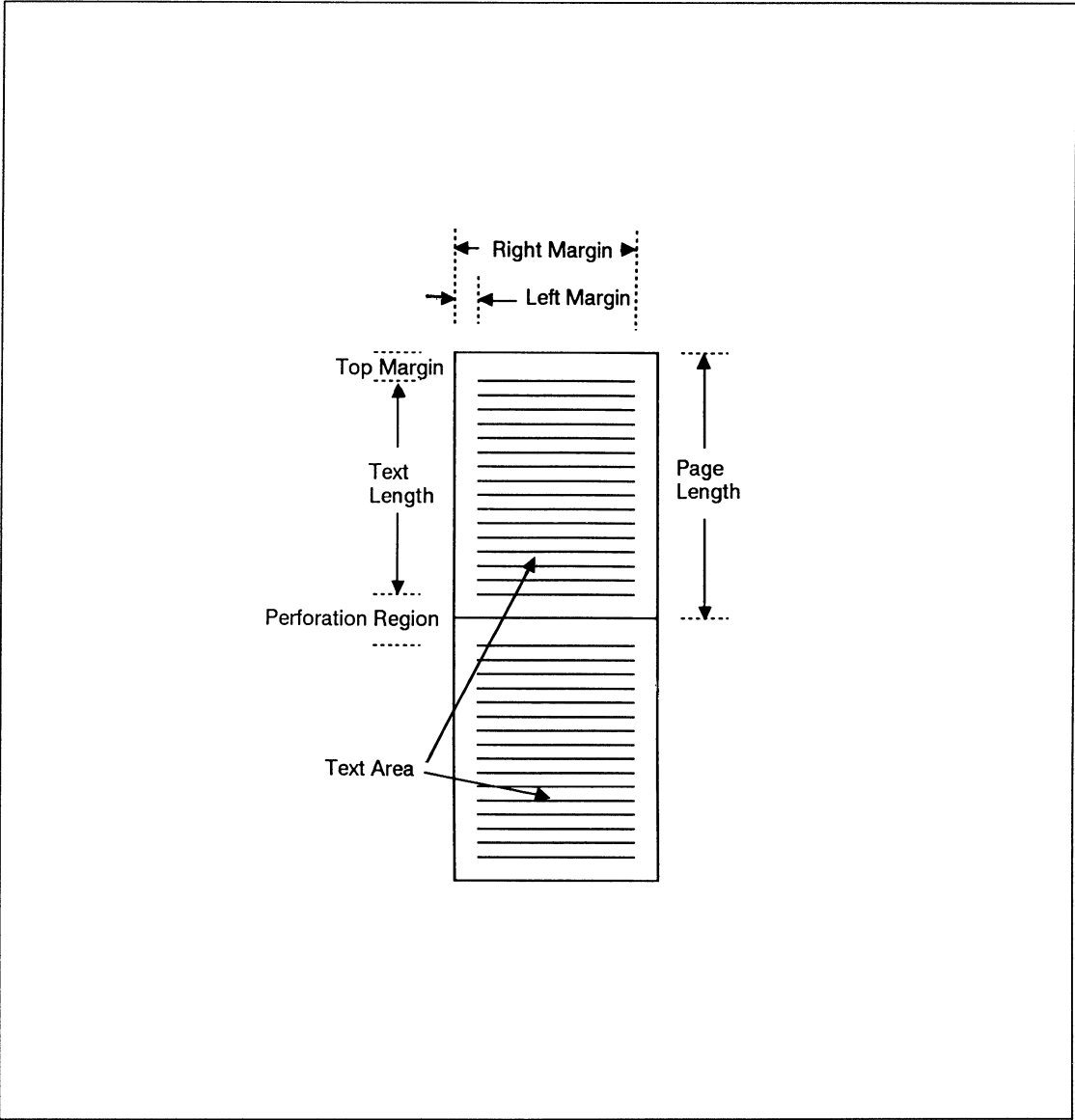


Figure 5-2. Text Area within the Page

Left Margin

The Left Margin command sets the left margin to the left edge of the specified column.

$\text{F}_c \& a \# L$

= Column number

The first column within a line is column 0, which is located at the left edge of the logical page (HMI defines the distance between columns). If the value field specifies a column greater than the current right margin, the command is ignored.

Margins represent a physical position and once set do not change with subsequent changes in HMI.

If the cursor is to the left of the new left margin, the cursor will be moved to the new left margin.

The factory default left margin is column 0.

Example To set the left margin to column 5, send:

$\text{F}_c \& a 5 L$

Right Margin

The Right Margin command sets the right margin to the right edge of the specified column.

`^c & a # M`

`#` = Column number

The maximum right column is located at the right edge of the logical page (HMI defines the distance between columns). If the value field specifies a column which is greater than the right edge of the logical page, the right margin is set to the right edge of the logical page. If the value field specifies a column less than the left margin, the command is ignored.

Margins represent a physical position and once set do not change with subsequent changes in HMI.

If the cursor position is to the right of the new right margin, the cursor will be moved to the new right margin.

The factory default right margin is the right edge of the logical page.

Example To set the right margin to column 45, send:

`^c&a45M`

Clear Horizontal Margins

The Clear Horizontal Margins command resets the left and right margins. The left margin is set to the left edge of the logical page (column 0) and the right margin is set to the right edge of the logical page.

EC 9 - Reset Left and Right Margins

Top Margin

The Top Margin command designates the number of lines between the top of the logical page and the top of the text area.

`^C & l # E`

= Number of lines

The Top Margin command is ignored if the value field (#) is greater than the current logical page length or if the current VMI is 0 (VMI defines the distance between lines of text). Receipt of a Top Margin command resets the text length to (logical page length in inches - top margin in inches - 1/2 inch).

The top margin represents a physical position and once set does not change with subsequent changes in VMI or line spacing.

The vertical cursor position of the first line of print on the logical page is determined by the current values of top margin and VMI, using the following equation:

$$\text{first line in inches} = \text{top margin in inches} + (72/100 * \text{VMI})$$

Example To set the top margin to line 4, send:

`^C&l4E`

NOTE: The first line of the logical page is line 0.

Text Length

The Text Length command designates the number of lines within the logical page available for printing text.

$\text{E}_c \ \& \ \text{Q} \ \# \ \text{F}$

= Number of lines

The value field (#) sets the text length in lines referenced from the top margin. If a value greater than the logical page length minus the top margin is specified or if the current VMI is 0, the command is ignored. The user default text length is invoked whenever the orientation, page length, page size or top margin is changed. The user default text length is computed as follows:

TEXT LENGTH IN LINES =

integer portion of $((\text{logical page length in inches} - \text{top margin in inches} - 1/2 \text{ inch}) 48/\text{VMI})$

The factory default text length in lines is:

$((\text{logical pagelength in inches} - 1") \times 6)$.

Note



The user default VMI is selectable using the control panel; that is, the FORM menu item is equal to VMI.

Example

To select a text length of 60 lines, send:

$\text{E}_c \ \& \ \text{Q} \ 60 \ \text{F}$

Perforation Region

The perforation region is the distance from the bottom of the text area to the top of the text area of the next page. When perforation skip is enabled a line feed or half line feed that would move the cursor beyond the bottom of the text area, moves the cursor to the top of the text area on the next page. When perforation skip is disabled, a line feed or half-line feed moves to the next line or half-line within the perforation region.

F_c & l # L

= 0 - Disable
1 - Enable

The factory default is perforation skip enabled.

Note



When perforation skip is disabled, some print lines could fall outside the printable area, therefore, these lines will be lost.

Horizontal Motion Index

The Horizontal Motion Index (HMI) command designates the distance between columns.

E_C & k # H

= Number of 1/120th inch increments.

The value may range from 0 to 840.

The value field is valid to 4 decimal places.

When fixed pitch fonts are selected, all printable characters including the space and backspace characters are affected by HMI. When proportional fonts are selected, the HMI affects only the control code space character.

HMI is defaulted when font orientation, symbol set, pitch, spacing or height is specified and when switching between primary and secondary fonts with shift in and shift out.

The default HMI is equal to the pitch value in the font header. The factory default font's HMI is 12 (which is $12/120^{\text{th}} = 1/10^{\text{th}}$ inch per character or 10 characters per inch).

Example To select an HMI for 12 characters per inch, send:

E_C &k10H

Vertical Motion Index

The Vertical Motion Index (VMI) command designates the distance between rows.

$\text{F}_C \& \ell \# C$

= number of 1/48th inch increments between rows.

The range of the value field (#) is from 0 to 336

The value field is valid to 4 decimal places. A 0 in the value field indicates no vertical movement.

This command affects the line feed and half line feed spacing.

The factory default VMI is 8 which corresponds to 6 lines per inch. A user default VMI can be selected from the control panel using the FORM menu item.

Example To designate a VMI of 6 (8 lines per inch) send:

$\text{F}_C \& \ell 6 C$

(ie., $6/48^{\text{th}} = 1/8^{\text{th}}$ inch/line)

Note



-
1. The following converts lines-per-inch spacing to VMI:

$$\text{VMI} = 48 \times \left(\frac{1}{\text{\# of desired lines per inch}} \right)$$

2. A change in the control panel FORM setting results in a modification of VMI (given that the paper tray has not changed). If the Page Length command ($\text{F}_C \& \ell \# P$) follows a VMI change, the physical size of the page is recalculated. Therefore, depending on the VMI modification made, the printer may request a different paper size.
-

Line Spacing

The Line Spacing command sets the number of lines printed per inch.

$\text{F}_C \ \& \ \ell \ \# \ D$

= 1 - 1 lpi
2 - 2 lpi
3 - 3 lpi
4 - 4 lpi
6 - 6 lpi
8 - 8 lpi
12 - 12 lpi
16 - 16 lpi
24 - 24 lpi
48 - 48 lpi

This command performs the same function as the Vertical Motion Index (VMI) command except that it identifies the VMI in lines per inch (lpi).

The factory default lines per inch setting is 6. A user default line spacing can be selected from the control panel using the FORM menu item.

Example To select 12 lpi, send:

$\text{F}_C \ \& \ \ell \ 12 \ D$

6

Cursor Positioning

Contents

Introduction	6-1
Relative/Absolute Cursor Positioning	6-2
Cursor Positioning Units	6-3
Horizontal Cursor Positioning (Columns)	6-4
Horizontal Cursor Positioning (Decipoints)	6-5
Horizontal Cursor Positioning (Dots)	6-6
Horizontal Cursor Positioning Control Codes	6-7
Vertical Cursor Positioning (Rows)	6-8
Vertical Cursor Positioning (Decipoints)	6-9
Vertical Cursor Positioning (Dots)	6-10
Half-Line Feed	6-11
Vertical Cursor Positioning Control Codes	6-12
Line Termination	6-13
Push/Pop Cursor Position	6-14

Introduction

This section describes the cursor positioning commands. Although the printer does not actually have a cursor, the cursor position refers to the currently active printing position (like the blinking underline character [cursor] used on most computer terminals). The cursor can be moved anywhere within the logical page using a combination of horizontal and vertical cursor positioning commands and control codes.

Absolute/Relative Cursor Positioning

Either relative or absolute motion can be specified. **Relative motion** specifies the distance to move from the current active position; **absolute motion** specifies a physical position from the top margin at the left bound of the logical page, which is the horizontal and vertical 0 position.

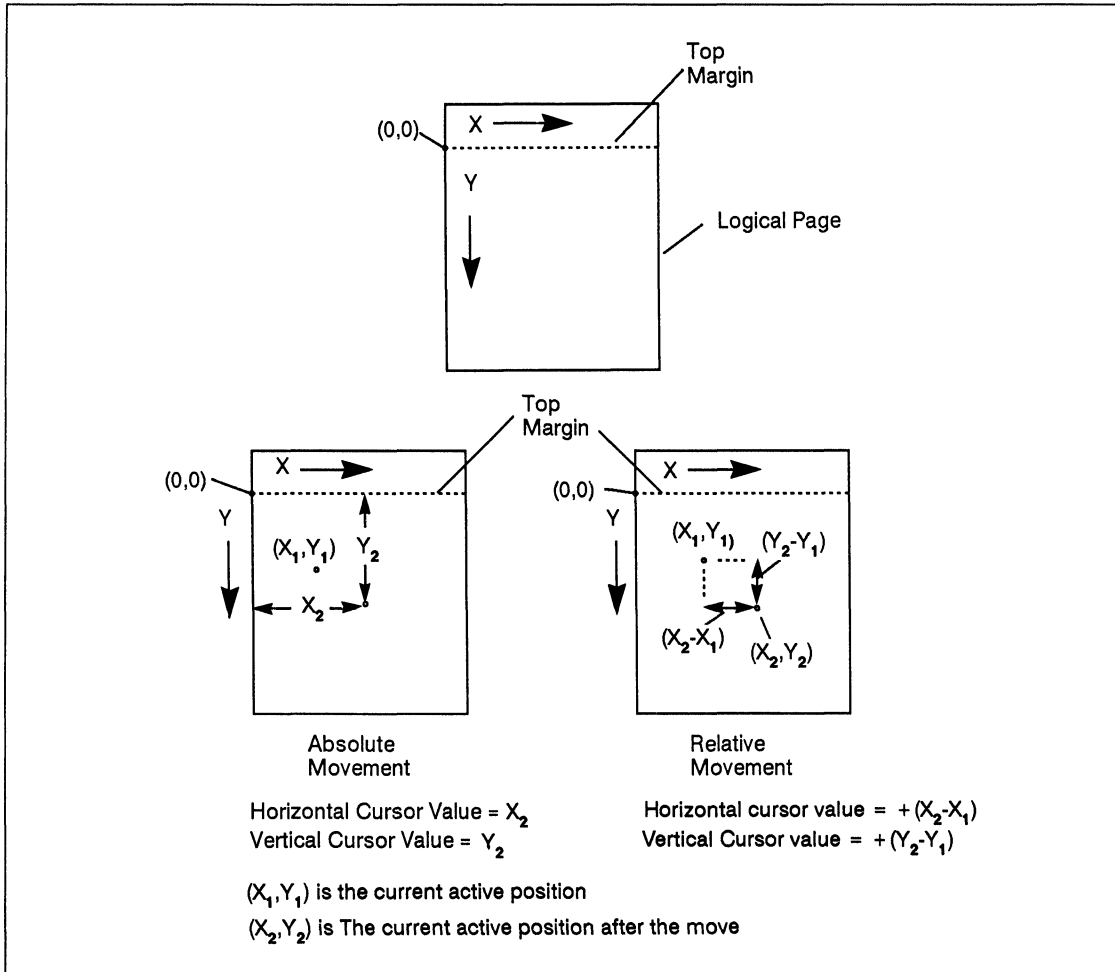


Figure 6-1. Absolute and Relative Cursor Positioning

Cursor Positioning Units

Cursor positioning is done in PCL coordinate system units.

The units of the X-axis of the PCL coordinate system may be dots, decipoints or columns. The units of the Y-axis of the PCL coordinate system may be dots, decipoints or rows.

A dot is the smallest printable unit. On the **LaserJet 2000** printer one dot equals $1/300^{\text{th}}$ inch. The number of dots printed per inch is referred to as the printer's resolution.

A decipoint is $1/720^{\text{th}}$ inch or $1/10^{\text{th}}$ of a PCL typographic point.

The width of a column is defined by the current horizontal motion index (HMI). The distance between rows is defined by the current vertical motion index (VMI). HMI is the distance between consecutive characters. VMI is the distance between consecutive lines of text. HMI and VMI are described in more detail in Chapter 5.

Horizontal Cursor Positioning (Columns)

This Horizontal Cursor Positioning command moves the current active horizontal position to a new column position on the current line.

$\text{E}_C \& a \# C$

$\#$ = Number of Columns

The width of a column is defined by the current HMI. A value field ($\#$) with a plus sign (+) indicates the new position is to the right of and relative to the current cursor position; a minus sign (-) indicates the new position is to the left of and relative to the current cursor position. No sign indicates an absolute distance which is referenced from the left edge of the logical page. The first column within a line is column 0. This sequence ignores margins and can therefore be used to set the current active position to any location along the current line. If a request is made for a location outside the printer's logical page, the current active position is moved to the appropriate logical page limit.

The value field is valid to 4 decimal places.

Horizontal Cursor Positioning (Decipoints)

This Horizontal Cursor Positioning command moves the current active horizontal position to a new position along the horizontal axis.

$\text{E}_C \& a \# H$

$\#$ = Number of Decipoints (1/720th inch)

A value field ($\#$) with a plus sign (+) indicates the new position is to the right of and relative to the current cursor position; a minus sign (-) indicates the new position is to the left of and relative to the current cursor position. No sign indicates an absolute distance which is referenced from the left edge of the logical page. The left most position is 0 and the right most position is the right bounds of the logical page. If a request is made for a location outside the printer's logical page, the current active position is moved to the appropriate logical page limit.

The value field is valid to 2 decimal places.

Horizontal Cursor Positioning (Dots)

This Horizontal Cursor Positioning command moves the current active horizontal position to a new position along the horizontal axis.

$$^E_C * p \# X$$

= Number of dots

A value field (#) with a plus sign (+) indicates the new position is to the right of and relative to the current cursor position; a minus sign (-) indicates the new position is to the left of and relative to the current cursor position. No sign indicates an absolute distance which is referenced from the left edge of the logical page. The left most position is 0 and the right most position is the right bounds of the logical page. If a request is made for a location outside the printer's logical page, the current active position is moved to the appropriate logical page limit.

Horizontal Cursor Positioning Control Codes

There are 4 control codes which can be used to position the cursor horizontally on the current line. These control codes are explained below.

- CR - Carriage Return** Moves the current active position to the left margin on the current line. (Refer to the Line Termination command described later in this chapter.)
- SP - Space** Moves the current active position to the right 1 column position. Space may be a printable character or a control code. If a character is defined for the space code, space is printable; otherwise, it is a control code. For proportionally spaced fonts a space control code updates the cursor by the current HMI value; however, a printable space updates the cursor the width of the character. For fixed pitch fonts a space whether it be a control code or printable, updates the cursor according to the HMI value.
- BS - Backspace** Moves the current active position left a distance equal to the width of the last printed symbol or space. If the active position is already at the left margin, no action is taken.
- When using fixed pitch fonts, the backspace distance is defined by the current print pitch (that is HMI setting).
- When using proportionally-spaced fonts, a single backspace moves back in such a way as to center the overstriking character with the character being overstruck. After printing the overstrike character the cursor position is at the same position as before the backspace. Multiple backspaces each move back the distance of the last printed symbol or space. For example, if "world" was printed with a proportional font and then 5 backspaces were performed, the distance moved back would be five times the width of the "d." If the active position is already at the left margin, no action is taken.
- HT - Horizontal Tab** Moves the current active position to the next tab stop on the current line. The tab stops are at the left margin and every 8th column between the left margin and the right bounds of the logical page. If the new horizontal position crosses the right margin, the new horizontal position is set to the right margin. If the current HMI value is 0, the command is ignored.

Vertical Cursor Positioning (Rows)

This Vertical Cursor Positioning command moves the current active vertical position to the same column position on a new line.

E_C & a # R

= Number of Rows

A value field (#) with a plus sign (+) indicates the new position is downward from and relative to the current cursor position and a minus sign (-) indicates the new position is upward from and relative to the current cursor position. No sign indicates the new position is absolute from the top margin. The top position, defined by the top margin, is 0 and the bottom position is determined by the bottom of the logical page.

Absolute or negative relative requests which exceed the logical page limits move the cursor to the appropriate logical page limit. Positive relative positioning allows the user to move off the current page the number of lines specified. Vertical cursor positioning ignores perforation skip mode, allowing the user to move into the perforation region.

The value field is valid to 4 decimal places.

Vertical Cursor Positioning (Decipoints)

This Vertical Cursor Positioning command moves the current active vertical position to a new position along the vertical axis.

E_C & a # V

= Number of Decipoints (1/720th inch)

A value field (#) with a plus sign (+) indicates the new position is downward from and relative to the current cursor position and a minus sign (-) indicates the new position is upward from and relative to the current cursor position. No sign indicates an absolute distance from the top margin. The top position, defined by the top margin, is 0 and the bottom position is determined by the bottom of the logical page. If a request is made for a location outside the printer's logical page, the current active position is moved to the appropriate logical page limit.

The value field is valid to 2 decimal places.

Vertical Cursor Positioning (Dots)

This Vertical Cursor Positioning command moves the current active vertical position to a new position along the vertical axis.

$E_c * p \# Y$

= Number of Dots

A value field (#) with a plus sign (+) indicates the new position is downward from and relative to the current cursor position and a minus sign (-) indicates the new position is upward from and relative to the current cursor position. No sign indicates an absolute distance from the top margin. The top position, defined by the top margin, is 0 and the bottom position is determined by the bottom of the logical page. If a request is made for a location outside the printer's logical page, the current active position is moved to the appropriate logical page limit.

Half-Line Feed

The Half-Line Feed command moves the cursor to the same character position one-half line down. The distance moved for a half-line feed is one-half of the current line spacing (defined by the last VMI or line spacing setting).

$E_C =$ - Half-line Feed

Vertical Cursor Positioning Control Codes

There are 2 control codes which can be used to position the cursor vertically. These control codes are explained below.

- LF - Line Feed** Advances the current active position to the same horizontal position on the next line. The distance to the next line is defined by the current line spacing (defined by the last VMI or line spacing setting). (Refer to the Line Termination command described later in this chapter.)
- FF - Form Feed** Advances the current active position to the same horizontal position at the top of the text area on the next page. (Refer to the Line Termination command described later in this chapter.)

Line Termination

The Line Termination command controls the way the printer interprets CR, LF, and FF control characters.

E_C & k # G

- # = 0 - CR→CR; LF→LF; FF→FF
- 1 - CR→CR-LF; LF→LF; FF→FF
- 2 - CR→CR; LF→CR-LF; FF→CR-FF
- 3 - CR→CR-LF; LF→CR-LF; FF→CR-FF

The factory default line termination value is 0.

Push/Pop Cursor Position

The Push/Pop Cursor Position command allows the current cursor position to be stored and recalled.

$E_c \& f \# S$

= 0 - Push (Store cursor position)
1 - Pop (Recall a cursor position)

A value field of 0 **pushes** the cursor position onto the stack (leaving the current position unaffected). A value field of 1 **pops** the position from the stack, restoring it as the current cursor position.

Note



The last item **pushed** is the first item **popped**.

Twenty positions may be pushed. If the user tries to save more than 20 positions, the command is ignored. If the user tries to restore more positions than were pushed, the command is ignored. A printer reset restores the current active position stack to the top (all saved positions are discarded).

Contents

Introduction	7-1
Orientation	7-2
Symbol Set	7-3
Spacing	7-4
Pitch	7-5
Height	7-6
Style	7-7
Stroke Weight	7-8
Typeface	7-9

Fonts

Introduction

A font is a set of characters that have similar characteristics. A font has an assigned name, **typeface**, and is further described by its **spacing**, **height**, **pitch**, **style**, **stroke weight**, **symbol set**, and **orientation**.

For example, the name of the font used for this text is TmsRmn; its **height** is 10 point, its **style** is upright, and its **stroke weight** is medium. The headings in this manual use a Helv font; the heading, “Fonts” at the top of this page, is 18-point Helv, upright, bold.

The following are some examples of different fonts:

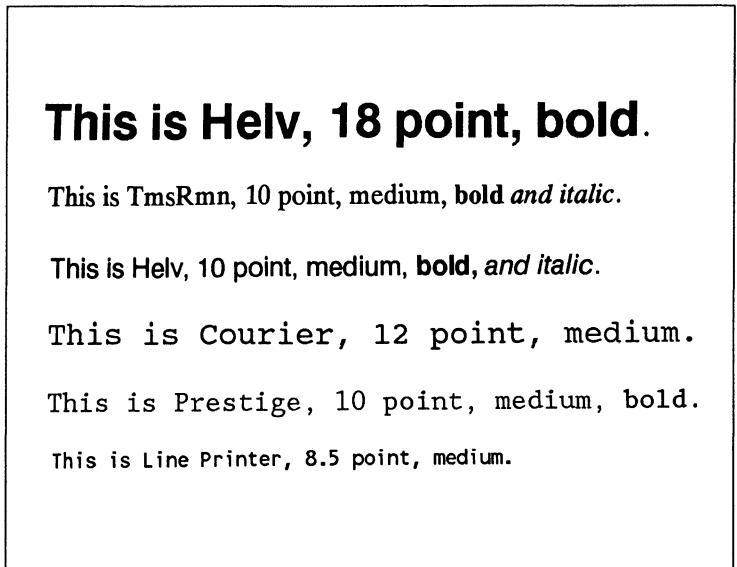


Figure 7-1. Font Samples

Orientation

Orientation defines the position of the logical page and direction of print with respect to the physical page as shown in the following diagram.

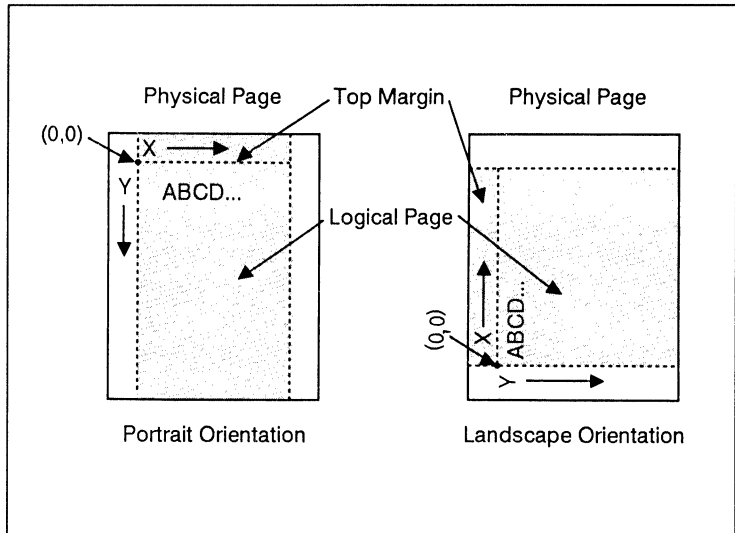


Figure 7-2. Orientation

Once print orientation is chosen, only those fonts with the corresponding orientation are available for selection.

Spacing

Another characteristic that differentiates fonts is spacing. Fonts have either fixed or proportional spacing. Fixed-spaced fonts are those for which the inter-character spacing is constant. Proportionally-spaced fonts are those for which the inter-character spacing varies with the natural shape of a character.

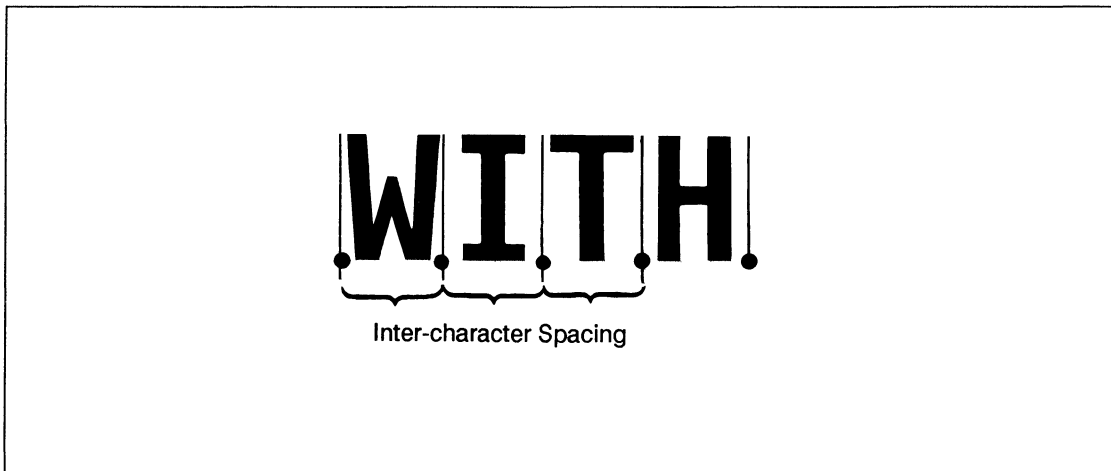


Figure 7-4. Fixed Spacing

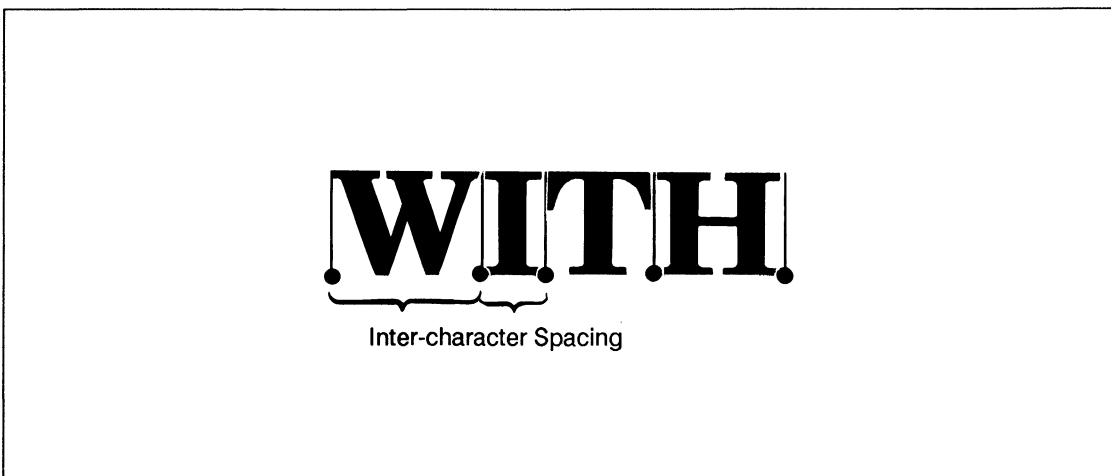


Figure 7-5. Proportional Spacing

Pitch

Pitch describes the number of characters printed in a horizontal inch. Pitch only applies to fixed spaced fonts since the number of characters per inch varies for proportional fonts.

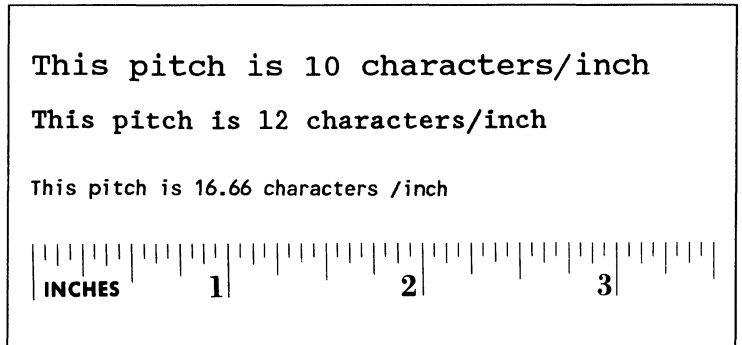


Figure 7-6. Pitch

Height

The height of a font is the measurement of the body of the type in points. A PCL point is $1/72^{\text{nd}}$ inch. The body of the type is slightly greater than the distance from the bottom of a descender to the top of an unaccented capital letter.

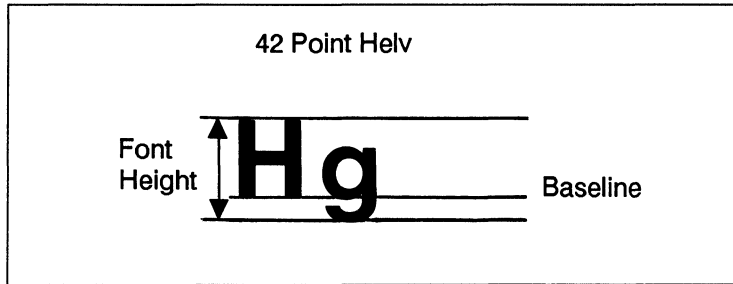


Figure 7-7. Height

Style

Font style is defined by the angularity of the strokes of the characters with respect to the X-axis. Examples of upright and italic styles are shown.

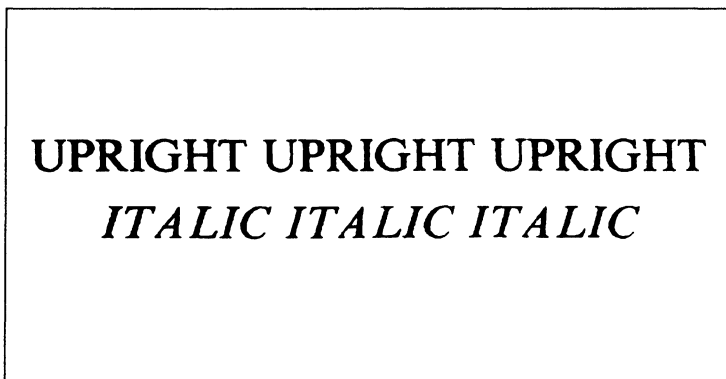


Figure 7-8. Style

Stroke Weight

Stroke weight describes the thickness of the strokes that compose characters. Examples of medium and bold stroke weights are shown.

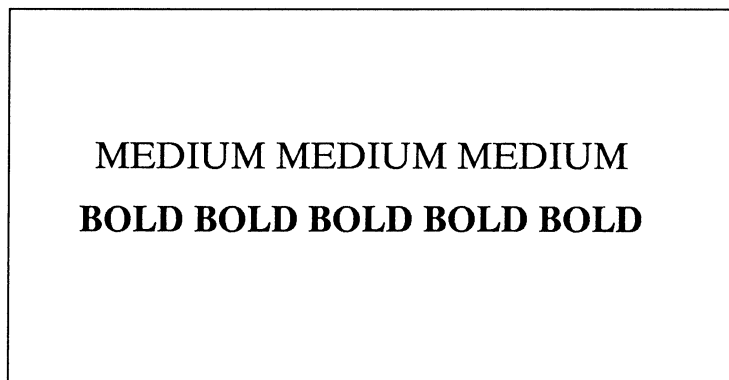


Figure 7-9. Stroke Weight

Typeface

Typeface is a generic name for graphics symbols having common design features. Each typeface has unique and distinguishing characteristics. The following example shows three typefaces.



Cooper Black Soft Font
Coronet Bold Soft Font
Broadway Soft Font

Figure 7-10. Typeface

Contents

Introduction	8-1
Font Selection by Characteristic	8-2
Primary and Secondary Fonts	8-4
Orientation	8-5
Symbol Set	8-6
ISO Symbol Sets	8-8
Spacing	8-10
Pitch	8-11
Height	8-12
Style	8-13
Stroke Weight	8-14
Typeface	8-16
Internal Fonts	8-18
Font Selection Example	8-19
Summary of Font Selection by Characteristic	8-20
Selection of Default Font	8-22
Transparent Print Data	8-23
Underline Command	8-24

Introduction

A typical document is printed using a variety of fonts. For example, a large font may be used for the title and chapter headings of a document, a standard size font may be used for the body of the document, and key words or phrases may be highlighted, using a **bold** or *italic* font.

A number of fonts are supplied with the printer; these fonts are referred to as internal fonts. Additional fonts can be used by the printer by inserting font cartridges or downloading soft fonts.

Cartridge fonts plug into font cartridge slots on the printer. The fonts contained in the cartridge become available once the cartridge is plugged into the printer. A large number of font cartridges may be purchased from Hewlett-Packard or an authorized dealer. Refer to your *HP LaserJet Printer Family Font Catalog* for a list of available cartridges. Contact your HP Sales Representative or authorized dealer for purchasing information.

Soft fonts are supplied on flexible discs. These discs are inserted into the personal computer disc drive, and the font files from the disc are transferred (downloaded) into the printer's RAM memory. Once the font has been downloaded into the printer, it may be selected for printing. A large number of soft fonts may be purchased from Hewlett-Packard or an authorized dealer. Refer to your *HP LaserJet Printer Family Font Catalog* for a list of available soft fonts. Contact your HP Sales Representative or authorized dealer for purchasing information.

Any internal, cartridge, or soft font may be selected for printing. Fonts are selected using font selection escape sequences. This chapter describes how to select fonts.

Font Selection by Characteristic

There are several characteristics used to identify a font; these characteristics are described in Chapter 7. A font is selected by specifying its characteristics. The font characteristics that must be specified are as follows: orientation, symbol set, spacing, pitch, height, style, stroke weight, and typeface.

The printer maintains a table which contains the values of all of the currently specified characteristics. Whenever the printer receives an escape sequence specifying a font characteristic, the printer records that characteristic in the table.

The printer selects a font based on a prioritization of the characteristics in the table. The priority of the characteristics is shown in the following list:

Priority of Characteristics

Orientation	highest
Symbol Set	|
Spacing	|
Pitch	|
Height	|
Style	|
Stroke Weight	|
Typeface	↓ lowest

When selecting a font, the printer compares the highest priority characteristic in the table to the corresponding characteristic of the available fonts. If only one font is available that matches, that font is selected. However, when several fonts match, the printer compares the next highest priority characteristic to the corresponding characteristic of the available fonts and so on down the list. When only one font remains, that font is selected. If, after comparing all characteristics, more than one font remains, selection is determined by the priority of the font location. The highest priorities of the font locations are listed below:

Soft font (Lowest ID)
Cartridge Font*
Internal Font

*All cartridge fonts have the same priority regardless of location.

Page 8-20 summarizes font selection by characteristic.

The initial font specification in a job should be made using all of the font characteristics.

To select a portrait, HP Roman-8, fixed-spaced, 10 pitch, 12 point, upright, bold, Courier font, specify each of the characteristics using font selection escape sequences. Once the characteristics have been specified, the font characteristic table will appear as follows:

Orientation	Portrait
Symbol Set	HP Roman-8
Spacing	Fixed
Pitch	10
Height	12 point
Style	Upright
Stroke Weight	Bold
Typeface	Courier

To subsequently select a font with the same characteristics differing only in stroke weight, medium rather than bold, only the stroke weight characteristic must be specified. Note the following change to the font characteristic table:

Orientation	Portrait
Symbol Set	HP Roman-8
Spacing	Fixed
Pitch	10
Height	12 point
Style	Upright
Stroke Weight	Medium
Typeface	Courier

In general, when specifying a font, only the characteristics of the new font that differ from those of the previously designated font must be specified.

Note



The HP LaserJet series II Printer can print 16 distinct fonts per page.

Primary and Secondary Fonts

The printer maintains two independent font characteristic tables for use in selecting a primary font and a secondary font. All of the characteristics previously described apply to both tables. This provides access to two distinct fonts, only one of which is selected at a given time. To alternate between the primary and the secondary font, the control codes “SI” and “SO” are used. The font described by the primary table is designated by the “SI” control code; the font described by the secondary table is designated by the “SO” control code.

The factory default state is primary font designated.

Orientation

The Orientation command designates the position of the logical page and direction of print with respect to the physical page.

E_c & l # **O**

= 0 Portrait
= 1 Landscape

Note that this command applies to both the primary and secondary fonts. Once print orientation is chosen only those fonts with the designated orientation are available for selection.

The Orientation command sets the page length, top margin, text length, left and right margins, HMI and VMI to their user default values, and disables the auto overlay macro.

All data received prior to this command will be printed and a form feed and carriage return executed. When the orientation is changed, the primary and secondary fonts are re-evaluated based on the new orientation.

The factory default orientation is portrait.

The user default orientation can also be implicitly selected from the control panel by selecting a user default font that is in the desired orientation (refer to the *LaserJet series II User's Manual* for more information).

Symbol Set

The Symbol Set escape sequence designates a unique ordering of characters in a font.

E_c (ID Primary Symbol Set

E_c) ID Secondary Symbol Set

If the specified symbol set does not exist, the previous symbol set will be maintained.

The factory default symbol set is selectable from the control panel configuration menu. Selecting a value for the “SYM SET” configuration menu item designates the primary and secondary factory default symbol sets.

The primary and secondary user default symbol sets are implicitly set when the user default font is selected using the control panel printing menu (refer to the *LaserJet series II User's Manual*).

Table 8-1 lists HP defined symbol sets.

Example

To select ASCII as the symbol set for the primary font, send:

E_c (0U

To select HP Roman-8 as the symbol set for the secondary font, send:

E_c)8U

Table 8-1. HP Defined Symbol Sets

Symbol Set Name	Symbol Set ID
HP Math-7	0A
HP Line Draw	0B
ISO 60: Norwegian version 1	0D
ISO 61: Norwegian version 2	1D
HP Roman Extension	0E
ISO 4: United Kingdom	1E
ISO 25: French	0F
ISO 69: French	1F
HP German	0G
ISO 21: German	1G
HP Greek-8	8G
ISO 15: Italian	0I
ISO 14: JIS ASCII	0K
ISO 57: Chinese	2K
Technical-7	1M
HP Math-8	8M
ISO 100: ECMA-94 (Latin 1)	0N
OCR A	0O
OCR B	1O
ISO 11: Swedish	0S
HP Spanish	1S
ISO 17: Spanish	2S
ISO 10: Swedish	3S
ISO 16: Portuguese	4S
ISO 84: Portuguese	5S
ISO 85: Spanish	6S
ISO 6: ASCII	0U
HP Legal	1U
ISO 2: International Reference Version	2U
OEM-1	7U
HP Roman-8	8U
PC-8	10U
PC-8 (D/N)	11U
HP Pi Font	15U

ISO Symbol Sets

The printer provides several ISO (International Standards Organization) symbol sets to support European languages. Each ISO symbol set is a unique ordering of symbols contained in the HP Roman-8 symbol set (see Table 8-2). The printer automatically generates the requested ISO symbol set from an HP Roman-8 symbol set.

Example To select the ISO French symbol set for the primary font, send:

ESC(1F

Table 8-2. ISO Substitution Characters

ISO	Name	ID	DECIMAL CHARACTER EQUIVALENTS											
			35	36	64	91	92	93	94	96	123	124	125	126
6	ASCII	0U	#	\$	@	[	\	\]	^	'	{	|	}	~
2	ISO IRV	2U	#	¤	@	[	\	\]	^	'	{	|	}	~
4	ISO United Kingdom	1E	£	\$	@	[	\	\]	^	'	{	|	}	~
25	ISO French	0F	£	\$	à	°	ç	§	^	'	é	ù	è	¨
69	ISO French	1F	£	\$	à	°	ç	§	^	µ	é	ù	è	¨
	German	0G	£	\$	§	Ä	ö	Ü	^	'	ä	ö	ü	ß
21	ISO German	1G	#	\$	§	Ä	ö	Ü	^	'	ä	ö	ü	ß
15	ISO Italian	0I	£	\$	§	°	ç	é	^	'	ù	à	ò	è
14	JIS ASCII	0K	#	\$	@	[	¥	]	^	'	{	|	}	~
57	ISO Chinese	2K	#	¥	@	[	\	\]	^	'	{	|	}	~
10	ISO Swedish	3S	#	¤	@	Ä	ö	Å	^	'	ä	ö	å	—
11	ISO Swedish	0S	#	¤	É	Ä	ö	Å	Ü	é	ä	ö	å	ü
	Spanish	1S	#	\$	@	í	ñ	¿	°	'	{	ñ	}	~
17	ISO Spanish	2S	£	\$	§	í	ñ	¿	^	'	°	ñ	ç	~
85	ISO Spanish: IBM	6S	#	\$	·	í	ñ	Ç	¿	'	'	ñ	ç	¨
16	ISO Portuguese	4S	#	\$	§	Ä	Ç	õ	^	'	ã	ç	õ	°
84	ISO Portuguese	5S	#	\$	'	Ä	Ç	õ	^	'	ã	ç	õ	'
60	ISO Norwegian v1	0D	#	\$	@	Æ	Ø	Å	^	'	æ	ø	å	—
61	ISO Norwegian v2	1D	§	\$	@	Æ	Ø	Å	^	'	æ	ø	å	|

Note



HP font cartridge products A through H, J through N, P through R, T through Y and HP soft font products AD, AF, and DA support a subset of the new HP Roman-8 symbol set. Characters with decimal character codes 177, 178, and 242 to 245 have since been added. These characters are \acute{Y} \acute{y} \cdot μ ¶ $\frac{3}{4}$ respectively.

Spacing

Inter-character spacing can be specified as either proportional or fixed.

E_c (s # P - Primary spacing

E_c) s # P - Secondary spacing

= 0 - Fixed spacing

1 - Proportional spacing

When proportional spacing is specified and a proportionally-spaced font is not available, a fixed pitch font with the current pitch specification will be selected.

The factory default primary and secondary spacings are fixed.

The user default primary and secondary spacings are implicitly set by selection of a user default font from the control panel printing menu (refer to the *LaserJet series II User's Manual*).

Example To specify proportional spacing for the primary font, send:

E_c (s1P

To specify fixed spacing for the secondary font, send:

E_c)s0P

Pitch

The Pitch command designates the horizontal spacing of a fixed-spaced font in terms of the number of characters per inch.

E_c (s # H - Primary pitch

E_c) s # H - Secondary pitch

= Pitch in characters/inch

The value field (#) is valid to two decimal places.

If a pitch is specified that is not available, the next greater available pitch will be selected. If no greater value is available, the closest available lesser value will be selected.

The factory default primary and secondary pitches are ten characters per inch.

The user default primary and secondary pitches are implicitly set by selection of a user default font from the control panel printing menu (refer to the *LaserJet series II User's Manual*).

Example To specify 10 pitch for the primary font, send:

E_c (s10H

To specify 16.66 pitch for the secondary font, send:

E_c)s16.66H

Height

The Height command specifies the height of the font in points.

E_c (s # V - Primary Height

E_c) s # V - Secondary Height

= Height in points

The value field (#) is valid to two decimal places. If the requested height is unavailable, the closest height will be selected. All fonts whose heights are within a quarter point of the specified height are considered to have the specified height.

The factory default primary and secondary heights are 12 point. A PCL typographic point is $1/72^{\text{nd}}$ inch.

The user default primary and secondary heights are implicitly set by selection of a user default font from the control panel printing menu (refer to the *LaserJet series II User's Manual*).

Example To specify a height of 12 points for the primary font, send:

E_c (s12V

To specify a height of 14.4 points for the secondary font, send:

E_c)s14.4V

Style

The Style command designates either upright or italic font style.

E_c (s # S - Primary Style

E_c) s # S - Secondary Style

= 0 - Upright
1 - Italic

If the requested style is not present, this characteristic is ignored during font selection. The factory default primary and secondary styles are upright.

The user default primary and secondary styles are implicitly set by selection of a user default font from the control panel printing menu (refer to the *LaserJet series II User's Manual*).

Example

To specify an upright style for the primary font, send:

E_c (s0S

To specify an italic style for the secondary font, send:

E_c)s1S

Stroke Weight

The Stroke Weight command designates the thickness of the strokes that compose the characters of a font.

^E_c (s # B - Primary stroke weight

^E_c) s # B - Secondary stroke weight

The value field (#) specifies the thickness of the strokes used in the design of the font. The supported stroke weight values are -7 through 7. The thinnest font available is -7; the thickest font available is +7. The standard stroke weight for a medium font is 0; the standard stroke weight for a bold font is 3; the standard stroke weight for a light font is -3.

Table 8-3. Stroke Weights

Value (#)	Typeface
-7	Ultra Thin
-5	Thin
-3	Light
0	Medium
+3	Bold
+5	Black
+7	Ultra Black

If the specified stroke weight is greater than or equal to 0 and is not available, the next thicker available stroke weight will be selected. If no thicker stroke weight is available, the closest available thinner stroke weight will be selected.

If the specified stroke weight is less than zero and is not available, the next thinner available stroke weight will be selected. If no thinner stroke weight is available, the closest available thicker stroke weight will be selected.

The factory default primary and secondary stroke weights are zero.

The user default primary and secondary stroke weights are implicitly set by selection of a user default font from the control panel printing menu (refer to the *LaserJet series II User's Manual*).

Example To specify a bold stroke weight for the primary font, send:

`^C(s3B`

To specify a medium stroke weight for the secondary font, send:

`^C)s0B`

Typeface

The Typeface command designates the design of the font.

$\text{F}_c (s \# T$ - Primary typeface

$\text{F}_c)s \# T$ - Secondary typeface

$\#$ = Typeface value

Table 8-4. Typeface Value Numbers*

Value (#)	Typeface
0	Line Printer
3	Courier
4	Helv
5	Tms Rmn
6	Letter Gothic
8	Prestige
11	Presentations
17	Optima **
18	Garamond **
19	Cooper Black **
20	Coronet Bold **
21	Broadway **
22	Bauer Bodoni Black Condensed**
23	Century Schoolbook **
24	University Roman **

* Additional typefaces will be available in the future.

** These typeface names may be registered trade marks of a third party. Use of these fonts may be conditional upon a license grant from the owners of the fonts. Hewlett-Packard makes no representation as to the quality or performance of the fonts, and references to the fonts does not grant any license or right to use the fonts.

If the value field ($\#$) specifies a typeface that is unavailable this characteristic is ignored during font selection.

The factory default primary and secondary typefaces are Courier.

The user default primary and secondary typefaces are implicitly set by selection of a user default font from the control panel printing menu (refer to the *LaserJet series II User's Manual*).

Example To specify Helv for the typeface of the primary font, send:

`^C(s4T`

To specify Letter Gothic for the typeface of the secondary font, send:

`^C)s6T`

Internal Fonts

Table 8-5. LaserJet series II Internal Fonts

Characteristic	Courier*	Courier Bold	Line Printer Compressed
ORIENTATION	Portrait/Landscape	Portrait/Landscape	Portrait/Landscape
SYMBOL SET**	Roman-8/IBM-US /IBM-DN/ECMA-94	Roman-8/IBM-US /IBM-DN/ECMA-94	Roman-8/IBM-US /IBM-DN/ECMA-94
SPACING	Fixed	Fixed	Fixed
PITCH	10 CPI	10 CPI	16.66 CPI
HEIGHT	12 Point	12 Point	8.5 Point
STYLE	Upright	Upright	Upright
STROKE WEIGHT	Medium	Bold	Medium
TYPEFACE	Courier	Courier	Line Printer

*The portrait, HP Roman-8, fixed-spaced, 10 pitch, 12 point, upright, medium Courier font is the printer's primary and secondary factory default font. This font is used unless a font cartridge with a default font is installed, unless a user default font is selected using the control panel, or unless font selection escape sequences are used to request a font to be used in place of the default.

** These additional symbol sets can be used with internal fonts: ISO 2, 4, 6, 10, 11, 14, 15, 16, 17, 21, 25, 57, 60, 61, 69, 84, 85, HP Spanish, and HP German. ISO denotes International Standards Organization symbol sets, these are primarily for use in Europe or for printing foreign characters. For a list of the available ISO symbol sets see Appendix A.

Font Selection Example

This example illustrates how to select a primary font with the following characteristics (note that all of the font characteristics are specified):

CHARACTERISTIC	VALUE	ESCAPE SEQUENCE
Orientation	Portrait	$\text{E}_c\&l\theta\theta$
Symbol set	ASCII	$\text{E}_c(\theta U$
Spacing	Fixed	$\text{E}_c(s\theta P$
Pitch	10 cpi	$\text{E}_c(s1\theta H$
Height	12 point	$\text{E}_c(s12 V$
Style	Upright	$\text{E}_c(s\theta S$
Stroke weight	Bold	$\text{E}_c(s3B$
Typeface	Courier	$\text{E}_c(s3T$

The following escape sequences could be sent to the printer to select a primary font with the above characteristics:

$\text{E}_c\&l\theta\theta\text{E}_c(\theta U\text{E}_c(s\theta P\text{E}_c(s1\theta H\text{E}_c(s12 V\text{E}_c(s\theta S\text{E}_c(s3B\text{E}_c(s3T$

The previous sequence can be shortened by combining sequences that have the same two characters following the E_c character.

$\text{E}_c\&l\theta\theta\text{E}_c(\theta U\text{E}_c(s\theta p1\theta h12 v\theta s3b3T$

Once the font has been selected as explained above, selecting another font with similar characteristics only requires changing the characteristics that are different. For example, to specify a font differing only in style (italic) and stroke weight (medium), only style and stroke weight need to be specified, as shown below:

$\text{E}_c(s1S\text{E}_c(s\theta B$

or shortened:

$\text{E}_c(s1s\theta B$

Note



If an escape sequence does not contain a value field, the printer assumes a value of zero; therefore, the sequence $\text{E}_c(sB$ could be sent to the printer instead of $\text{E}_c(s\theta B$.

Summary of Font Selection by Characteristic

The following summarizes the procedure the printer uses to select a font. The 8 steps are performed in the following order.

1. The specified orientation is selected.
2. If the specified symbol set exists, that symbol set is selected; otherwise the previously selected symbol set is selected.
3. If proportional spacing is specified and available, proportional spacing is selected. If proportional spacing is specified but is not available, fixed spacing is selected in the current pitch. If fixed spacing is specified and available, fixed spacing in the specified pitch is selected. If the specified pitch is not available, the next greater available pitch is selected. If no greater pitch is available, the closest available lesser pitch is selected. If fixed spacing is specified but is not available, proportional spacing is selected and the pitch characteristic is ignored.

Note



The pitch of a 16.66 cpi font is larger than the pitch of a 12 cpi font, and the pitch of a 10 cpi font is smaller than the pitch of a 12 cpi font.

4. The closest height available from the remaining fonts is selected. The closest height is in terms of absolute difference. All fonts whose heights are within a quarter point of the specified height are considered to have the specified height. For example, if the device has 6, 8, and 12 point fonts and the specified height is 10, both 8 and 12 point fonts are picked for the next selection criterion.
5. If the specified style is available in the remaining fonts, that style is selected; otherwise, this characteristic is ignored.
6. If the specified stroke weight is available in the remaining fonts, that stroke weight is selected. If the specified stroke weight is greater than or equal to 0 and is not available, the next thicker available stroke weight will be selected. If no thicker stroke weight is available, the closest available thinner stroke weight will be selected.

If the specified stroke weight is less than 0 and is not available, the next thinner available stroke weight will be selected. If no thinner stroke weight is available, the closest available thicker stroke weight will be selected.

7. If the requested typeface is available in the remaining fonts, that typeface is selected; otherwise, this characteristic is ignored.
8. If after performing all the preceding steps, more than one font remains, the available font from the highest priority font location is selected. The priority of the font locations is as follows:

Soft Font (Lowest ID)	<i>highest</i>
Cartridge Font*	↓
Internal Font	<i>lowest</i>

*All cartridge fonts have the same priority regardless of location.

Selection of the Default Font

The Default Font command sets all of the font characteristics, except for orientation, to those of the user default font.

$\text{^E}_c (3 @$ - Default primary font characteristics

$\text{^E}_c) 3 @$ - Default secondary font characteristics

Note



If the user default font is a proportionally-spaced font, the pitch characteristic will not be affected by the default font command.

Transparent Print Data

The Transparent Print Data command provides printing access to all characters in a font including those defined as unprintable.

E_c & p # X [Transparent Data]

= Number of bytes of transparent print data.

Each transparent print data byte is interpreted as a single character code. The appropriate character is printed if one exists; otherwise, a space is processed. For Example, control codes such as LF, CR, FF are treated as print data while in Transparent Print Data mode.

Example

Assuming the currently selected symbol set is PC-8, send the following to print a left arrow (decimal code 27):

E_c &p1X[27]

Note



The E_c character is decimal code 27 in the ASCII symbol set. Decimal code 27 is the left arrow in the PC-8 symbol set.

Underline Command

The Underline commands control automatic text underlining.

$\text{\textasciitilde}\text{_c}$ & **d** # **D** - Enable underline

= 0 - Fixed position

3 - Floating position

$\text{\textasciitilde}\text{_c}$ & **d** @ - Disable underline

Once underlining is enabled, any positive horizontal movement causes an underline to be drawn. Positive horizontal movement includes the printing of text and positive horizontal cursor motion.

When fixed position underlining is enabled, the underline is drawn five dots below the baseline and is three dots thick. (The baseline is an imaginary dot row on which all of the characters in a given line stand, see Chapter 10.) When floating position underline is enabled, the underline position is determined by the greatest underline distance below the baseline of all of the fonts printed on the current line. (The underline distance is defined in a font's descriptor, see Chapter 10.)

The factory default is underline disabled.

9

Font Management

Contents

Introduction	9-1
Downloading Soft Fonts	9-2
Temporary/Permanent Fonts	9-3
Deleting Fonts	9-3
Font ID	9-4
Font Control	9-5
Font Selection by ID	9-6
Font Management Example	9-7

Introduction

A number of fonts are supplied with the printer; these fonts are referred to as internal fonts. Additional fonts can be added to the printer by inserting font cartridges or downloading soft fonts. Font management provides mechanisms for downloading and manipulating soft fonts.

Downloading Soft Fonts

The process of transferring soft fonts from a host computer to the printer's user memory is called downloading. A unique identification (ID) number should be designated prior to the download of a font. This number is then associated with the soft font. If a font is already associated with this ID number, the font will be deleted during the download. Subsequent manipulation of the soft font is accomplished using the font's ID number.

Several escape sequences are required to download fonts to the printer. These escape sequences are described in detail in Chapter 10. Hewlett-Packard font files include the necessary escape sequences, thus assigning a font ID number, and then copying the file to the printer, downloads the font.

Once downloaded, a font occupies a portion of user memory. Depending on the amount of user memory available, up to 32 soft fonts can be stored simultaneously.

Temporary / Permanent Fonts

Once downloaded, a font is automatically designated as temporary. A temporary soft font is one that is deleted from user memory during a printer reset. A soft font can be designated as permanent to prevent the printer from deleting it during a printer reset. A soft font is designated as temporary or permanent by reference to its ID number.

Note



Temporary and permanent fonts are removed from user memory whenever the printer's power is turned off.

Deleting Fonts

There are several mechanisms provided by PCL font management for explicit deletion of soft fonts from user memory. These include commands to delete all soft fonts, all temporary soft fonts, or an individual soft font by reference to its font ID number.

Font ID

The Font ID command is used to specify an ID number for use in subsequent font management commands.

$\text{E}_c^*c\#D$

= ID number - (0 through 32767)

The font ID number will be used during subsequent soft font downloads, selections or deletions.

The factory default font ID is 0.

Example To specify a font ID number of 1, send:

E_c^*c1D

Font Control

The Font Control command provides mechanisms for manipulating soft fonts.

$\text{E}_c * c \# F$

- # = 0 - Delete all soft fonts
- 1 - Delete all temporary soft fonts
- 2 - Delete soft font (last ID specified)
- 4 - Make soft font temporary (last ID specified)
- 5 - Make soft font permanent (last ID specified)

Note



If a font used on the current page is deleted, the formatting of the page stops and that page is printed. If the deleted font is the primary or secondary font, a new primary or secondary font whose characteristics most closely resemble those of the deleted font is automatically selected from the remaining fonts.

Examples

To remove all soft fonts from user memory, send:

$\text{E}_c * c 0 F$

To remove only those soft fonts that are temporary, send:

$\text{E}_c * c 1 F$

To delete the soft font with an ID of 1, send:

$\text{E}_c * c 1 d 2 F$

To make the soft font with an ID of 2 permanent, send:

$\text{E}_c * c 2 d 5 F$

To make the soft font with an ID of 2 temporary, send:

$\text{E}_c * c 2 d 4 F$

Font Selection by ID

Soft fonts can be selected using their associated ID numbers.

$\text{E}_C (\# X$ - Designates soft font as primary

$\text{E}_C)\# X$ - Designates soft font as secondary

$\#$ = font ID number

If the designated font is present, the font is selected as the primary/secondary font and all primary/secondary font characteristics are set to those of the selected font. However, if the selected font is proportionally spaced, the pitch characteristic is not changed.

Note



For shared or multi-user environments, Hewlett-Packard recommends that soft fonts be selected by characteristics rather than ID number.

Examples

To select the font associated with ID number 7 as the primary font, send:

$\text{E}_C(7X$

To select the font associated with ID number 5 as the secondary font, send:

$\text{E}_C)5X$

Font Management Example

This example illustrates several typical font management operations. It assumes a soft font is stored and available on a MS-DOS based hard disc.

1. Set the font ID number to 2:

```
^c*c2D
```

2. Download a soft font file using the MS-DOS COPY command with the /B option:

```
>COPY /B filename PRN
```

(Refer to your DOS manual for information on using the DOS Copy command.)

Note that the soft font is associated with font ID 2.

3. Make the soft font permanent in order to prevent its deletion during a printer reset:

```
^c*c5F
```

4. Designate the permanent soft font as primary:

```
^c(2X
```


Contents

Introduction	10-1
Coordinate System	10-2
Font Descriptor Format	10-3
Font Descriptor Command	10-13
Character Descriptor and Data Format	10-15
Character Code Command	10-21
Character Descriptor and Data Command	10-22

Introduction

A font descriptor and one or more character descriptors define a soft font. A font descriptor is a block of data used to communicate font design characteristics to the printer.

A character descriptor is a block of data describing for the printer the position and shape of an individual character and the implied movement after printing the character. Following each character descriptor is a block of raster data containing the dot-per-bit image of the character.

Coordinate System

Characters of a font are designed within a rectangular area referred to as a cell. The dimensions of the cell are in PCL Coordinate system dots and are therefore page orientation-independent. Refer to Chapter 2, page 3, for a complete description of the PCL Coordinate System.

Character design dimensions within the cell are in physical coordinate system dots (rather than PCL Coordinate System dots). The physical coordinate system is defined in terms of the directions of raster scan (X) and paper motion (Y) as illustrated in the following figure:

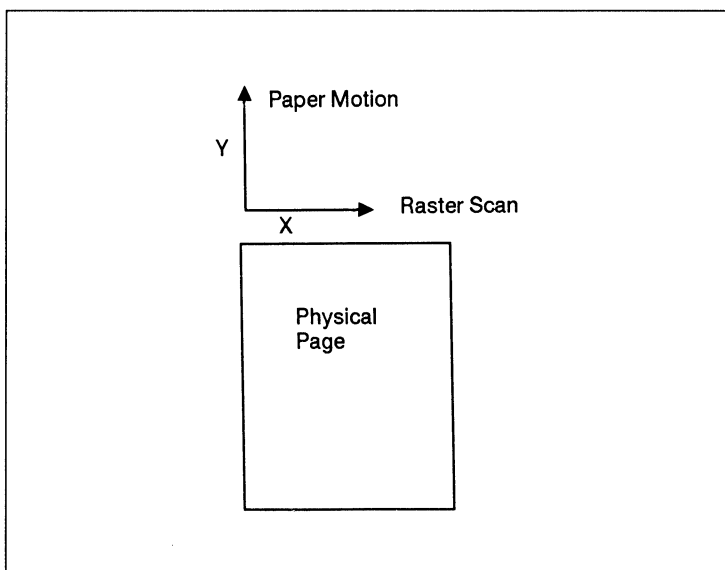


Figure 10-1. Physical Coordinate System

Since the raster scan and paper motion directions of a device are fixed, the physical coordinate system is page-orientation dependent. Character design dimensions within the cell are in physical coordinate system dots and therefore depend on the print orientation.

Font Descriptor Format

A unique ID number should be designated prior to downloading a font descriptor. If a font is already associated with this ID, the existing font will be deleted during the download of the font descriptor. Unless otherwise specified, inappropriate values in a font descriptor field will invalidate the font download process; a font will not be created and the associated font data will be discarded.

Although some devices do not use all of the data in the font descriptor, a font creator should use valid values in all of the font descriptor fields to insure font compatibility across the LaserJet family.

Those font descriptor fields identified as “reserved” should be set to 0.

The following illustrates the format of the font descriptor:

Byte	15 - MSB	8	7	LSB - 0
0	Font descriptor Size			
2	Reserved		Font Type	
4	Reserved			
6	Baseline Distance			
8	Cell Width			
10	Cell Height			
12	Orientation		Spacing	
14	Symbol Set			
16	Pitch (Default HMI)			
18	Height			
20	xHeight			
22	Width Type		Style	
24	Stroke Weight		Typeface	
26	Reserved		Serif Style	
28	Reserved			
30	Underline Distance		Underline Height	
32	Text Height			
34	Text Width			
36	Reserved			
38	Reserved			
40	Pitch Extended		Height Extended	
42	Reserved			
44	Reserved			
46	Reserved			
48-63	Font Name			

Figure 10-2. Font Descriptor Format

Note

The following notation is used to define the data type of each field in the font descriptor

(B)	: Boolean	(0,1)
(UB)	: Unsigned Byte	(0 . . 255)
(SB)	: Signed Byte	(-128 . . 127)
(UI)	: Unsigned Integer	(0 . . 65535)
(SI)	: Signed Integer	(-32768..32767)
(ASCxx)	: ASCII string	array (0...xx -1) of characters

Font Descriptor Size (UI)

Specifies the number of bytes in the font descriptor. This value is ignored by the **LaserJet series II** printer but should be set to 64.

Font Type (UB)

Specifies one of the following defined font types. The font type should be set appropriately for the font's symbol set.

Table 10-1. Font Type Values.

Value	Font Type
0	7-bit (32 to 127 decimal are printable)
1	8-bit (32 to 127 and 160 to 255 decimal are printable)
2	PC-8 (All character codes are printable except 0, 7 to 15, and 27 decimal)

Note

To access those character codes that are unprintable, that have a character defined, requires the use of transparent print data.

Baseline Distance (UI) Specifies the distance from the top of the cell to the baseline. The baseline is an imaginary dot row on which all of the characters in a line stand. The measurement of this distance is in PCL coordinate system dots. The legal range for the baseline distance is 0 to cell height minus 1.

Cell Width (UI) Specifies the width of the cell in PCL coordinate system dots. The legal range for the **LaserJet series II** printer is 1 to 4200.

Cell Height (UI) Specifies the height of the cell in PCL coordinate system dots. The legal range for the **LaserJet series II** printer is 1 to 4200.

Orientation (UB) Specifies the orientation of the font. All characters within the font must have the same orientation; otherwise they will be discarded as they are downloaded. Zero specifies portrait and one specifies landscape.

Spacing (B) Specifies the spacing of the font. Zero specifies fixed spacing and one specifies proportional spacing.

Symbol Set (UI) Specifies the symbol set for the font. This value is computed by taking the PCL escape sequence value field value for the symbol set, multiplying it by 32, adding the ordinal value (ASCII decimal value) of the PCL escape sequence termination character, and subtracting 64.

Font Descriptor Symbol Set =

$$\text{(PCL Escape Sequence Value Field Value * 32) + (Ordinal of PCL Escape Sequence Termination Character) - 64}$$

The legal range of the PCL symbol set escape sequence value field is 0 to 2047. Refer to Table 10-2 for the HP defined font descriptor symbol set values. HP reserves the right to use the font descriptor symbol set values of 0 to 1023. PCL symbol set escape sequence value field values 1024 to 2047 are available for use by independent font vendors. PCL symbol set escape sequence termination characters can be any of the upper case ASCII characters "A" through "V."

Table 10-2. Symbol Set Values

Symbol Set Name	PCL Value Field	PCL Termination Character	Symbol Set Value
HP Math-7	0	A	1
HP Line Draw	0	B	2
ISO 60: Norwegian version 1	0	D	4
ISO 61: Norwegian version 2	1	D	36
HP Roman Extensions	0	E	5
ISO 4: United Kingdom	1	E	37
ISO 25: French	0	F	6
ISO 69: French	1	F	38
HP German	0	G	7
ISO 21: German	1	G	39
HP Greek-8	8	G	263
ISO 15: Italian	0	I	9
ISO 14: JIS ASCII	0	K	11
ISO 57: Chinese	2	K	75
Technical-7	1	M	45
HP Math-8	8	M	269
ISO 100: ECMA-94 (Latin 1)	0	N	14
OCR A	0	O	15
OCR B	1	O	47
ISO 11: Swedish	0	S	19
HP Spanish	1	S	51
ISO 17: Spanish	2	S	83
ISO 10: Spanish	3	S	115
ISO 16: Portuguese	4	S	147
ISO 84: Portuguese	5	S	179
ISO 85: Spanish	6	S	211
ISO 6: ASCII	0	U	21
HP Legal	1	U	53
ISO 2: Intl Reference Version	2	U	85
OEM-1	7	U	245
HP Roman-8	8	U	277
PC-8	10	U	341
PC-8 (D/N)	11	U	373
HP Pi Font	15	U	501

Pitch (UI) Specifies the pitch of the font in quarter-dot units (four quarter dot units equal one dot). This defines the default HMI for the font.

The supported pitch range is 0 to 16800; values greater than 16800 are set to 16800.

Height (UI) Specifies the design height of the font in quarter-dot units. This value, converted to points, is used to select the height of the font. A PCL point is 1/72nd inch.

The supported height range is 0 to 10922; values greater than 10922 are set to 10922.

xHeight (UI) Specifies the height of the lower case “x” in quarter-dot units.

This field is ignored by the LaserJet series II printer.

Width Type (SB) Specifies the proportionate width of characters in the font.

This field is ignored by the LaserJet series II printer.

Table 10-3. Width Type Values.

Value	Width Type
-2	Condensed
-1	Semi-Condensed
0	Normal
1	Semi-Expanded
2	Expanded

Additional width types may be added.

Style (UB) Specifies the style of the font. Upright is specified by 0; 1 specifies italics. Additional styles may be added.

Stroke Weight (SB) Specifies the thickness of the strokes used in designing the font. The supported stroke weight values are -7 through 7. The thinnest stroke weight is -7; the thickest is 7. The standard stroke weight for a medium font is 0; the standard stroke weight for a bold font is 3; the standard stroke weight for a light font is -3.

Typeface (UB) Specifies one of the following defined typefaces.

Table 10-4. Typeface Values *

Value	Typeface
0	Line Printer
3	Courier
4	Helv
5	TmsRmn
6	Letter Gothic
8	Prestige
11	Presentations
17	Optima**
18	Garamond**
19	Cooper Black**
20	Coronet Bold**
21	Broadway**
22	Bauer Bodoni Black Condensed**
23	Century Schoolbook**
24	University Roman**

* Additional typefaces will be available in the future.

** These typeface names may be registered trade marks of a third party. Use of these fonts may be conditioned upon a license grant from the owners of the fonts. Hewlett-Packard makes no representation as to the quality or performance of the fonts, and references to the fonts does not grant any license or right to use the fonts.

Independent font vendors should contact their Hewlett-Packard representative for assignment of typeface values.

Serif Style (UB) Specifies one of the following defined serif styles.
This field is ignored by the **LaserJet series II** printer.

Table 10-5. Serif Style Values

Value	Serif Style
0	Sans Serif Square
1	Sans Serif Round
2	Serif Line
3	Serif Triangle
4	Serif Swath
5	Serif Block
6	Serif Bracket
7	Rounded Bracket
8	Flair Stroke

Additional serif styles may be added.

Underline Distance (SB) Specifies the distance from the baseline to the top dot row of the underline in dots. Zero specifies an underline position at the baseline. A positive value specifies an underline position above the baseline. A negative value specifies an underline position below the baseline.

Underline Height (UB) Specifies the thickness of the underline in dots.
This field is ignored by the **LaserJet series II** printer. It always prints 3 dot thick underlines.

- Text Height (UI)** Specifies the font's optimum inter-line spacing in quarter-dot units.
This field is ignored by the **LaserJet series II** printer.
- Text Width (UI)** Specifies the font's optimum character spacing in quarter-dot units. HP recommends setting this value to the average width of the lower case letters "a" through "z."
This field is ignored by the **LaserJet series II** printer.
- Font Name (ASC16)** This is a 16 character ASCII field to which the user may assign a font name.
The **LaserJet series II** printer prints this font name on the Font Sample Printout (refer to the *LaserJet series II User's Manual* for instructions on how to obtain a Font Sample Printout).
- Pitch Extended (UB)** This is an addition to the Pitch field which extends the pitch an extra eight bits. The value of this field is in 1024^{ths} of one dot. For example, a 17 pitch font would have a Pitch field of 70 (17.5 dots, or 17.1429 cpi) and a Pitch Extended field of 150 (0.1465 dots additional, which adds to 17.6465 dots, or 17.0005 pitch).
- Height Extended (UB)** This is an additional to the Height field which extends the height an extra eight bits. The value field is in 1024^{ths} of one dot. For example, a 10 point font would have a Height field of 166 (41.5 dots, or 9.96 points) and a Height Extended field of 170 (0.1660 dots additional, which adds to 9.9998 points).

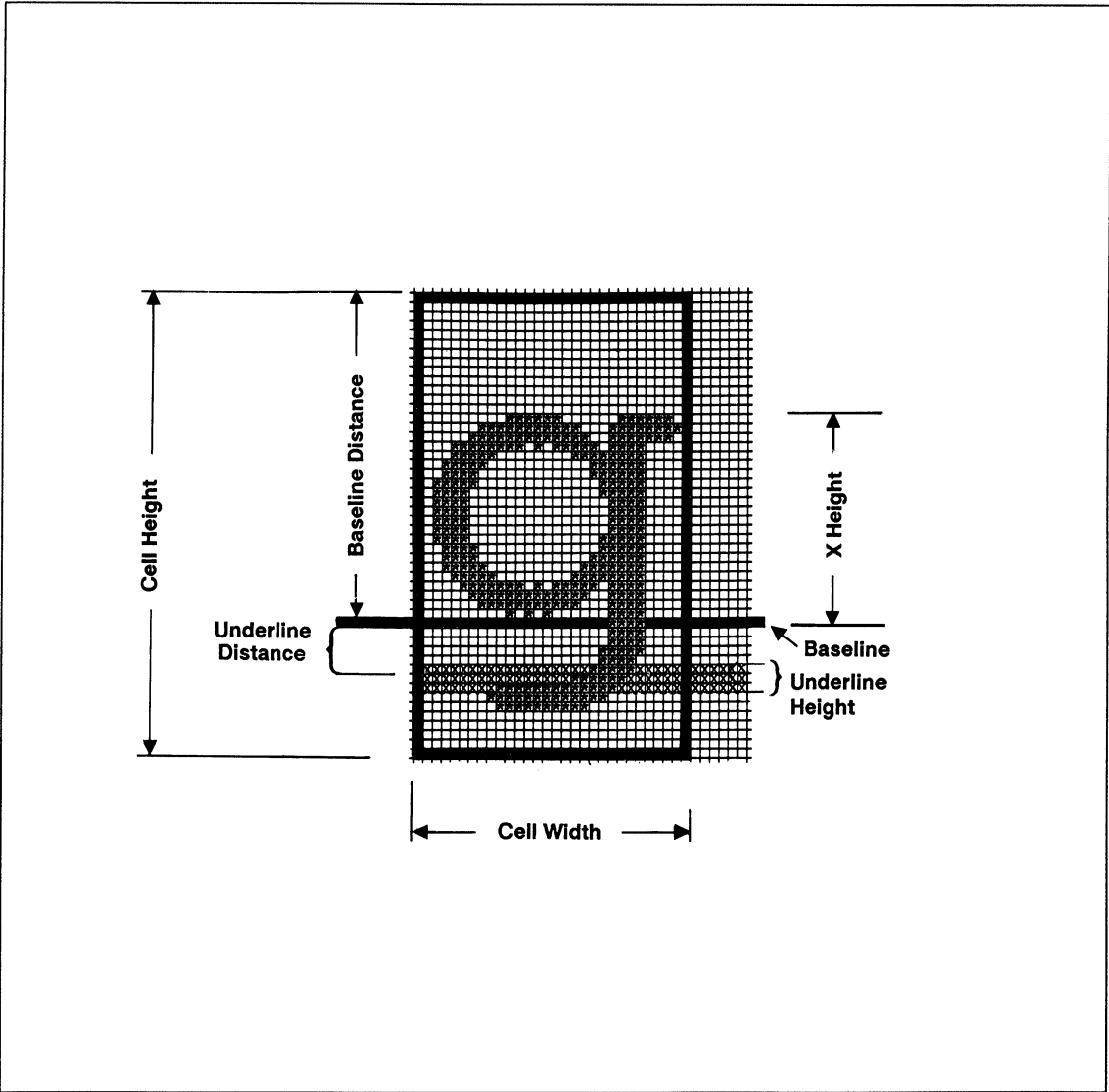


Figure 10-3. Character Cell

Font Descriptor Command

The Font Descriptor command is used to download a font descriptor to the printer.

E_C) s # W [font descriptor]

The value field (#) identifies the number of bytes in the font descriptor (see example on following page).

Example

To download a font descriptor for a portrait, HP Roman-8, 10 pitch, 12 point, upright, medium, Courier font, with an ID number of one, send:

E_C * c 1 D

E_C) s 64 W [64 bytes of font descriptor data]

Font descriptor data bytes are shown on the following page.

Font descriptor data (64 bytes):

Field Name	Value	Description
Font Descriptor Size	64	
Reserved	0	
Font Type	1	8-bit
Reserved	0	
Baseline Distance	35	
Cell Width	30	
Cell Height	50	
Orientation	0	Portrait
Spacing	0	Fixed pitch
Symbol Set (8U)	277	(8*32 + (85-64))
Pitch	120	30 dots
Height	200	50 dots
x Height	92	23 dots
Width Type	0	Normal
Style	0	Upright
Stroke Weight	0	Medium
Typeface	3	Courier
Reserved	0	
Serif Style	2	Serif Line
Reserved	0	
Underline Distance	-5	
Underline Height	3	
Text Height	200	50 dots
Text Width	120	30 dots
Reserved	0	
Reserved	0	
Pitch Extended	0	
Height Extended	0	
Reserved	0	
Reserved	0	
Reserved	0	
Font Name	Courier10	

Character Descriptor and Data Format

A unique character code must be designated prior to the download of a character descriptor and data. If the font being downloaded already contains a character with this code, the existing character will be deleted during the download of the character descriptor and data. Unless otherwise specified, inappropriate values in a character descriptor field will invalidate the character download process; a character will not be created, and the associated descriptor and data will be discarded.

Those character descriptor fields identified as "reserved" should be set to zero.

The following illustrates the format of the character descriptor and data:

Byte	15 - MSB	8	7	LSB - 0
0	Format			Continuation
2	Descriptor Size			Class
4	Orientation			Reserved
6	Left Offset			
8	Top Offset			
10	Character Width			
12	Character Height			
14	Delta X			
16	Character Data: (in bytes) • • •			

Figure 10-4. Character Descriptor and Data Format

Note



The following notation is used to define the data type of each field in the character descriptor.

(B)	: Boolean	(0,1)
(UB)	: Unsigned Byte	(0 . . 255)
(SB)	: Signed Byte	(-128 . . 127)
(UI)	: Unsigned Integer	(0 . . 65535)
(SI)	: Signed Integer	(-32768 . . 32767)

Format (UB) Specifies the format of the character descriptor and data. The format number used by the **LaserJet series II** is 4.

Continuation (B) Specifies whether the following data is a character descriptor block (0) or a continuation of the data (1) associated with the previous character descriptor.

Because the PCL escape sequence value field is limited to 32767, characters whose number of descriptor and data block bytes would exceed this limit must be downloaded in two or more blocks. The following illustrates the format of a character data continuation block.

Byte	15 - MSB	8	7	LSB - 0
0	Format		Continuation (1)	
2	Character Data: • • •			

Figure 10-5. Data Continuation

- Descriptor Size (UB)** Specifies the size of the character descriptor in bytes. The descriptor size used by the **LaserJet series II** is 14.
- Class (UB)** Specifies the format of the character data. The character data format number used by the **LaserJet series II** is 1.
- Orientation (UB)** Specifies the orientation of the character. Zero specifies portrait and one specifies landscape. The orientation of the character must match the orientation of the font.
- Left Offset (SI)** Specifies the distance in dots from the reference point to the left side of the character pattern on the physical page coordinate system (i.e, this value is orientation dependent). The left and top offsets locate the character reference point about the current active position (see Figures 10-5 and 10-6).
The legal range for the left offset is -4200 to 4200.
- Top Offset (SI)** Specifies the distance in dots from the reference point to the top of the character pattern on the physical coordinate system (i.e., this value is orientation dependent.) The left and top offsets locate the character reference point about the current active position (see figures 10-5 and 10-6).
The legal range for the left offset is -4200 to 4200.
- Character Width (UI)** Specifies the width of the character in dots on the physical coordinate system.
The legal range for character width is 1 to 4200.
Values that extend the character beyond the cell boundary (as specified in the font descriptor) invalidate the character download.

Character Height (UI) Specifies the height of the character in dots on the physical coordinate system.

The legal range for character height is 1 to 4200. Values that extend the character beyond the cell boundary (as specified in the font descriptor) invalidate the character download.

Delta X (SI) Specifies the number of quarter-dot units by which the horizontal position within the PCL logical page coordinate system will be incremented after printing the character. This value is only used by the printer when the font is proportionally spaced.

The **LaserJet series II** printer rounds delta X to an integer dot. The legal range for delta X is 0 to 16800.

Character Data Character data is a string of bytes containing the dot-per-bit image of the character. If a bit is set to one, the corresponding dot will be printed. The data is grouped in dot rows; a row describes a one-dot high strip of the character from left to right, parallel to the printer's raster scan direction (see Figure 10-6). Zeroed bits must be added to the end of each row to make it contain an integral number of bytes. The dot rows are organized from top to bottom of the character, i.e., the first dot row of data corresponds to the top dot row of the character.

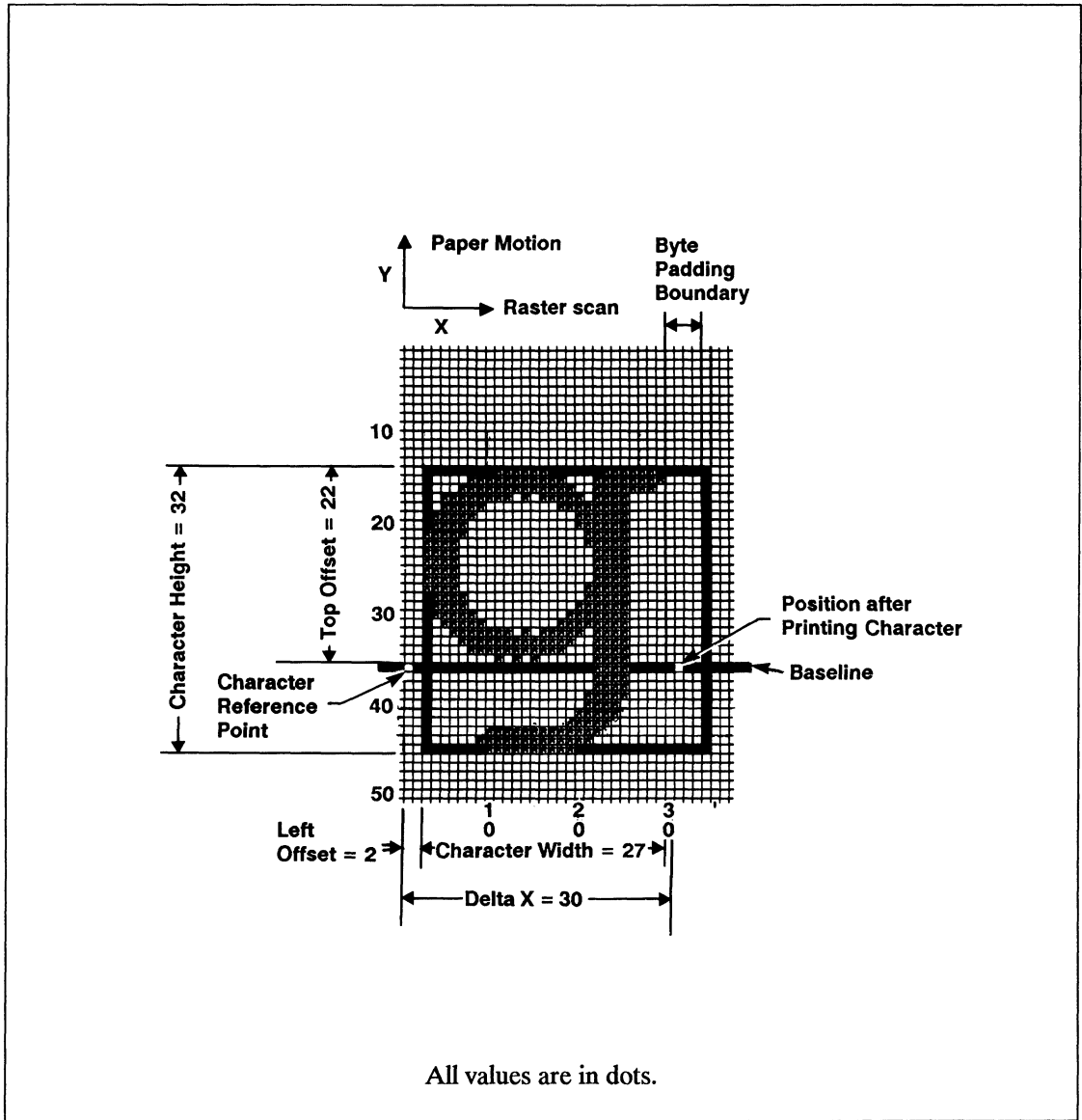
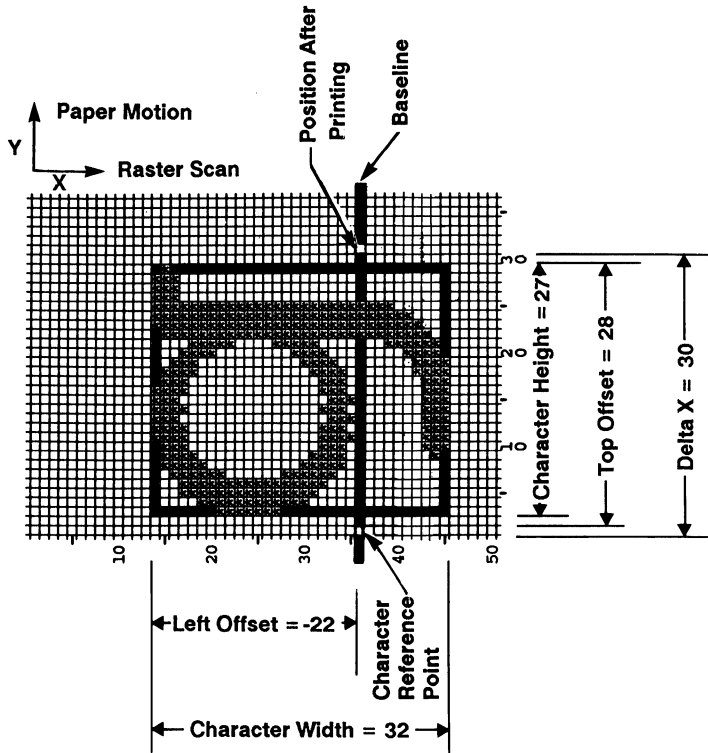


Figure 10-6. Portrait Character Example



All values are in dots.

Figure 10-7. Landscape Character Example

Character Code Command

The Character Code command establishes the decimal code that will be associated with the next character downloaded. This single byte value is used to reference the character for printing.

`^c * c # E`

= character code

Example To designate the character code for an ASCII lower-case "g", send:

`^c*c103E`

Character Descriptor and Data Command

The Character Descriptor and Data command is used to download a character descriptor and associated character data to the printer.

E_c (s # W [character descriptor and data])

The value field (#) identifies the number of bytes in the character descriptor and data. The maximum number is 32767.

Example

To download the character descriptor and data for a portrait, 10 pitch, 12 point, upright medium, Courier lower-case "g", send:

$\text{E}_c *c103E$ (103 is the decimal character code for an ASCII lower- case "g")

$\text{E}_c(s144W$ [character descriptor and data])

Character format, continuation, and descriptor:

Field	Value	Description
Format	4	
Continuation	0	
Descriptor Size	14	
Class	1	
Orientation	0	Portrait
Reserved	0	
Left Offset	2	
Top Offset	22	
Character Width	27	
Character Height	32	
Delta X	120	30 dots

Character data (shown on next page):

Dot Row	Bit Map	Decimal Equivalent			
01	00000000 11111100 00001111 11000000	0	252	15	192
02	00000111 11111111 00011111 11100000	7	255	31	224
03	00001111 11111111 10011111 11000000	15	225	159	192
04	00111111 11010111 11011110 00000000	63	219	224	0
05	00111110 00000001 11111110 00000000	62	1	254	0
06	01111100 00000000 01111110 00000000	124	0	126	0
07	01111000 00000000 01111110 00000000	120	0	126	0
08	11110000 00000000 00111110 00000000	240	0	62	0
09	11110000 00000000 00111110 00000000	240	0	62	0
10	11110000 00000000 00011110 00000000	240	0	30	0
11	11110000 00000000 00011110 00000000	240	0	30	0
12	11110000 00000000 00011110 00000000	240	0	30	0
13	11110000 00000000 00011110 00000000	240	0	30	0
14	11110000 00000000 00111110 00000000	240	0	62	0
15	01111000 00000000 00111110 00000000	120	0	62	0
16	01111000 00000000 01111110 00000000	120	0	126	0
17	01111100 00000000 11111110 00000000	124	0	254	0
18	00111110 00000001 11111110 00000000	62	1	254	0
19	00011111 11010111 11011110 00000000	31	219	222	0
20	00001111 11111111 10011110 00000000	15	255	158	0
21	00000111 11111111 00011110 00000000	7	255	30	0
22	00000000 10101000 00011110 00000000	0	172	30	0
23	00000000 00000000 00011110 00000000	0	0	30	0
24	00000000 00000000 00011110 00000000	0	0	30	0
25	00000000 00000000 00011110 00000000	0	0	30	0
26	00000000 00000000 00111110 00000000	0	0	62	0
27	00000000 00000000 00111100 00000000	0	0	60	0
28	00000000 00000000 01111100 00000000	0	0	124	0
29	00000000 00000001 11111000 00000000	0	1	248	0
30	00000001 11111111 11110000 00000000	1	255	240	0
31	00000011 11111111 11100000 00000000	3	255	224	0
32	00000001 11111111 10000000 00000000	1	255	128	0

Figure 10-8. Portrait Character Data Example

Example To download the character descriptor and data for a landscape, 10 pitch, 12 point, upright, medium, Courier lower-case “g”, send:

`^c*c103E` (103 is the decimal character code for an ASCII lower-case “g”)

`^c(s124W [character descriptor and data]`

Character format, continuation, and descriptor:

Field	Value	Description
Format	4	
Continuation	0	
Descriptor Size	14	
Class	1	
Orientation	1	
Reserved	0	
Left Offset	-22	
Top Offset	28	
Character Width	32	
Character Height	27	
Delta X	120	30 dot

Character data (shown on next page):

Dot Row	Bit Map	Decimal Equivalent			
01	01000000 00000000 00000000 00000000	64	0	0	0
02	11100000 00000000 00000000 00000000	224	0	0	0
03	11100000 00000000 00000000 00000000	224	0	0	0
04	11100000 00000000 00000000 00000000	224	0	0	0
05	11111111 11111111 11111111 11000000	255	255	255	192
06	11111111 11111111 11111111 11110000	255	255	255	240
07	11111111 11111111 11111111 11111000	255	255	255	248
08	01111111 11111111 11111111 11111100	127	255	255	252
09	00001111 10000111 11000000 01111110	15	135	192	126
10	00011110 00000001 11100000 00011110	30	1	224	30
11	00111000 00000000 11110000 00001111	56	0	240	15
12	01111000 00000000 01111000 00001111	120	0	120	15
13	01110000 00000000 00111000 00000111	112	0	56	7
14	11110000 00000000 00111000 00000111	240	0	56	7
15	11100000 00000000 00011100 00000111	224	0	28	7
16	11110000 00000000 00111000 00000111	240	0	56	7
17	11100000 00000000 00011100 00000111	224	0	28	7
18	11110000 00000000 00111000 00000111	240	0	56	7
19	11110000 00000000 00111100 00000111	240	0	60	7
20	01110000 00000000 00111000 00000111	112	0	56	7
21	01111000 00000000 01111000 00000010	120	0	120	2
22	01111100 00000000 11111000 00000000	124	0	248	0
23	00111111 00000011 11110000 00000000	63	3	240	0
24	00011111 11111111 11100000 00000000	31	255	224	0
25	00011111 11111111 11000000 00000000	31	255	192	0
26	00000111 11111111 10000000 00000000	7	255	128	0
27	00000001 11111100 00000000 00000000	1	252	0	0

Figure 10-9. Landscape Character Data Example

Contents

Introduction	11-1
Raster Graphics	11-2
Raster Graphics Resolution.	11-4
Start Raster Graphics.	11-5
Transfer Raster Data	11-6
End Raster Graphics	11-8
Raster Graphics Example	11-9
Rectangular Area Fill	11-12
Horizontal Rectangle Size (Decipoints)	11-13
Horizontal Rectangle Size (Dots)	11-13
Vertical Rectangle Size (Decipoints)	11-14
Vertical Rectangle Size (Dots)	11-14
Area Fill ID	11-15
Fill Rectangular Area.	11-18
Rectangular Area Fill Examples	11-19

Introduction

PCL provides several forms of graphics functionality. Included is the ability to build dot-per-bit raster images and to fill or shade rectangular areas with pre-defined patterns.

Raster Graphics

Images composed of groups of dots are raster images. Pictures in newspapers or on televisions are examples of raster images. PCL includes commands for printing raster images. The image is divided into dot rows; a row describes a one dot high strip of the image. A dot row of raster image data is transferred to the printer as a string of bytes containing a dot-per-bit representation of the row. If a bit in a row is set to one, the corresponding dot will be printed. Zeroed bits must be added to the end of each row to make it contain an integral number of bytes. The dot rows are organized from top to bottom of the image, i.e., the first dot-row of data transferred to the printer corresponds to the top dot-row of the image.

The following is an example of a raster image in the shape of an arrow:

Dot Row	Binary Representation			
	Byte 1	Byte 2	Byte 3	Byte 4
1	00000000	00000000	10000000	00000000
2	00000000	00000000	11000000	00000000
3	00000000	00000000	11100000	00000000
4	00000000	00000000	11110000	00000000
5	00000000	00000000	11111000	00000000
6	00000000	00000000	11111100	00000000
7	00000000	00000000	11111110	00000000
8	00000000	00000000	11111111	00000000
9	00000000	00000000	11111111	10000000
10	11111111	11111111	11111111	11000000
11	11111111	11111111	11111111	11100000
12	11111111	11111111	11111111	11110000
13	11111111	11111111	11111111	11111000
14	11111111	11111111	11111111	11111100
15	11111111	11111111	11111111	11111110
16	11111111	11111111	11111111	11111111
17	11111111	11111111	11111111	11111111
18	11111111	11111111	11111111	11111110
19	11111111	11111111	11111111	11111100
20	11111111	11111111	11111111	11111000
21	11111111	11111111	11111111	11110000
22	11111111	11111111	11111111	11100000
23	11111111	11111111	11111111	11000000
24	00000000	00000000	11111111	10000000
25	00000000	00000000	11111111	00000000
26	00000000	00000000	11111110	00000000
27	00000000	00000000	11111100	00000000
28	00000000	00000000	11111000	00000000
29	00000000	00000000	11110000	00000000
30	00000000	00000000	11000000	00000000
31	00000000	00000000	10000000	00000000
32	00000000	00000000	10000000	00000000

Figure 11-1. Arrow-Shaped Raster Image

Raster Graphics Resolution

Raster graphics can be printed at 300, 150, 100 or 75 dots-per-inch. This command designates the resolution of subsequent raster data transfers.

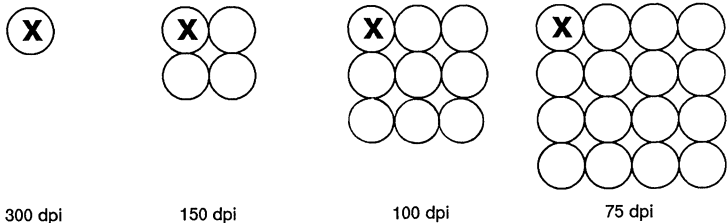
E_c * t # R

= 75 - 75 dots-per-inch
100 - 100 dots-per-inch
150 - 150 dots-per-inch
300 - 300 dots-per-inch

This command must be sent prior to the start graphics command. The factory default resolution is 75 dots-per-inch.

The **LaserJet series II** print resolution is 300 dots-per-inch. **LaserJet series II** printer automatically expand raster graphics transferred at resolutions less than 300 dots-per-inch to 300 dots-per-inch during printing.

The following illustrates a single bit translated into the corresponding printed dots in each of the four resolutions:



X = Reference Point

Lower resolution graphics occupy less user memory. For example, the number of bits required to represent a two-inch by three-inch image at 75 dots-per-inch is 34,200. The same image at 300 dots-per-inch requires 540,000 bits.

Start Raster Graphics

The start raster graphics command specifies the left raster graphics margin.

$E_C * r \# A$

$\# = 0 \text{ or } 1$

A value of 0 specifies that the left graphics margin is at X position 0. A value of 1 specifies that the left graphics margin is at the current X position.

Once a start raster graphics command is received by the printer, the raster graphics resolution, and left raster graphics margin are fixed until an end raster graphics command is received.

Transfer Raster Data

The transfer raster data command is used to transfer a row of raster data to the printer.

$E_C * b \# W$ [raster data]

The value field (#) identifies the number of bytes in the raster row. These bytes are interpreted as one row of raster graphics data that will be printed at the current Y position at the left raster graphics margin. Upon completion of this command, the current active position is at the beginning of the next raster row at the left raster graphics margin. Within the raster data, each bit describes a single dot. The most significant bit (bit 7 is the most significant, bit 0 is the least significant) of the first byte of data corresponds to the first dot within that row. If a bit is set to 1, the corresponding dot will be printed. Each dot of the raster data is expanded according to the specified raster resolution.

Raster graphics is independent of the text area and perforation skip mode, i.e., these boundaries are ignored.

Raster graphic images are limited to the printable area; images that extend beyond the printable area are clipped.

On the LaserJet series II, raster graphics rows are printed along the width of the physical page, regardless of logical page orientation. In portrait orientation, a raster row is printed in the positive X-direction of the PCL coordinate system and a subsequent raster row will be printed beginning at the next dot row position in the positive Y-direction. In landscape orientation, a raster row is printed in the positive Y-direction of the PCL coordinate system and a subsequent raster row will be printed beginning at the next dot row position in the negative X-direction. The following illustrates raster graphics presentation on LaserJet series II:

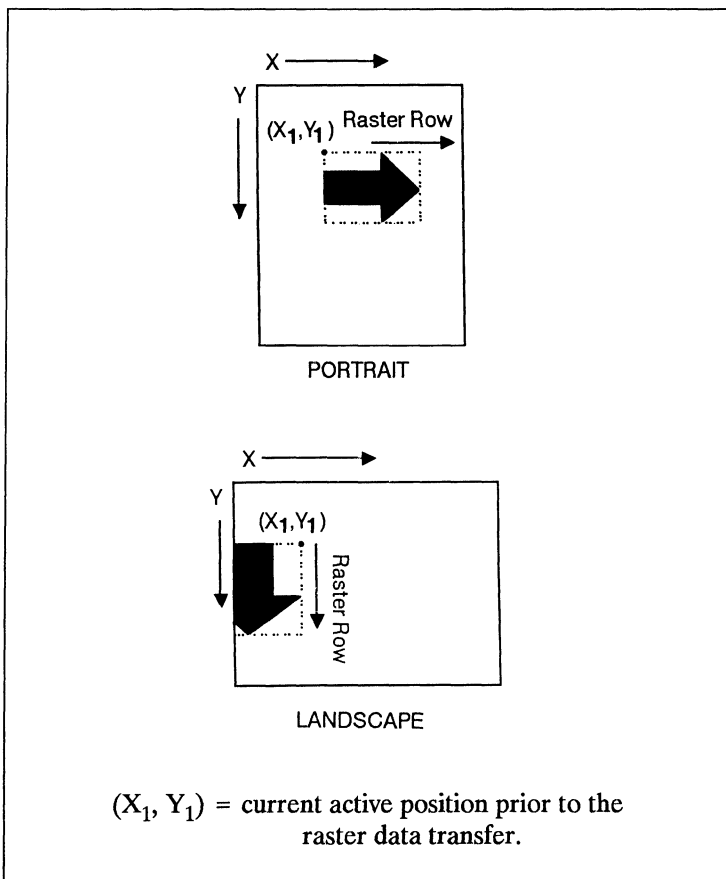


Figure 11-2. Raster Graphics Presentation

End Raster Graphics

The end raster graphics command signifies the end of the transfer of a raster graphic image.

$E_C * r B$

Raster Graphics Example

To transfer a raster graphic image in the shape of an arrow, perform the following steps:

1. Position the cursor:

`^C*p300x400Y` This moves the cursor to dot position (300, 400) within the PCL coordinate system.

2. Specify the raster graphics resolution:

`^C*t75R` This sets the raster graphics resolution to 75 dots-per-inch.

3. Specify the left raster graphics margin:

`^C*r1A` This sets the left graphics margin to the current X position (300).

4. Transfer the raster data to the printer:


Divide the image into dot rows and transfer each dot row to the printer as a string of bytes as illustrated in Figure 11-3.

5. Signify the end of the raster graphic image transfer:


`^C*rB`

This example prints the arrow as shown in Figure 11-4.

Dot Row	byte 1	byte 2	byte 3	byte 4	Decimal Equivalent*
1	00000000	00000000	10000000	00000000	$E_C*b4W[0, 0, 128, 0]$
2	00000000	00000000	11000000	00000000	$E_C*b4W[0, 0, 192, 0]$
3	00000000	00000000	11100000	00000000	$E_C*b4W[0, 0, 224, 0]$
4	00000000	00000000	11110000	00000000	$E_C*b4W[0, 0, 240, 0]$
5	00000000	00000000	11111000	00000000	$E_C*b4W[0, 0, 248, 0]$
6	00000000	00000000	11111100	00000000	$E_C*b4W[0, 0, 252, 0]$
7	00000000	00000000	11111110	00000000	$E_C*b4W[0, 0, 254, 0]$
8	00000000	00000000	11111111	00000000	$E_C*b4W[0, 0, 255, 0]$
9	00000000	00000000	11111111	10000000	$E_C*b4W[0, 0, 255, 128]$
10	11111111	11111111	11111111	11000000	$E_C*b4W[255, 255, 255, 192]$
11	11111111	11111111	11111111	11100000	$E_C*b4W[255, 255, 255, 224]$
12	11111111	11111111	11111111	11110000	$E_C*b4W[255, 255, 255, 240]$
13	11111111	11111111	11111111	11111000	$E_C*b4W[255, 255, 255, 248]$
14	11111111	11111111	11111111	11111100	$E_C*b4W[255, 255, 255, 252]$
15	11111111	11111111	11111111	11111110	$E_C*b4W[255, 255, 255, 254]$
16	11111111	11111111	11111111	11111111	$E_C*b4W[255, 255, 255, 255]$
17	11111111	11111111	11111111	11111111	$E_C*b4W[255, 255, 255, 255]$
18	11111111	11111111	11111111	11111110	$E_C*b4W[255, 255, 255, 254]$
19	11111111	11111111	11111111	11111100	$E_C*b4W[255, 255, 255, 252]$
20	11111111	11111111	11111111	11111000	$E_C*b4W[255, 255, 255, 248]$
21	11111111	11111111	11111111	11110000	$E_C*b4W[255, 255, 255, 240]$
22	11111111	11111111	11111111	11100000	$E_C*b4W[255, 255, 255, 224]$
23	11111111	11111111	11111111	11000000	$E_C*b4W[255, 255, 255, 192]$
24	00000000	00000000	11111111	10000000	$E_C*b4W[0, 0, 255, 128]$
25	00000000	00000000	11111111	00000000	$E_C*b4W[0, 0, 255, 0]$
26	00000000	00000000	11111110	00000000	$E_C*b4W[0, 0, 254, 0]$
27	00000000	00000000	11111100	00000000	$E_C*b4W[0, 0, 252, 0]$
28	00000000	00000000	11111000	00000000	$E_C*b4W[0, 0, 248, 0]$
29	00000000	00000000	11110000	00000000	$E_C*b4W[0, 0, 240, 0]$
30	00000000	00000000	11100000	00000000	$E_C*b4W[0, 0, 224, 0]$
31	00000000	00000000	11000000	00000000	$E_C*b4W[0, 0, 192, 0]$
32	00000000	00000000	10000000	00000000	$E_C*b4W[0, 0, 128, 0]$



Raster Image



Raster Data Commands

* The brackets and commas are not part of the raster data command; they are used only to delineate the data.

Figure 11-3. Example of Raster Graphic Image Data

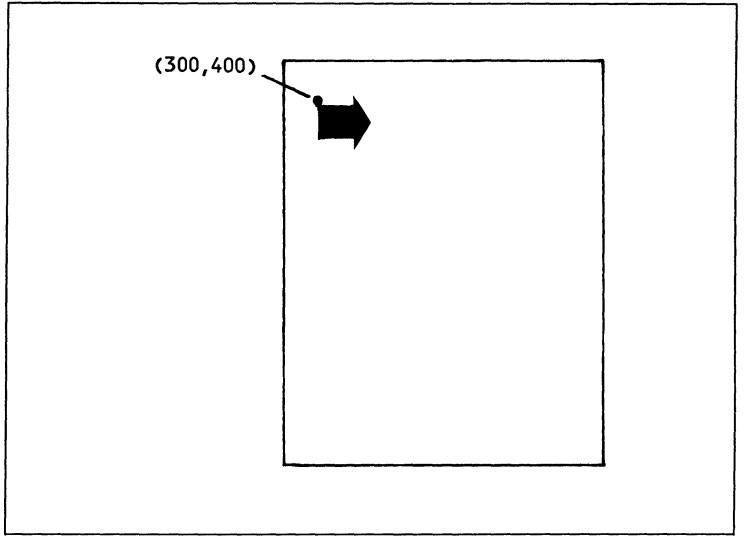


Figure 11-4. Example of Raster Graphic Image Transfer

Rectangular Area Fill

PCL includes commands for filling or shading rectangular areas with pre-defined patterns. Rectangular areas are printed in the orientation of the logical page. An area's width extends in the positive X-direction of the PCL coordinate system; an area's height extends in the positive Y-direction.

Note



Rectangular areas are not affected by the raster graphics resolution command.

**Horizontal Rectangle
Size (Decipoints)**

This Horizontal Rectangle Size command specifies the rectangle width in decipoints.

$$^E_C * c \# H$$

= Number of decipoints (1/720th inch)

The value field (#) is valid to 4 decimal places.

The printer converts the specified width to dots by rounding up to an integral number of dots. For example, 5 decipoints, which corresponds to 2.08 dots on the **LaserJet series II**, is converted to 3 dots.

The factory default horizontal rectangle size is 0.

**Horizontal Rectangle
Size (Dots)**

This Horizontal Rectangle Size command specifies the rectangle width in dots.

$$^E_C * c \# A$$

= Number of dots.

The factory default horizontal rectangle size is 0.

Vertical Rectangle Size (Decipoints)

This Vertical Rectangle Size command specifies the rectangle height in decipoints.

$E_C * c \# V$

$\#$ = Number of decipoints (1/720th inch)

The value field ($\#$) is valid to 4 decimal places.

The printer converts the specified width to dots by rounding up to an integral number of dots. For example, 5 decipoints, which corresponds to 2.08 dots on the **LaserJet series II**, is converted to 3 dots.

The factory default vertical rectangle size is 0.

Vertical Rectangle Size (Dots)

This Vertical Rectangle Size command specifies the rectangle height in dots.

$E_C * c \# B$

$\#$ = Number of dots

The factory default vertical rectangle size is 0.

Area Fill ID This command specifies the level of shading or type of patterned fill to be used when filling a rectangular area.

$E_c * c \# G$

The value field (#) identifies the level of shading or type of patterned fill. There are eight shading levels defined within PCL. To specify a shading level use any value between 1 and 100. Use a value within the range indicated in Figure 11-5 for the desired shading level.

There are six fill patterns defined within PCL. To specify a fill pattern type use any value between 1 and 6. Use a value indicated in Figure 11-6 for the desired fill pattern.

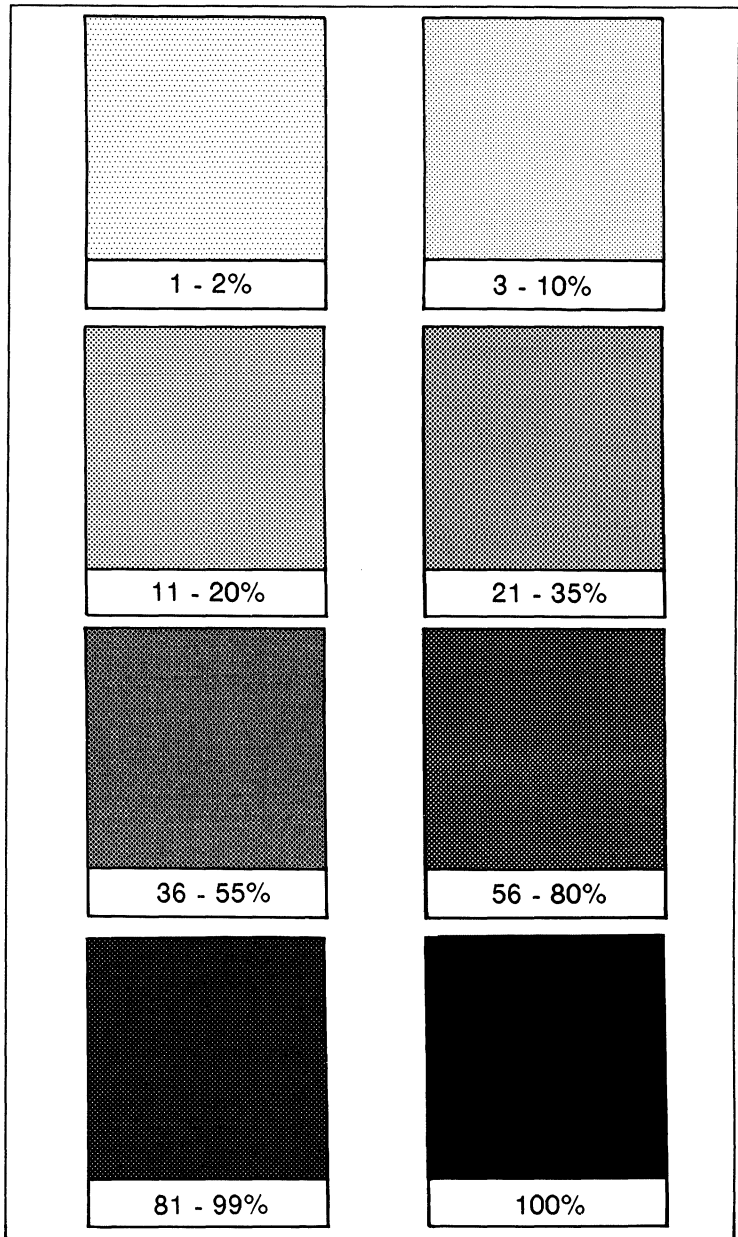


Figure 11-5. Shading Levels

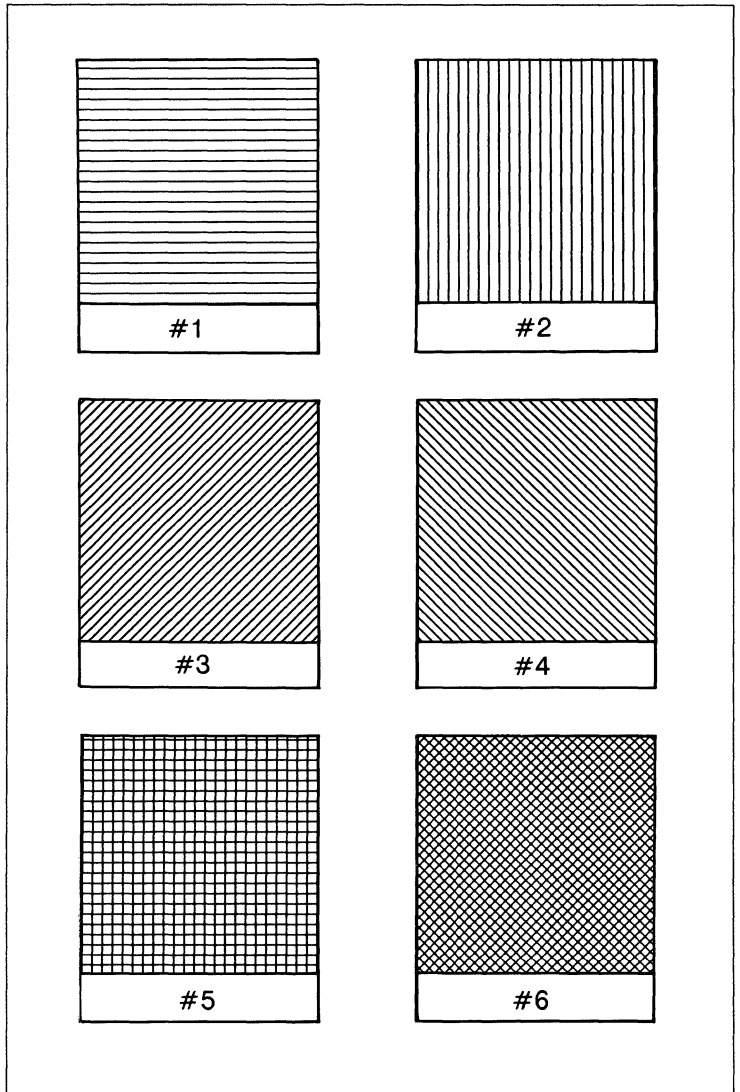


Figure 11-6. Fill Patterns

Fill Rectangular Area

This command is used to fill a rectangular area of the specified width and height.

$F_C * c \# P$

- # = 0 - Solid fill
- = 2 - Shaded fill
- = 3 - Patterned fill

The level of shading or type of patterned fill used when filling a rectangle is specified by the current area fill ID. A solid-filled rectangular area is also known as a black rule and does not require specification of an area fill ID.

The upper left corner of the rectangular area is located at the current active position. The current active position is not changed during the printing of a rectangular area.

Rectangular areas are independent of the text area and perforation skip mode, i.e., these boundaries are ignored.

Rectangular areas are limited to the printable area; rectangular areas that extend outside the printable area will be clipped.

Rectangular Area Fill Examples

To print a 3 inch by 5 inch black rule, perform the following steps.

1. Position the cursor:

E_c*p300x400Y

This moves the cursor to dot position (300, 400) within the PCL coordinate system.

2. Specify the width of the rule:

E_c*c900A

This sets the rule width to 900 dots (3 inches).

3. Specify the height of the rule:

E_c*c1500B

This sets the rule height to 1500 dots (5 inches).

4. Print the rule:

E_c*c0P

This example prints the following:

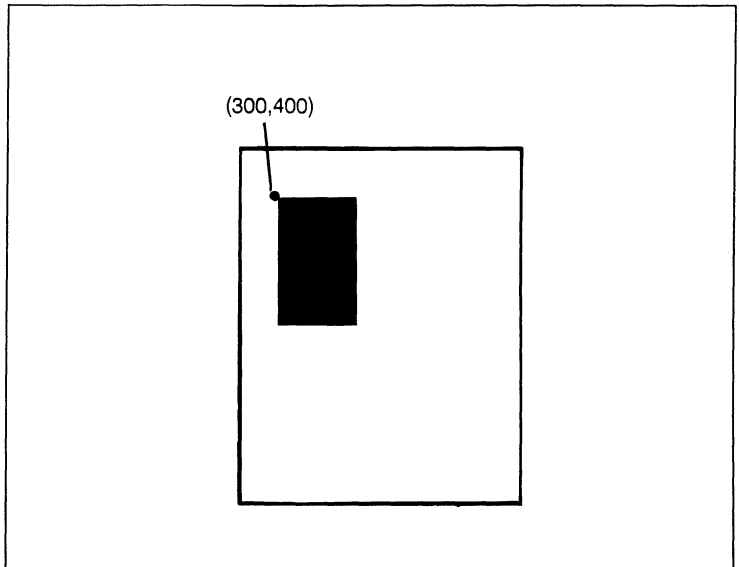


Figure 11-7. Rule (Solid Fill) Example

To print a 3 inch by 5 inch 25% shaded rectangle, perform the following steps.

1. Position the cursor:

`^C*p300x400Y` This moves the cursor to dot position (300, 400) within the PCL coordinate system.

2. Specify the width of the rectangle:

`^C*c900A` This sets the rectangle width to 900 dots (3 inches).

3. Specify the height of the rectangle:

`^C*c1500B` This sets the rectangle to 1500 dots (5 inches).

4. Specify the area fill ID:

`^C*c25G` This sets the area fill ID to 25.

5. Print the rectangular shaded area:

`^C*c2P`

This example prints the following:

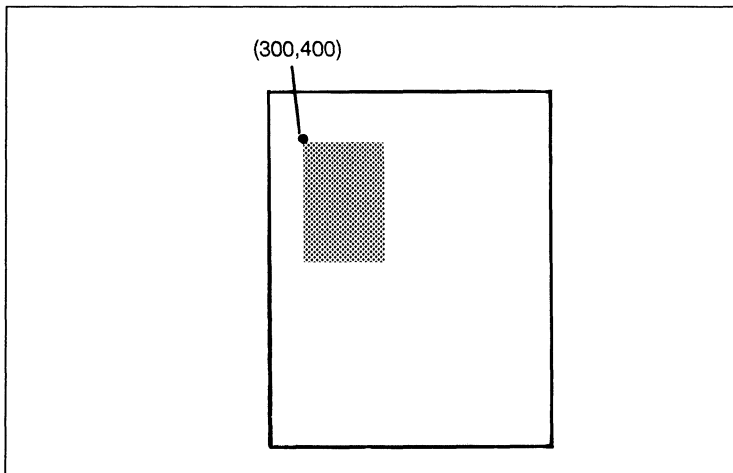


Figure 11-8. Shaded Rectangle

To print a 3 inch by 5 inch rectangular area filled with a horizontal line pattern, perform the following steps:

1. Position the cursor:

E_C*p300x400Y Moves the cursor to dot position (300,400) within the PCL coordinate systems.

2. Specify the width of the rectangle:

E_C*c900A Sets the rectangle width to 900 dots (3 inches).

3. Specify the height of the rectangle:

E_C*c1500B Sets the rectangle height to 1500 dots (5 inches).

4. Specify the area fill ID:

E_C*c1G Sets the area fill ID to 1.

5. Print the rectangular pattern-filled area:

E_C*c3P

This example prints the following:

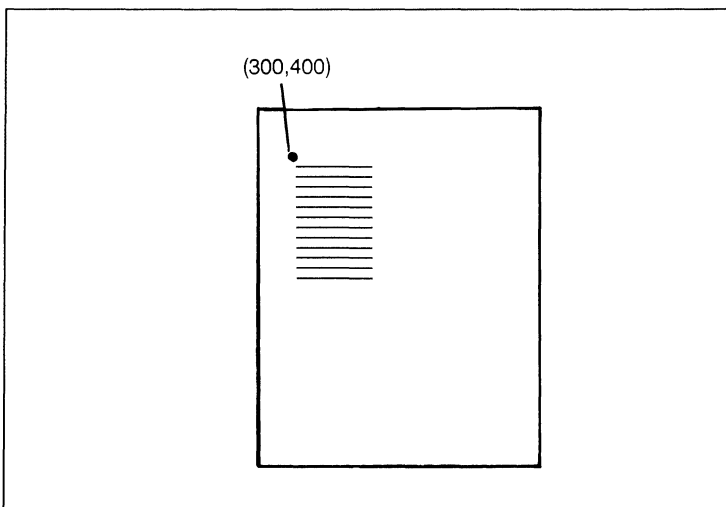


Figure 11-9. Pattern Example

Contents

Introduction	12-1
Macro Creation	12-2
Macro Invocation	12-3
Temporary/Permanent Macros	12-4
Deleting Macros	12-4
Macro ID	12-5
Macro Control	12-6
Macro Control Example	12-8

A typical printer task requires the use of several commands. Applications may perform the same task numerous times. For tasks performed repeatedly, PCL provides macro functionality to reduce the number of commands that must be sent to the printer. A macro is a collection of escape sequences, control codes, and data, downloaded to the printer, whose execution can be initiated using a single command.

Macro Creation

A unique identification (ID) number should be designated prior to the definition of a macro; this number is then associated with the macro. If a macro is already associated with this ID number, the existing macro will be deleted from user memory during the definition of the new macro. Subsequent macro operations are accomplished using the macro ID number.

A macro is created in several steps. First, a command is sent to the printer that indicates the start of a macro definition. Next, the escape sequences, control codes, and data that constitute the macro are sent to the printer in the intended order of their execution. Finally, a command is sent to the printer that indicates the end of the macro definition.

Macros occupy a portion of user memory. Depending on the amount of available user memory, up to 32 macros can be stored in memory simultaneously.

There are three ways to invoke a macro: **execute**, **call** and **overlay**.

When a macro is **executed**, it begins performing its commands using the current modified print environment. Changes made to feature settings during macro **execution** are recorded in the modified print environment; these changes are retained upon completion of the macro **execution**.

When a macro is **called**, it begins performing its commands using the current modified print environment. Changes made to feature settings during a macro **call** are recorded in the modified print environment; however, these changes are not retained upon completion of the macro **call**. The modified print environment that existed prior to the macro **call** is restored.

When a macro is enabled for automatic **overlay**, its execution will be the final operation each time a page is printed. Before the macro is executed, the current modified print environment is saved and replaced with the overlay environment. The overlay environment is a combination of the user default and the current modified print environments. Changes made to feature settings during macro **overlay** are recorded in the modified print environment; however, these changes are not retained upon completion of the macro **overlay**. The modified print environment that existed prior to the macro **overlay** is restored.

The overlay environment consists of the current settings for the following features with the remainder of the environmental features set to their user default values:

Page length	Paper source
Page size	Number of copies
Orientation	Cursor position stack

Refer to Chapter 3 for descriptions of environments.

Note



The current cursor position is not part of the modified print environment; therefore, the cursor position is not saved when a macro is **called**, nor is it restored upon completion. The push/pop cursor position command can be used to save and recall a cursor position.

Temporary / Permanent Macros

During its definition, a macro is automatically designated as temporary. A temporary macro is one that is deleted from user memory during a printer reset. A macro can be designated as permanent to prevent the printer from deleting it during a printer reset. A macro is designated as temporary or permanent by reference to its ID number.

Note



Temporary and permanent macros are removed from user memory whenever the printer's power is turned off.

Deleting Macros

There are several mechanisms provided by PCL macro control for explicit deletion of macros from user memory. These include commands to delete all macros, all temporary macros, or an individual macro by reference to its macro ID number.

Macro ID

The Macro ID command specifies an ID number for use in subsequent macro commands.

$\text{E}_c \& f \# Y$

= Macro ID number (0 to 32767)

The factory default macro ID is zero.

Example To establish a macro ID number of 5, send:

$\text{E}_c \& f 5 Y$

This number (5) will be used in subsequent macro operations.

Macro Control

The macro control command provides mechanisms for definition, invocation, and deletion of macros.

$\text{E}_c \ \& \ f \ \# \ X$

- # = 0 Start macro definition (last ID specified)
- = 1 Stop macro definition
- = 2 Execute macro (last ID specified)
- = 3 Call macro (last ID specified)
- = 4 Enable macro for automatic overlay (last ID specified)
- = 5 Disable automatic overlay
- = 6 Delete all macros
- = 7 Delete all temporary macros
- = 8 Delete macro (last ID specified)
- = 9 Make macro temporary (last ID specified)
- = 10 Make macro permanent (last ID specified)

Note



1. A macro may **call** or **execute** another macro which in turn may **call** or **execute** another macro; two levels of "nesting" are allowed.
 2. Other than **call** and **execute**, no macro control operations may occur within a macro.
 3. A printer reset command is not allowed in a macro.
 4. No font management commands are allowed in a macro, that is, fonts may not be downloaded, deleted or made permanent in a macro.
-

Example To define a macro with an ID of 7, send:

`^C&f7y0X`

⋮

escape sequences, control codes, and data

⋮

`^C&f1X`

To make the macro with an ID of 7 permanent, send:

`^C&f7y10X`

To enable the macro with an ID of 7 for automatic overlay, send:

`^C&f7y4X`

To delete the macro with an ID of 7, send:

`^C&f7y8X`

Macro Control Example

The following illustrates the definition of a letterhead macro.

<code>^C&f1Y</code>	Specify the Macro ID as one.
<code>^C&f0X</code>	Start Macro Definition.
<code>^C&a540h360V</code>	Position logo at (540, 360) decipoints in the PCL coordinate system.
<code>^C*t150R</code>	Set graphics resolution to 150 dots-per-inch.
<code>^C*r1A</code>	Start raster image of logo.
<code>^C*b60W [Raster data]</code>	Send the first raster line.
•	•
•	•
•	•
<code>^C*b60W [Raster data]</code>	Send the last raster line.
<code>^C*rB</code>	Stop raster graphics.
<code>^C&a540h780V</code>	Position for lettering at (540,780) decipoints.
<code>^C(1X</code>	Select font 1.
ABC Corp.	Text
Post Office Box 15	Text
Fred, Texas 83707	Text
<code>^C&a540h960V</code>	Position first rule at (540,960) decipoints.
<code>^C*c10v4680H</code>	Set rule height and width.
<code>^C*c0P</code>	Print the first rule.
<code>^C&a540h980V</code>	Position second rule at (540, 980) decipoints.
<code>^C*c0P</code>	Print second rule.
<code>^C&a540h1200V</code>	Position first line of text at (540, 1200) decipoints.
<code>^C&f1X</code>	Stop Macro Definition.

This macro can now be **executed**, **called** or enabled for automatic **overlay**.

Introduction	13-1
PCL Command Parsing	13-2
Job Control	13-2
Printer Reset	13-2
Page Control	13-3
Page Source	13-3
Page Length	13-3
Text Area/Margins	13-3
HMI	13-4
Cursor Positioning	13-4
Fonts	13-5
Raster Graphics	13-6
Macros	13-7
Performance	13-8
PCL Commands	13-8
Print Data	13-8
Print Overrun	13-9
I/O	13-9
Troubleshooting Commands	13-10
End-of-Line Wrap	13-10
Display Functions Mode	13-11
Auto-Continue Mode	13-12
Memory Usage	13-13
Common Errors	13-14
20 Error	13-14
21 Error	13-14
22 Error	13-14
40 Error	13-14

Introduction

This chapter provides information for use during the development of PCL software.

PCL Command Parsing

A job stream may contain commands that are **device specific**. If these commands are not supported by the **PCL device**, they are ignored. For example, a job separation command will have no effect on the LaserJet, LaserJet Plus, and LaserJet series II; however, a LaserJet 500 Plus and LaserJet 2000 will perform job separation.

Job Control

Printer Reset

- A printer reset (^cE) should be included as the first and last command of every job. A printer reset should not be used within a job.

Page Control

Paper Source

- After specifying a paper source, the page size or page length must be set to the size of the paper in the selected source.

Page Length

- In landscape orientation, the page lengths of letter and legal paper are the same; therefore, to select legal paper for use in landscape orientation, specify the legal page length while in portrait orientation and then specify landscape orientation.
- The physical page size is calculated by multiplying the number of lines specified in the page length command by the current line spacing (i.e., the last VMI or lpi command). For example, to select executive size paper (7.25"x10.5") when the current VMI is 6 (i.e., 8 lines-per-inch), select a page length of 84 lines.

Text Area/Margins

- Avoid setting the top margin or text length to values outside of the printable area. This may cause data loss.
- Top margin and text length commands use the current line spacing (i.e., the last VMI or lpi commands).
- Specifying the text length establishes the bottom margin.
- When using both the top margin and text length commands, the top margin command should be sent before the text length command.
- To address the entire logical page set the top margin to 0, set perforation skip mode OFF, and position the cursor to the desired location.
- The user default VMI is selectable from the control panel printing menu, using the FORM menu item (see the *LaserJet series II User's Manual*). If the Page Length command (`^C&l#P`) follows a VMI change (produced by a control panel selection or a PCL command), the length of a page will be recalculated; therefore, the printer may request a different page size.

HMI

- When font selection occurs following specification of style, stroke weight, or typeface only, HMI is unaffected. Any other font specification method causes HMI to be automatically set to the pitch of the selected font; therefore, when using a non-standard HMI value, the value should be re-specified following font selection.

Cursor Positioning

- Horizontal (decipoint, dot and column) positioning ignores margins and can therefore be used to move the cursor anywhere along the present line.
- When performing cursor positioning with decipoints, dots, or rows and columns, do not use margins. Margins are intended for print and space (i.e., CR, LF, FF) applications.
- Vertical (decipoint, dot and row) positioning allows the cursor to be moved into the perforation region.
- The top margin is the reference point for absolute vertical positioning.
- The left edge of the logical page is the reference point for absolute horizontal positioning.

Fonts

- Character spacing information for proportionally spaced fonts is available from Hewlett-Packard.
- Since line spacing is independent of font height, line spacing may require adjustment following font selection to insure proper vertical alignment of text.
- To insure compatibility with future products, select fonts by specifying all of the font characteristics. If all of the characteristics are not designated, the primary and secondary font tables may not contain the correct information to select the requested font from those available in the printer.
- The transparent print data command is required to access characters with character codes in the decimal range of 7 to 15 and 27 in the PC-8 symbol sets.
- All information about the design of a font, as well as the design of its characters, can be found in the font and character descriptors.
- A control code space is printed when an attempt is made to print a non-existent character.
- When a soft font is specified using an ID number with which no soft font has been associated, no font change occurs.
- When a soft font is specified using an ID number and the specified font's orientation differs from the current orientation, no font change occurs.
- Font characteristics combined into a single escape sequence are processed more efficiently than those sent independently.
- The shortcut method of font selection (as documented in some previous font product literature) may not result in the desired font change. This is due to the increased number of available fonts in the printer.

Raster Graphics

- To minimize I/O transmission time and conserve memory, avoid sending unnecessary raster data to the printer that represents white space.
- Resolution should be set prior to the start raster graphics command. Once the start raster command is received, the resolution cannot be set until after a subsequent end raster graphics command.
- Hewlett-Packard recommends all raster graphics applications use only portrait orientation on the LaserJet series II. To represent landscape graphic images, send rotated data.
- Some applications and I/O drivers insert carriage returns or line feeds into the data stream sent to the printer. This modification of the data stream must be suppressed for correct printer operation.
- The most efficient way to draw lines (horizontal and vertical) is using graphics rules (solid-filled rectangular areas).

Macros

- When a macro ID is specified for which no macro has been defined, the macro invocation, macro deletion, and make macro permanent or temporary commands are ignored.
- The macro enabled for auto macro overlay is executed on each page, until the macro is disabled or deleted, a reset occurs ("E" or control panel), or the page length, page size or orientation is changed.
- When the modified print environment is restored, if the page length, page size, or the orientation has changed, or the primary or secondary font has been deleted, the following will occur:
 1. If the original page length or page size is different than the current page length and page size, the current page is closed and printed, the page length and page size are changed to their original value, and the cursor is positioned at the left edge of the logical page at the top margin on the following page
 2. If the primary or secondary font is deleted, a new primary or secondary font is automatically selected from the remaining fonts using the current font characteristics.

Performance

PCL Commands

- Since PCL printers are command driven devices and each command takes a finite amount of time to process, pages that are composed of a large number of commands may not print at maximum speed. Most commands can be used frequently on a page without adversely affecting the printer's performance; however, certain commands take more time to process and therefore, if used frequently on a page, may decrease printer performance. An excessive number of font selections per page (selection using font characteristic commands or selection by ID number) may decrease printer performance.

Print Data

- There is a limit on the amount of data, as well as the number of commands, that the printer can process per page at maximum speed. In general, the LaserJet family of printers can print at least 2500 uniformly distributed 12-point characters per page at maximum speed. This assumes the data does not contain any PCL commands and there are no I/O or host CPU constraints.

Print Overrun

- As data is received by the printer, it is processed and stored in an intermediate format. The intermediate data is later processed and printed. During the physical printing of a page, the page moves through the printer at a constant speed. Thus, there are pages that cannot be printed because the page's intermediate data cannot be processed and printed fast enough to keep up with the physical speed of the page as it moves through the printer. When this condition occurs, "21 ERROR" is displayed on the printer's control panel. A page causing this error can never be printed by this device; however, it may be possible to remove or redistribute the page's data and subsequently print the page.

I/O

- The Parallel (Centronics) I/O has higher throughput than the RS-232C serial I/O. While text processing may not benefit from a faster I/O, raster graphics processing and soft font downloads benefit from increased I/O throughput.

Troubleshooting Commands

End-of-Line Wrap

The End-of-Line Wrap command defines the action that occurs when a line of text reaches the right margin.

`^C & s # C`

= 0 - Enables End-of-Line Wrap

1 - Disables End-of-Line Wrap

When end-of-line wrap is enabled, a character or space that would move the cursor to the right of the right margin causes a CR-LF to be executed (prior to the printing of the character or space).

When end-of-line wrap is disabled, a character or space that would move the cursor to the right of the right margin is clipped (refer to Chapter 2). When a character is clipped, the cursor is set to the right margin.

The primary use of this command is with display functions mode.

The factory default is end-of-line wrap disabled.

Example

To enable end-of-line wrap mode, send:

`^C&s0C`

Display Functions Mode

The Display Functions Mode command allows all escape sequences and control codes to be printed instead of being executed.

- $\text{E}_c Y$ - Enables Display Functions Mode
- $\text{E}_c Z$ - Disables Display Functions Mode

When the printer is in display functions mode, all control codes and escape sequences are printed and not executed with the following exceptions.

- CR is printed and executed as CR-LF.
- $\text{E}_c Z$ is printed and executed.

Display functions mode instructs the printer to display rather than execute the data it receives. The data is printed using the current text area and selected font.

Example

To enable display functions mode, send:

$\text{E}_c \&s\theta C$ Enables end-of-line wrap to prevent data truncation.

$\text{E}_c Y$ Enable Display Functions Mode.

-
-
-

Data sent to the printer.

-
-
-

$\text{E}_c Z$ Disable Display Functions Mode.

Note



Most symbol sets do not have printable characters defined in the control code decimal range 0 to 31 and 128 to 159. If a printable character is not defined, a control code space is printed while in display functions mode. The PC-8 symbol sets do have printable characters defined in this range.

Auto Continue Mode

- Automatic error clearing (refer to the *LaserJet series II User's Manual* for a list of clearable errors) can be achieved by setting Auto-Continue Mode to ON using the Operator Control Panel configuration menu. When "Auto-Cont" is set to ON, the device will display a message for a fixed length of time and then attempt to continue printing the job. When "Auto-Cont" mode is set to OFF, all errors cause the device to stop printing.

Memory Usage

- The standard user memory is 395 Kbytes.
- The memory used by each rule, underline, and pattern is 15 bytes.
- The memory used for each printed character is 4.25 bytes.
- The memory used by each line of raster is the number of bytes of data in the line plus 10 bytes.
- In addition the memory used by each soft font character is calculated as follows:

$$\# \text{ BYTES/FONT} = \# \text{ Chars. in Font} \times 64 \left[\left(\text{integer of } \left(\frac{\text{char. width in bytes} \times \text{char. height in dots} - 1}{64} \right) + 1 \right) \right]$$

- The memory used by a macro is calculated as follows:

$$\text{MACRO MEMORY USAGE} = \left(\frac{\text{total \# of bytes of macro data} - 1}{250} + 1 \right) 256$$

- All optional memory added to the printer becomes available, to the user, as user memory.

Common Errors

- 20 ERROR** This error occurs when the printer runs out of memory during a font download, macro creation, raster graphic download, or page composition. To alleviate this error, the quantity of data sent to the printer must be reduced. This can be accomplished by eliminating unnecessary fonts or macros, reducing the raster graphics white space sent to the printer, or selecting a lower resolution for the raster graphics. An alternative solution is to install additional memory. (Additional memory is available from your Hewlett-Packard Sales Representative or authorized dealer.)
- 21 ERROR** This error results when a page is too complex to print. This can be corrected by reducing the complexity of the page. (Refer to the "Print Overrun" section described earlier in this chapter for additional information.)
- 22 ERROR** This error indicates an I/O protocol problem between the printer and the host system. Make sure the printer and the host system protocol (i.e., hardware handshake or Xon/Xoff handshake) correspond. (Refer to Appendix B for interface information.)
- 40 ERROR** An error occurred while transferring data from the computer to the printer. This error occurs if the computer is turned ON and OFF while the printer is on-line or if the printer's baud rate is not the same as the computer's. To clear the error message press the CONTINUE/RESET key (refer to the *LaserJet series II User's Manual*). Make sure the printer is set to the same baud rate as the computer. If the error continues, call your HP Service Representative.

A

Reference Tables

Appendix

Roman-8 Symbol Set Table	A-1
Control Code Table	A-2
Roman-8 Character Conversion Table	A-3
Printer Command Table	A-11

Table A-1. Roman-8 Character Set (ASCII Plus ROMAN EXTENSION)

8-bit character = [b₈ b₇ b₆ b₅ b₄ b₃ b₂ b₁]

				b ₈	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
				b ₇	0	0	0	0	1	1	1	1	0	0	0	0	1	1	1	1	
				b ₆	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	
				b ₅	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	
b ₄	b ₃	b ₂	b ₁		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
0	0	0	0	0	NUL	DLE	SP	0	@	P	'	p			—	à	Å	Á	Ð		
0	0	0	1	1	SOH	DC1	!	1	A	Q	a	q			À	Ý	é	ì	Ã	þ	
0	0	1	0	2	STX	DC2	"	2	B	R	b	r			Â	ý	ò	ø	ä	·	
0	0	1	1	3	ETX	DC3	#	3	C	S	c	s			È	°	û	Æ	Ð	μ	
0	1	0	0	4	EOT	DC4	\$	4	D	T	d	t			Ê	Ç	á	â	ƒ	¶	
0	1	0	1	5	ENQ	NAK	%	5	E	U	e	u			Ë	ç	é	í	Í	¾	
0	1	1	0	6	ACK	SYN	&	6	F	V	f	v			Ï	Ñ	ó	ø	ì	—	
0	1	1	1	7	BEL	ETB	'	7	G	W	g	w			ÿ	ñ	ú	æ	Ó	¼	
1	0	0	0	8	BS	CAN	(	8	H	X	h	x			'	i	à	Ä	Ò	½
1	0	0	1	9	HT	EM	)	9	I	Y	i	y			`	ı	è	ı	Õ	a
1	0	1	0	10	LF	SUB	*	:	J	Z	j	z			ˆ	Ɔ	ò	Ö	õ	o	
1	0	1	1	11	VT	ESC	+	;	K	[	k	{			˜	£	ü	Ü	Š	<<
1	1	0	0	12	FF	FS	,	<	L	\	l	|			˘	¥	ä	É	š	■	
1	1	0	1	13	CR	GS	-	=	M	]	m	}			ù	š	ë	ï	Ú	>>
1	1	1	0	14	SO	RS	.	>	N	^	n	~			Û	f	ö	β	ÿ	±	
1	1	1	1	15	SI	US	/	?	O	_	o	DEL			£	ç	ü	Ô	ÿ		

Table A-2. Control Codes

Backspace	B S	Move one column left unless at left margin in which case no action is taken.
Line Feed	L F	Move to next print line while maintaining current column position.
Form Feed	F F	Move to first line at top of the next page while maintaining current column position.
Carriage Return	C R	Move to the left margin on current print line.
Shift Out	S O	Select characters that follow from the current secondary font until receipt of a Shift In.
Shift In	S I	Select characters that follow from the current primary font until receipt of a Shift Out.
Escape	E C	Indicates the beginning of a special control sequence (escape sequence).
Horizontal Tab	H T	Move to next horizontal tab stop. The tab stops are at the left margin and at every eight columns to the right of the left margin.
Space	S P	Move one column to the right unless at right margin in which case no action is taken.

Table A-3. Roman-8 Character Conversion Table

Graphic	Binary	Hex	Dec	Oct	Description
	0000 0000	00	0	000	NUL (null)
	0000 0001	01	1	001	SOH (start of heading)
	0000 0010	02	2	002	STX (start of text)
	0000 0011	03	3	003	ETX (end of text)
	0000 0100	04	4	004	EOT (end of transmission)
	0000 0101	05	5	005	ENQ (enquiry)
	0000 0110	06	6	006	ACK (acknowledge)
	0000 0111	07	7	007	BEL (bell)
	0000 1000	08	8	010	BS (backspace)
	0000 1001	09	9	011	HT (horizontal tabulation)
	0000 1010	0A	10	012	LF (line feed)
	0000 1011	0B	11	013	VT (vertical tabulation)
	0000 1100	0C	12	014	FF (form feed)
	0000 1101	0D	13	015	CR (carriage return)
	0000 1110	0E	14	016	SO (shift out)
	0000 1111	0F	15	017	SI (shift in)
	0001 0000	10	16	020	DLE (data link escape)
	0001 0001	11	17	021	DC1 (device control 1 or X-ON)
	0001 0010	12	18	022	DC2 (device control 2)
	0001 0011	13	19	023	DC3 (device control 3 or X-OFF)
	0001 0100	14	20	024	DC4 (device control 4)
	0001 0101	15	21	025	NAK (negative acknowledge)
	0001 0110	16	22	026	SYN (synchronous idle)
	0001 0111	17	23	027	ETB (end of transmission block)
	0001 1000	18	24	030	CAN (cancel)
	0001 1001	19	25	031	EM (end of medium)
	0001 1010	1A	26	032	SUB (substitute)
	0001 1011	1B	27	033	ESC (escape)
	0001 1100	1C	28	034	FS (file separator)
	0001 1101	1D	29	035	GS (group separator)
	0001 1110	1E	30	036	RS (record separator)
	0001 1111	1F	31	037	US (unit separator)
	0010 0000	20	32	040	Space
!	0010 0001	21	33	041	Exclamation point
"	0010 0010	22	34	042	Quotation mark
#	0010 0011	23	35	043	Number sign (hash mark)
\$	0010 0100	24	36	044	Dollar sign
%	0010 0101	25	37	045	Percent sign
&	0010 0110	26	38	046	Ampersand
'	0010 0111	27	39	047	Apostrophe (closing single quote)

A
 Reference
 Tables

Table A-3. Roman-8 Character Conversion Table (continued)

Graphic	Binary	Hex	Dec	Oct	Description
(	0010 1000	28	40	050	Opening parenthesis
)	0010 1001	29	41	051	Closing parenthesis
*	0010 1010	2A	42	052	Asterisk
+	0010 1011	2B	43	053	Plus
,	0010 1100	2C	44	054	Comma
-	0010 1101	2D	45	055	Hyphen (minus)
.	0010 1110	2E	46	056	Period (point)
/	0010 1111	2F	47	057	Slant (solidus)
0	0011 0000	30	48	060	Zero
1	0011 0001	31	49	061	One
2	0011 0010	32	50	062	Two
3	0011 0011	33	51	063	Three
4	0011 0100	34	52	064	Four
5	0011 0101	35	53	065	Five
6	0011 0110	36	54	066	Six
7	0011 0111	37	55	067	Seven
8	0011 1000	38	56	070	Eight
9	0011 1001	39	57	071	Nine
:	0011 1010	3A	58	072	Colon
;	0011 1011	3B	59	073	Semicolon
<	0011 1100	3C	60	074	Less than sign
=	0011 1101	3D	61	075	Equal sign
>	0011 1110	3E	62	076	Greater than sign
?	0011 1111	3F	63	077	Question mark
@	0100 0000	40	64	100	Commercial at
A	0100 0001	41	65	101	Uppercase A
B	0100 0010	42	66	102	Uppercase B
C	0100 0011	43	67	103	Uppercase C
D	0100 0100	44	68	104	Uppercase D
E	0100 0101	45	69	105	Uppercase E
F	0100 0110	46	70	106	Uppercase F
G	0100 0111	47	71	107	Uppercase G
H	0100 1000	48	72	110	Uppercase H
I	0100 1001	49	73	111	Uppercase I
J	0100 1010	4A	74	112	Uppercase J
K	0100 1011	4B	75	113	Uppercase K
L	0100 1100	4C	76	114	Uppercase L
M	0100 1101	4D	77	115	Uppercase M
N	0100 1110	4E	78	116	Uppercase N
O	0100 1111	4F	79	117	Uppercase O

Table A-3. Roman-8 Character Conversion Table (continued)

Graphic	Binary	Hex	Dec	Oct	Description
P	0101 0000	50	80	120	Uppercase P
Q	0101 0001	51	81	121	Uppercase Q
R	0101 0010	52	82	122	Uppercase R
S	0101 0011	53	83	123	Uppercase S
T	0101 0100	54	84	124	Uppercase T
U	0101 0101	55	85	125	Uppercase U
V	0101 0110	56	86	126	Uppercase V
W	0101 0111	57	87	127	Uppercase W
X	0101 1000	58	88	130	Uppercase X
Y	0101 1001	59	89	131	Uppercase Y
Z	0101 1010	5A	90	132	Uppercase Z
[	0101 1011	5B	91	133	Opening square bracket
]	0101 1100	5C	92	134	Reverse slant
^	0101 1101	5D	93	135	Closing square bracket
~	0101 1110	5E	94	136	Caret (circumflex)
_	0101 1111	5F	95	137	Underscore (low line)
'	0110 0000	60	96	140	Opening single quote
a	0110 0001	61	97	141	Lowercase a
b	0110 0010	62	98	142	Lowercase b
c	0110 0011	63	99	143	Lowercase c
d	0110 0100	64	100	144	Lowercase d
e	0110 0101	65	101	145	Lowercase e
f	0110 0110	66	102	146	Lowercase f
g	0110 0111	67	103	147	Lowercase g
h	0110 1000	68	104	150	Lowercase h
i	0110 1001	69	105	151	Lowercase i
j	0110 1010	6A	106	152	Lowercase j
k	0110 1011	6B	107	153	Lowercase k
l	0110 1100	6C	108	154	Lowercase l
m	0110 1101	6D	109	155	Lowercase m
n	0110 1110	6E	110	156	Lowercase n
o	0110 1111	6F	111	157	Lowercase o
p	0111 0000	70	112	160	Lowercase p
q	0111 0001	71	113	161	Lowercase q
r	0111 0010	72	114	162	Lowercase r
s	0111 0011	73	115	163	Lowercase s
t	0111 0100	74	116	164	Lowercase t
u	0111 0101	75	117	165	Lowercase u
v	0111 0110	76	118	166	Lowercase v
w	0111 0111	77	119	167	Lowercase w

Table A-3. Roman-8 Character Conversion Table (continued)

Graphic	Binary	Hex	Dec	Oct	Description
x	0111 1000	78	120	170	Lowercase x
y	0111 1001	79	121	171	Lowercase y
z	0111 1010	7A	122	172	Lowercase z
|	0111 1011	7B	123	173	Opening brace (curly bracket)
	0111 1100	7C	124	174	Vertical line
}	0111 1101	7D	125	175	Closing brace (curly bracket)
	0111 1110	7E	126	176	Tilde
~	0111 1111	7F	127	177	Delete (rubout)
	1000 0000	80	128	200	--undefined control code--
	1000 0001	81	129	201	--undefined control code--
	1000 0010	82	130	202	--undefined control code--
	1000 0011	83	131	203	--undefined control code--
	1000 0100	84	132	204	--undefined control code--
	1000 0101	85	133	205	--undefined control code--
	1000 0110	86	134	206	--undefined control code--
	1000 0111	87	135	207	--undefined control code--
	1000 1000	88	136	210	--undefined control code--
	1000 1001	89	137	211	--undefined control code--
	1000 1010	8A	138	212	--undefined control code--
	1000 1011	8B	139	213	--undefined control code--
	1000 1100	8C	140	214	--undefined control code--
	1000 1101	8D	141	215	--undefined control code--
	1000 1110	8E	142	216	--undefined control code--
	1000 1111	8F	143	217	--undefined control code--
	1001 0000	90	144	220	--undefined control code--
	1001 0001	91	145	221	--undefined control code--
	1001 0010	92	146	222	--undefined control code--
	1001 0011	93	147	223	--undefined control code--
	1001 0100	94	148	224	--undefined control code--
	1001 0101	95	149	225	--undefined control code--
	1001 0110	96	150	226	--undefined control code--
	1001 0111	97	151	227	--undefined control code--
	1001 1000	98	152	230	--undefined control code--
	1001 1001	99	153	231	--undefined control code--
	1001 1010	9A	154	232	--undefined control code--
	1001 1011	9B	155	233	--undefined control code--
	1001 1100	9C	156	234	--undefined control code--
	1001 1101	9D	157	235	--undefined control code--
	1001 1110	9E	158	236	--undefined control code--
	1001 1111	9F	159	237	--undefined control code--

Table A-3. Roman-8 Character Conversion Table (continued)

Graphic	Binary	Hex	Dec	Oct	Description
À	1010 0000	A0	160	240	--undefined--
Á	1010 0001	A1	161	241	Uppercase A grave accent
Â	1010 0010	A2	162	242	Uppercase A circumflex
Ã	1010 0011	A3	163	243	Uppercase E grave accent
Ä	1010 0100	A4	164	244	Uppercase E circumflex
Å	1010 0101	A5	165	245	Uppercase E umlaut or diaeresis
Ï	1010 0110	A6	166	246	Uppercase I circumflex
Ï	1010 0111	A7	167	247	Uppercase I umlaut or diaeresis
´	1010 1000	A8	168	250	Acute accent
˘	1010 1001	A9	169	251	Grave accent
ˆ	1010 1010	AA	170	252	Circumflex accent
¨	1010 1011	AB	171	253	Umlaut (diaeresis) accent
˙	1010 1100	AC	172	254	Tilde accent
À	1010 1101	AD	173	255	Uppercase U grave accent
Â	1010 1110	AE	174	256	Uppercase U circumflex
₣	1010 1111	AF	175	257	Italian Lira symbol
—	1011 0000	B0	176	260	Over line (high line)
Ý	1011 0001	B1	177	261	Uppercase Y acute accent
ý	1011 0010	B2	178	262	Lowercase y acute accent
°	1011 0011	B3	179	263	Degree (ring)
Ç	1011 0100	B4	180	264	Uppercase C cedilla
ç	1011 0101	B5	181	265	Lowercase c cedilla
Ñ	1011 0110	B6	182	266	Uppercase N tilde
ñ	1011 0111	B7	183	267	Lowercase n tilde
¡	1011 1000	B8	184	270	Inverse exclamation mark
¿	1011 1001	B9	185	271	Inverse question mark
¤	1011 1010	BA	186	272	General currency symbol
£	1011 1011	BB	187	273	British pound sign
¥	1011 1100	BC	188	274	Japanese yen symbol
§	1011 1101	BD	189	275	Section sign
f	1011 1110	BE	190	276	Dutch guilder symbol
¢	1011 1111	BF	191	277	U.S. cent symbol
â	1100 0000	C0	192	300	Lowercase a circumflex
è	1100 0001	C1	193	301	Lowercase e circumflex
ò	1100 0010	C2	194	302	Lowercase o circumflex
û	1100 0011	C3	195	303	Lowercase u circumflex
á	1100 0100	C4	196	304	Lowercase a acute accent
é	1100 0101	C5	197	305	Lowercase e acute accent
ó	1100 0110	C6	198	306	Lowercase o acute accent
ú	1100 0111	C7	199	307	Lowercase u acute accent

Table A-3. Roman-8 Character Conversion Table (continued)

Graphic	Binary	Hex	Dec	Oct	Description
à	1100 1000	C8	200	310	Lowercase a grave accent
è	1100 1001	C9	201	311	Lowercase e grave accent
ò	1100 1010	CA	202	312	Lowercase o grave accent
ù	1100 1011	CB	203	313	Lowercase u grave accent
ä	1100 1100	CC	204	314	Lowercase a umlaut or diaeresis
ë	1100 1101	CD	205	315	Lowercase e umlaut or diaeresis
ö	1100 1110	CE	206	316	Lowercase o umlaut or diaeresis
ü	1100 1111	CF	207	317	Lowercase u umlaut or diaeresis
À	1101 0000	D0	208	320	Uppercase A degree
ì	1101 0001	D1	209	321	Lowercase i circumflex
Ø	1101 0010	D2	210	322	Uppercase O crossbar
Æ	1101 0011	D3	211	323	Uppercase AE ligature
à	1101 0100	D4	212	324	Lowercase a degree
í	1101 0101	D5	213	325	Lowercase i acute accent
ø	1101 0110	D6	214	326	Lowercase o crossbar
æ	1101 0111	D7	215	327	Lowercase ae ligature
Ä	1101 1000	D8	216	330	Uppercase A umlaut or diaeresis
ï	1101 1001	D9	217	331	Lowercase i grave accent
Ö	1101 1010	DA	218	332	Uppercase O umlaut or diaeresis
Ü	1101 1011	DB	219	333	Uppercase U umlaut or diaeresis
É	1101 1100	DC	220	334	Uppercase E acute accent
ï	1101 1101	DD	221	335	Lowercase i umlaut or diaeresis
ß	1101 1110	DE	222	336	Sharp s
Ö	1101 1111	DF	223	337	Uppercase O circumflex
Á	1110 0000	E0	224	340	Uppercase A acute accent
À	1110 0001	E1	225	341	Uppercase A tilde
ã	1110 0010	E2	226	342	Lowercase a tilde
Ð	1110 0011	E3	227	343	Uppercase D with stroke
ð	1110 0100	E4	228	344	Lowercase d with stroke
Í	1110 0101	E5	229	345	Uppercase I acute accent
Ì	1110 0110	E6	230	346	Uppercase I grave accent
Ó	1110 0111	E7	231	347	Uppercase O acute accent
Ò	1110 1000	E8	232	350	Uppercase O grave accent
Õ	1110 1001	E9	233	351	Uppercase O tilde
õ	1110 1010	EA	234	352	Lowercase o tilde
Š	1110 1011	EB	235	353	Uppercase S with caron
š	1110 1100	EC	236	354	Lowercase s with caron
Û	1110 1101	ED	237	355	Uppercase U acute accent
ÿ	1110 1110	EE	238	356	Uppercase Y umlaut or diaeresis
ÿ	1110 1111	EF	239	357	Lowercase y umlaut or diaeresis

Table A-3. Roman-8 Character Conversion Table (continued)

Graphic	Binary	Hex	Dec	Oct	Description
þ	1111 0000	F0	240	360	Uppercase Thorn
þ	1111 0001	F1	241	361	Lowercase Thorn
•	1111 0010	F2	242	362	Middle dot
μ	1111 0011	F3	243	363	Lowercase mu (micro sign)
¶	1111 0100	F4	244	364	Pilcrow (paragraph sign)
¾	1111 0101	F5	245	365	Vulgar fraction ¾
—	1111 0110	F6	246	366	Long dash (horizontal bar)
¼	1111 0111	F7	247	367	One fourth (one quarter)
½	1111 1000	F8	248	370	One half
ª	1111 1001	F9	249	371	Feminine ordinal indicator
º	1111 1010	FA	250	372	Masculine ordinal indicator
«	1111 1011	FB	251	373	Opening guillemets (angle quotes)
■	1111 1100	FC	252	374	Solid
»	1111 1101	FD	253	375	Closing guillemets (angle quotes)
±	1111 1110	FE	254	376	Plus / minus sign
	1111 1111	FF	255	377	--undefined--

Table A-4. Printer Command Table*

FUNCTION	PARAMETER	PRINTER COMMAND	DECIMAL VALUE	HEXADECIMAL VALUE
JOB CONTROL COMMANDS				
RESET				
RESET		EcE	027 069	1B 45
NUMBER OF COPIES	# of Copies (1-99)	Ec&l#X	027 038 108 #...# 088	1B 26 6C #...# 58
PAPER INPUT CONTROL	Eject Page	Ec&l0H	027 038 108 048 072	1B 26 6C 30 48
	Feed from Tray	Ec&l1H	027 038 108 049 072	1B 26 6C 31 48
	Manual Feed	Ec&l2H	027 038 108 050 072	1B 26 6C 32 48
	Manual Env. Feed	Ec&l3H	027 038 108 051 072	1B 26 6C 33 48
PAGE LENGTH and SIZE				
PAGE SIZE	Executive	Ec&l1A	027 038 108 049 065	1B 26 6C 31 41
	Letter	Ec&l2A	027 038 108 050 065	1B 26 6C 32 41
	Legal	Ec&l3A	027 038 108 051 065	1B 26 6C 33 41
	A4	Ec&l26A	027 038 108 050 054 065	1B 26 6C 32 36 41
	Monarch	Ec&l80A	027 038 108 056 048 065	1B 26 6C 38 30 41
	Commercial 10	Ec&l81A	027 038 108 056 049 065	1B 26 6C 38 31 41
	International DL	Ec&l90A	027 038 108 057 048 065	1B 26 6C 39 30 41
International C5	Ec&l91A	027 038 108 057 049 065	1B 26 6C 39 31 41	
PAGE LENGTH	# of Lines	Ec&l#P	027 038 108 #...# 080	1B 26 6C #...# 50
ORIENTATION	Portrait	Ec&l00	027 038 108 048 079	1B 26 6C 30 4F
	Landscape	Ec&l10	027 038 108 049 079	1B 26 6C 31 4F
MARGINS and TEXT LENGTH				
TOP MARGIN	# of Lines	Ec&l#E	027 038 108 #...# 069	1B 26 6C #...# 45
TEXT LENGTH	# of Lines	Ec&l#F	027 038 108 #...# 070	1B 26 6C #...# 46
LEFT MARGIN	Left (col #)	Ec&a#L	027 038 097 #...# 076	1B 26 61 #...# 4C
RIGHT MARGIN	Right (col #)	Ec&a#M	027 038 097 #...# 077	1B 26 61 #...# 4D
CLEAR HORIZONTAL MARGINS		Ec9	027 057	1B 39
PERFORATION SKIP MODE				
PERF SKIP	Disable	Ec&l0L	027 038 108 048 076	1B 26 6C 30 4C
	Enable	Ec&l1L	027 038 108 049 076	1B 26 6C 31 4C
HORIZONTAL COLUMN SPACING				
HORIZONTAL MOTION INDEX	# of 1/20" Increments	Ec&k#H	027 038 107 #...# 072	1B 26 6B #...# 48
VERTICAL LINE SPACING				
VERTICAL MOTION INDEX	# of 1/48" Increments	Ec&l#C	027 038 108 #...# 067	1B 26 6C #...# 43
LINES/INCH	1 line /inch	Ec&l1D	027 038 108 049 068	1B 26 6C 31 44
	2 lines /inch	Ec&l2D	027 038 108 050 068	1B 26 6C 32 44
	3 lines /inch	Ec&l3D	027 038 108 051 068	1B 26 6C 33 44
	4 lines /inch	Ec&l4D	027 038 108 052 068	1B 26 6C 34 44
	6 lines /inch	Ec&l6D	027 038 108 054 068	1B 26 6C 36 44
	8 lines /inch	Ec&l8D	027 038 108 056 068	1B 26 6C 38 44
	12 lines /inch	Ec&l12D	027 038 108 049 050 068	1B 26 6C 31 32 44
	16 lines /inch	Ec&l16D	027 038 108 049 054 068	1B 26 6C 31 36 44
	24 lines /inch	Ec&l24D	027 038 108 050 052 068	1B 26 6C 32 34 44
	48 lines /inch	Ec&l48D	027 038 108 052 056 068	1B 26 6C 34 38 44

A
Reference
Tables

Table A-4. Printer Command Table (continued)

FUNCTION	PARAMETER	PRINTER COMMAND	DECIMAL VALUE	HEXADECIMAL VALUE	
CURSOR POSITIONING					
VERTICAL and HORIZONTAL					
VERTICAL	Row #	Ec&a#R	027 038 097 #...# 082	1B 26 61 #...# 52	
	# of Dots	Ec*p#Y	027 042 112 #...# 089	1B 2A 70 #...# 59	
	# of Decipoints	Ec&a#V	027 038 097 #...# 086	1B 26 61 #...# 56	
HORIZONTAL	Column #	Ec&a#C	027 038 097 #...# 067	1B 26 61 #...# 43	
	# of Dots	Ec*p#X	027 042 112 #...# 088	1B 2A 70 #...# 58	
	# of Decipoints	Ec&a#H	027 038 097 #...# 072	1B 26 61 #...# 48	
HALF LINE FEED		Ec=	027 061	1B 3D	
END-OF-LINE TERMINATION					
LINE TERMINATION	CR=CR LF=LF FF=FF	Ec&k0G	027 038 107 048 071	1B 26 6B 30 47	
	CR=CR+LF LF=LF FF=FF	Ec&k1G	027 038 107 049 071	1B 26 6B 31 47	
	CR=CR LF=CR+LF FF=CR+FF	Ec&k2G	027 038 107 050 071	1B 26 6B 32 47	
	CR=CR+LF LF=CR+LF FF=CR+FF	Ec&k3G	027 038 107 051 071	1B 26 6B 33 47	
PUSH/POP POSITION					
PUSH/POP POSITION	Push	Ec&f0S	027 038 102 048 083	1B 26 66 30 53	
	Pop	Ec&f1S	027 038 102 049 083	1B 26 66 31 53	
FONT SELECTION					
ORIENTATION					
ORIENTATION	Portrait	Ec&/00	027 038 108 048 079	1B 26 6C 30 4F	
	Landscape	Ec&/10	027 038 108 049 079	1B 26 6C 31 4F	
SYMBOL SET SELECTION					
PRIMARY SYMBOL SET	HP Math7	Ec(0A	027 040 048 065	1B 28 30 41	
	HP Line Draw	Ec(0B	027 040 048 066	1B 28 30 42	
	ISO 60: Norwegian 1	Ec(0D	027 040 048 068	1B 28 30 44	
	ISO 61: Norwegian 2	Ec(1D	027 040 049 068	1B 28 31 44	
	HP Roman Extension	Ec(0E	027 040 048 089	1B 28 30 45	
	ISO 4: United Kingdom	Ec(1E	027 040 049 069	1B 28 31 45	
	ISO 25: French	Ec(0F	027 040 048 070	1B 28 30 46	
	ISO 69: French	Ec(1F	027 040 049 070	1B 28 31 46	
	HP German	Ec(0G	027 040 048 071	1B 28 30 47	
	ISO 21: German	Ec(1G	027 040 049 071	1B 28 31 47	
	HP Greek8	Ec(8G	027 040 056 71	1B 28 38 47	
	ISO 15: Italian	Ec(0I	027 040 048 073	1B 28 30 49	
	ISO 14: JIS ASCII	Ec(0K	027 040 048 075	1B 28 30 4B	
	HP Katakana	Ec(1K	027 040 049 075	1B 28 31 4B	
	ISO 57: Chinese	Ec(2K	027 040 050 075	1B 28 32 4B	
	HP Math7	Ec(0M	027 040 048 077	1B 28 30 4D	
	Technical	Ec(1M	027 040 049 077	1B 28 31 4D	
	HP Math8	Ec(8M	027 040 056 77	1B 28 38 4D	

FUNCTION	PARAMETER	PRINTER COMMAND	DECIMAL VALUE	HEXADECIMAL VALUE	
	ISO 100: ECMA-94 (Latin 1)	Ec(ØN	027 040 048 78	1B 28 30 4E	
	OCR A	Ec(ØO	027 040 048 079	1B 28 30 4F	
	OCR B	Ec(1O	027 040 049 079	1B 28 31 4F	
	ISO 11: Swedish	Ec(ØS	027 040 048 083	1B 28 30 53	
	HP Spanish	Ec(1S	027 040 049 083	1B 28 31 53	
	ISO 17: Spanish	Ec(2S	027 040 050 083	1B 28 32 53	
	ISO 10: Swedish	Ec(3S	027 040 051 083	1B 28 33 53	
	ISO 16: Portuguese	Ec(4S	027 040 052 083	1B 28 34 53	
	ISO 84: Portuguese	Ec(5S	027 040 053 083	1B 28 35 53	
	ISO 85: Spanish	Ec(6S	027 040 054 083	1B 28 36 53	
	ISO 6: ASCII	Ec(ØU	027 040 048 085	1B 28 30 55	
	HP Legal	Ec(1U	027 040 049 085	1B 28 31 55	
	ISO 2: IRV	Ec(2U	027 040 050 085	1B 28 32 55	
	OEM-1	Ec(7U	027 040 055 85	1B 28 37 55	
	HP Roman8	Ec(8U	027 040 056 85	1B 28 38 55	
	PC-8	Ec(1ØU	027 040 049 048 085	1B 28 31 30 55	
	PC-8 (D/N)	Ec(11U	027 040 049 049 085	1B 28 31 31 55	
	HP Pi Font	Ec(15U	027 040 049 053 085	1B 28 31 35 55	
	SPACING				
	PRIMARY SPACING	Proportional	Ec(s1P	027 040 115 049 080	1B 28 73 31 50
Fixed		Ec(sØP	027 040 115 048 080	1B 28 73 30 50	
PITCH					
PRIMARY PITCH	# CPI	Ec(s#H	027 040 115 #...# 072	1B 28 73 #...# 48	
POINT SIZE					
PRIMARY POINT SIZE	# Pt.	Ec(s#V	027 040 115 #...# 086	1B 28 73 #...# 56	
STYLE					
PRIMARY STYLE	Upright	Ec(sØS	027 040 115 048 083	1B 28 73 30 53	
	Italic	Ec(s1S	027 040 115 049 083	1B 28 73 31 53	
STROKE WEIGHT					
PRIMARY STROKE WEIGHT	Medium (0)	Ec(sØB	027 040 115 048 066	1B 28 73 30 42	
	Bold (3)	Ec(s3B	027 040 115 051 066	1B 28 73 33 42	
TYPEFACE					
PRIMARY TYPEFACE	Line Printer	Ec(sØT	027 040 115 048 084	1B 28 73 30 54	
	Courier	Ec(s3T	027 040 115 051 084	1B 28 73 33 54	
	Helv	Ec(s4T	027 040 115 052 084	1B 28 73 34 54	
	Tms Rmn	Ec(s5T	027 040 115 053 084	1B 28 73 35 54	
	Letter Gothic	Ec(s6T	027 040 115 054 084	1B 28 73 36 54	
	Prestige	Ec(s8T	027 040 115 056 084	1B 28 73 38 54	
	Presentations	Ec(s11T	027 040 115 049 049 084	1B 28 73 31 31 54	
	Optima	Ec(s17T	027 040 115 049 055 084	1B 28 73 31 37 54	
	ITC Garamond	Ec(s18T	027 040 115 049 056 084	1B 28 73 31 38 54	
	Cooper Black	Ec(s19T	027 040 115 049 057 084	1B 28 73 31 39 54	
	Coronet Bold	Ec(s20T	027 040 115 050 048 084	1B 28 73 32 40 54	
	Broadway	Ec(s21T	027 040 115 050 049 084	1B 28 73 32 41 54	

Table A-4. Printer Command Table (continued)

FUNCTION	PARAMETER	PRINTER COMMAND	DECIMAL VALUE	HEXADECIMAL VALUE
	Bauer Bodoni	Ec(s22T	027 040 115 050 050 084	1B 28 73 32 42 54
	Black Condensed			
	Century	Ec(s23T	027 040 115 050 051 084	1B 28 73 32 43 54
	Schoolbook			
	University Roman	Ec(s24T	027 040 115 050 052 084	1B 28 73 32 44 54
FONT PITCH				
PRIMARY & SECONDARY FONT PITCH (Alternate Method)	10.00 Pitch	Ec&k0S	027 038 107 048 083	1B 26 6B 30 53
	16.66 Pitch	Ec&k2S	027 038 107 050 083	1B 26 6B 32 53
DEFAULT FONT	Primary Font	Ec(3@	027 040 051 064	1B 28 33 40
	Secondary Font	Ec)3@	027 041 051 064	1B 29 33 40
UNDERLINE				
UNDERLINE	Enable Fixed	Ec&d0D	027 038 100 048 068	1B 26 64 30 44
	Enable Floating	Ec&d3D	027 038 100 051 068	1B 26 64 33 44
	Disable	Ec&d@	027 038 100 064	1B 26 64 40
FONT MANAGEMENT				
ASSIGN FONT ID	Font ID #	Ec*c#D	027 042 099 #...# 068	1B 2A 63 #...# 44
FONT AND CHARACTER CONTROL	Delete all Fonts	Ec*c0F	027 042 099 048 070	1B 2A 63 30 46
	Delete all Temporary Fonts	Ec*c1F	027 042 099 049 070	1B 2A 63 31 46
	Delete Last Font ID Specified	Ec*c2F	027 042 099 050 070	1B 2A 63 32 46
	Make Font Temp.	Ec*c4F	027 042 099 052 070	1B 2A 63 34 46
	Make Font Perm.	Ec*c5F	027 042 099 053 070	1B 2A 63 35 46
FONT SELECTION BY ID NUMBER				
SELECT FONT WITH ID #	ID #			
	Primary Font	Ec(#X	027 040 #...# 088	1B 28 #...# 58
	ID #			
	Secondary Font	Ec)#X	027 041 #...# 088	1B 29 #...# 58
SOFT FONT CREATION				
CREATE FONT (FONT HEADER)	# of Bytes	Ec)s#W [Data]	027 041 115 #...# 087	1B 29 73 #...# 57
DOWNLOAD CHARACTER	# of Bytes	Ec(s#W [Data]	027 040 115 #...# 087	1B 28 73 #...# 57
CHARACTER CODE	ASCII Code # (Decimal)	Ec*c#E	027 042 099 #...# 069	1B 2A 63 #...# 45

FUNCTION	PARAMETER	PRINTER COMMAND	DECIMAL VALUE	HEXADECIMAL VALUE
GRAPHICS				
RASTER GRAPHICS				
RESOLUTION	75 Dots/inch	Ec*t175R	027 042 116 055 053 082	1B 2A 74 37 35 52
	100 Dots/inch	Ec*t100R	027 042 116 049 048 082	1B 2A 74 31 30 30 52
	150 Dots/inch	Ec*t150R	027 042 116 049 053 048 082	1B 2A 74 31 35 30 52
	300 Dots/inch	Ec*t300R	027 042 116 051 048 048 082	1B 2A 74 33 30 30 52
START GRAPHICS	Left Graphics			
	Margin	Ec*r0A	027 042 114 048 065	1B 2A 72 30 41
	Current Cursor	Ec*r1A	027 042 114 049 065	1B 2A 72 31 41
TRANSFER	# of Rows	Ec*b#W [Data]	027 042 098 #...# 087	1B 2A 62 #...# 57
END GRAPHICS		Ec*rB	027 042 114 066	1B 2A 72 42
RECTANGLE DIMENSIONS				
RECTANGLE WIDTH (Horizontal Size)	# of Dots	Ec*c#A	027 042 099 #...# 065	1B 2A 63 #...# 41
	# of Decipoints	Ec*c#H	027 042 099 #...# 072	1B 2A 63 #...# 48
RECTANGLE HEIGHT (Vertical Size)	# of Dots	Ec*c#B	027 042 099 #...# 066	1B 2A 63 #...# 42
	# of Decipoints	Ec*c#V	027 042 099 #...# 086	1B 2A 63 #...# 56
RECTANGULAR AREA FILL				
FILL RECTANGLE AREA	Rule	Ec*c0P	027 042 099 048 080	1B 2A 63 30 50
	Gray Scale	Ec*c2P	027 042 099 050 080	1B 2A 63 32 50
	HP Pattern	Ec*c3P	027 042 099 051 080	1B 2A 63 33 50
SHAPE	2% Gray	Ec*c2G	027 042 099 050 071	1B 2A 63 32 47
	10% Gray	Ec*c10G	027 042 099 049 048 071	1B 2A 63 31 30 47
	15% Gray	Ec*c15G	027 042 099 049 053 071	1B 2A 63 31 35 47
	30% Gray	Ec*c30G	027 042 099 051 048 071	1B 2A 63 33 30 47
	45% Gray	Ec*c45G	027 042 099 052 053 071	1B 2A 63 34 35 47
	70% Gray	Ec*c70G	027 042 099 055 048 071	1B 2A 63 37 30 47
	90% Gray	Ec*c90G	027 042 099 057 048 071	1B 2A 63 39 30 47
	100% Gray	Ec*c100G	027 042 099 049 048 048 071	1B 2A 63 31 30 30 47
PATTERN	1 Horiz. Line	Ec*c1G	027 042 099 049 071	1B 2A 63 31 47
	2 Vert. Lines	Ec*c2G	027 042 099 050 071	1B 2A 63 32 47
	3 Diagonal Lines	Ec*c3G	027 042 099 051 071	1B 2A 63 33 47
	4 Diagonal Lines	Ec*c4G	027 042 099 052 071	1B 2A 63 34 47
	5 Square Grid	Ec*c5G	027 042 099 053 071	1B 2A 63 35 47
	6 Diagonal Grid	Ec*c6G	027 042 099 054 071	1B 2A 63 36 47

FUNCTION	PARAMETER	PRINTER COMMAND	DECIMAL VALUE	HEXADECIMAL VALUE
MACROS				
MACRO ID and CONTROL				
MACRO ID	Macro ID #	Ec&f#Y	027 038 102 #...# 089	1B 26 66 #...# 59
MACRO CONTROL	Start Macro Def.	Ec&f0X	027 038 102 048 088	1B 26 66 30 58
	Stop Macro Def.	Ec&f1X	027 038 102 049 088	1B 26 66 31 58
	Execute Macro	Ec&f2X	027 038 102 050 088	1B 26 66 32 58
	Call Macro	Ec&f3X	027 038 102 051 088	1B 26 66 33 58
	Enable Overlay	Ec&f4X	027 038 102 052 088	1B 26 66 34 58
	Disable Overlay	Ec&f5X	027 038 102 053 088	1B 26 66 35 58
	Delete Macros	Ec&f6X	027 038 102 054 088	1B 26 66 36 58
	Delete All Temp. Macros	Ec&f7X	027 038 102 055 088	1B 26 66 37 58
	Delete Macro ID	Ec&f8X	027 038 102 056 088	1B 26 66 38 58
	Make Temporary	Ec&f9X	027 038 102 057 088	1B 26 66 39 58
	Make Permanent	Ec&f10X	027 038 102 049 048 088	1B 26 66 31 30 58
	PROGRAMMING AIDS			
DISPLAY FUNCTIONS	ON	EcY	027 089	1B 59
	OFF	EcZ	027 090	1B 5A
TRANSPARENT PRINT DATA	# of Bytes	Ec&p#X [Data]	027 038 112 #...# 088	1B 26 70 #...# 58
END-OF-LINE WRAP				
END-OF-LINE WRAP	Enabled	Ec&s0C	027 038 115 048 067	1B 26 73 30 43
	Disabled	Ec&s1C	027 038 115 049 067	1B 26 73 31 43

B

Interfacing

Contents

Introduction	B-1
Parallel Interface	B-2
Input	B-3
Output	B-3
Handshake Timing	B-6
Hardware	B-7
Serial Interface	B-8
RS-232C/RS422 Operation	B-8
Serial Data Format	B-10
Throughput	B-10
Handshake Protocol	B-10
XON/XOFF	B-10
Data Terminal Ready	B-11
Hardware	B-12

Introduction

The **LaserJet series II** printer supports an RS-232C serial interface, an RS-422 differential serial interface, and a parallel (Centronics) interface. Two connectors, a parallel and serial connector, are provided at the rear of the printer to connect to one of the three interfaces.

The interface is configured using the Operator Control Panel's configuration menu (refer to the *HP LaserJet series II User's Manual* for configuration information).

The printer stores the I/O configuration information in non-volatile RAM, thus the configuration is saved even if the printer is powered off.

Parallel Interface

Parallel I/O operation is enabled from the printer's Operator Control Panel configuration menu (refer to the *LaserJet series II User's Manual*). Once parallel operation is enabled, the user can transfer data to the printer using parallel (Centronics) communication protocol. The signals used for parallel communication are listed in Table B-1.

Table B-1 Parallel Interface Connector Pin Assignments

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	-Input Prime (Input)
NC	14	32	-Nfault (Output)
NC	15	33	Auxout1 (Output)
0 VDC	16	34	NC
Chassis GND	17	35	Auxout2 (Output)
+5 VDC (Output)	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 printer. This line is normally HIGH, and is set LOW when data to be written to the printer is valid. BUSY is set HIGH at the falling edge of this signal. Refer to Figure B-1.

Data Lines (Pins 2-9)

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

Input Prime (Pin 31)

The printer will ignore this input signal.

Output signals

Select line (Pin 13)

This signal indicates that the printer has been placed ON-LINE and that no printer errors or malfunctions exist. The select line is HIGH when the printer is ON-LINE, LOW when the printer is OFF-LINE.

When the printer is changed from OFF-LINE to ON-LINE, this signal changes from the **de-select** state to the **select** state, an -Ack pulse is sent to the host CPU and the BUSY signal is set LOW.

When the printer is changed from ON-LINE to OFF-LINE, this signal changes from the **select** state to the **de-select** state. If the BUSY signal is HIGH when **select** changes, BUSY remains HIGH. If the BUSY signal is LOW when **select** changes, BUSY will change to HIGH to indicate that the printer is no longer ready for data. If no -Ack pulse is generated before **select** changes, no -Ack pulse will be generated until the printer is put back ON-LINE. The host CPU can catch either the momentary not-BUSY signal or an extraneous -Ack pulse and strobe another character into the printer while it is going OFF-LINE. The printer interface can detect and accept this late-coming character without data loss.

If a malfunction occurs in the printer while in the ON-LINE state, the printer goes OFF-LINE and this signal changes just as it would for a normal ON-LINE to OFF-LINE transition.

The printer is set to a **select** state at power-on.

Fault line (Pin 32)

-Fault goes LOW when the printer is OFF-LINE or if any malfunction or error occurs in the printer.

Busy line (Pin 11 & 29)

When Busy is LOW, the printer can accept another character from the host. Busy goes HIGH after every HIGH-to-LOW transition of the -Strobe signal. This allows a host CPU to handshake data with the printer using the BUSY signal instead of the -Ack signal. Busy will stay HIGH (not ready for data) whenever -Fault is LOW and whenever the I/O buffer is full.

Acknowledge line (Pin 10 & 28)

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

Paper error line (Pin 12)

Normally LOW, this signal changes to HIGH when the printer runs out of paper. In addition to paper errors, this signal responds to any fault that occurs in the printer 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. .sp 2ln

Chassis Grounds (Pin 17)

Same as frame ground.

+5 Volts (Pin 18)

This is not +5 VDC directly, but rather it is +5 VDC with a 220 ohm in-line resistor. This signal is not intended to provide power to any external devices; it is provided only to be compatible with host CPU's that may test this pin for a logic HIGH before attempting data transfers.

Auxout1 (Pin 33)

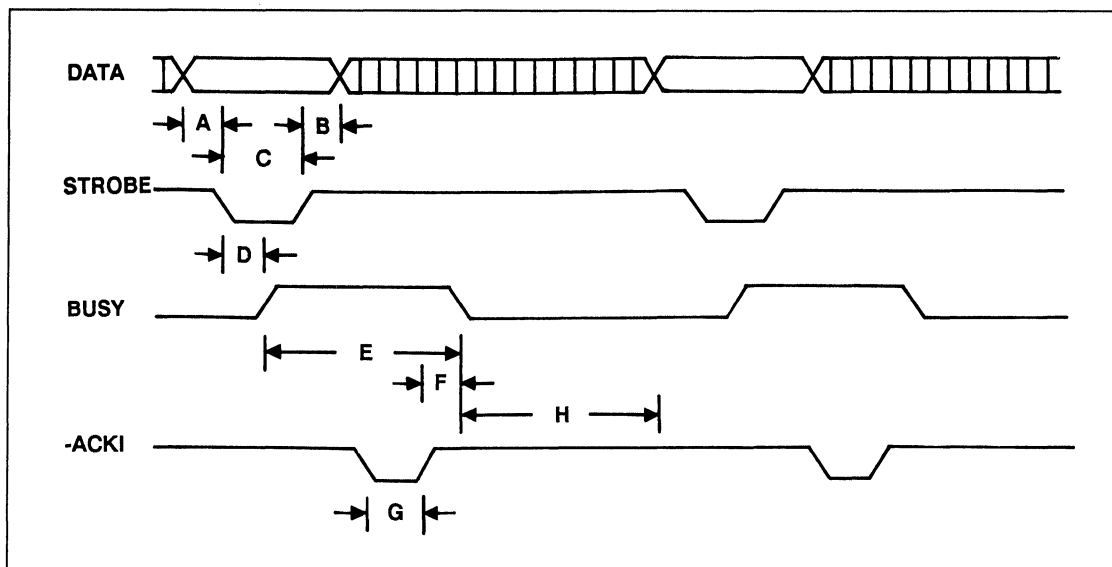
This signal is always HIGH while the printer is powered on.

Auxout2 (Pin 35)

This signal is always HIGH while the printer is powered on.

Handshake Timing

The timing 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	1.0 usec.	-	500 usec.
D: -Strobe-on to Busy-on	0.0 usec.	-	1.0 usec.
E: Busy-on duration (printer-ON-LINE)	10.0 usec.	* 143 usec. **2.0 msec.	10 Sec
F: -Ack-off to Busy-off	0.0 usec.	2.5 usec.	
G: -Ack-on pulse width	2.5 usec.	-	10 usec.
H: Busy-Off to start of next cycle	0.0 usec.		

*Image and font download data

**Text data

Figure B-1. Parallel Handshake Timing

Hardware Connector

The receptacle installed in the printer is the Amphenol 850-57FE-403600-20 36-pin connector, or equivalent.

Cable

The external cable connecting the host CPU to the printer is supplied by the user. The plug required for the user's cable must be compatible with the Amphenol 57-30360 36-pin connector. The parallel interface is designed to work with cables shorter than ten feet.

Line Driver Circuitry

Each output signal from the printer (-Ack, Busy, Paper Error, Select, Auxout1, Auxout2, and -Fault) is driven onto the interface cable line with an SN7407 (or equivalent) open-collector buffer with an output pull-up resistor between 1K and 3.3K ohms to +5 VDC. The -Ack and Busy signals have a "return" line associated with them; this is simply logic ground

Line Receiver Circuitry

Each Data input signal to the printer is received off the interface cable with an SN74LS241 (or equivalent) buffer with hysteresis with an input pull-up 1K ohm resistor to +5 VDC. The "return" signal associated with each data line is simply logic ground.

The Strobe input signal to the printer is received off the interface cable with an SN74LS14 buffer with hysteresis with an input pull-up 680 ohm resistor to +5 VDC and a 33pF capacitor to ground. The "return" signal associated with the Strobe line is simply logic ground. The "return" signal associated with the Strobe line is simply logic ground.

Serial Interface

Serial I/O operation is enabled from the printer's Operator Control Panel Menu (refer to the *LaserJet series II User's Manual*). When serial operation is enabled, the user can transfer data to the printer using serial protocol. Either RS-232C or RS-422 operation may be used. The signals used by the printer for serial communication are listed in Table B-2.

RS-232C/RS-422A Operation

The printer can be set for either RS-232C or RS-422 operation. A switch is provided inside the back cover for selection of either operation. To set the printer for RS-232C operation set the switch to the down position; to set the printer for RS-422 operation set the switch to the up position (refer to Figure B-2). The printer is shipped from the factory set for RS-232C operation.

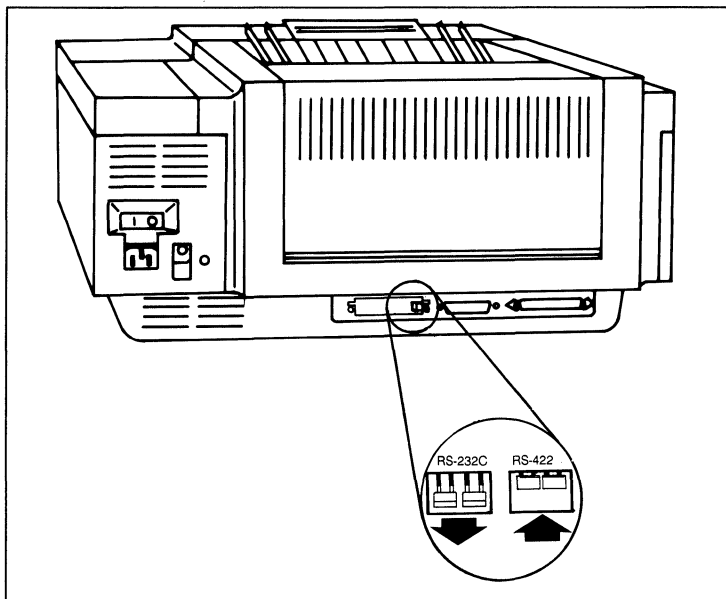


Figure B-2. RS-232C/RS-422 Selection

The following table lists RS-232C and RS-422 pin assignments and signal descriptions.

Table B-2 RS-232C/422 Signals; Connector Pin Assignments

Pin Number	Description	RS232C	RS422	I/O
1	Protective ground	*	*	-
2	Transmitted data (data from printer)	*		Output
3	Received data (received from printer)	*		Input
	Received data inverted (RDA) (received by printer)		*	Input
4	Request to send. This signal is HIGH when unit is powered on	*		Output
5	Clear to send. This signal is not required for the controller to transmit flow control characters. (DC1/DC3)	*		Input
6	Data set ready. This signal is not required for the controller to receive data	*		Input
7	Signal ground	*	*	
8	NC			
9	Send data inverted (SDA)		*	Output
10	Send data noninverted (SDB)		*	Output
11	NC			
18	Receive data noninverted (RDB)		*	Input
19				
20	Data terminal ready	*		Output
25	NC			

The asterisks identify signals that are used.

Serial Data Format

Transmission is asynchronous, with one start bit, eight data bits and one stop bit. Parity is not used.

Serial Data Communication Throughput

Unlike the parallel interface, the selected baud rate of the serial interface limits the rate at which data passes through the machine. *LaserJet series II* supports the following baud rates:

300 600
1200 2400
4800 9600
19,200

The baud rate is configured via the configuration menu on the operator control panel (refer to the *LaserJet series II User's Manual* for configuration information).

Serial Interface Protocol

Two handshake methods are always available for controlling data transfer between the host and the printer: Xon/Xoff and a hardware handshake protocol. (The Data Terminal Ready signal, pin 20, is available for hardware handshake.)

Xon/Xoff

Xon/Xoff is a data stream handshake protocol which sends Xon (DC1; 11 Hex) to the computer when the printer is able to accept data and sends Xoff (DC3; 13 Hex) when the printer is not ready for data.

The printer transmits an Xon when it is ready to accept more data from the host. The printer requests data when the following three conditions exist:

1. when the 1 kbyte I/O buffer has less than 128 bytes of data (has at least 896 bytes empty),
2. when it is ON-LINE,
3. when it is NOT BUSY.

If no data is received within approximately one second of the transmission of an Xon, the printer may be configured so that it sends additional Xon's at one second intervals until data is received. The **ROBUST-XON** Operator Control Panel configuration menu item is used to select whether additional Xon's should be transmitted. If **ROBUST-XON** is set to ON, additional Xon's will be transmitted at one second intervals until data is received. If **ROBUST-XON** is set to OFF, additional

Xon's are not transmitted. The factory setting is **ROBUST-XON** set to ON.

Xoff's are transmitted by the printer to the computer to indicate that the printer is not ready to accept data. An Xoff is transmitted when any one of the following conditions exist:

- The I/O buffer has 64 or fewer bytes empty,
- the printer is OFF-LINE, or
- the printer is BUSY.

If additional data bytes are received from the host after the Xoff is transmitted, additional Xoff characters are transmitted when the buffer has 32, 16, 8, 4, 2, 1, and 0 bytes empty. Also, an Xoff is transmitted as soon as state "05 SELF TEST," changes to "02 WARMING UP" when the printer is powered ON.

Data Terminal Ready (RS-232C - pin 20)

A Hardware handshake is also available with the printer. The Data Terminal Ready (DTR) signal line is available for hardware handshake at pin 20 of the serial connector. This signal line is always operating; it does not require enabling.

The DTR signal line indicates whether the printer is "ready" or "not ready" for data. When the printer is ready for data, the DTR signal switches to a HIGH (or a LOW, if the DTR line is set for inverted operation). The printer will request data when the following three conditions exist:

1. when its 1 kbyte I/O buffer has less than 128 bytes of data (has at least 896 bytes empty),
2. when it is ON-LINE, and
3. when it is not BUSY.

The DTR signal goes LOW (HIGH, if the DTR line is set for inverted operation) when the printer is not ready to accept data. Data will not be accepted by the printer when any one of the following conditions exist:

- the I/O buffer has 64 or fewer bytes empty,
- it is OFF-LINE, or
- it is in a BUSY state (such as performing Self-Test).

Transitions on the line correspond to the transmissions of Xon (asserted) and Xoff (not-asserted).

The signal logic or "sense" of the DTR signal line can be switched to either active high or active low from the printer's Operator Control Panel. To select the DTR line for active high signal polarity select **DTR POLARITY=HI*** using the printer's Operator Control Panel, configuration menu; to select active low signal polarity set the configuration menu ITEM to **DTR POLARITY=LO**.

Hardware

Connector

The common RS-232C/RS-422 connector is a 25-pin, D-subminiature female connector.

Cable

The external cable connecting the host CPU to the printer must be supplied by the user. The plug required for the user's cable must be a male, 25-pin, D-subminiature connector.

The RS-232C interface is designed to work with cables shorter than 15 metres (50 feet). RS-422 is designed for operation with cables up to 1200 metres (4000 feet) in length.

Glossary

Auto-Continue	Auto-Continue mode can be configured using the LaserJet series II printer control panel (refer to the <i>LaserJet series II User's Manual</i>).
Baud Rate	Baud rate is the rate at which information is transferred between the computer and the printer. To communicate properly, the computer and the printer must both be configured to the same baud rate.
Centronics I/O	An industry standard parallel input/output (I/O) interface.
Column	The width of a column is defined by the current horizontal motion index (HMI).
Configuration	Configuration is the process of changing certain printer settings to allow a computer to communicate properly with the printer. For example, interface selection is part of printer configuration. The printer is configured using the control panel configuration menu.
Control Code	A control code is a type of PCL command. A control code is a character that initiates a printer function, for example CR, LF and FF.
Control Panel	The combination of keys, LEDs, and a display that allow an operator to communicate with a device and allow the device to communicate with an operator.
Current Active Position	See Cursor.
Cursor	Although the printer does not actually have a cursor, the cursor position refers to the currently active printing position (like the blinking underline character used on most computer terminals). The cursor can be moved anywhere within the logical page using a combination of horizontal and vertical cursor positioning commands and control codes.
Decipoint	A decipoint is a unit of measurement that equals 1/720 th of an inch.

Default	A value used in lieu of a programmatically selected value. A factory default is a value programmed into the device at the factory; this value is stored in read-only memory (ROM) and cannot be changed by a user or operator. A user default is a default that is selectable via the control panel.
Dot	The dot is the smallest printable unit. On LaserJet series II printer, one dot equals 1/300 th inch. The number of dots printed per inch is referred to as the printer's resolution.
Download	The process of transferring soft fonts, macros, or raster data from a host computer to the printer's user memory is called downloading.
DTR Polarity	The configuration of DTR polarity determines whether pin 20, on the serial interface connector, is high or low when the printer is ready. If DTR polarity is HI, pin 20 is high when the printer is ready. If DTR polarity is LO, pin 20 is low when the printer is ready.
Escape Character	The first character of a PCL escape sequence, identified by the "Esc" symbol, (ASCII decimal code 27). This character is a control code used specifically by the printer to identify a string of characters as a printer command. As the printer monitors incoming data from a computer, it is "looking" for this character. When this character appears, the printer reads it and its associated characters as a command to be performed and not as data to be printed.
Escape Sequence	PCL escape sequences consist of two or more characters. The first character is always the escape character, identified by "Esc" symbol. This character is a control code used specifically by the printer to identify a string of characters as a printer command. As the printer monitors incoming data from a computer, it is "looking" for this character. When this character appears, the printer reads it and its associated characters as a command to be performed and not as data to be printed.
Factory Default	Factory default's refer to the settings that are programmed into the printer at the factory. These settings are in use unless you override them using either the control panel or by sending printer commands.

Factory Default Environment	A factory default is a setting programmed into the printer at the factory. The group of all the printer's factory settings is referred to as the factory default environment. The factory default symbol set is selectable from the control panel configuration menu (refer to the <i>LaserJet series II User's Manual</i>).
Font	A font is a set of characters that have similar characteristics. A font has an assigned name, typeface, and is further described by its spacing, height, pitch, style, stroke weight, symbol set, and orientation. For example, the name of the font used for this text is Tm-sRmn; its height is 10 point, its style is upright, and its stroke weight is medium.
Font Cartridge	A removable media containing multiple fonts. When a cartridge is plugged into the slot in the printer provided for this purpose, the printer has access to the fonts contained in the cartridge.
Height	The height of a font is the measurement of the body of the type in points. A PCL point is 1/72 th inch. The body of the type is slightly greater than the distance from the bottom of a descender to the top of an unaccented capital letter.
Horizontal Motion Index (HMI)	HMI defines the distance between columns in 1/120 th inch increments. When fixed pitch fonts are selected all printable characters including the space and backspace characters are affected by HMI. When proportional fonts are selected, the HMI affects only the control code space character. HMI is defaulted when font orientation, symbol set, pitch, spacing or height is specified and when switching between primary and secondary fonts with shift in and shift out. The default HMI is equal to the pitch value in the font header. The factory default font's HMI is 12 (which is 12/120 = 1/10 inch per character or 10 characters per inch.)
I/O	I/O is an acronym for input/output (I/O) and is used in this document when referring to hardware used to interface printers with computers.

I/O Buffer	The area within the device's internal random access memory where PCL commands and data are stored.
Interface Connector	The LaserJet series II printer comes with two interface connectors, serial and parallel, located on the lower part of the back panel. The cable that attaches the computer to the printer is connected here.
Internal Fonts	Internal fonts are the fonts resident in the printer when shipped.
ISO Symbol Set	128 symbol sets containing European versions of the Roman alphabet (e.g., ISO-German contains umlaut vowels, ISO-French contains e accent grave, etc.) based on the standards produced by the International Standards Organization (ISO).
Landscape	See Orientation.
Logical Page	The PCL logical page (also referred to as the addressable area) defines the area in which the cursor can be positioned. Although the printer does not actually have a cursor (like the blinking underline character used on most computer terminals), the cursor position refers to the currently active printing position. In other words, the location of the "cursor" is the position on the logical page where the next character will be positioned. You can move the cursor to different points on the logical page using the cursor positioning commands; however, the cursor cannot be moved outside of the logical page bounds.
Macro	A macro is a collection of escape sequences, control codes, and data downloaded to the printer, whose execution can be initiated using a single command.
Menu	A list of configurable items. In the nomenclature of this document, an "item" is one particular configurable entity (that is, Copies); a "value" is an "item's" particular configuration (that is, Copies = 10).
Modified Print Environment	The current printer feature settings constitute the modified print environment. Whenever a feature setting is altered using escape sequences, the new setting is recorded in the modified print environment.

Non-volatile RAM	Random Access Memory whose contents are preserved following a power failure (volatile RAM is memory whose contents are not preserved when the device is powered off). Non-volatile RAM is generally used to preserve configured (vs. programmed) device state information.
Off-line/On-line	On-line is a condition when the printer will accept data from the host computer. When the LaserJet series II is on-line, the ON LINE lamp is lit. When off-line, the printer will not accept data from the host.
Orientation	The orientation of characters on a page; if the print is across the width of the page, it is "portrait-oriented"; if the print is across the length of the page, it is "landscape-oriented". Orientation is a PCL font attribute; portrait-oriented fonts are not printable in landscape orientation and vice versa.
Overlay Environment	The overlay environment consists of the current settings for the following features with the remainder of the environmental features set to their user default values: Page length Paper source Page size Number of copies Orientation Cursor position stack
Parallel I/O	An input/output interface that transmits more than one bit of information simultaneously. Centronics is an industry-wide standard form of a parallel interface.
PCL Commands	<p>PCL commands provide access to printer features. Once a PCL command sets a parameter, that parameter remains set until the same PCL command is repeated with a new value or the printer is reset. There are three types of PCL commands: control codes, two-character escape sequences, and parameterized escape sequences.</p> <p>A control code is a character that initiates a printer function, for example CR, LF, and FF.</p> <p>PCL escape sequences consist of two or more characters. The first character is always the escape character, identified by the "Esc" symbol. This character is a control code used specifically by the printer to identify a string of characters as a printer command. As the printer monitors incoming data from a computer, it is "looking" for this character. When this character appears, the printer reads it and its associated characters as a command to be performed and not as data to be printed. (Note, PCL printer commands are also referred to as escape sequences.)</p>

PCL Coordinate System Units	The units of the X-axis of the PCL coordinate system may be dots, decipoints, or columns. The units of the Y-axis may be dots, decipoints, or rows.
Perforation Region	The perforation region is the distance from the bottom of the text area to the top of the text area of the next page. When perforation skip is enabled a line feed or half line feed that would move the cursor beyond the bottom of the text area, moves the cursor to the top of the text area on the next page. When perforation skip is disabled, a line feed or half line feed moves to the next line or half line within the perforation region.
Permanent Image	An image (font, macro, etc.) can be designated "permanent" via a PCL escape sequence. A "permanent" image is not cleared from internal memory as a result of either an E_cE or an operator control reset whereas a "temporary" one is cleared by either of the aforementioned operations. Both "permanent" and "temporary" images are cleared from internal memory by a power failure.
Pitch	Pitch describes the number of characters printed in a horizontal inch. Pitch only applies to fixed-spaced fonts since the number of characters per inch varies for proportionally-spaced fonts.
Point	A PCL point is a unit of measurement that equals $1/72^{\text{th}}$ inch. Font height is measured in points.
Primary (Secondary) Font	A PCL convention whereby two fonts can be defined internally simultaneously; the primary font is accessed via the control code "SI" and the secondary font is accessed via the control code "SO." The factory default state is primary font designated.
Printable Area	The printable area is the area of the physical page in which the printer is able to place a dot. The physical page refers to the size of the media installed in the printer. The relationship between physical page, logical page and printable area, is defined in Figures 2-2 and 2-3.
Portrait	See Orientation.

Print Environment	The group of all the printer's current feature settings, collectively, is referred to as the print environment. The printer maintains four print environments: the factory default environment, the user default environment, the modified print environment and the overlay environment.
Printer Commands	See PCL Commands.
Raster Graphics	Images composed of groups of dots are raster images. Pictures in newspapers or on televisions are examples of raster images. PCL includes commands for printing raster images.
Robust-Xon	The configuration of ROBUST-XON determines the method by which Xon's are generated. If ROBUST-XON is ON an Xon is transmitted by the controller to the host system when the controller's 1 Kbyte I/O buffer has less than 128 data bytes remaining (896 bytes empty), the printer is in the on-line state, and the printer is not busy. If no data is received within approximately one second, then additional Xon's are to be transmitted at one second intervals until data is received. If ROBUST-XON is OFF, the printer sends one Xon when the printer can accept more data, the printer is in the online state, and the printer is not busy. The printer does not send Xon's every second while the printer is online and ready for more data.
Row	The distance between rows is defined by the current vertical motion index (VMI).
Rule	A solid-filled rectangular area.
Serial I/O	An input/output (I/O) interface that transmits information bit-by-bit. RS-232 is an industry-wide standard form of a serial interface.
Soft Font	Soft fonts are fonts stored on floppy discs. These fonts can be transferred to the printer's memory and used the same way as cartridge or resident fonts.
Spacing	Fonts have either fixed or proportional spacing. Fixed-spaced fonts are those for which the inter-character spacing is constant. Proportionally-spaced fonts are those for which the inter-character spacing varies with the natural shape of a character.

Stroke Weight	Stroke weight describes the thickness of the strokes that compose characters. Medium and bold are examples of stroke weights.
Style	Font style is defined by and angularity of the strokes of the characters with respect to the X-axis. Upright and italics are examples of font styles.
Symbol Set	A symbol set is a unique ordering of the characters in a font. Each symbol set is defined with a unique set of applications in mind. Symbol sets are created for many purposes, for example the PC-8 (IBM-US) symbol set was designed to support US IBM-PC applications.
Typeface	Typeface is a generic name for graphics symbols having common design features. Each typeface has unique and distinguishing characteristics.
User Default	A user default is a default that is selectable via the operator control panel. User defaults may be selected for the following items via the LaserJet series II control panel: (1) number of copies, (2) manual feed mode, (3) font, and (4) vertical form length (i.e., VMI).
User Default Environment	The User Default Environment consists of the user default settings (any user default settings selected from the control panel) with the remainder of the environment features set to their factory default values.
Vertical Motion Index (VMI)	VMI defines the distance between rows in 1/48 inch increments. This command affects the line feed and half line feed spacing. The factory default VMI is eight which corresponds to six lines per inch. A user default VMI can be selected from the control panel using the FORM menu item.

A

absolute cursor position (hints) 13-4
 absolute motion 6-2
 addressable area 2-2
 architecture, PCL 1-2
 area fill ID command 11-15
 ASCII table A-1
 ASCxx (ASCII string) 10-5
 auto macro overlay (hints) 13-7
 auto-continue mode (hints) 13-12
 auto-continue (definition) Glossary-1
 automatic macro overlay 12-3

B

B (boolean) 10-5
 backspace (BS) 6-7
 baseline distance, font descriptor 10-6
 baud rate (definition) Glossary-1
 binary data 1-6
 bottom margin (hints) 13-3
 boundaries:
 landscape page 2-6
 portrait page 2-5
 printable area 2-5, 2-6
 BS (backspace) 6-7
 buffer I/O (definition) Glossary-4
 buffer overflow (error 22) 13-14

C

cable:
 parallel I/O B-7
 serial I/O B-12
 call, macro 12-3
 carriage return (CR) 6-7
 carriage return suppression (hints) 13-6
 carriage return, interpretation 6-13
 cartridge fonts 8-1

cell height, font descriptor 10-6
 cell width, font descriptor 10-6
 cell 10-2
 Centronics I/O (definition) Glossary-1
 character:
 design dimension 10-2
 group 1-6
 height 7-6, 8-12
 parameterized 1-5
 pitch 7-5, 8-11
 positioning 2-7
 spacing (hints) 13-5
 stroke weight 8-13, 8-14
 style 8-13, 7-7, 8-13
 typeface 8-16
 character cell clipping 2-7
 character cell descriptor features 10-12
 character code command 10-21
 character data example:
 landscape 10-25
 portrait 10-23
 character data 10-18
 character descriptor:
 class 10-17
 continuation 10-16
 delta x 10-18
 format 10-16
 height 10-18
 left offset 10-17
 orientation 10-17
 size 10-17
 top offset 10-17
 width 10-17
 character descriptor and data format 10-15
 character descriptor and data command 10-22
 characteristics, font 7-1, 13-5
 characters, printable (hints) 13-11
 class, character descriptor 10-17
 clear horizontal margin command 5-11
 clipping, character cell 2-7
 column width 6-3

- column (definition) Glossary-1
- columns, distance between 5-15
- combining escape sequences 1-8
- command language, printer 1-1
- command listing (table) A-11
- command parsing (hints) 13-2
- command processing time (hints) 13-8
- command structure, general 1-4
- command, macro control 12-6
- commands:
 - PCL (definition) Glossary-5
 - printer 1-4
 - printer (definition) Glossary-7
- compatibility 1-1
- compatibility with LaserJet software 3-6
- compatibility, LaserJet series II 3-6
- configuration (definition) Glossary-1
- connector:
 - interface (definition) Glossary-4
 - parallel I/O B-2
 - serial I/O B-12
- connector signals, serial I/O B-9
- continuation, character descriptor 10-16
- control code printing 8-23, 13-11
- control code (definition) Glossary-1
- control codes (table) A-2
- control panel (definition) Glossary-1
- control, macro 12-6
- coordinate system 2-3, 10-2
- coordinate system units 6-3
- copies, number of 4-3
- CR (carriage return) 6-7
- current active position (definition) Glossary-1
- cursor 6-1, Glossary-1
- cursor position, absolute (hints) 13-4
- cursor positioning:
 - general 6-1
 - (hints) 13-4
 - horizontal 6-4, 6-5, 6-6
 - push/pop 6-14
 - vertical 6-8, 6-9, 6-10

D

- data command 10-22
- data format 10-15
- data terminal ready protocol B-11
- decimal values, Roman-8 characters A-3
- decipoint 2-4, 6-3
- decipoint (definition) Glossary-1
- default:
 - definition 3-1, Glossary-2
 - factory 3-2
 - factory (definition) Glossary-3
 - HMI 5-15
 - left margin 5-9
 - page length 5-4
 - page orientation 5-6
 - perforation skip 5-14
 - right margin 5-10
 - setting 3-1
 - text length 5-13
 - user 3-3
 - user (definition) Glossary-8
 - VMI 5-16
- default font command 8-22
- deleting fonts 9-3, 9-5
- deleting macros 12-2, 12-4
- delta x, character descriptor 10-18
- descriptor, font/character 10-1
- design dimension, character 10-2
- display functions command 13-11
- document control 4-1
- dot rows, raster graphics 11-2
- dot 2-4, 6-3
- dot (definition) Glossary-2
- download (definition) Glossary-2
- downloading soft fonts 9-2
- DTR handshake B-11
- DTR polarity (definition) Glossary-2



EDP & transaction printers (level II) 1-2
 end raster graphics command 11-8
 end-of-line wrap command (hints) 13-10
 environment:
 factory default 3-1, 3-2
 modified print 3-1
 modified print (definition) Glossary-4
 overlay 12-3
 overlay (definition) Glossary-5
 print (definition) Glossary-7
 user default 3-1, 3-3
 user default (definition) Glossary-8
 error 20 - memory overflow 13-14
 error 21 - print overrun 13-9, 13-14
 error 22, buffer overflow 13-14
 error 40 13-14
 escape character (definition) Glossary-2
 escape sequence listing (table) A-11
 escape sequence syntax 1-5
 escape sequence (definition) Glossary-2
 escape sequences:
 combining 1-8
 parameterized 1-5
 PCL 1-4
 two-character 1-5



factory default (definition) Glossary-2
 factory default environment 3-1, Glossary-3
 factory default settings 3-2
 factory default symbol set 8-6
 features, printer 3-2
 FF (form feed) 6-12
 fill patterns, samples 11-17
 fill rectangular area command 11-18
 first line of print 5-12
 fixed underline 8-24
 fixed vs proportional spacing 7-4, 8-10
 floating underline 8-24
 font cartridge (definition) Glossary-3

font characteristics, priority 8-2
 font characteristics 7-1
 font characteristics (hints) 13-5
 font control command 9-5
 font deletion (hints) 13-7
 font descriptor:
 baseline distance 10-6
 cell height 10-6
 cell width 10-6
 command 10-13
 data 10-14
 font name 10-11
 format 10-3
 (general usage) 10-1
 height extended 10-8
 height 10-8
 orientation 10-6
 pitch extended 10-8
 pitch 10-8
 serif style 10-10
 size 10-5
 spacing 10-6
 stroke weight 10-9
 style 10-9
 symbol set 10-6
 text height 10-11
 text width 10-11
 typeface 10-9
 underline distance 10-10
 underline height 10-10
 width type 10-8
 xheight 10-8
 font examples 7-1
 font management 9-1
 font management example 9-7
 font name, font descriptor 10-11
 font selection:
 by characteristic (hints) 13-5
 by ID 9-6, 13-5
 (general usage) 8-1
 (hints) 13-5
 example 8-19
 summary 8-19

font style:

- italic 8-13
- upright 8-13

font type 10-5

fontid command 9-4

fonts:

- cartridge 8-1
- (definition) Glossary-3
- general 7-1
- (hints) 13-5
- internal 8-1
- internal (definition) Glossary-4
- permanent 9-3, 9-5
- primary 8-4
- primary (definition) Glossary-6
- secondary 8-4
- secondary (definition) Glossary-6
- soft 8-1
- soft (definition) Glossary-7

form feed (FF) 6-12

form feed interpretation 6-13

format:

- character descriptor 10-16
- font descriptor 10-3

formatting, page control 5-1

front panel functionality 3-6

G

general command structure 1-4

graphics:

- errors (hints) 13-14
- patterns 11-12, 11-17
- shading 11-12, 11-18
- raster (definition) Glossary-7
- rule (definition) Glossary-7
- rules 11-18

group character 1-6

H

half-line feed 6-11

handshake timing protocol B-6

handshake, DTR B-11

hardware, serial I/O B-12

height (general usage) 7-6

height character 8-11

height command 8-11

height extended, font descriptor 10-8

height:

- character descriptor 10-18
- (definition) Glossary-3
- font descriptor 10-8
- secondary 8-12

hexadecimal values, Roman-8 characters A-3

history, PCL 1-1

HMI (horizontal motion index) 5-15, 13-4

HMI default 5-15

HMI (definition) Glossary-3

horizontal cursor positioning 6-4, 6-5, 6-6

horizontal margin, clear 5-11

horizontal rectangle size command 11-13

horizontal spacing 8-11

horizontal tab (HT) 6-7

HT (horizontal tab) 6-7

I

I/O buffer (definition) Glossary-4

I/O connector signals, serial B-9

I/O (definition) Glossary-3

ID number:

- font 9-6
- soft fonts 9-2

input signals, parallel I/O B-3

interface connector (definition) Glossary-4

interface throughput (hints) 13-9

interface:

- parallel B-2
- parallel (definition) Glossary-5
- serial B-8
- serial (definition) Glossary-7

interfaces B-1
 internal fonts 8-1
 internal fonts (definition) Glossary-4
 internal unit 2-4
 invocation, macro 12-3
 ISO symbol sets 8-8, 8-18
 italic font style 8-13

J

job control commands 4-1, 5-1
 job control (hints) 13-2
 job structure 4-1

K

key, Reset 3-5

L

landscape character data example 10-25
 landscape character example 10-20
 landscape print boundaries 2-6
 landscape (definition) Glossary-4
 LaserJet series II compatibility 3-6
 left margin default 5-9
 left margin 5-9
 left offset, character descriptor 10-17
 legal page length selection (hints) 13-3
 legal size paper 5-5
 letter page length selection (hints) 13-3
 letterhead macro, example 12-8
 level I (print & space) 1-2
 level II (EDP transaction) 1-2
 level III (word processing) 1-2
 level IV (page formatting) 1-2
 levels, PCL 1-2
 LF (line feed) 6-12
 line driver circuitry, parallel I/O B-7
 line feed (LF) 6-12
 line feed suppression (hints) 13-6
 line feed, interpretation 6-13
 line receiver circuitry, parallel I/O B-7

line spacing command (in lines per inch) 5-17
 line termination 6-13
 logical page boundaries 2-5, 2-6
 logical page 2-2
 logical page (definition) Glossary-4

M

macro:

call 12-3
 control command 12-6
 control 12-6
 creation 12-2
 deletion 12-2, 12-4
 execute 12-3
 (general usage) 12-1
 (hints) 13-7
 ID command 12-4
 invocation 12-3
 number identification 12-5
 overlay 12-3
 overlay (hints) 13-7
 letterhead 12-8
 (definition) Glossary-4
 margin 5-9, 5-10
 margin, top 5-12
 memory overflow (hints) 13-14
 memory usage calculation 13-13
 memory usage (hints) 13-13
 menu (definition) Glossary-4
 modified print environment 3-1, 3-4, Glossary-4

N

non-volatile ram (definition) Glossary-5
 number of copies 4-3

O

- octal values, Roman-8 characters A-3
- off-line (definition) Glossary-5
- on-line (definition) Glossary-5
- orientation:
 - character descriptor 10-17
 - command 8-5
 - (definition) Glossary-5
 - font descriptor 10-6
 - general information 5-6, 7-2
 - raster graphics 11-7
- output signals, parallel I/O B-3
- overlay environment 12-3
- overlay environment (definition) Glossary-5
- overlay:
 - macro 12-3
 - macro (hints) 13-7

P

- page control commands 5-1
- page control (hints) 13-3
- page formatting printers (level IV) 1-2
- page length:
 - command 5-4
 - default 5-4
 - (hints) 13-3
 - settings 5-5
 - value 5-4
- page orientation, default 5-6
- page printing boundaries 2-5, 2-5, 2-6
- page size 5-3
- page size (hints) 13-3
- page, logical (definition) Glossary-4
- paper sizes (in dots) 2-5, 2-6
- paper source commands 5-2
- paper source (hints) 13-3
- parallel connector pin assignments B-2
- parallel interface B-2
- parallel I/O:
 - cable B-7
 - connector B-7
 - (definition) Glossary-5
 - handshake timing B-6
 - hardware B-7
 - line driver circuitry B-7
 - line receiver circuitry B-7
 - signals B-3
- parameterized character 1-5
- parameterized escape sequences 1-5
- parsing, PCL command (hints) 13-2
- patterns, graphics 11-12, 11-17
- PCL:
 - architecture 1-2
 - command processing time (hints) 13-8
 - commands (definition) Glossary-5
 - coordinate system units 2-4
 - coordinate system 2-3
 - coordinates (definition) Glossary-6
 - escape sequences 1-4
 - history 1-1
 - levels 1-2
 - system units (definition) Glossary-6
- perforation region 5-8, 5-14
- perforation skip:
 - default 5-14
 - (definition) Glossary-6
 - (general usage)..... 5-8, 5-14
- performance (hints) 13-8
- permanent fonts 9-3, 9-5
- permanent image (definition) Glossary-6
- permanent macros 12-4
- physical coordinate system 10-2
- physical page size (in dots) 2-5, 2-6
- pin assignments:
 - parallel B-2
 - serial I/O B-9
- pitch:
 - command 8-11
 - (definition) Glossary-6
 - extended, font descriptor 10-8
 - font descriptor 10-8
 - (general usage) 7-5

point (definition) Glossary-6

portrait character data example 10-23

portrait character example 10-19

portrait orientation (definition) Glossary-6

portrait print boundaries 2-5

positioning, cursor 6-1

preforation region (definition) Glossary-6

primary font 8-4

primary font (definition) Glossary-6

print & space printers (level I) 1-2

print boundaries 2-5, 2-6

print data processing time (hints) 13-8

print environment:

- (definition) Glossary-7
- factory default 3-2
- general information 3-1

print overrun (hints) 13-9, 13-14

print shading/pattern graphics 11-18

printable area boundaries 2-5, 2-6

printable area 2-4

printable area (definition) Glossary-6

printable characters (hints) 13-11

printable control codes (hints) 13-11

printer command language 1-1

printer command listing (table) A-11

printer commands 1-4

printer commands (definition) Glossary-7

printer default settings 3-2

printer features 3-2

printer reset 4-2

printing all character codes 8-23

printing control codes (hints) 13-11

printing patterns/shading 11-15

priority, font characteristics 8-2

programming errors, common 13-14

proportional vs fixed spacing 7-4, 8-10

protocol:

- data terminal ready B-11
- xon/xoff B-10

push/pop cursor positioning 6-14

R

raster graphics:

- (definition) Glossary-7
- (general usage)..... 11-2
- memory usage (hints) 13-13
- orientation 11-7
- resolution command 11-4
- resolution (hints) 13-6
- throughput (hints) 13-6

rectangular area fill 11-12

rectangular area (definition) Glossary-7

relative motion 6-2

Reset key 3-5

Reset menu 3-5

reset (hints) 13-2

resolution, raster graphics 11-4, 13-6

right column 5-10

right margin default 5-10

right margin 5-10

robust xon/xoff B-10

robust-xon (definition) Glossary-7

Roman-8 character conversion, table A-3

Roman-8 character set, table A-1

row (definition) Glossary-7

rows 6-8

RS-232C operation B-8

RS-422 operation B-8

rules graphics 11-18

rules graphics (definition) Glossary-7

S

SB (signed byte) 10-5

secondary font table 8-4

secondary font 8-4

secondary font (definition) Glossary-6

secondary height 8-12

selecting RS-232C/RS-422 operation B-8

selection:

- default font 8-22
- font 8-1

serial I/O:

- cable B-12
- connector signals B-9
- connector B-12
- (definition) Glossary-7
- data format B-10
- data throughput B-10
- hardware B-12
- serial protocol B-10
- serif style, font descriptor 10-10
- settings:
 - factory default 3-2
 - page length 5-5
- shading levels, samples 11-16
- shading, graphics 11-12, 11-18
- SI (shift in) 8-4
- SI (signed integer) 10-5
- size:
 - character descriptor 10-17
 - font descriptor 10-5
- SO (shift out) 8-4
- soft fonts:
 - (definition) Glossary-7
 - downloading 9-2
 - general information 8-1
 - temporary 9-3, 9-5
- solid-filled rectangular area Glossary-7
- SP (space) 6-7
- spacing:
 - character (hints) 13-5
 - command 8-10
 - (definition) Glossary-7
 - (general usage) 7-4
 - font descriptor 10-6
- specifications, page boundaries 2-5, 2-6
- start raster graphics command 11-5
- stroke weight:
 - command 8-14
 - (definition) Glossary-8
 - font descriptor 10-9
 - (general usage) 7-8

style:

- command 8-13
- (definition) Glossary-8
- font descriptor 10-9
- (general usage) 7-7
- symbol sets:
 - command 8-6
 - (definition) Glossary-8
 - font descriptor 10-6
 - (general usage) 7-3
 - ISO 8-8, Glossary-4
 - listing 8-7
 - user/factory default 8-6
 - values, font descriptor 10-7
- syntax, escape sequence 1-5

T

table:

- ASCII A-1
- control codes A-2
- printer commands A-11
- Roman-8 character conversion A-3
- Roman-8 A-1
- temporary macros 12-4
- temporary soft fonts 9-3, 9-5
- termination character 1-6
- text area 5-7
- text area/margins (hints) 13-3
- text height, font descriptor 10-11
- text length:
 - command 5-13
 - default 5-13
 - (hints) 13-3
- text printing 5-7
- text width, font descriptor 10-11
- thickness, character 8-14
- throughput:
 - interface (hints) 13-9
 - raster graphics (hints) 13-6
 - serial B-10

timing diagram, parallel I/O B-6
 top margin command 5-12
 top margin (hints) 13-3
 top offset, character descriptor 10-17
 transfer raster data command 11-6
 transparent print data command 8-23
 transparent print data (hints) 13-5
 troubleshooting command (hints) 13-10
 two-character escape sequences 1-5
 typeface (general usage) 7-9
 typeface command 8-16
 typeface values:
 assigned numbers 8-16
 font descriptor 10-9
 typeface, font descriptor 10-9
 typeface (definition) Glossary-8

U

UB (unsigned byte) 10-5
 UI (unsigned integer) 10-5
 underline:
 command 8-24
 distance, font descriptor 10-10
 fixed 8-24
 floating 8-24
 height, font descriptor 10-10
 units, PCL coordinate system 2-4
 upright font style 8-13
 user default:
 (definition) Glossary-8
 environment 3-1, 3-3
 environment (definition) Glossary-8
 symbol set 8-6

V

value field 1-6
 value, page length 5-4
 vertical cursor positioning 6-8, 6-9, 6-10
 vertical motion index (definition) Glossary-8
 vertical rectangle size command 11-14
 VMI (vertical motion index) 5-16
 VMI default 5-16
 VMI (definition) Glossary-8

W

width type, font descriptor 10-8
 width, character descriptor 10-17
 word processing printers (level III) 1-2

X

xheight, font descriptor 10-8
 xon/xoff protocol B-10
 xon/xoff robust protocol B-10

ESCAPE SEQUENCES

E_C E 3-5	E_C (s#W [descriptor and data] 10-22
E_C &a#C 6-4	E_C)#X 9-6
E_C &a#H 6-5	E_C)3 8-22
E_C &a#L 5-9	E_C)ID 8-6
E_C &a#M 5-10	E_C)s#B 8-14
E_C &a#R 6-8	E_C)s#H 8-11
E_C &a#V 6-9	E_C)s#P 8-10
E_C &d#D 8-24	E_C)s#S 8-13
E_C &f#X 12-5	E_C)s#T 8-16
E_C &f#Y 12-5	E_C)s#V 8-12
E_C &k#G 6-13	E_C)s#W [font descriptor] 10-13
E_C &k#H 5-15	E_C *b#W 11-6
E_C &l#A 5-3	E_C *c#A 11-13
E_C &l#C 5-16	E_C *c#B 11-14
E_C &l#D 5-17	E_C *c#D 9-4
E_C &l#E 5-12	E_C *c#E 10-21
E_C &l#F 5-13	E_C *c#F 9-5
E_C &l#H 5-2	E_C *c#G 11-15
E_C &l#L 5-14	E_C *c#H 11-13
E_C &l#O 8-5	E_C *c#P 11-18
E_C &l#P 5-4	E_C *c#V 11-14
E_C &l#X 4-3	E_C *p#X 6-6
E_C &p#X 8-23	E_C *p#Y 6-10
E_C &s#C (hints) 13-10	E_C *r#A 11-5
E_C (#B 8-14	E_C *rB 11-8
E_C (#X 9-6	E_C *t#R 11-4
E_C (3 8-22	E_C 9 5-11
E_C (ID 8-6	E_C d 8-24
E_C (s#H 8-11	E_C E 3-5, 4-2
E_C (s#P 8-10	E_C Y 13-10
E_C (s#S 8-13	E_C Z 13-10
E_C (s#T 8-16	
E_C (s#V 8-12	

Sales and Service Offices

Calling for Help

To find an Authorized HP Dealer call: (800) 367-4772

To find an Authorized HP Service Dealer call: (800) 835-4747

Or contact one of the regional offices below:

United States:

Hewlett-Packard
4 Choke Cherry Road
Rockville, MD 20850
(301) 948-6370

Hewlett-Packard
5201 Tollview Drive
Rolling Meadows, IL 60008
(312) 255-9800

Hewlett-Packard
5161 Lankershim Blvd.
North Hollywood, CA 91601
(818)505-5600

Hewlett-Packard
2000 South Park Place
Atlanta, GA 30339
(404) 955-1500

Canada:

Hewlett-Packard (Canada) Ltd.
6877 Goreway Drive
Mississauga, Ontario
Canada, L4V 1M8
(416) 678-9430

Europe:

Hewlett-Packard S.A.
World Trade Center
110 Avenue Louis Casai
1215 Cointrin, Geneva, Switzerland
(022) 98 96 51

Australia/New Zealand:
Hewlett-Packard Australia Ltd.
31-41 Joseph Street
Blackburn, Victoria 3130, Australia
895-2895

Japan:
Yokogawa-Hewlett-Packard Ltd.
29-21, Takaido-Higashi 3-chome
Suginami-ku, Tokyo 168
(03) 331-6111

Far East Area:
Hewlett-Packard Asia Ltd.
47/F, 26 Harbour Road.
Wanchai, Hong Kong
G.P.O. Box 863, Hong Kong
5-8330833

Latin America:
Hewlett-Packard Co.
InterContinental Headquarters
3495 Deer Creek Road
Palo Alto, CA 94304 USA
(415) 857-1501



HEWLETT
PACKARD



HEWLETT
PACKARD

LaserJet series II Technical Reference Manual

33440-90905
Edition 1
E0587
Printed in U.S.A. 8/89