

 **IntelliBar**

Label Printer

Models 48, 412, and 88

Programmer's Reference Guide



Advancing the way the world prints labels...

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Preface

This IntelliBar Programmer's Reference Guide contains programming and hardware interface information written for programmers who want to generate labels from a data stream.*

An understanding of the HP PCL language, ASCII coding, hexadecimal numbers, and BASIC programming is useful when referencing several of the sections in this manual.

The manual is organized as follows:

A list of the abbreviations used in this manual follows the preface.

Section 1 HP PCL Background describes page characteristics, the HP PCL coordinate system, and the printable area of a label.

Section 2 IntelliBar Extensions to HP PCL Commands describes print and format command extensions and bar code generation command extensions.

Section 3 HP PCL Print Commands describes standard HP PCL commands you can use to control the printing operation.

Section 4 HP PCL Page Format Commands describes page format commands you can use to set page length, margins, orientation, and other features.

Section 5 HP PCL Cursor Position Commands explains commands you can use to set the active print position (or cursor position) in the printable area of the label.

Section 6 HP PCL Font Characteristics discusses the characteristics of a font and the commands you can use to select a font for printing. It also describes primary and secondary fonts.

Section 7 HP PCL Font Management and Soft Font Downloading describes the commands you use to download soft fonts to the printer's virtual memory, as well as commands for deleting a font.

Section 8 HP PCL Soft Font Design explains the commands and criteria you use to design a soft font.

Section 9 HP PCL Graphics Commands provides the commands you use to create raster images and fill (or shade) graphics.

Section 10 HP PCL Macro Commands and Programming Hints explains how you can create and control temporary and permanent macros to make more efficient use of your printer. This appendix also contains information useful for PCL software development.

Section 11 IntelliBar SAP Device Types a reference for programming the custom SAP device types for IntelliBar printers.

RELATED DOCUMENTS

The following documents provide detailed information about the IntelliBar printer and PCL 5:

- *IntelliBar User's Guide*
describes the operation of the IntelliBar printer. Available from IntelliTech International, Inc.
- *PCL Printer Language Technical Reference Manual*
describes the PCL 5 language codes and escape sequences for experienced users and programmers. Available from Hewlett-Packard (Part number 5961-0509)
- *Printer Job Language Technical Reference Manual*
describes the printer job language (PJM) for experienced users and programmers. Available from Hewlett-Packard (Part number 5961-0509)
- *PCL/PJM Technical Quick Reference Guide*
Available from Hewlett-Packard (Part number 5961-0512)

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Section 1

PCL Background

PAGE CHARACTERISTICS

This section describes the system and page characteristics. The IntelliBar defines a label (or page) by using the HP PCL coordinate system.*

Addressable Area

The addressable area describes the area within which the active printing position (or cursor) can move to print. By using the cursor positioning commands (see Section 4), you can move the cursor to different locations within the addressable area. You cannot move the cursor outside the area.

PCL Coordinate System

The PCL coordinate system uses an x-y axis with its origin (point 0,0) on the left edge and at the top margin of the addressable area. Figure 1-1 shows the coordinate system. The position of the origin can change if the top margin position is changed through a printer command.

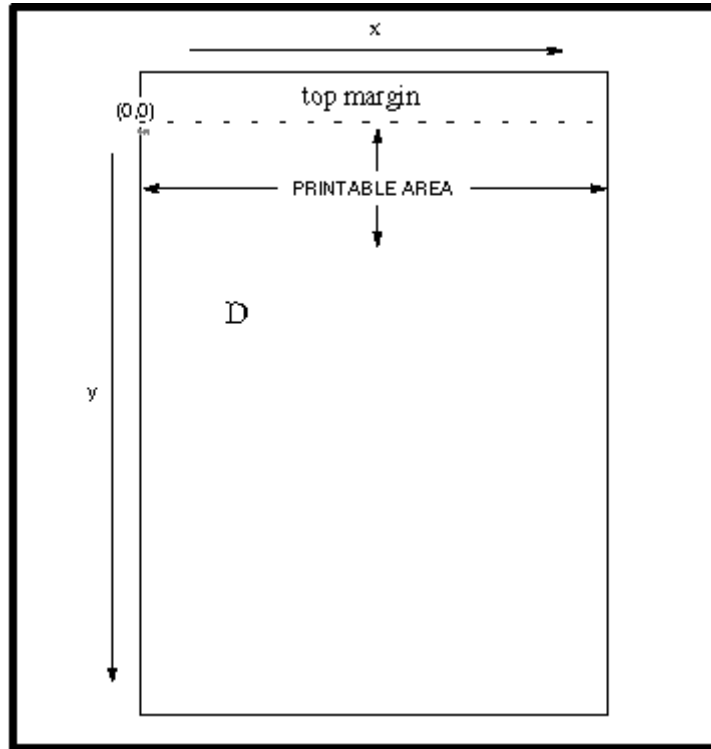


Figure 1-1 PCL Coordinate System

Points within the PCL coordinate system can be expressed in dots, decipoints, columns (for the x-axis) and rows (for the y-axis).

The dot represents the smallest printable point with a size equal to 1/300 inch. Printer resolution refers to the number of dots per inch.

PRINTABLE AREA

The printable area refers to that part of the label where printing is possible. Within the area, the printer can position at least one dot. Figure 1-2 shows the printable area.

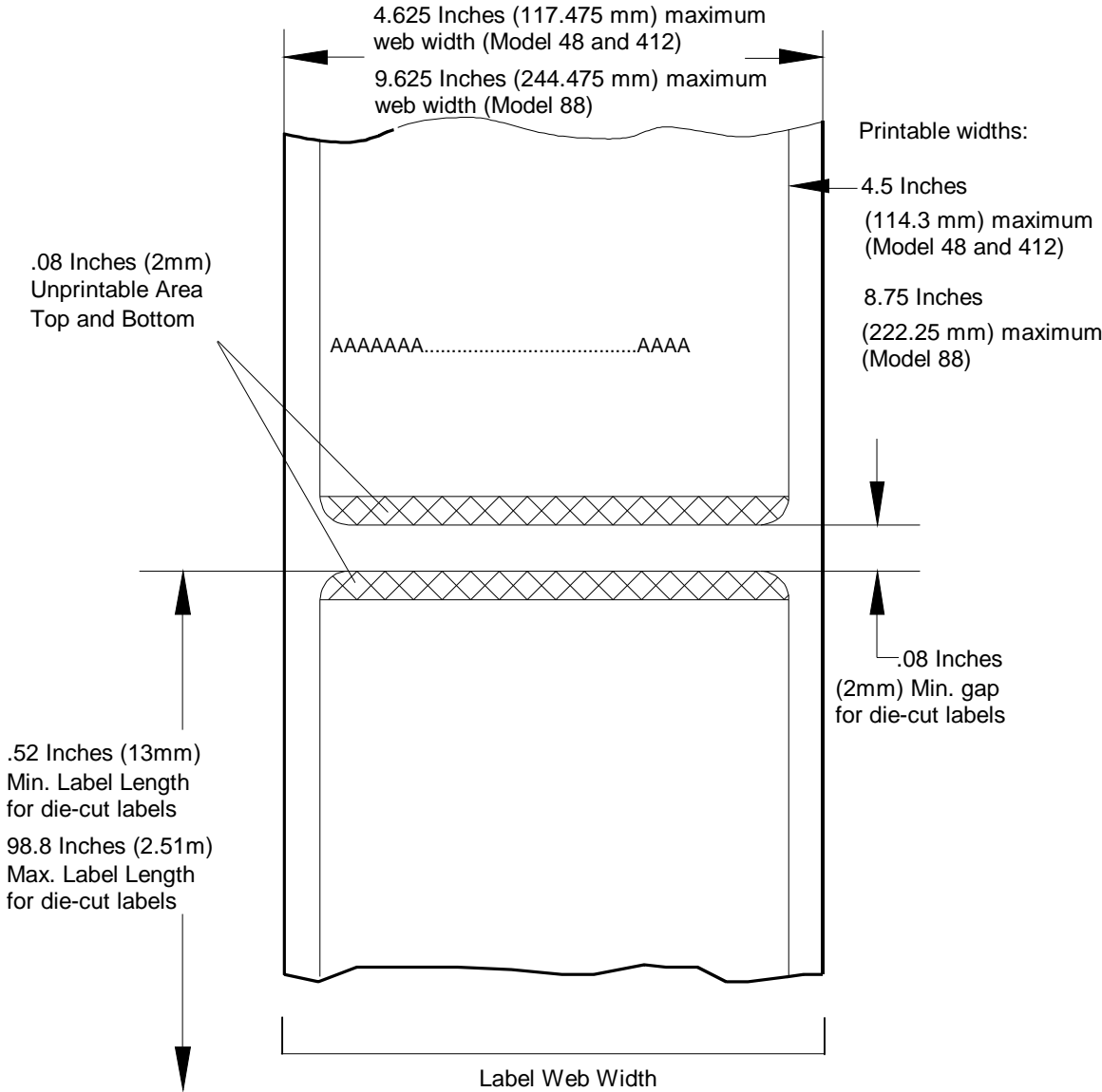


Figure 1-2 Printable Area

Orientation

The printable area defined in PCL can have either of two standard orientations: portrait or landscape. The relationship between the printable area and the two orientations is shown in following figures. Portrait orientation can be used for most printing applications. Landscape orientation is useful for printing larger labels.

Range

The IntelliBar can print in four different different orientation ranges:

- portrait (0 degrees rotation)
- landscape (90 degrees rotation)
- reverse portrait (180 degrees rotation)
- reverse landscape (270 degrees rotation).

This range of orientations provides tremendous versatility for printing complex label designs. Figure 1-3 provides an example of each orientation.

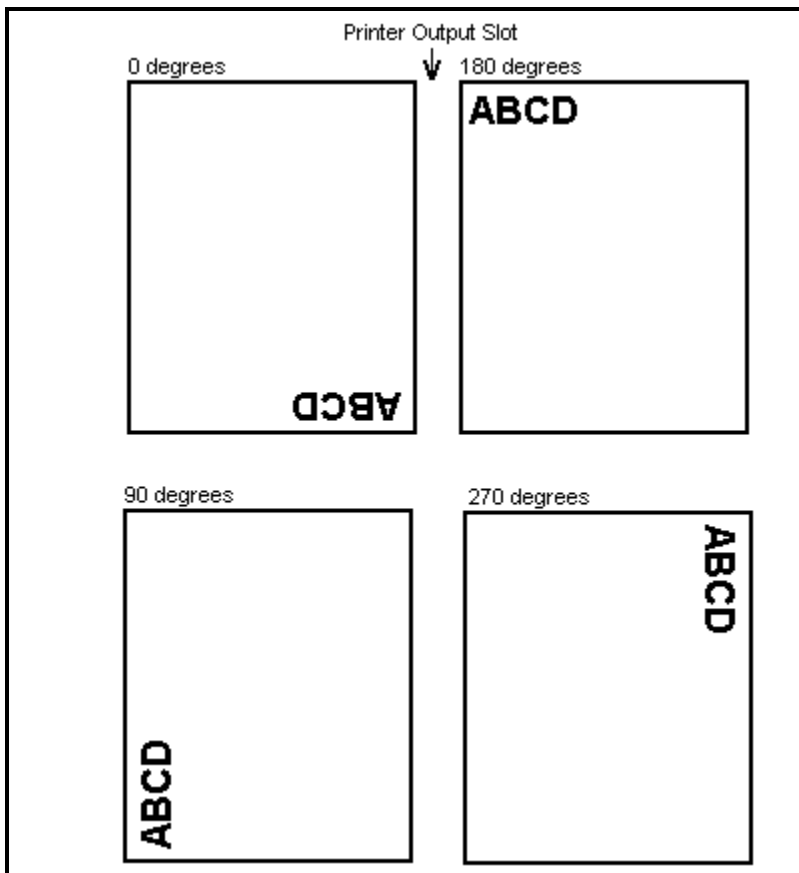


Figure 1-3 Orientation Examples

PCL Portrait Orientation Print Area

Figure 1-4 shows the PCL portrait orientation print area.

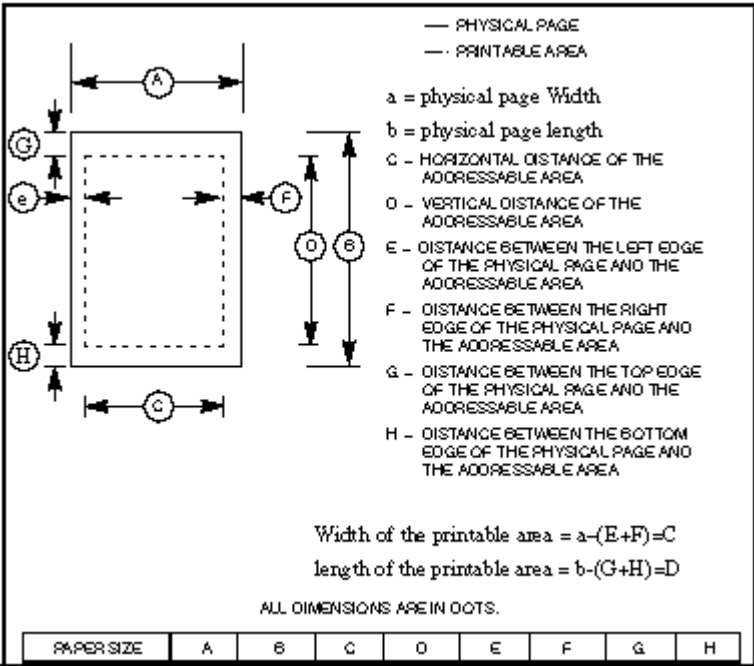


Figure 1-4 PCL Portrait Orientation Print Area

Landscape Orientation Print Area

Figure 1-5 shows the landscape orientation print area.

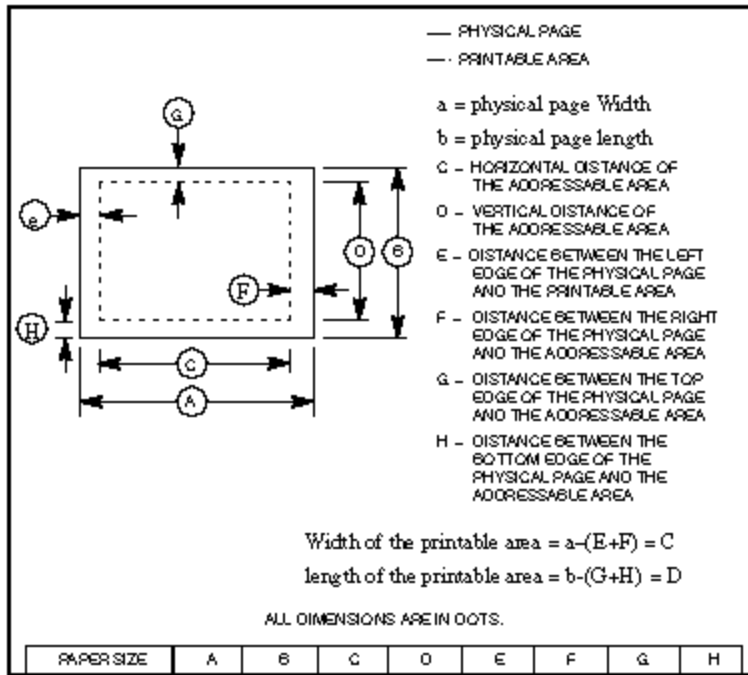


Figure 1-5 Landscape Orientation Print Area

Character Clipping

The printable area has tightly defined boundaries. If any part of a character falls outside of the printable area, it will not print. The printer will treat the character as a space (see Figure 1-6).

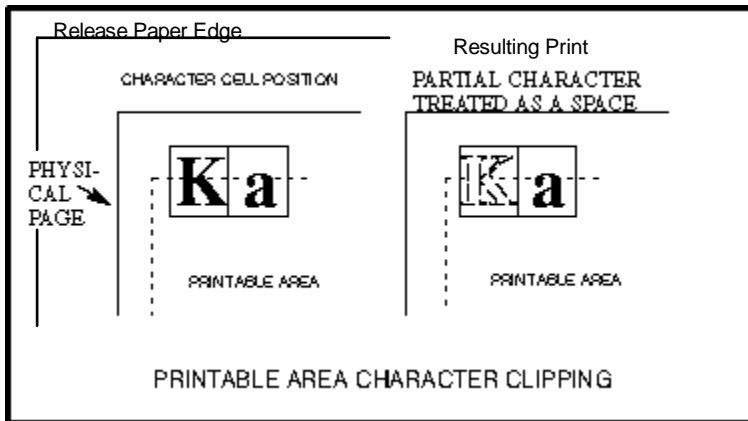


Figure 1-6 Character Clipping

Raster Graphic Clipping

If raster graphics or rules are being printed and the cursor is initially positioned within the printable area, only that portion of the image that is outside the printable area will be clipped (see Figure 1-7).

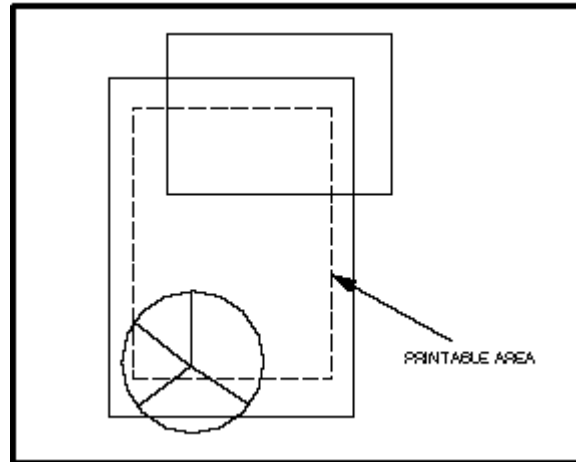


Figure 1-7 Raster Graphic Clipping

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Section 2

IntelliBar Extensions to HP PCL Commands

This section describes IntelliBar HP PCL print and format command extensions and bar code generation command extensions.*

PRINT AND FORMAT COMMAND EXTENSIONS

The following print and format extension commands have been added to the existing IntelliBar HP PCL5 command set to take full advantage of features found in the printer.

NOTE: If you are using multiple print and format extension commands to control the printer, the IntelliBar PCL5 Extension Commands should be sent in the following order.

- Variable Form Length— defines printable area on labels longer or shorter than 11 inches, clarifies label length and character clipping
- Print Speed — controls the IntelliBar printing speed
- Density — controls print density (lightness/darkness of printed image)
- Print and Tear — executes the tear command
- Print and Cut — controls the operation of the optional cutter bar

You can easily control printer operation using these five extension commands (plus the standard HP PCL reset, number of copies, and text position commands described in Section 3).

In the following sections, the name of the command is followed by the escape sequence, its decimal and hex formats, and a description of how to use the command.

Variable Form Length

ESC !f1Z

Decimal: 027 033 102 049 090

Hex: 1B 21 66 31 5A

Use the Variable Form Length command to define the size of printable area on the label, clarify the label length, and eliminate character clipping.

This command enables variable form length and sets the job (page) size to the last selected value (Letter, Executive, A4, Legal, COM-10, Monarch C5, or DL).

Variable Form Length consists of a command group used to define labels longer or shorter than 11-inches. The command group includes

- Setting Variable Form Length
- Disabling Variable Form Length

In all cases, the top of the logical page corresponds to the top of the printable area.

If “Ignore Margins” is set using the control panel menu buttons, or if a host command is received to set the top margin to zero (0), the vertical cursor position of 0 is printable as the first printable scan line on the page. (Vertical cursor positioning in PCL is relative to the top margin). The exact location of this scan line varies with the setting of the Print Position command in the Adjustment Menu (± 3 mm).

See “Left Margin,” “Right Margin,” and “Top Margin” in Section 3 for information on margin settings for standard label sizes.

Use the following software command group to define the printable area of labels larger or smaller than 11 in. The allowable range of values is 0.5 in. to 99 in.

Setting Variable Form Length

This command is used to define labels longer or shorter than 11-inches. The allowable range is 0.5 inches to 99 inches.

ESC !f#Z

Decimal: 027 033 102 #.# 090

Hex: 1B 21 66 #.# 5A

- #: 1 = enables variable form length and sets job (page) size to the last selected value.
- # = enables variable form length and sets page length to #, where # is the form length in printer scan lines. There are 300 scan lines per inch.
- 0 = disables the variable form feature

This command sets the form length by measuring the length of the label and multiplying by 300. For example, a five-inch label has 1500 scan lines (5 x 300).

Continuous Media

For continuous media, setting the Variable Form Length command causes a soft engine reset to be executed with the label pitch length set to the form length +2 mm gap.

Therefore, the logical paper length (bitmap size) and the paper movement are always synchronized.

If Variable Form Length is not set, or the form length is set to 0, or a reset (ESC E) is received, the logical paper length and paper movement are set from the control panel using the “Operator Panel” parameter under “Label Menu.”

NOTE: Under “Label Menu”, there exists a “Label Measurement” selection that contains three choices: “Automatic”, “Fixed,” or “Operator Panel.” This selection determines how the printer synchronizes form length and label length. For example, when set to “Automatic,” the printer advances a certain number of die-cut labels during power-up in order to calculate label and label gap lengths. When set to “Fixed,” the value calculated from the last “Automatic” measurement is stored and used at power-up. This prevents feeding of blank labels. When set to “Operator Panel,” you must manually enter the label length and label gap length into NVRAM for use during power-up calculations. “Operator Panel” is primarily used for continuous label, ticket, or tag media.

Die Cut Media

For die-cut media, the Variable Form Length command changes the logical paper length (bitmap size) to the specified length. However, the pitch length in the printer remains as “Measured” (read by the “Fixed” control panel setting) or it can be set using the “Operator Panel” parameter under “Label Menu.” If the specified form length is less than the printer’s value, white space shows in each label. If the specified form length is greater than the printer’s value, the page will be formatted internally as specified, but all printing outside the engine printable area will be clipped. This is consistent with the PCL command language and allows relative movements from the bottom of the edge of the logical page to position correctly.

Within “Label Menu” exists a “Label Measurement” selection that contains three choices: “Automatic”, “Fixed”, and “Operator Panel”. These selections determine how the printer synchronizes form length and label length.

If no Variable Form Length command is received, or the form length is set to 0, or a reset (ESC E) command is received, the logical paper length and the paper movement are determined by the value measured by the control panel's "Automatic" or "Fixed" or "Operator Panel" parameters. (The self-test is printed under these conditions.)

In PCL, Line Feeds off the bottom of the logical page cause a form feed, but vertical cursor positioning commands off the bottom of the logical page position the cursor to the logical page limit without printing the page.

Disabling Variable Form Length

ESC!f0Z
Decimal: 027 033 102 048 090
Hex: 1B 21 66 30 5A

This command disables the Variable Form feature.

Print Speed

ESC !p###S
Decimal: 027 033 112 ### 83
Hex: 1B 21 70 ## 53

where ### is a number (mm) that represents increasing print speeds (see Table 2-1).

This command controls the IntelliBar printing speed. For example, ESC !p15S sets the printing speed to 15 mm/sec (0.6 in/sec).

Table 2-1 IntelliBar Print Speed Command Codes

### Value	Print Speed
15	15 mm/sec (0.6 in/sec)
20	20 mm/sec (0.8 in/sec)
30	30 mm/sec (1.2 in/sec)
40	40 mm/sec (1.6 in/sec)
60	60 mm/sec (2.4 in/sec)
80	80 mm/sec (3.1 in/sec)
100	100 mm/sec (3.9 in/sec)
120	120 mm/sec (4.7 in/sec)
150	150 mm/sec (5.9 in/sec)
200	200 mm/sec (7.9 in/sec)
250	250 mm/sec (9.8 in/sec)
300	300 mm/sec (11.8 in/sec)

Print Density

ESC !d##A

Decimal: 027 033 100 ## 65

Hex: 1B 21 64 ## 41

##: print head voltage adjustment value

This command lets you adjust the black/white contrast between the output and the label (print density) by adjusting the temperature of the print head.

ESC!d##A sets the print density for all subsequent printing, where ## = -15 to +15 (default is 0). Positive values for ## increase voltage and result in darker print; negative values decrease voltage and result in lighter print.

For example, ESC!d-3 sets the print density to a value of -3.

Print and Tear

ESC !n##T

Decimal: 027 033 110 ## 084

Hex:: 1B 21 6E ## 54

where ## equals the tear-off frequency (1 to 99, default = 1)

This command instructs the printer to print (##) labels, and then the printer pauses (with the “Tear Off Label” instruction appearing in the control panel LCD). The bottom of the last printed label is positioned at the tear bar for easy tear off. After you tear off the label stock, printing resumes automatically for the next ## labels.

For example, ESC !n3T issues a pause after every 3 labels.

NOTE: If the number of labels in the print job is less than the tear-off frequency (##), the “Tear Off Label” instruction is not displayed on the control panel LCD, and the bottom of the last printed label is not positioned at the tear bar.

For example, if the tear-off frequency is set to 15 (ESC!n15T) and the total number of labels to be printed is 20, you are prompted to tear off labels after the 15th label. After you have torn off the label, the remaining five labels print to the bottom of the 20th label positioned under the print head, not the tear bar.

Print and Cut

ESC !n##C

Decimal: 027 033 110 ## 067

Hex: 1B 21 6E ## 43

where ## equals the cut-off frequency (1 to 99, default = 1)

Use this command to control how many labels pass through the output slot before a cutting action occurs. For example, ESC !n3C issues a cut after every 3 labels.

NOTE: If the number of labels in the print job is less than the cut-off frequency (##), the last printed label is not cut.

For example, if the cut-off frequency is set to 15 (ESC!n15C) and the total number of labels to be printed is 20, cutting occurs after the 15th label. The remaining five labels will print, but no cutting occurs after the 20th label.

PCL BAR CODE COMMAND EXTENSIONS

Use the following command extensions to create bar codes with the printer's internal bar code capability. Familiarity with HP PCL is required.

NOTE: When using multiple bar code commands, send them in the following order:

First command = Set Bar Code Type
Second command = Set Bar Code Height,
Width, etc. (specific order does not matter)
Third command = Print Bar Code

Set Bar Code Type

ESC!b#C

Decimal: 027 033 098 # 067

where # is a number that sets the bar code type as follows:

- 0 only print text (default)
- 1 UPC-A
- 2 UPC-E
- 5 Code 39
- 12 Code 93
- ... etc (see below).

Supported Bar Codes

The type of bar code that you wish to produce is passed to Bar Code Library as a number in the Bar Type parameter. The following is a list of numbers to use for each bar code type:

- 1 UPC-A
- 2 UPC-E
- 3 EAN/JAN-13 (with or without 2 or 5 digit supplements)
- 4 EAN/JAN-8 (with or without 2 or 5 digit supplements)
- 5 3 of 9 (Code 39)
- 6 Extended 3 of 9
- 7 Interleaved 2 of 5
- 8 Code 128
- 9 Codabar
- 10 Zip + 4 Postnet
- 11 MSI Plessey
- 12 Code 93
- 14 UCC-128
- 15 HIBC
- 16 UPC/EAN extension (2 or 5 digit supplemental)
- 17 PDF 417

Set Bar Code Height (Decipoints)

ESC!b#H

Decimal: 027 033 098 # 072

where # is a number that sets the bar code height in decipoints (1/720 inch)

Default = 720 decipoints (1 inch)

Set Bar Code Height (Dots)

ESC!b#J

Decimal: 027 033 098 # 074

where # is a number that sets the bar code height in picture elements (pixels) (1/300 inch)

Default = 300 pixels (1 inch)

Set Bar Code Width (Dots)

ESC!b#N

Decimal: 027 033 098 # 078

where # is a number that sets the width of a narrow bar in dots (1/300 inch for IntelliBar)

Default = 2 dots

Range 1 to 6

Set Bar Code Ratio (Code 39, Extended 3 of 9, and Interleaved 2 of 5)

ESC!b#R

Decimal: 027 033 098 # 082

where # is a number that sets the ratio of wide to narrow bars as follows:

- 1 Ratio of 2 to 1
- 2 Ratio of 5 to 2 (narrow bar is double setting of width)
- 3 Ratio of 3 to 1 (default)

Set Bar Code 128 Subset Mode

ESC!b#S

Decimal: 027 033 098 # 083

where # is a number that sets subset mode for Code 128 bar codes as follows:

- 0 Automatic subset switching (default)
 - 1 Subset A (upper case/control characters)
 - 2 Subset A (upper and lower case characters)
 - 3 Subset A (double density numbers)
-

Set UPC-E Bar Code Method

ESC!b#E

Decimal: 027 033 098 # 069

where # is a number that sets the UPC-E bar code method as follows:

- 0 Requires 11 digits to print 6 digit bar code (default)
- 1 System 0 (6 digit input string)
- 2 System 1 (6 digit input string)

Print Human-Readable Text

ESC!b#T

Decimal: 027 033 098 # 084

where # is a number that determines the position of human-readable text as follows (printed with the currently selected font):

- 0 Disable (default)
- 1 Enable printing below barcode with check digit
- 2 Enable printing below bar code with check digit
- 3 Enable printing above bar code without check digit
- 4 Enable printing above bar code without check digit
- 5 Enable printing in NOTCHED bar code with check digit
- 6 Enable printing in NOTCHED bar code without check digit

The following symbologies print the human-readable check digit in the text (if enabled):

UPC-A	Code 39	Interleaved 2 of 5
EAN/JAN-8	Extended 3 of 9	Codabar
EAN/JAN-13	Code 93	HIBC
UCC-128	Extended 93	MSI Plessey (Mod 10)

Human-Readable Positioning with Bar Code

The text is centered horizontally above or below the bar code. Text printed *above* the bar code has a baseline at $1/4$ of the vertical motion index (VMI) + 5 scan lines above the top of the bar code. This leaves space for descenders and 5 blank scan lines. Text printed below the bar code has a baseline at 1 VMI below the bottom of the bar code.

Positioning after Printing a Bar Code

The horizontal position is restored. The vertical position is at the scan line after the bottom of the bar code if no text is printed or if the text is printed above the bar code. The vertical position is a VMI (line feed) below the text if text is printed below the bar code.

Printing in Notched Bar Code

The NOTCHED option only applies to UPC-A, UPC-E, EAN-8, and EAN-13 bar code types (and *only* if 2 or 5 supplemental digit code *is not* included). If the supplemental digits are included in these four bar code types, NOTCHED printing is ignored and printing defaults to below the bar code.

It is important that the application selects an appropriate size font and set the vertical motion index (VMI) accordingly when using the NOTCHED option. The depth of the NOTCH is 1/2 of the VMI and the characters are printed with the baseline at 3/4 of the VMI from the top of the notched area. The characters are evenly spaced within the notched area.

Calculate Optional Check Digit

ESC!b#K

Decimal: 027 033 098 # 075

where # is a number that enables/disables optional check digit calculation as follows:

- 0 Disable(default)
- 1 Enable
- 2 Enable optional second check digit

The following symbologies print the human-readable check digit in the text (if enabled):

UPC-A	Code 39	Interleaved 2 of 5
EAN/JAN-8	Extended 3 of 9	Codabar
EAN/JAN-13	Code 93	HIBC
UCC-128	Extended 93	MSI Plessey (Mod 10)

The following symbologies always calculate a checksum:

UPC-A	Code 128
UPC-E	UCC-128
EAN/JAN-8	MSI Plessey (Mod 10)
EAN/JAN-13	Zip+4 Postnet

The following symbologies calculate a checksum if Optional Check Digit is enabled:

Code 39	Extended 39
HIBC	Code 93
Extended 93	Interleaved 2 of 5
Codabar (Mod 16)	MSI Plessey 2 (Mod 10)

Setting the Optional Check Digit to 2 has the following effect:

Codabar calculates Mod 10 checksum.

MSI Plessey calculates 1 Mod 11 and Mod 10 checksum.

PDF417 Bar Code

PDF417 bar code capability is implemented with the following features.

Additional # for Bar Code Type selection:

ESC!b#c – Set Bar Code Type, where # is:

17 = PDF417 type bar code

Escape sequences:

ESC!b#B – Enable/disable Binary Only Mode, where # is:

0 – disable Binary Only Mode (default)

1 – enable Binary Only mode (determinant symbol size)

ESC!b#D – Set RESOLUTION for encoding data to printer.

Default = 100 DPI

Range: 75, 100, 150, 300

ESC!b#F – Enable/Disable TRUNCATED PDF symbols.

0 – disable Truncated Mode (default)

1 – enable Enable Truncated Mode

ESC!b#L – Set ECC (Error Correction Code) LEVEL

Default = 0 (i.e. Use Percentage command “ESC!b#P”).

Range: 0 through 8

ESC!b#P – Set ECC LEVEL as a PERCENTAGE of data code words

Default = 10 (10% of data code words).

Range: 0 through 400

ESC!b#Q – Set mode for stripping bits to compensate for bleeding.

0 – no reduction (default)

1 – reduce Bar Height (only valid if Y SCALE > 1)

2 – reduce Bar Width (only valid if X SCALE > 1)

3 – reduce both Bar Height and Bar Width(valid as above)

ESC!b#U – Set Row count used for sizing a PDF symbol.

Default = 0

Range: 0, 3 through 90

ESC!b#V – Set Column count used for sizing the PDF symbol.

Default = 0

Range: 0 through 30

If both ROW and COLUMN count are defaulted to 0, the bar code aspect ratio is set to 1:2, i. e., the bar code will be twice as wide as it is high

ESC!b#X – Set X Scale, also known as X Element Size (multiple of Resolution) in mils (thousandths of an inch)

Default = 1

Range 1 through 20

An X Scale of 1 with a Resolution of 100 DPI generates an X Element Size of 10 mil.

ESC!b#Y – Set Y Scale (also known as module aspect ratio), which sets the row height as an integer multiple of the X element size.

Default = 3

Range 1 through 10

Print Bar Code

ESC!b#W [data]

Decimal: 027 033 098 # 087

Prints the bar code for the given # of characters of ASCII data at the current position.

Prints only text if the Bar Code Type is 0.

If a bar code is being printed, the top, left corner of the bar code will be at the current position. If only text is being printed, the left, baseline of the first character will be at the current position. (The only reason for using this command to print only text is in order to utilize the auto-incrementing option (see below).

Auto Incrementing/Decrementing Fields

This feature lets you automatically increment or decrement fields when multiple copies of a page are requested. The following two extension commands are available:

ESC!b#I

where # is a number that increments/decrements subsequent bar code or string fields as follows:

0	Disables incrementing fields (default)
1 to 32767	Increments field by the specified number
-1 to -32767	Decrements field by the absolute value of the specified number. The field is scanned from right to left until a numeric character is encountered to use as a starting value. The width of the field remains constant. Therefore, leading spaces or zeroes should be used as place holders for the largest number expected (see the following).

ESC!b#Z

where # is a number that enables/disables printing of leading zeroes in incrementing fields as follows:

- 0 Disable (default). Use spaces as placeholders. When the field value is zero, the final zero is not suppressed.
- 1 Enable (use zeroes as placeholders).

In addition, the following standard PCL macro commands must be used:

- Specify Macro ID

ESC&f0Y
027 038 102 # 089

- Start Macro Definition

ESC&f0X
027 038 102 048 088

- Stop Macro Definition

ESC&f1X
027 038 102 049 088

- Enable Macro for Automatic Overlay

ESC&f4X
027 038 102 052 088

The application must specify the Macro ID (see Section 10), download the entire page into the macro, enable the macro for automatic overlay, set the copy count, and issue a form feed. The first copy of the page will print the macro exactly as downloaded. Subsequent copies will print with appropriately modified incrementing or decrementing fields within the macro. Incrementing/decrementing fields is limited to 20 characters each, and the number of auto-incrementing fields is limited to 10 per page.

Bar Code Generation Example

The following programming example produces the label shown in Figure 2-1 using the IntelliBar Model 48 and 412 internal bar code fonts.

```
←E←&130←&18D  
3 of 95 to 2 Ratio  
Ladder Bar Code  
←!b5C←!b150J←!b3N←!b2R←!b4W1234  
x = 3 Dots  
←!b5C←!b150J←!b4N←!b2R←!b2W12  
x = 4 Dots  
Test
```

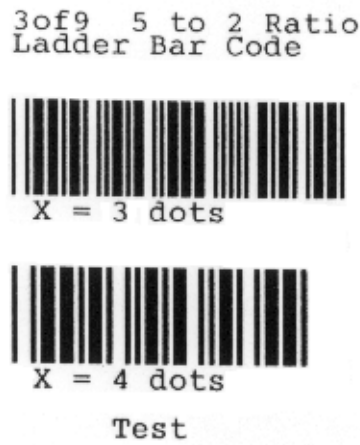


Figure 2-1 Internal Bar Code Example

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Section 3

HP PCL Print Commands

You can easily control printer operation using four standard HP PCL print commands.* These commands, or escape sequences, allow you to:

- restore user default settings (reset)
- select the number of copies needed for each label
- adjust text position across width of page (long-edge offset registration)
- designate text position across length of page (short-edge offset registration)

In the following sections, the name of the command is followed by the escape sequence, its decimal and hex formats, and a description of how to use the command.

For information on the Intellibar extension commands used to control printer operation, see Section 2.

RESET

ESC E

Decimal: 027 069

Hex: 1B 45

Use this command at the beginning and end of each print job. The command deletes any temporary fonts and macros, prints any pages remaining in the printer buffer, and restores user default settings. This allows the next job to start with the default settings as a known base. Starting with the default environment at the beginning of each print job eliminates the need to set every feature each time a job is run.

Do not perform a printer reset *within* a job.

NUMBER OF COPIES

ESC &I#X

Decimal: 027 038 108 #...# 088

Hex: 1B 26 6C #...# 58

#: number of copies (maximum = 32,767)

Use this command to set the number of copies printed for each page in a job. The command can occur anywhere on the page. Thus, it will be invoked for the current page and remain in effect for subsequent pages. The factory default setting is 1 copy.

LONG-EDGE (LEFT) OFFSET REGISTRATION

ESC&!#U

Decimal: 027 038 108 #...#085

Hex: 1B 26 6C #...# 55

#: number of decipoints (1/720 inch)

Default = 0

Range = -32767 to 32767

This command designates the position of the logical page across the width (short side) of the physical page. This command can be used to adjust the text position on the page to allow room for the page binding.

The value (#) is a signed number valid to 2 decimal places. The units are decipoints. Positive values cause the logical page, regardless of orientation, to move right along the width of the physical page, except on the back side (duplex print) of sheets printed in long-edge binding duplex mode, where positive values cause it to move left.

Negative values cause the logical page, regardless of orientation, to move left along the width of the physical page, except on the back side of sheets printed in long-edge binding duplex mode, where negative values cause it to move right.

SHORT-EDGE (TOP) OFFSET REGISTRATION

ESC&!#Z

Decimal: 027 038 108 #...#090

Hex: 1B 26 6C #...# 5A

#: number of decipoints (1/720 inch)

Default = 0

Range = -32767 to 32767

This command designates the position of the logical page across the length (long side) of the physical page.

The value (#) is a signed number valid to 2 decimal places. The units are decipoints. Positive values cause the logical page, regardless of orientation, to move down along the length of the physical page, except on the back side of sheets printed in short-edge binding duplex mode, where positive values cause it to move up.

Negative values cause the logical page, regardless of orientation, to move up along the length of the physical page, except on the back side of sheets printed in short-edge binding duplex mode, where negative values cause it to move down.

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Section 4

HP PCL Page Format Commands

In addition to using print commands to control printer operation, you can use page format commands to set up all your labels.* These commands or escape sequences allow you to:

- select page size and length
- select the page source
- select orientation (portrait or landscape)
- select the print direction
- set margins and text length
- set row and column dimensions
- set line spacing

This section lists the page format commands by subsection. The name of the command is followed by the escape sequence, its decimal and hex formats, and a description of how to use the command.

For information on the IntelliBar extension commands used to control printer operation, see Section 2.

PAGE SIZE

ESC &l#A

Decimal: 027 038 108 # 065

Hex: 1B 26 6C # 41

#: Paper

1 = Executive (7.25 in. x 10.5 in.)

2 = Letter (8.5 in. x 11 in.)

3 = Legal (8.5 in. x 14 in.)

26 = A4 (210 mm x 297 mm)

Envelopes

80 = Monarch (Letter – 3 7/8 in. x 7 1/2 in.)

81 = Commercial 10 (Business – 4 1/8 in. x 9 1/2 in.)

90 = International DL (110 mm x 220 mm)

91 = International C5 (162 mm x 229 mm)

The page size command sets the page size installed in the printer. This also sets the size of the addressable print area.

NOTE: The IntelliBar does not respond to this command.

When the printer receives the page size command, it will print subsequent labels using the user default settings for the top margin, text length, and left and right margins. The macro overlay is disabled and the cursor position moves to the left edge of the addressable print area on the top margin of the next label.

If a page size other than the size set by the command is installed, the printer shows an error message on the control panel display.

The factory default setting is for letter-sized labels.

PAGE LENGTH

ESC &I#P

Decimal: 027 038 108 # 080

Hex: 1B 26 6C # 50

#: number of lines.

Use the page length command to set the number of lines on a page. The value field (#) sets the length of the addressable print area in lines. The printer ignores the page length command if the command is set for a value greater than the maximum supported page size or if the Vertical Motion Index (VMI) is set at 0.

If a page length other than the size set by the command is installed, the printer shows an error message on the control panel display.

When the printer receives the page length command, it prints subsequent pages using the user default settings for the top margin, text length, and left and right margins. The macro overlay is disabled, and the cursor position moves to the left edge of the addressable print area on the top margin of the next page.

The factory default setting is for a letter-sized page.

Table 4-1 and Table 4-2 provide page length values for the standard page sizes in portrait and landscape orientations.

Determine the number of lines per page by multiplying the line spacing setting (lines per inch) times the length of the page in inches

Table 4-1 Page Lengths for Portrait Orientation

Page Size	LINES PER INCH	
	6	8
Letter	66	88
Legal	84	112
A4	70	93
Executive	63	84

Table 4-2 Page Lengths for Landscape Orientation

Page Size	LINES PER INCH	
	6	8
Letter	51	68
Legal	–	–
A4	49	66
Executive	43	58

You can print a legal-size page in landscape orientation by starting in portrait orientation and setting the page length using ESC&l84P. Next, set the orientation to landscape using ESC&l10.

PAPER SOURCE

ESC &l#H

Decimal: 027 038 108 # 072

Hex: 1B 26 6C # 48

- #:
- 0 = print the current label
 - 1 = feed paper from paper cassette
 - 2 = feed paper from manual feed slot

Use this command to select either the paper cassette or the manual feed feature.

NOTE: The IntelliBar does not respond to this command.

ORIENTATION

ESC &l#O

Decimal: 027 038 108 48 079 (portrait)

027 038 108 49 079 (landscape)

027 038 108 50 079 (reverse portrait)

027 038 108 51 079 (reverse landscape)

Hex: 1B 26 6C 3# 4F

- #:
- 0 = portrait orientation
 - 1 = landscape orientation
 - 2 = reverse portrait
 - 3 = reverse landscape

Use this command to set the page orientation. The command sets user default values for page length, top margin, text length, left and right margins, horizontal motion index (HMI), and vertical motion index (VMI). Any data in the print buffer received before the command will be printed, followed by a form feed and carriage return. The cursor moves to the left edge of the top margin on the addressable print area of the next page.

The factory default setting is portrait orientation. You can select landscape orientation through the control panel.

NOTE: You can use only one orientation per page. To print multiple directions per page, use the Print Direction command (see “Print Direction”).

The printer automatically rotates all fonts to the currently selected orientation.

Figure 4-1 shows the features of portrait and landscape orientation modes.

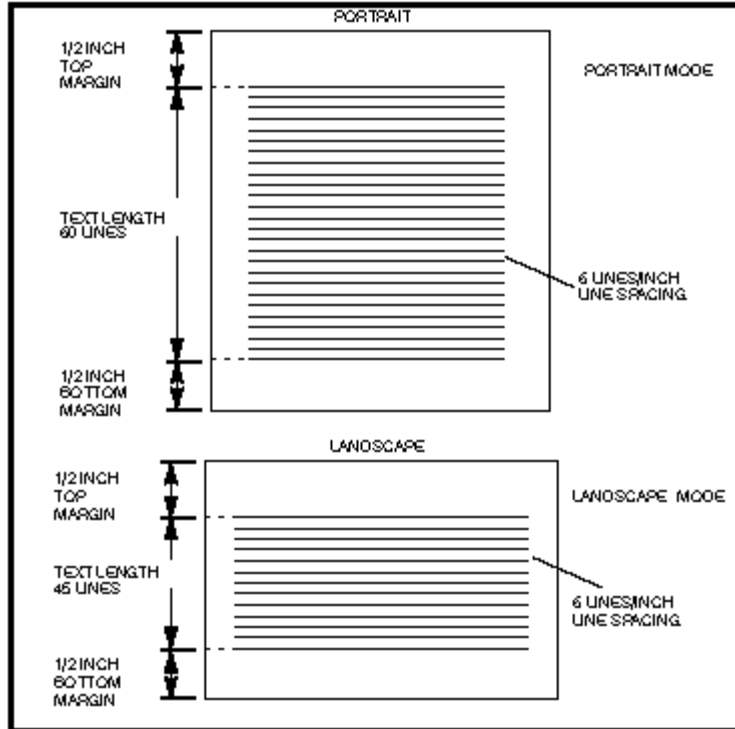


Figure 4-1 Orientation Features

PRINT DIRECTION

ESC &I#P

Decimal: 027 038 097 #...# 080

Hex: 1B 26 61 #...# 50

- #:
- 0 = 0° rotation
 - 90 = 90° counterclockwise rotation
 - 180 = 180° counterclockwise rotation
 - 270 = 270° counterclockwise rotation

Default = 0

Range = 0, 90, 180, 270 (all other values ignored)

This command rotates the logical page coordinate system *with respect to the current orientation* without performing a page eject. This rotation is performed in 90° degree increments in a counterclockwise direction. This allows printing in four directions on the same page.

Changing the print direction causes the following to occur:

- The print origin moves with the logical page rotation. For example, rotating a default page (Portrait orientation, 0° print direction) 90° causes data to print in the landscape direction across the “portrait” page.
- The margins are translated (when the print direction changes by 90°, the left margin becomes the new top margin, the former top margin becomes the new right margin, etc.)
- The cursor position remains at the same physical location.
- All subsequent printing (characters, area fill patterns, raster images) is rotated to coincide with the new print direction.
- Any current raster graphics end when the print direction changes.

NOTE: This command does not affect HPGL/2 vector graphic images. HPGL/2 graphics can be rotated only with the Orientation command (see “Orientation”) or the HPGL/2 “RO” command.

- The Print Direction command does not default HMI.

LEFT MARGIN

ESC &a#L

Decimal: 027 038 097 #...# 076

Hex: 1B 26 61 #...# 4C

#: column number

Use the left margin command to set the left margin to the left edge of a column you specify.

The default first column is column 0, located at the left edge of the addressable print area. If you specify a value greater than the current right margin, the printer ignores the escape sequence.

The HMI sets the distance between columns. Because margins are a physical position, they will not change once set even though the HMI may change.

If a new left margin is set within the existing left margin, the cursor shifts to the new left margin.

Column 0 is the factory default setting for the left margin.

RIGHT MARGIN

ESC &a#M

Decimal: 027 038 097 #...# 077

Hex: 1B 26 61 #...# 4D

#: column number

Use the right margin command to set the right margin to the right edge of a column you specify.

The maximum default right column is located at the right edge of the addressable print area. If you specify a value greater than the right margin of the addressable print area, the printer uses the right margin of the addressable print area. If you specify a column value less than the left margin, the printer ignores the escape sequence.

The HMI sets the distance between columns. Because margins are physical positions, they will not change when set even though the HMI may change.

If a new right margin is set to the right of the existing right margin, the cursor shifts to the new right margin.

The factory default setting for the right margin is the right edge of the addressable print area.

TOP MARGIN

ESC &l#E

Decimal: 027 038 108 #...# 069

Hex: 1B 26 6C #...# 45

#: number of lines

Use the top margin command to set the number of lines between the top of the addressable print area and the top of the text area.

The printer ignores this escape sequence if you specify a value greater than the length of the current addressable print area or if the current VMI is 0 (VMI sets the space between lines of text). When the printer receives a valid top margin command, it resets the text length according to the following equation:

Text length = addressable print area length (in inches) – top margin (in inches) – 1/2 inch.

Because the top margin is a physical position, it will not change once set, even though the VMI or line spacing may change.

The current values of the top margin and VMI determine the vertical cursor position through the following equation:

First line (in inches) = top margin (in inches) + (72/100 * VMI)

This position will be at the baseline of a character to provide the correct character position in a character cell. Figure 4-2 shows the relationship of the cursor position to the top margin and the VMI.

NOTE: The first line of the addressable print area is 0.

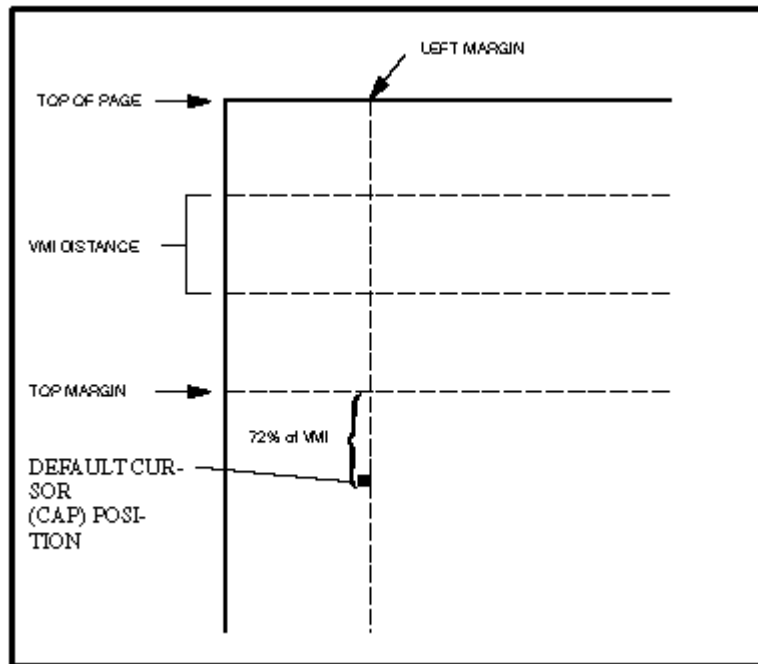


Figure 4-2 Top Margin Cursor Position

CLEAR HORIZONTAL MARGINS

ESC 9

Decimal: 027 057

Hex: 1B 39

Use the clear horizontal margin command to reset the left and right margins. The printer will set the left margin to the left edge (column 0) of the addressable print area and the right margin to the right edge of the addressable print area.

TEXT LENGTH

ESC &l#F

Decimal: 027 038 108 #...# 070

Hex: 1B 26 6C #...# 46

#: number of lines

Use the text length command to set the number of lines available for printing text within the addressable print area.

Text length in lines is set by the value field (#) starting from the top margin. If you specify a value greater than the addressable print area minus the top margin, or if the VMI is 0, the printer ignores the command. The default text length is used if values for orientation, page length, page size, or top margin change.

The printer calculates the user default text length according to the following equation:

$$\text{Text length (in lines)} = \text{Integer portion (of addressable print area (in inches) - top margin (in inches) - 1/2 inch) \times 48/VMI}$$

The factory default is as follows:

$$\text{Text length (in lines)} = ((\text{addressable print area length (in inches)} - 1 \text{ inch}) \times 6).$$

You must select the user default VMI through software commands.

PERFORATION SKIP

ESC &l#L

Decimal: 027 038 108 # 076

Hex: 1B 26 6C # 4C

#: 0 = disable

1 = enable

Use the perforation skip command to move the cursor from the bottom line on the page to the top of the text area on the following page.

The perforation region starts at the bottom of the text area on a page and ends at the top of the text area on the next page. When the skip is enabled, a line feed or half-line feed moves the cursor to the top of the text area on the following page. When the skip is disabled, a line feed or half-line feed moves the cursor into the perforation region where printing will continue.

HORIZONTAL MOTION INDEX

ESC &k#H

Decimal: 027 038 107 #...# 072

Hex: 1B 26 6B #...# 48

#: number of 1/120 increments

Use the horizontal motion index (HMI) to set the distance between columns. You can specify a value from 0 to 840. Values can be set to four decimal places. No horizontal motion will occur if the HMI is 0.

If you use fixed pitch fonts, all printable characters including the space and backspace characters, are affected by the HMI. If you select proportional fonts, the HMI affects only the control code space character.

The HMI defaults if any font characteristics change and if shift in and shift out are used to switch between primary and secondary fonts.

The pitch value in the font header equals the default HMI value. The factory default font HMI value is 12 to give 10 characters per inch ($12/120 = 1/10$).

VERTICAL MOTION INDEX

ESC &l#C

Decimal: 027 038 108 # 067

Hex: 1B 26 6C # 43

#: number of 1/48 inch increments between rows

Use the vertical motion index (VMI) to set the space between rows. You can specify a value from 0 to 336. If you specify a VMI value greater than the current addressable print area length, the printer ignores the command. You can specify a value up to four decimal points. A zero value indicates no vertical motion.

The VMI command affects the spacing of both line feed and half-line feed. The factory default VMI value is 8. This is the same as six lines per inch.

LINE SPACING

ESC &l#D

Decimal: 027 038 108 #...# 068

Hex: 1B 26 6C #...# 44

#: 1 = 1 lines per inch (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

Use the line spacing command to set the number of lines printed per page. This command functions like the VMI command; however, it sets the VMI in lines per inch.

The factory default setting is six lines per inch.

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Section 5

HP PCL Cursor Position Commands

The IntelliBar prints with an active printing position typically referred to as the cursor position. You can use several commands to move the cursor for customized applications.*

- Cursor position commands deal with the following features.
- Absolute/relative position
- Cursor addressing units
- Horizontal control
- Vertical control
- Half-line feed
- Line feed
- Line termination
- Push/pop

In this section, cursor position commands are listed by subsection. The name of the command is followed by the escape sequence, its decimal and hex formats, and a description of how to use the command.

ABSOLUTE/ RELATIVE POSITION

You can specify either absolute or relative cursor motion to position the cursor. Absolute motion specifies movement to a physical position from the left edge of the top margin (position 0,0). Relative motion specifies the distance to move from the current cursor position. Figure 5-1 shows the relationships of cursor movement.

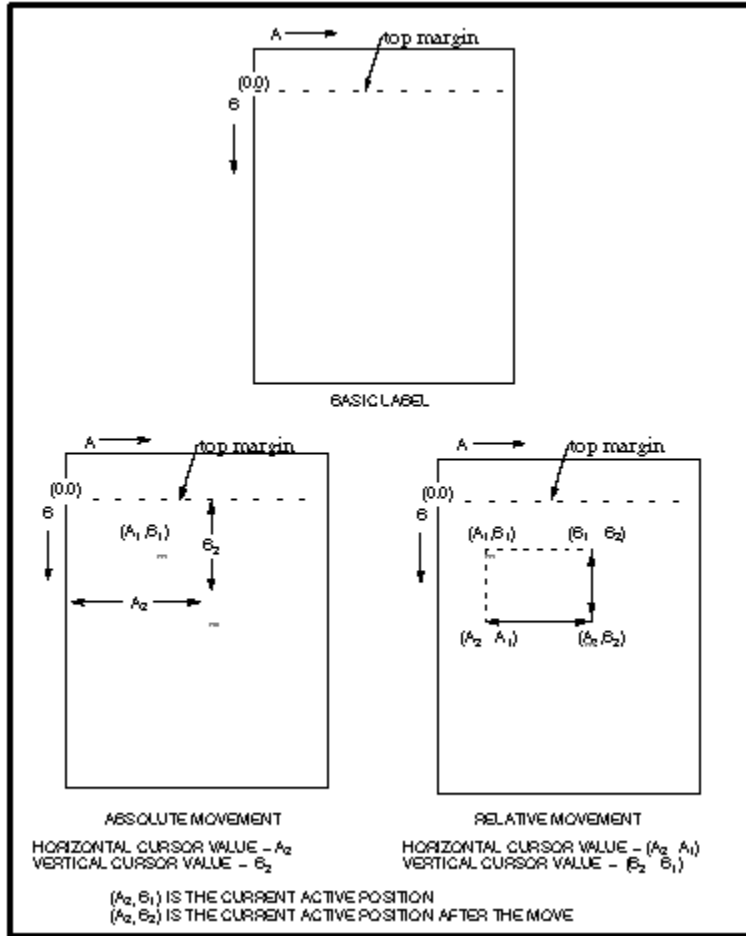


Figure 5-1 *Cursor Positioning*

CURSOR ADDRESSING UNITS

All position commands are expressed in PCL coordinate system units on an x-y axis. The x-axis units can be dots, decipoints, or columns. The y-axis units can be dots, decipoints, or rows.

The dot (or PCL typographic point) represents the smallest printable point with a size equal to 1/300 inch. Printer resolution refers to the number of dots per inch.

The decipoint equals 1/720 inch. It is one-tenth of a PCL typographic point.

Column width or distance between consecutive characters is expressed by the current horizontal motion index (HMI). Row values (the distance between the rows or the lines) are given through the current vertical motion index (VMI) or lines per inch (lpi).

HORIZONTAL CONTROL (COLUMNS)

ESC &a#C

Decimal: 027 038 097 # 067

Hex: 1B 26 61 # 43

#: number of columns

Use this horizontal control command to move the current horizontal cursor (or active print position) to a new column position on the current line.

The column width is defined by the current HMI value. If you specify a positive value (using a plus sign (+)) in the value field (#), the new position will be to the right of the current cursor position. If you specify a negative value (using a minus sign (-)) in the value field (#), the new position will be to the left of the current cursor position. By not specifying a sign, you obtain an absolute distance that is referenced from the left edge of the addressable print area.

The printer recognizes the first column in a line as column 0. The printer ignores margins when this escape sequence is used, so you can set the cursor position to any point along the current line using this sequence.

If you specify a location outside of the addressable page area, the cursor moves to the edge of the addressable page area.

You can specify a value to four decimal places.

HORIZONTAL CONTROL (DECIPOINTS)

ESC &a#H

Decimal: 027 038 097 # 072

Hex: 1B 26 61 # 48

#: number of decipoints (1/720 inch).

Use this horizontal control command, or escape sequence, to move the current horizontal cursor (or active print position) to a new position on the current line.

If you specify a positive value (using a plus sign (+)) in the value field (#), the new position will be to the right of the current cursor position. If you specify a negative value (using a minus sign (-)) in the value field (#), the new position will be to the left of the current cursor position. By not specifying a sign, you obtain an absolute distance that is referenced from the left edge of the addressable print area. The extreme left position is 0 and the extreme right position is the right edge of the addressable print area.

If you specify a location outside of the addressable page area, the cursor will move to the edge of the addressable page area.

You can specify a value to two decimal places.

HORIZONTAL CONTROL (DOTS)

ESC *p#X

Decimal: 027 042 112 # 088

Hex: 1B 2A 70 # 58

#: number of dots

Use this horizontal control command to move the current horizontal cursor (or active print position) to a new position on the current line.

If you specify a positive value (using a plus sign (+)) in the value field (#), the new position will be to the right of the current cursor position. If you specify a negative value (using a minus sign (-)) in the value field (#), the new position will be to the left of the current cursor position. By not specifying a sign, you obtain an absolute distance that is referenced from the left edge of the addressable print area. The extreme left position is 0 and the extreme right position is the right edge of the addressable print area.

If you specify a location outside of the addressable page area, the cursor will move to the edge of the addressable page area.

HORIZONTAL CONTROL (CONTROL CODES)

You can also use the four control codes described below to position the cursor horizontally on the current line.

CR – Carriage Return

The CR control code moves the cursor to the left margin of the current line. Its use is affected by the line termination command (explained later in this section).

SP – Space

The SP control code moves the cursor one column position to the right. You can define space as a printable character or a control code. When used with proportionally spaced fonts, the SP control code moves the cursor by the current HMI value. As a printable character, however, the cursor moves the width of a character. When used with fixed fonts, cursor movement is according to the HMI value, regardless of how space is used.).

BS – Backspace

The BS control code moves the cursor to the left a distance that is equal to the width of last printed character or space. No movement occurs if the cursor is already at the left margin.).

The backspace distance equals the HMI value when used with fixed pitch fonts.

When used with proportionally-spaced fonts, the backspace centers the overstriking character on the character being overstruck. After printing the overstrike character the cursor position will be at the same position before the backspace. Each movement back equals the distance of the last symbol or space. If the cursor is on the left margin, no movement occurs.

HT – Horizontal Tab

The HT control code moves the cursor to the next tab stop on the current line. Tab stops start on the left margin and occur at every eighth column to the right edge of the addressable print area. If the right margin is crossed by a new tab request, the new value is set at the right margin. When the HMI value is 0, the command is ignored.).

VERTICAL CONTROL (ROWS)

ESC &a#R

Decimal: 027 038 097 # 082

Hex: 1B 26 61 # 52

#: number of rows

Use this vertical control command to move the current vertical cursor (or active print position) along the current column position on a new line.

If you specify a positive value (using a plus sign (+)) in the value field (#), the new position will be down from the current cursor position. If you specify a negative value (using a minus sign (-)) in the value field (#), the new position will be above the current cursor position. By not specifying a sign, you obtain an absolute distance that is referenced from the top margin of the addressable print area.

If you specify an absolute or negative relative value outside of the addressable page area, the cursor will move to the edge of the addressable page area. You can specify a positive relative value to move the cursor down and off the current page. You can move the cursor into the perforation region because this command allows the printer to ignore the perforation skip mode. The printer, however, will only advance the cursor to the top of form of the page following the next page (thus, form feeding a blank page).

You can specify a value to four decimal places.

VERTICAL CONTROL (DECIPOINTS)

ESC &a#V

Decimal: 027 038 097 # 086

Hex: 1B 26 61 # 56

#: number of decipoints (1/720 inch)

Use this vertical control command to move the current vertical cursor (or active print position) along the y-axis.

If you specify a positive value (using a plus sign (+)) in the value field (#), the new position will be down from the current cursor position. If you specify a negative value (using a minus sign (-)) in the value field (#), the new position will be above the current cursor position. By not specifying a sign, you obtain an absolute distance that is referenced from the top margin of the addressable print area. The uppermost position is the top margin with a value of 0. The lowermost position is the bottom of the addressable print area. If you specify an absolute or negative relative value outside of the addressable page area, the cursor will move to the edge of the addressable page area.

You can specify a value to two decimal places.

VERTICAL CONTROL (DOTS))

ESC *p#Y

Decimal: 027 042 112 #...# 089

Hex: 1B 2A 70 #...# 59

#: number of dots.

Use this vertical control command to move the current vertical cursor (or active print position) to a new position along the y-axis.

If you specify a positive value (using a plus sign (+)) in the value field (#), the new position will be down from the current cursor position. If you specify a negative value (using a minus sign (-)) in the value field (#), the new position will be above the current cursor position. By not specifying a sign, you obtain an absolute distance that is referenced from the top margin of the addressable print area. The uppermost position is the top margin with a value of 0. The lowermost position is the bottom of the addressable print area. If you specify an absolute or negative relative value outside of the addressable page area, the cursor will move to the edge of the addressable page area.

HALF-LINE FEED)

ESC =
Decimal: 027 061
Hex: 1B 3D

Use the half-line feed command to move the cursor down one-half line feed to the same character position. The distance is one-half of the current VMI or line spacing setting.

VERTICAL CONTROL (CONTROL CODES).

You can use two control codes, described below, to position the cursor vertically.

LF – Line Feed

The LF control code moves the cursor to the same horizontal position on the next line. The space between the lines is set by the last VMI or line spacing setting. The line termination command affects the use of this control code.).

FF – Form Feed

The FF control code moves the cursor to the same horizontal position at the top of the text area on the next page. The line termination command affects the use of this control code.).

LINE TERMINATION).

ESC &k#G
Decimal: 027 038 107 # 071
Hex: 1B 26 6B # 47

#: 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

Use the line termination command to control the printer's interpretation of the CR, LF, and FF control codes.

PUSH/POP CONTROL).

ESC &f#S

Decimal: 027 038 102 # 083

Hex: 1B 26 66 # 53

#: 0 = push (store cursor position)

1 = pop (recall cursor position)

Use the push/pop command to store or recall the cursor position. Using the value 0 pushes the cursor position onto the first in last out (FILO) stack while keeping the current cursor position. Using the value 1 pops the cursor off the stack, restoring it as the current cursor position.

You can push up to 20 positions. Any more than 20 are ignored. If you pop more positions than you pushed, the command is ignored. If you reset the printer, the current cursor position is placed on the top of the stack and all other pushed are lost.

If a position is outside of the addressable print area, the cursor is positioned at the edge of the addressable print area.

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Section 6

HP PCL Font Characteristics

You can print documents using a variety of fonts. For example, you can use a large font for the title or company name, a standard-size font for the body of the label, and a bold or italic font to highlight key words or phrases.*

A number of fonts are supplied with the printer; these fonts are referred to as internal fonts. Additional fonts are available for the printer as downloadable fonts on diskettes.

These diskettes are inserted into the personal computer disk drive, and the font files downloaded (transferred) from the disk into the printer's RAM memory. Once the font has been downloaded into the printer, it may be selected for printing.

Any internal font or downloadable font may be selected for printing. Fonts are selected using font selection commands. This section describes how to select fonts.

There are several characteristics (or attributes) used to identify a font. A font is selected by specifying these characteristics: symbol set, spacing, pitch, height, style, stroke weight, and typeface.

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

NOTE: For detailed information on the commands described in this section, refer to the PCL5 printer language document set available from Hewlett-Packard.

FONT SELECTION BY CHARACTERISTIC

The printer selects a font based on its priority of characteristics, its physical location in the printer, and finally its orientation.

Priority of Characteristics

The printer first selects a font based on the priority of the characteristics. The priority of the characteristics, from highest to lowest, is shown in the following list.

- Symbol Set
- Spacing
- Pitch
- Point Size (Height)
- Style
- Stroke
- Typeface

When selecting a font, the printer compares the highest priority characteristic in its font selection 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. However, if after comparison of all the font characteristics, more than one font still remains, then the location of the fonts is considered.

Location

There are two locations in which a font may be stored: printer ROM (internal font) and printer RAM (soft font). The priority of the two font locations, from highest to lowest, are shown below. The font that matches the font characteristics is selected from the highest priority location.

- Internal Font
- Soft font, lowest ID

Orientation

Orientation refers to the direction of print on a page. Portrait orientation is across the page width, while landscape orientation is across the page length. The IntelliBar can print in either orientation. When the orientation is changed, the printer will select a font in the new orientation that has attributes closely resembling the currently selected font of the other orientation..

Number of Fonts

Table 6-1 lists the maximum number of fonts that the IntelliBar can manage from the three font storage locations..

Table 6-1 Number of Fonts

Font Source	Maximum Number of Fonts	Number of Fonts Per Label
Download	Up to 32 fonts	The Intellibar can print up to 80 fonts per page from a mixture of these font sources.
Internal	8 fonts	

NOTE: The printer will select only one symbol set from internal fonts or fonts that support multiple symbol sets.

If you download 33 or more fonts, the printer will discard any subsequent downloaded data without producing an error message.

Font Specification

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

To select a Roman-8, fixed-spaced, 10 pitch, 12 point, upright, bold, Courier font, for the current page orientation, specify each of the characteristics using font selection escape sequences. Once the characteristics have been specified, the printer will have the following font select table (see Table 6-2).

Table 6-2 Font Characteristics

Characteristic	Selection
Symbol Set	Roman-8
Spacing	Fixed
Pitch	10
Point Size	12 point
Style	Upright
Stroke	Bold
Typeface	Courier

To subsequently select a font with the same characteristics except in stroke weight (medium rather than bold) only the stroke weight characteristic must be specified. Note the following change to the printer's font select table: (see Table 6-3).

Table 6-3 Font Characteristics (Medium Stroke Weight)

Characteristic	Selection
Symbol Set	Roman-8
Spacing	Fixed
Pitch	10
Point Size	12 point
Style	Upright
Stroke	Medium
Typeface	Courier

Even though only the characteristics of the new font that differ from those of the previously designated font must be sent, IntelliTech recommends that all of the characteristics be sent to ensure that the correct font gets selected.

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.

SYMBOL SET

A symbol set identifies the specific symbols and/or characters in a font. Characters refer to the alphabetic, numeric, punctuation symbols, and/or any other symbols that may be included.

Symbol sets and their identification (ID) numbers are listed in Table 6-4. Commands are used to designate symbol sets as a primary or secondary. To select symbol sets, send the following commands.

ESC(ID Primary symbol set ID =
Symbol Set ID number

Decimal: 027 040 ID

Hex: 1B 28 ID

ESC)ID Secondary Symbol Set ID =
Symbol Set ID number

Decimal: 027 041 ID

Hex: 1B 29 ID

If the specified symbol set does not exist, the default symbol set will be used.

The factory default primary and secondary symbol set is Roman-8. However, you can select a user default symbol set from the printer control panel printing menu.

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 Section 3 in the user's guide).

For example, to select ASCII as the symbol set for the primary font, send:

ESC(0U

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

ESC)8U

Table 6-4 Defined Symbol Sets

Symbol Set Name	Symbol Set ID
ECMA-94 Latin 1	0N
*HP German	0G
HP Roman-8	8U
Spanish	1S
*ISO 2: International Reference Version	2U
ISO 4: United Kingdom	1E
ISO 6: ASCII	0U
*ISO 10: Swedish	3S
ISO 11: Swedish	0S
*ISO 14: JIS ASCII	0K
ISO 15: Italian	0I
*ISO 16 Portuguese	4S

*Not recommended for future use.

Table 6-4 Defined Symbol Sets (cont'd)

Symbol Set Name	Symbol Set ID
*ISO 17: Spanish	2S
*ISO 21: German	1G
*ISO 25: French	0F
*ISO 57 Chinese	2K
*ISO 60 Norwegian version 1	0D
*ISO 60 Norwegian version 2	1D
ISO 69 French	1F
*ISO 84 Portuguese	5S
*ISO 85: Spanish	6S
PC-8	10U
PC-8 (Danish/Norwegian)	11U
PC850	12U

*Not recommended for future use.

ISO SYMBOL SETS

The printer provides several ISO (International Standards Organization) symbol sets to support European languages. Given the correct PCL commands, the printer automatically generates the requested ISO symbol set which is a unique ordering of symbols contained in the Roman-8 symbol set (see Table 6-5).

To select the ISO 69 French symbol set for the primary font, send:

ESC(1F

Table 6-5 ISO Substitution Characters

ISO	NAME	ID	DECIMAL CHARACTER EQUIVALENTS											
			35	36	64	91	92	93	94	95	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	ì
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	ù
	Spanish*	1S	#	\$	@	í	Ñ	¿	^	'	{	ñ	}	-
17	ISO Spanish	2S	£	\$	§	í	Ñ	¿	^	'	°	ñ	ç	-
85	ISO Spanish:*	6S	#	\$	·	í	Ñ	ç	¿	'	'	ñ	ç	-
16	ISO Portuguese*	4S	#	\$	§	Ä	Ç	Ö	^	'	ä	ç	ö	°
84	ISO Portuguese:*	5S	#	\$	'	Ä	Ç	Ö	^	'	ä	ç	ö	-
60	ISO Norwegian v1	0D	#	\$	@	Æ	Ø	Å	^	'	æ	ø	å	-
61	ISO Norwegian v2*	1D	§	\$	@	Æ	Ø	Å	^	'	æ	ø	å	

* Not recommended for future use.

SPACING

Inter-character spacing can be specified as either proportional or fixed by sending the following commands.

ESC(s#P Primary spacing

Decimal: 027 040 115 049 080 (proportional spacing)

027 040 115 048 080 (fixed spacing)

Hex: 1B 28 73 31 50 (proportional spacing)

1B 28 73 30 50 (fixed spacing)

ESC)s#P Secondary spacing

Decimal: 027 040 115 049 080 (proportional spacing)

027 040 115 048 080 (fixed spacing)

Hex: 1B 28 73 31 50 (proportional spacing)

1B 28 73 30 50 (fixed 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 is 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 (refer to Section 3).

For example, to specify proportional spacing for the primary font, send:

```
ESC(s1P
```

To specify fixed spacing for the secondary font, send:

```
ESC)s0P
```

PITCH

Pitch designates the horizontal spacing of a fixed-spaced font in terms of the number of characters per inch. The following commands designate pitch for primary fonts.

```
ESC(s#H Primary pitch  
Decimal: 027 040 115 #..# 072  
Hex: 1B 28 73 #...# 48
```

```
ESC)s#H Secondary pitch  
Decimal: 027 041 115 #..# 072  
Hex: 1B 29 73 #...# 48
```

#: Pitch in characters/inch

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

For example, to specify 10 pitch for the primary font, send:

```
ESC(s10H
```

To specify 16.66 pitch for the secondary font, send:

```
ESC)s16.66H
```

If a pitch is specified that is not available, the next greater available pitch is selected. If no greater value is available, the closest available lesser value is 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 (refer to Section 3 in the user's guide).

SET PITCH MODE

ESC&k0S 10.0 characters per inch

Decimal: 027 038 107 048 083

Hex: 1B 26 6B 30 53

ESC&k2S Compressed Mode (16.5 - 16.7 character per inch)

Decimal: 027 038 107 050 083

Hex: 1B 26 6B 32 53

ESC&k4S Elite Mode (12.0 characters per inch)

Decimal 027 038 107 052 083

Hex: 1B 26 6B 34 53

HEIGHT

Height specifies the height of the font in points.

ESC(s#V Primary Height

Decimal: 027 040 115 # 086

Hex: 1B 28 73 # 56

ESC)s#V Secondary Height

Decimal: 027 041 115 # 086

Hex: 1B 29 73 # 56

#: Height in points

The value field (#) is valid to two decimal places. If the requested height is unavailable, the closest height is 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 (0.01389) inch.

The user default primary and secondary heights are implicitly set by selection of a user default font from the control panel (refer to Section 3 in the user's guide).

For example, to specify a height of 12 points for the primary font, send:

ESC(s12V

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

ESC)s14.4V

STYLE

Style designates either upright or italic font.

ESC(s#S Primary Style
Decimal: 027 040 115 # 083
Hex: 1B 28 73 # 53

ESC)s#S Secondary Style
Decimal: 027 041 115 # 083
Hex: 1B 29 73 # 53

#: 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 (refer to Section 3 in the user's guide).

For example to specify an upright style for the primary font, send:

ESC(s0S

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

ESC)s1S

STROKE WEIGHT

Stroke weight designates the thickness of the strokes that compose the characters of a font..

ESC(s#B Primary stroke weight
Decimal: 027 040 115 # 066
Hex: 1B 28 73 # 42

ESC)s#B Secondary stroke weight
Decimal: 027 041 115 # 066
Hex: 1B 29 73 # 42

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 6-6 lists the values for the stroke weights.

Table 6-6 Stroke Weights

Value (#)	Typeface
-7	Ultra Thin
-6	Extra thin
-5	Thin
-4	Extra light
-3	Light
-2	Demi light
-1	Semi light
0	Medium, Book, or Text
+1	Semi bold
+2	Demi bold
+3	Bold
+4	Extra bold
+5	Black
+6	Extra 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 is selected. If no thicker stroke weight is available, the closest available thinner stroke weight is selected.

If the specified stroke weight is less than zero and is not available, the next thinner available stroke weight is selected. If no thinner stroke weight is available, the closest available thicker stroke weight is 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 (refer to Section 3).

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

ESC(s3B

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

ESC)s0B

TYPEFACE

Typeface designates the design of the font..

ESC(s#T Primary typeface
Decimal: 027 040 115 # 084
Hex: 1B 28 73 # 54

ESC)s#T Secondary typeface
Decimal: 027 041 115 # 084
Hex: 1B 29 73 # 54

#: Typeface value (see Table 6-7).

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 (refer to Section 3 in the user's guide).

For example, to specify Univers for the typeface of the primary font, send:

ESC(s4148T

To specify CG Times for the typeface of the secondary font, send:

ESC)s4101T

Table 6-7 Typeface Values

Value (#)	Typeface
0	Line Printer
3	Courier
6	Letter Gothic
4148	Univers
4101	CG Times

ORIENTATION

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

ESC&I#O

- #: 0 = portrait
- 1 = landscape
- 2 = reverse portrait
- 4 = reverse landscape

Note that this command applies to both the primary and secondary fonts. The printer automatically rotates all fonts to the currently selected orientation.

For further details, see “Orientation” and “Print Direction” in Section 4.

FONT SELECTION EXAMPLE

Table 6-8 illustrates how to select a primary font with the following characteristics (note that all of the font characteristics are specified):.

Table 6-8 Font Selection

Characteristic	Value	Escape Sequence
Symbol set	ASCII	ESC(0U
Spacing	Fixed	ESC(s0P
Pitch	10 cpi	ESC(s10H
Height	12 point	ESC(s12V
Style	Upright	ESC(s0S
Stroke weight	Bold	ESC(s3B)
Typeface	Courier	ESC(s3T

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

```
ESC(0U ESC(s0P ESC(s10H ESC(s12V
ESC(s0S ESC(s3B ESC(s3T
```

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

```
ESC(0UESC(s0p10h12v0s3b3T
```

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:

```
ESC(s1S ESC(s0B
```

or shortened:

```
ESC(s1s0B
```

NOTE: If an escape sequence does not contain a value field, the printer assumes a value of zero; therefore, the sequence ESC(sB could be sent to the printer instead of ESC(s0B.

When several fonts with similar characteristics are available in the printer at the same time, you should use full character description strings to select the desired fonts.

SELECTION OF THE DEFAULT FONT

Default font sets all of the font characteristics to those of the user default font..

ESC(3@ Default primary font characteristics

Decimal: 027 040 051 064

Hex: 1B 28 33 40

ESC)3@ Default secondary font characteristics

Decimal: 027 041 051 064

Hex: 1B 29 33 40

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

TRANSPARENT PRINT DATA

Transparent print data provides printing access to all characters in a font including those defined as unprintable..

ESC&p#X [Transparent Print Data]

Decimal: 1B 027 038 112 # 088

Hex: 1B 26 70 # 58

#: 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.

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

ESC&p1X[27]

NOTE: The ESC 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..

ESC&d#D Enable underline
Decimal: 027 038 100 # 068
Hex: 1B 26 64 # 44

#: 0 = Fixed position
3 = Floating position

ESC&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. 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 Section 9).

The factory default is underline disabled.

HPGL/2 FONT SELECTION

In addition to selecting fonts using the PCL font selection commands, fonts can also be selected and printed in HPGL/2 mode using the following HPGL/2 commands. The HPGL/2 font selection commands allow you to print text within vector graphic images.

Primary Font (FI)

FI *font_ID*[:]

This command allows any accessible font that has been assigned a *font ID* number to be selected as the primary (standard) font (the font characteristics are assigned to the standard font). The font must be assessible to the printer as either a resident font or a downloaded font. To be selected, the font must have been previously assigned a font ID number in PCL mode. Also, for scalable fonts, the FI command must be accompanied by an SD command (standard font definition) specifying the font's point size or pitch. When the printer receives this command and the requested font is present, the primary font characteristics are set to those of the requested font. If the selected font is proportionally spaced, the pitch characteristic is not changed.

Table 6-9 Primary Font Command Parameters

Parameter	Format	Functional Range	Default
font_ID	integer	0 to 32767	None

This command does not select the font for text printing if you are currently using the secondary (alternate) font.

The FI (and FN) commands implicitly change the value of the SB command (scalable or bitmapped fonts). For example, if SB = 0 and FI selects a bitmap font, SB is set to 1. This affects the performance of certain HPGL/2 commands. See the SB command later in this section.

Secondary Font (FN)

FN *font_ID*[:;]

This command allows any accessible font that has been assigned a *font ID* number to be selected as the secondary (alternate) font (the font characteristics are assigned to the secondary font). The font must be assessible to the printer as either a resident font or a downloaded font. To be selected, the font must have been previously assigned a font ID number in PCL mode. Also, the FN command must be accompanied by an AD command (alternate font definition) specifying the font's point size. When the printer receives this command and the requested font is present, the secondary font characteristics are set to those of the requested font. If the selected font is proportionally spaced, the pitch characteristic is not changed.

Table 6-10 Secondary Font Command Parameters

Parameter	Format	Functional Range	Default
font_ID	integer	0 to 32767	None

This command does not select the font for text printing if you are currently using the primary (standard) font.

The FN (and FI) commands implicitly change the value of the SB command (scalable or bitmapped fonts). For example, if SB = 0 and FN selects a bitmap font, SB is set to 1. This affects the performance of certain HPGL/2 commands. See the following description of the SB command.

Scalable or Bitmap Fonts (SB)

SB [*n*;] or SB [;]

n: 0 - Scalable fonts only

1 - Bitmap fonts allowed

No parameter - Defaults to scalable fonts. Equivalent to SB0.

This command specifies which types of fonts are used for text printing commands. It allows you to restrict font selection to only scalable fonts, disregarding bitmap fonts.

Table 6-11 Scalable or Bitmap Fonts Command Parameters

Parameter	Format	Functional Range	Default
n	clamped integer	0 or 1	0

This command is defaulted by the DV command (default value). The SB command takes affect immediately, changing both the the standard (primary) and alternate (secondary) fonts to be scalable only or bimap, as requested.

The FN and FI commands implicitly change the value of the SB command. For example, if SB = 0 and FN selects a bitmap font, SB is set to 1.

When (SB1;) is set, all fonts obey the same restrictions as bitmapped fonts regarding character fill, orientation, size, and slant.

Scalable fonts respond more accurately to some HPGL/2 commands. The choice of scalable or bitmap fonts can affect the performance of the following HPGL/2 commands (see Table 6-12).

Table 6-12 Commands Effected by Choice of Scalable or Bitmapped Fonts

Affected Commands	Limitation
CF	Bitmapped characters cannot be edged.
DI, DR	Bitmapped characters can be printed only with orthogonal directions (0°, 90°, 180°, or 270°).
SI, SR	Sizes of bitmapped fonts are approximate only.
SL	The slant command is ignored for bitmapped fonts.
AD, SD, CP, LB	—

Select Standard Font (SS)

This command selects the standard font (already designed by the Standard Font Definition (SD) command) for subsequent text printing. Use the SS command to shift from the currently selected alternate font to the designated standard font.

SS [;]

The SS command tells the printer to print subsequent text printing commands using characters from the standard symbol set designated by the SD command. The SS command is equivalent to using the Shift In control character (SI, ASCII decimal code 15) within a text printing string.

The default designated standard font is the Stick font, which uses symbol set 277 (Roman-8). This font is in effect when the printer is initialized or set to its default conditions. The SS command remains in effect until an SA command is executed.

Select Alternate Font (SA)

This command selects the alternate font (already designed by the Alternate Font Definition (AD) command) for subsequent text printing. Use the SA command to shift from the currently selected standard font to the designated alternate font.

SA [;]

The SA command tells the printer to print subsequent text printing commands using characters from the alternate symbol set designated by the AD command. The SA command is equivalent to using the Shift Out control character (SO, ASCII decimal code 14) within a text printing string.

The default designated alternate font uses symbol set 277 (Roman-8). The alternate font remains in effect until an SS command is executed, a Shift In control character (SI, decimal 15) is encountered, or the printer is initialized or set to its default conditions.

Absolute Direction (DI)

This command specifies the the angle (slope or direction) at which you want to print text characters, independent of the location of scaling points P1 and P2. The DI (and DR) command allows you to print text at any angle with the letters in their normal side-by-side orientation. Use the DI command to change the printing direction when you are printing text labeling curves in line charts, schematic drawings, blueprints, and survey boundaries.

DI *run,rise* [;] or DI [;]

NOTE: Bit map characters are always printed orthogonally to the page. Scalable characters print in the direction specified. Using the DI (and DR) command, you can therefore place text anywhere on the page in any orientation.

Table 6-13 Absolute Direction Command Parameters

Parameter	Format	Functional Range	Default
run (or $\cos \emptyset$)	clamped real	-32768 to 32767	1
rise (or $\sin \emptyset$)	clamped real	-32768 to 32767	0

The DI command updates the carriage return point to the current location. While the DI command is in effect, with or without parameters, the text printing direction is not affected by changes in the locations of P1 and P2.

No parameters - Defaults the text printing direction to absolute and horizontal (parallel to X-axis). Equivalent to (DI1,0).

Run or $\cos \emptyset$ - Specifies the X-component of the text printing direction.

Rise or $\sin \emptyset$ - Specifies the Y-component of the text printing direction.

Together, the parameters specify the slope and direction of the printed characters.

You can express the parameters in measured units as rise and run, or using the trigonometric functions cosine and sine according to the following relationship:

Where: run and rise = number of measured units

\emptyset = the angle measured in degrees

$\sin \emptyset / \cos \emptyset = \text{rise/run}$

$\emptyset = \tan^{-1} (\text{rise/run})$

and

$\tan \emptyset = \sin \emptyset / \cos \emptyset$

Relative Direction (DR)

This command specifies the the direction in which text characters are printed, relative to the location of scaling points P1 and P2. The text printing direction is adjusted when P1 and P2 change so that the printed text maintains the same relationship to the scaled data. Use the DR command to change the printing direction when you are printing text labeling curves in line charts, schematic drawings, blueprints, and survey boundaries.

DR *run,rise* [:] or DR [:]

Table 6-14 Relative Direction Command Parameters

Parameter	Format	Functional Range	Default
run	clamped real	-32768 to 32767	1% of $P2_x - P1_x$
rise	clamped real	-32768 to 32767	0

The DR command updates the carriage return point to the current location. While the DR command is in effect, with or without parameters, the text printing direction is affected by changes in the locations of P1 and P2.

No parameters - Defaults the text printing direction to relative and horizontal (parallel to X-axis). Equivalent to (DR1,0).

Run - Specifies the percentage of the distance between $P1_x$ and $P2_x$.

Rise - Specifies the percentage of the distance between $P1_y$ and $P2_y$.

Absolute Character Size (SI)

This command specifies the size of text characters in centimeters. Use the SI command to establish character size independent of scaling points P1 and P2.

SI *width, height*[:] or SI [:]

Table 6-15 Absolute Character Size Command Parameters

Parameter	Format	Functional Range	Default
width	clamped real	-32768 to 32767	Dependent*
height	clamped real	-32768 to 32767	Dependent*

*Dependent on the current pitch and font height set by the AD or SD commands.

While the SI command is in effect, with or without specifying parameter values, the size of characters in the currently selected font are not affected by changes in P1 and P2.

No parameters - Character size is as specified by the SD (standard font definition) and AD (alternate font definition) commands.

Width - Specifies the width of the nominal character in centimeters. A negative width parameter mirrors text characters in the right-to-left direction.

NOTE: Changing character size also changes the width of line used to draw Stick font characters.

Height - Specifies the cap height in centimeters. A negative height parameter mirrors text characters in the top-to-bottom direction.

Note that in most languages the width of a letter is typically less than the height. If you set your characters to have a different 'aspect ratio', they may look odd in terms of readability.

An SI command remains in effect until another SI command is executed, an SR command is executed, or the printer is initialized or set to its default conditions.

Relative Character Size (SR)

This command specifies the size of characters as a percentage of the distance between P1 and P2. Use the SR command to establish relative character size so that if the P1/P2 scaling point distance changes, the character size adjusts to occupy the same relative amount of space.

SR *width, height*[:] or SR [:]

Table 6-16 *Relative Character Size Command Parameters*

Parameter	Format	Functional Range	Default
width	clamped real	-32768 to 32767	0.75% of $P2_x - P1_x$
height	clamped real	-32768 to 32767	1.5% of $P2_y - P1_y$

While the SR command is in effect, with or without specifying parameter values, the size of characters in the currently selected font are affected by changes in P1 and P2.

No parameters - Defaults the relative character width to 0.75% of the distance ($P2_x - P1_x$) and the height to 1.5% of the distance ($P2_y - P1_y$).

NOTE: Changing character size also changes the apparent stroke weight of text characters; the printer adjusts characters relative to changes in P1/P2. As long as the aspect ratio remains the same with changes in P1/P2, characters will have the same appearance relative to the new P1/P2 rectangle.

Width - Sets the character height to the specified percentage of the distance between the X-coordinates of P1 and P2. A negative width parameter mirrors text characters in the right-to left direction.

Height - Sets the character height to the specified percentage of the distance between the Y-coordinates of P1 and P2. A negative height parameter mirrors text characters in the top-to bottom direction.

The character size you specify with the SR command is a percentage of $P2_x - P1_x$ and $P2_y - P1_y$. The printer calculates the actual character width and height from the specified parameters as follows:

$$\text{actual width} = (\text{width parameter}/100 \times (P2_x - P1_x))$$

$$\text{actual height} = (\text{height parameter}/100 \times (P2_y - P1_y))$$

Character Slant (SL)

This command specifies the slant at which text characters are drawn. Use the SL command to create slanted text for emphasis, or to re-establish upright text characters after an SL command with parameters has been in effect. (Note that the SL command has no effect when an (SB1;) command is in effect.

SL tangent of angle[:] or SL [:]

Table 6-17 Character Slant Command Parameters

Parameter	Format	Functional Range	Default
tangent of angle	clamped real	-32768 to 32767	0

The printer interprets the parameters as follows:

No parameter - Defaults the slant to zero (no slant). Equivalent to (SL0).

Tangent of angle - Interpreted as an angle \emptyset from from vertical. The base of the character always stays on the horizontal plane.

The SL command only affects each character relative to an imaginary line beside the text characters. The direction or placement of the text on the drawing does not affect the SL command; neither do the settings of the P1 and P2 scaling points. (The DI and DR commands, however, do affect the slant direction, since the base of a character always stays on the baseline of the text.

You can specify the actual tangent value, or you can use the TAN function available in most computer languages.

An SL command remains in effect until another SL command is executed, or the printer is initialized or set to its default conditions.

Extra Space (ES)

This command adjusts space between characters and lines of text without affecting character size.

ES *width*[,*height*;] or ES [;]

Table 6-18 Extra Space Command Parameters

Parameter	Format	Functional Range	Default
width	clamped real	-32768 to 32767	0
height	clamped real	-32768 to 32767	0

The printer interprets the parameters as follows:

No parameters - Defaults the spaces and lines between characters to no extra space. Equivalent to (ES0,0).

Width - Specifies an increase (positive number) or decrease (negative number) in the space between characters. For maximum legibility, do not specify more than one extra space or subtract more than half a space.

Height - Specifies an increase (positive number) or decrease (negative number) in the space between lines. For maximum legibility, do not specify more than two extra lines or subtract more than half a line.

An ES command remains in effect until another ES command is executed, or until the printer is initialized or set to default conditions.

Standard Font Definition (SD)

This command defines the standard font and its characteristics: symbol set, font spacing, pitch, height, posture, stroke weight, and typeface.

SD *kind,value* ... [*kind,value*;] or SD [:]

Table 6-19 Standard Font Definition Command Parameters

Parameter	Format	Functional Range	Default
kind	clamped integer	1 to 7	None
value	clamped real	Kind dependent*	Kind dependent*

*See Table .

The printer interprets the parameters as follows:

No parameters - Defaults the standard font characteristics.

Kind - Specifies the characteristic for which you are setting a value (see Table).

Table 6-20 Kind Parameter Characteristics

Kind	Characteristic	Default Value	Description
1	Symbol set	277	Roman-8
2	Font spacing	0	fixed spacing
3	Pitch	9	characters per inch
4	Height	11.5	font point size
5	Posture	upright	upright
6	Stroke weight	0	medium
7	Typeface	48	Stick (fixed vector)

Value - Defines the properties of the characteristic specified by the *kind* parameter.

NOTE: When selecting fonts, the different characteristics (symbol set, spacing, pitch, etc.) are prioritized as shown in Table , with symbol being the highest priority and typeface being the lowest. The font selection priority is the same for HPGL/2 as for PCL font selection.

Alternate Font Definition (AD)

This command is similar to the Standard Font Definition (SD) command that defines the primary HPGL/2 font. In addition the AD command defines an alternate HPGL/2 font and its characteristics: symbol set, font spacing, pitch, height, posture, stroke weight, and typeface. It allows the font characteristics to be assigned to the secondary (alternate) font definition.

AD *kind,value* ... [*,kind,value;*] or AD [*;*]

Table 6-21 Alternate Font Definition Command Parameters

Parameter	Format	Functional Range	Default
kind	clamped integer	1 to 7	None
value	clamped real	Kind dependent*	Kind dependent*

*See Table 6-22.

The printer interprets the parameters as follows:

No parameters - Defaults the alternate font characteristics to that of the Stick font (see Table 6-21).

Kind - Specifies the characteristic for which you are setting a value (see Table 6-22).

Table 6-22 Kind Parameter Characteristics

Kind	Characteristic	Default Value	Description
1	Symbol set	277	Roman-8
2	Font spacing	0	fixed spacing
3	Pitch	9	characters per inch
4	Height	11.5	font point size
5	Posture	upright	upright
6	Stroke weight	0	medium
7	Typeface	48	Stick (fixed vector)

Value - Defines the properties of the characteristic specified by the *kind* parameter.

NOTE: When selecting fonts, the different characteristics (symbol set, spacing, pitch, etc.) are prioritized as shown in Table , with symbol being the highest priority and typeface being the lowest. The font selection priority is the same for HPGL/2 as for PCL font selection.

Character Fill Mode (CF)

The character fill mode command specifies the way scalable fonts are filled and edged; bitmap and Stick fonts cannot be edged and can be filled only with raster fill, shading, or PCL cross-hatched patterns. Scalable characters may be filled with any of the fill patterns specified by the FT command (shading, hatching, cross-hatch, and user-defined raster fill patterns).

CF fill mode[,edge pen[:]] or CF [:]

Table 6-23 Character Fill Mode Command Parameters

Parameter	Format	Functional Range	Default
fill mode	clamped integer	0, 1, 2, or 3	0 (solid fill)
edge pen	integer	$-(2)^{30}$ to $2^{30} - 1$	0 (no edging)

No parameters - Defaults characters to solid fill with no edging. Equivalent to (CF0,0).

Fill mode - Specifies how the printer renders filled characters according to the following parameter values:

- 0: Specifies solid f using the current pen and edging with the specified pen (or current pen if the edge pen parameter is not specified).
 - 1: Specifies edging with the specified pen (or current pen if the edge pen parameter is not specified). Characters are filled only if they cannot be edged (bitmap or stick characters) using the edge pen.
 - 2: Specifies filled characters using the current fill type (refer to the FT command in Section 9. The currently selected pen is used. Characters are not edged. If the edge pen parameter is specified, it is ignored.
 - 3: Specifies filled characters using the current fill type (refer to the FT command in Section 9. The currently selected pen is used. Characters are edged with the specified pen (or current pen if the edge pen parameter is not specified).
-

Edge pen - For characters that are not to be edged, this parameter indicates the pen that is used to edge the character (black or white).

0: No edging

1: Black edging. The outline pen width is not selectable, but varies in thickness in proportion to the point size of the font.

Note that the absolute direction (DI) and relative direction (DR) commands do not cause rotation of fill patterns. Fill patterns remain fixed with respect to the current coordinate system. The CF command remains in effect until another CF command is executed or the printer is initialized or set to its default conditions.

Label Origin (LO)

This command positions text characters relative to the current pen location. Use the LO command to center, left justify, or right justify text. The text can be drawn above or below the current pen location and can also be offset by an amount equal to 0.25 times the point size (or 16 grid units [0.33 times the point size] for the Stick font).

LO *position*[:] or LO [:]

Table 6-24 Label Origin Command Parameters

Parameter	Format	Functional Range	Default
position	clamped integer	1 to 9, 11 to 19, or 21	1

The printer interprets the parameters as follows:

No parameters - Defaults the text origin. Equivalent to (LO1).

Position - Position numbers correspond to dots which graphically represent the current pen location. Positions LO 11 through LO 19 differ from position LO 9 only in that the text is offset from the current pen location. Position 21 provides a PCL-compatible text origin. Characters are printed in the same location as in PCL.

The LO command does not change the text path. To change the text path, use the DV command.

Each time the LO command is sent, the carriage return point is updated to the location the pen was in when the LO command was received. The current pen location (but not the carriage return point) is updated after each character is drawn, and the pen automatically moves to the next character origin. If you want to return a pen to its previous location prior to the next label (LB) command, you can send a carriage return after the text but before the label terminator.

When you embed carriage return characters in text, each portion of the text character is positioned according to the text origin, just as if they were written as separate label (LB) commands.

An LO command remains in effect until another LO command is executed, or the printer is initialized or set to its default conditions.

Label (LB)

This command prints text using the currently defined font. Use the LB command to annotate drawings or create text-only charts.

LB text ... text label terminator

Table 6-25 Label Command Parameters

Parameter	Format	Functional Range	Default
text ... text	character	any character(s)	None

The LB command includes an automatic pen down function. When the LB command completes, the original pen up/down status is restored.

text ... text - ASCII characters are drawn using the currently selected font. (Refer to the AD, SA, SD, and SS commands in this section for details on specifying and selecting fonts).

You can include non-printing characters such as the carriage return (CR - decimal code 13) and line feed (LF - decimal code 10). These characters invoke the specified function, but are not drawn.

The text begins at the current pen location (unless altered by the LO command). After each character is drawn, the pen location is updated to be the next character origin.

Label terminator - Terminates the LB command. You must use the special label terminator (refer to the DT command in this section) to tell the printer to exit the LB command mode. If you do not use the label terminator, everything following the LB mnemonic is printed as text characters, including other commands. The default label terminator is the non-printing, end-of-text ETX (decimal code 3) sequence. You can define a different terminator using the DT command.

Define Label Terminator (DT)

This command specifies the character to be used as the label terminator and whether it is printed. Use the DT command to define a new label terminator if you desire a different one or if your computer cannot use the default (ETX, decimal code 3) sequence.

DT label terminator[,mode;] or DT;

Table 6-26 Define Label Terminator Command Parameters

Parameter	Format	Functional Range	Default
label terminator	text	Any character except NULL, LF, ESC, and ; (decimal codes 0, 5, 27, and 29 respectively).	ETX (decimal code 3)
mode	clamped integer	0 or 1	1 (non-printing)

The character immediately following DT is interpreted to be the new label terminator. You must terminate all LB commands following a DT command with the specified label terminator.

No parameter - Defaults the label terminator to ETX (not a semicolon) and the mode to non-printing (1).

Label terminator - Specifies the label terminator as the character immediately following the DT mnemonic. (If you use a space between the mnemonic and the label terminator parameter, the space becomes the label terminator.

Mode - Specifies whether the label terminator is printed.

- 0: The label terminator prints if it is a printable character and performs its function if it is a control code.
- 1: (Default) The label terminator does not print if it is a printable character and does not perform its function if it is a control code.

A DT command remains in effect until another DT command is executed, or the printer is initialized or set to its default conditions.

Character Plot (CP)

This command moves the pen the specified number of spaces and lines from the current pen location. Use CP to position text for indenting, centering, and so on.

CP spaces,lines [:] or CP [:]

Table 6-27 Character Plot Command Parameters

Parameter	Format	Functional Range	Default
spaces	clamped real	-32768 to 32767	None
lines	clamped real	-32768 to 32767	None

The CP command includes an automatic pen down function. When the CP command completes, the original pen up/down status is restored.

The CP command moves the pen position in relation to the current position. CP is a movement command and does not affect the margin; to repeat the same movement for subsequent text, you must issue new CP commands.

No parameters - Performs a carriage return and line feed (moves one line down and returns to the carriage return point).

Spaces - Specifies the number of spaces the pen moves relative to the current pen location. Positive values specify the number of spaces that the pen moves to the right of the current pen position; negative values specify the number of spaces that the pen moves to the left. Right and left are relative to the current text direction. The space width is uniquely defined for each font; use the ES command described earlier in this section to adjust the width.

NOTE: If you are using a proportionally-spaced font, the width of the Space control code is used.

Lines - Specifies the number of lines the pen moves relative to the current pen location. Positive values specify the number of lines that the pen moves up from the current pen position; negative values specify the number of lines that the pen moves down (a value of -1 is equivalent to a line feed). Up and down are relative to the current text direction. The line feed distance is uniquely defined for each font; use the ES command described earlier in this section to adjust the height.

When you move the pen up or down a specific number of lines, the carriage return point shifts up or down accordingly.

Transparent Data (TD)

This command specifies whether control codes perform their associated functions or print as characters during text printing. Use the TD command to print characters that function only as control characters in normal mode.

TD mode[;] or TD [;]

Table 6-28 Transparent Data Command Parameters

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

The printer interprets the parameters as follows:

No parameters - Defaults the text printing mode to normal. Equivalent to (TD0).

Mode - Selects the normal or transparent data mode for text printing.

- 0: Normal. Control codes with an associated functionality perform their function and do not print..
- 1: Transparent. All characters print and perform no other function (except the currently defined label terminator, which terminates text printing). The printer prints a space for non-printing or undefined characters.

Transparent data mode must be enabled to access printable characters that have character codes with an associated functionality in normal mode. For example, the left arrow in the PC-8 symbol set has a character code of 27. In normal mode, a character code of 27 is interpreted as an escape character (ESC); in transparent data mode, a character code of 27 prints a left arrow.

Define Variable Text Path (DV)

This command specifies the text path for subsequent text characters and the direction of line feeds as either left or right, up or down. Use the DV command to “stack” characters in a column.

DV *path*[*line*;] or DV [;]

Table 6-29 Define Variable Text Path Command Parameters

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

The DV command determines the text path, which is the direction that the current location moves after each character is drawn and the direction that the carriage return point moves when a line feed is included in the text string.

No parameter - Defaults the text path to horizontal (not stacked) with normal line feed. Equivalent to (DV0,0).

Path - Specifies the location of each character with respect to the preceding character, relative to the labeling direction defined by the DI or DR commands. The text path set by the DV command is not affected by changes in scaling points P1 and P2.

- 0: 0 degrees. (Right) Within a label, each character begins to the right of the previous character. This is a horizontal text path (unless altered by the DI or DR commands).
- 1: 90 degrees. (Down) Within a label, each character begins below the previous character. This is a vertical text path (unless altered by the DI or DR commands).
- 2: 180 degrees. (Left) Within a label, each character begins to the left of the previous character. This is a horizontal text path (unless altered by the DI or DR commands).
- 3: 270 degrees. (Up) Within a label, each character begins above the previous character. This is a vertical text path (unless altered by the DI or DR commands).

Line - Specifies the location of each character with respect to the preceding character relative to the text printing direction defined by the DI or DR commands.

- 0 to -90 degrees. (Normal Line Feed) Sets the direction of line feeds -90 degrees with respect to the text path.
- 0 to +90 degrees. (Reverse Line Feed) Sets the direction of line feeds +90 degrees with respect to the text path.

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Section 7

HP PCL Font Management and Soft Font Downloading

The IntelliBar has eight internal fonts.* You can add more fonts by downloading soft fonts. Font management provides mechanisms for downloading and using soft fonts while providing the means for controlling which soft fonts are saved in user memory (RAM) or deleted. You can download and print up to 32 fonts per page. Each time you download a font, user memory is decreased.

Soft fonts are usually packaged on a diskette. In order to use your soft fonts you need to copy them from the diskette to your printer. This is termed downloading. Some applications download fonts for you, so refer to your application documentation. If not, follow the instructions (for MS-DOS systems) in this section.

DOWNLOADING SOFT FONTS

The process of transferring soft fonts from a host computer to the printer's user memory (RAM) is called downloading. You must designate a unique identification (ID) number prior to downloading the font. This number is then associated with the soft font. This number is assigned using the font ID command described later in this section. Subsequent manipulation of the soft font is accomplished using the font's ID number. If a font is already associated with this ID number in the printer, the existing font is deleted during the download..

Several commands are required to define a font before downloading it to the printer. These commands are described in Section 8. HP font files include the necessary commands that define the symbols of a font, including the typeface, style/weight, point size, orientation, and symbol set. Assigning a font ID number and then copying the font file to the printer downloads the font. Scalable fonts and typefaces may be prepared by font management software. Once prepared, scalable fonts are downloaded in much the same way as bit map fonts.

Once downloaded, the soft font occupies a portion of user memory (RAM). The number of soft fonts that can be stored in user memory is limited by the amount of available RAM.

- Make sure there is sufficient space in the printer memory before downloading fonts. Because you cannot determine exactly how much memory is free, you should initialize the printer to clear memory whenever possible before downloading soft fonts.
- Always remain within the same directory when working with fonts.
- Do not alter the font file names in any way.

TEMPORARY/ PERMANENT FONTS

The printer automatically designates a font as a temporary font after downloading. The font is deleted from memory during a printer reset. The font can be designated as a permanent font so it will remain after a printer reset. The status of the font is determined by the font control escape sequence and the font ID value..

NOTE: Temporary and permanent fonts do not remain in the user memory whenever printer power is turned off.

FONT CONTROL

Font control provides several ways for you to use fonts..

ESC *c#F

Decimal: 027 042 099 ### 070

Hex: 1B 2A 63 3# 46

- # (ESC)
- 0 = Delete all soft fonts
 - 1 = Delete all temporary soft fonts
 - 2 = Delete soft font (last ID and character code specified)
 - 3 = Delete character code (last ID and character code specified)
 - 4 = Make soft font temporary (last ID specified)
 - 5 = Make soft font permanent (last ID specified)
 - 6 = Copy/assign the currently invoked font as temporary

NOTE: If you delete a primary or secondary font, a new primary or secondary font is automatically selected from the remaining fonts.

For example, to remove all soft fonts from the user memory, send

ESC*c0F

To remove temporary soft fonts, send

ESC*c1F

To delete a soft font with an ID of 1, send

ESC*c1d2F

You can select soft fonts by using their ID numbers (see "Font Selection by ID").

If the designated font is available, it is selected as the primary/secondary font and all primary/secondary font characteristics are set to match the selected font. If the selected font is proportionally spaced, the pitch characteristic is not changed.

FONT SELECTION BY ID

ESC(# X designates the soft font # as primary

Decimal: 7 040 # 088

Hex: 28 # 58.

ESC)# X designates the soft font # as secondary

Decimal: 7 041 # 088

Hex: 29 # 58

For example, to select a font with an ID number of 7 as the primary font, send

ESC (7X

To select a font with an ID number of 5 as the secondary font, send

ESC)5X

The current font remains in use if designated font is unavailable.

NOTE: In shared or networked operations, soft fonts should be selected by characteristics rather than the font ID number.

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Section 8

HP PCL Soft Font Design

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 characteristics to the printer.*

A character descriptor specifies the position and shape of an individual character and the implied movement of the cursor after printing the character. Following each character descriptor is a block of raster data containing the dot-per-inch image of the character.

COORDINATE SYSTEM

Characters of a font are designed within a rectangular area called a cell. The dimensions of the cell are in PCL Coordinate system dots and are therefore page orientation-independent (refer to “Page Characteristics” in Section 2 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 Figure 8-1.

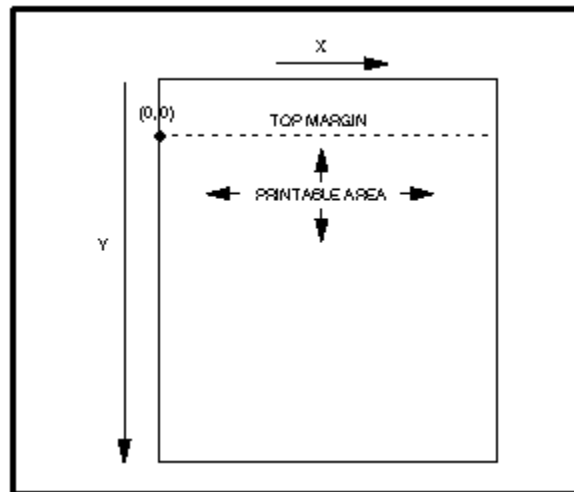


Figure 8-1 Physical Coordinate System

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.

Figure 8-2 shows a character cell.

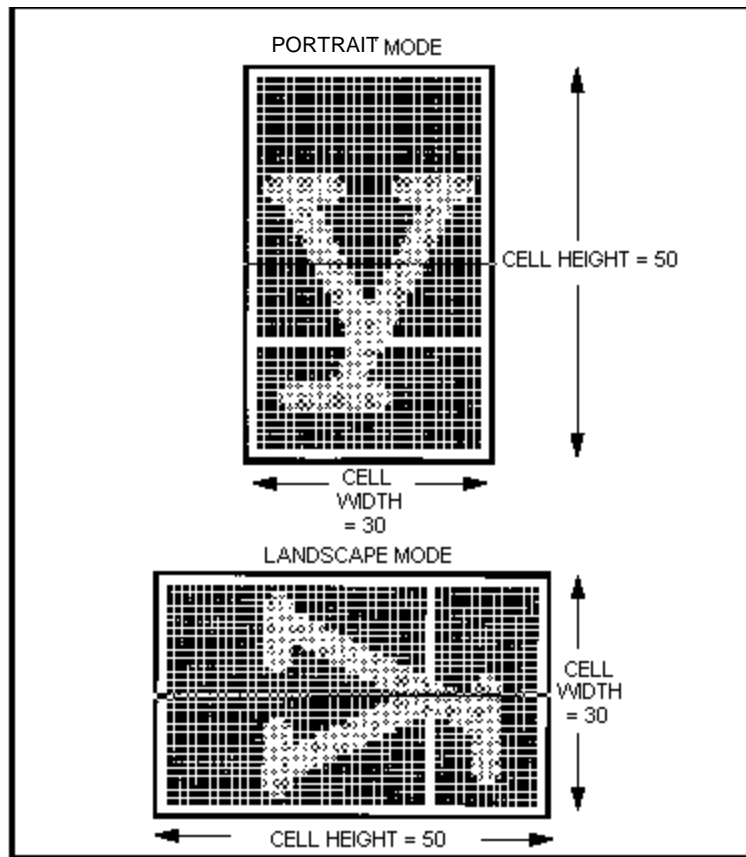


Figure 8-2 Character Cell

FONT DESCRIPTOR FORMAT

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

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

Table 8-1 describes the format of the font descriptor.

Table 8-1 Font Descriptor Format

Byte	15 (MSB)	8	7	(LSB) 0
0	Font Descriptor Size (64)			
2	Header format (0)		Font type	
4	Style MSB		Reserved	
6	Baseline position			
8	Cell width			
10	Cell height			
12	Orientation		Spacing	
14	Symbol set			
16	Pitch (default HMI)			
18	Height			
20	x - Height			
22	Width type		Style LSB	
24	Stroke weight		Typeface LSB	
26	Typeface MSB		Serif style	
28	Quality		Placement	
30	Underline position (Distance)		Underline thickness (height)	
32	Text height			
34	Text width			
36	First code			
38	Last code			
40	Pitch extended		Height extended	
42	Cap height			
44 - 47	Font number . . .			
48 - 63	Font name . . .			
64	Copyright (optional)			

NOTE: The following notation is used to define the data type of each field in the font descriptor described in the following subsections.

- (B) :Boolean (0,1)
(UB) :Unsigned Byte (0 # 225)
(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. The standard font descriptor size is 64 bytes.

Font Type (UB)

Specifies one of the font types defined in Table 8-2. The font type should be set appropriately for the font's symbol set.

Table 8-2 Font Type Values

Value	Font Type
0	7-bit (96 characters) – character codes 32 to 127 [decimal] are printable.
1	8-bit (192 characters) – character codes 32 to 127 [decimal] and 160 to 255 [decimal] are printable.
2	8-bit (256 characters) – All characters are printable, however 0, 7 to 15, 27, and 28 [decimal] must be in transparency mode to print.

Use the transparent print data command to access those codes that are unprintable, yet have a character defined.

Descriptor Format

The descriptor format byte should be set to zero.

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 valid 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.

Cell Height (UI)

Specifies the height of the cell in PCL coordinate system dots.

Orientation (UB)

Specifies the orientation of the font. All characters within the font must have the same orientation; otherwise they are 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 (shown in Table 8-3) is computed by taking the "value field" value for the symbol set, multiplying it by 32, adding the ASCII decimal value of the escape sequence termination character, and subtracting 64.

For example, the ISO Symbol Set 61 has a value field of 0 and a termination character of D (ASCII decimal 68). Therefore the symbol set value for ISO 61 is

$$(0 \times 32) + 68 - 64 = 4$$

The valid range of symbol set values is 0 to 2047. Refer to Table 8-3 for the font descriptor symbol set values. The Hewlett-Packard emulation uses the font descriptor symbol set values from 0 to 1023. Symbol set escape sequence value field values 1024 to 2047 are available for use by independent font vendors. Symbol set escape sequence termination characters can be any uppercase ASCII character "A" through "V".

Table 8-3 Symbol Set Values

Symbol Set Name	Value Field	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	0	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

*Not recommended for future use.

Table 8-3 Symbol Set Values (cont'd)

Symbol Set Name	Value Field	Termination Character	Symbol Set Value
*ISO 14: JIS ASCII	0	K	11
*ISO 57: Chinese	2	K	75
Technical-7	1	M	45
HP Math-8	8	M	269
ECMA-94 Latin 1	0	N	14
OCR A	0	O	15
OCR B	1	O	47
ISO 11: Swedish Names	0	S	19
*HP Spanish	1	S	51
ISO 17: Spanish	2	S	83
*ISO 10: Swedish	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 (Danish/Norwegian)	11	U	373
HP PI Font	15	U	501

* Not recommended for future use.

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 IntelliBar supports a pitch range of 0 to 16,800 quarter-dots. Any values greater than 16,800 are set to 16,800.

Height (UI)

Specifies the design height of the font in quarter-dot units. This value, converted to points, is used as the height characteristics value of the font. A PCL point is 1/72 (0.01389) inch. The IntelliBar supports a height range of 0 to 10,922 quarter-dots. Any values greater than 10,922 are set to 10,922.

x#Height (UI)

Specifies the height of the lowercase "x" in quarter-dot units. The IntelliBar does not use this field.

Width Type (SB)

Specifies the proportionate width of characters in the font. The IntelliBar does not use this field.

Style (UB)

Specifies the style of the font. Upright is specified by 0 and italics by 1.

Stroke Weight (SB)

Specifies the thickness of the strokes used in designing the font. The supported stroke weight values are -7 through 7 (see Table 8-4). The thinnest stroke available is -7; and 7 is the thickest stroke weight available. The standard stroke weight for a medium font is 0; the standard stroke weight for a bold font is 3; and the standard stroke weight for a light font is -3.

Table 8-4 Stroke Weights

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

Typeface

Specifies the least significant byte of the typeface of the font (see Table 8-5).

Table 8-5 Typeface Values

Value	Typeface
0	Line Printer
3	Courier
4	Helv
5	TmsRmn
6	Letter Gothic
8	Prestige
11	Presentations

Serif Style (UB)

Specifies one of the serif styles defined in Table 8-6.

Table 8-6 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

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. The IntelliBar always uses a three-dot thickness for an underline.

Text Height (UI)

Specifies the font's optimum inter-line spacing in quarter-dot units. The IntelliBar does not use this field.

Text Width (UI)

Specifies the font's average lowercase character width in quarter-dot units. The IntelliBar does not use this field.

Pitch Extended (UB)

This is an addition to the pitch field that extends the pitch an extra eight bits. The value of this field is 1/1024 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 addition to the height field that extends the height an extra eight bits. The value of this field is 1/1024 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).

Font Name (ASC16)

This is a 16-character ASCII field that you use to assign a font name. The IntelliBar prints this font name on the test print when you select font sample (see the *Intellibar User's Guide*).

FONT DESCRIPTOR (FONT HEADER) COMMAND

The font descriptor (font header) command is used to download font header data to the printer.

```
ESC)s#W [font header data]
```

The value field (#) identifies the number of bytes in the font header (see Table 8-7).

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

```
ESC*c1D (set Font ID to 1)
ESC)s64W [64 bytes of font header data]
```

Table 8-7 lists the font header data.

Table 8-7 Font Header Data

Field Name	Value	Description
Font Descriptor Size	64	Bytes
Reserved	0	
Font Type	1	Eight bit
Reserved	0	
Baseline Distance	35	
Cell Width	30	
Cell Height	50	
Orientation	0	Portrait
Spacing	0	Fixed Pitch
Symbol Set (8U)	277	(8x32 + (85-64))
Pitch	120	30 dots
Height	200	50 dots
xHeight	9	223 dots
Width Type	0	Medium
Style	0	Upright
Stroke Weight	0	Normal
Typeface (LSB)	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

Table 8-7 Font Header Data (cont'd)

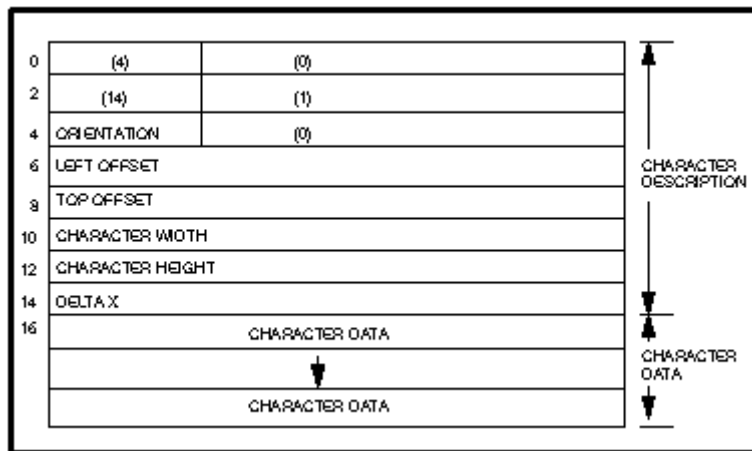
Field Name	Value	Description
Pitch Extended		0
Height Extended		0
Reserved		0
Reserved		0
Reserved		0
Font Name	Courier 10	0

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 is deleted during the download of the character descriptor and data. Unless otherwise specified, inappropriate values in a character descriptor field invalidate the character download process; a character is not created, and the associated descriptor and data is discarded.

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

Figure 8-3 illustrates the format of the character descriptor and data.

**Figure 8-3 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 printer 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 escape sequence value field is limited to 32767 bytes, characters whose number of descriptor and data block bytes exceed this limit must be downloaded in two or more blocks. Figure 8-4 illustrates the format of a character data continuation block.

Byte	15 – MSB	8	7	LSB – 0
0	Format (4)		Continuation (1)	
2	Character Data			
4	(in bytes)			
	–			
	–			
	–			

Figure 8-4 Character Descriptors/Data Continuation Block

Descriptor Size (UB)

Specifies the size of the character descriptor in bytes. The IntelliBar uses a descriptor size of 14.

Class (UB)

Specifies the format of the character data. The IntelliBar uses 1 as the character data format number.

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).

The valid 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 Figure I-5 and Figure I-6).

The valid range for the top offset is -4200 to 4200.

Character Width (UI)

Specifies the width of the character in dots on the physical coordinate system.

The valid range for the character width is 1 to 4200. If you exceed the cell boundary defined in the font descriptor, the character will not download.

Character Height (UI)

Specifies the height of the character in dots on the physical coordinate system.

The valid range for character height is 1 to 4200. If you exceed the cell boundary defined in the font descriptor, the character will not download.

Delta X (SI)

Specifies the number of quarter-dot units by which the horizontal position within the 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 valid 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 8-5 and Figure 8-6). 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.

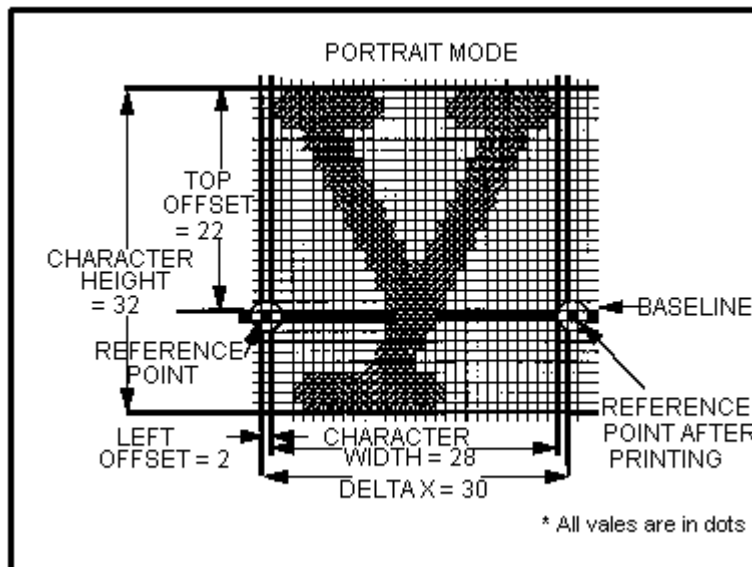


Figure 8-5 Portrait Character Example

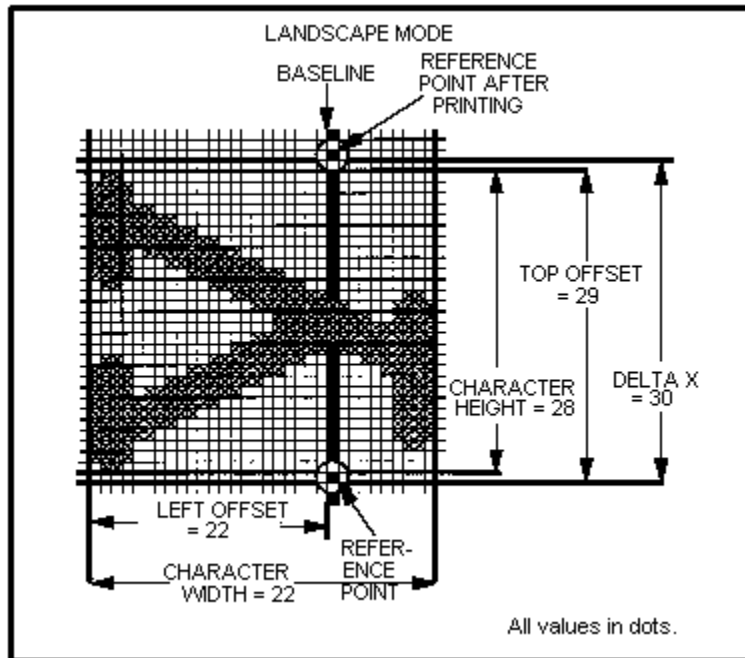


Figure 8-6 Landscape Character Example

CHARACTER CODE

The character code sequence 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.

ESC*c#E

Decimal: 027 042 099 # 069

Hex: 1B 2A 63 # 45

#: character code.

For example, to designate the character code for an ASCII lowercase "y", send:

ESC*c103E

DOWNLOAD CHARACTER

The download character sequence downloads a character descriptor and associated character data to the printer.

ESC(s#W [character descriptor and data]

Decimal: 027 040 115 # 087

Hex: 1B 28 73 # 57

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

For example, to download the character descriptor and data for a portrait, 10 Pitch, 12 point, upright medium, Courier lowercase “y”, send:

ESC*c121E (121 is the decimal character code for an ASCII lowercase “y”)

ESC(s144W [character descriptor and data]

Table 8-8 lists the character format, continuation, and descriptor data.

Table 8-8 Portrait Character Descriptor Data

Field Name	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

Figure 8-7 shows a portrait character data example.

Character data:

Dot Row	Bit Map				Decimal Equivalent			
01	01111111	11000000	00111111	11100000	127	192	63	224
02	11111111	11100000	01111111	11110000	255	224	127	240
03	11111111	11100000	01111111	11110000	255	224	127	240
04	01111111	11000000	00111111	11100000	127	192	63	224
05	00011110	00000000	00001111	10000000	30	0	7	128
06	00011111	00000000	00001111	10000000	31	0	15	128
07	00001111	00000000	00001111	00000000	15	0	15	0
08	00001111	10000000	00011111	00000000	15	128	31	0
09	00000111	10000000	00011110	00000000	7	128	30	0
10	00000111	11000000	00111110	00000000	7	192	62	0
11	00000011	11000000	00111100	00000000	3	192	60	0
12	00000011	11100000	01111100	00000000	3	224	124	0
13	00000001	11100000	01111000	00000000	1	224	120	0
14	00000001	11110000	11111000	00000000	1	240	248	0
15	00000000	11110000	11110000	00000000	0	240	240	0
16	00000000	11111001	11110000	00000000	0	249	240	0
17	00000000	01111001	11100000	00000000	0	121	224	0
18	00000000	01111111	11100000	00000000	0	127	224	0
19	00000000	00111111	11000000	00000000	0	63	192	0
20	00000000	00111111	11000000	00000000	0	63	192	0
21	00000000	00011111	10000000	00000000	0	31	128	0
22	00000000	00011111	10000000	00000000	0	31	128	0
23	00000000	00001111	00000000	00000000	0	15	0	0
24	00000000	00011111	00000000	00000000	0	31	0	0
25	00000000	00011110	00000000	00000000	0	30	0	0
26	00000000	00111110	00000000	00000000	0	62	0	0
27	00000000	00111100	00000000	00000000	0	60	0	0
28	00000000	01111100	00000000	00000000	0	124	0	0
29	00011111	11111111	00000000	00000000	31	255	0	0
30	00111111	11111111	10000000	00000000	63	255	128	0
31	00111111	11111111	10000000	00000000	63	255	128	0
32	00011111	11111111	00000000	00000000	31	255	0	0

Figure 8-7 Portrait Character Data Example

To download the character descriptor and data for a landscape, 10 pitch, 12 point, upright, medium, Courier lowercase “y”, send:

ESC*c121E (121 is the decimal character code for an ASCII lowercase “y”)

ESC(s124W [character descriptor and data]

Character format, continuation, and descriptor data are listed in Table 8-9.

Table 8-9 Landscape Character Descriptor Data

Field Name	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 dots

Figure 8-8 shows a landscape character data example.

Character data:

Dot Row	Bit Map				Decimal Equivalent			
01	01100000	00000000	00000000	00000000	96	0	0	0
02	11110000	00000000	00000000	00000000	240	0	0	0
03	11110000	00000000	00000000	00000000	240	0	0	0
04	11111100	00000000	00000000	00000000	252	0	0	0
05	11111111	00000000	00000000	00000000	255	0	0	0
06	11111111	11000000	00000000	00000000	255	192	0	0
07	11111111	11110000	00000000	00000000	255	240	0	0
08	11110111	11111100	00000000	00000000	247	252	0	0
09	11110001	11111111	00000000	00000000	241	255	0	0
10	11110000	01111111	11000000	00000000	240	127	192	0
11	01100000	00011111	11110000	00000000	96	31	240	0
12	00000000	00000111	11111100	00000110	0	7	252	6
13	00000000	00000001	11111111	00001111	0	1	255	15
14	00000000	00000000	01111111	11001111	0	0	127	207
15	00000000	00000000	01111111	11111111	0	0	127	255
16	00000000	00000001	11111111	11111111	0	1	255	255
17	00000000	00000111	11111101	11111111	0	7	253	255
18	01100000	00011111	11110000	01111111	96	31	240	127
19	11110000	01111111	11000000	00011111	240	127	192	31
20	11110001	11111111	00000000	00001111	241	255	0	15
21	11110111	11111100	00000000	00001111	247	252	0	15
22	11111111	11110000	00000000	00001111	255	240	0	15
23	11111111	11000000	00000000	00001111	255	192	0	15
24	11111111	00000000	00000000	00001111	255	0	0	15
25	11111100	00000000	00000000	00001111	252	0	0	15
26	11110000	00000000	00000000	00000110	240	0	0	6
27	11110000	00000000	00000000	00000000	240	0	0	0
28	01100000	00000000	00000000	00000000	96	0	0	0

Figure 8-8 Landscape Character Data Example

* "This information is subject to change without notice. This information is provided "as is" without either express or implied warranty. IntelliTech International, Inc. disclaims any and all warranties with regard to this information. IntelliTech shall not be liable in any event for any special, indirect or consequential damages or any damages whatsoever resulting from loss of data, profits or use, for any reason or in any action, arising out of or in connection with the use or performance of this information. "

Section 9

HP PCL Graphics Commands

PCL provides several forms of graphics functionality. Included is the ability to build dot-per-bit raster images, create pre-defined patterns, fill or shade rectangular areas with pre-defined patterns, and print vector graphics using the HPGL/2 graphics language.*

NOTE: For detailed information on the commands described in this section, refer to the PCL5 printer language document set available from Hewlett-Packard.

RASTER GRAPHICS

Images composed of groups of dots are raster images. Pictures in newspapers or on television are examples of raster images. PCL includes commands for printing raster images. The image is divided into rows one dot high. A dot row of raster image data is transferred to the printer as a string of bytes containing a dot-per-inch 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 each row 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.

Figure 9-1 shows an example of a raster image in the shape of a star.

Dot Row	Binary Representation			
	byte 1	byte 2	byte 3	byte 4
01	00000000	00000001	10000000	00000000
02	00000000	00000001	10000000	00000000
03	00000000	00000011	11000000	00000000
04	00000000	00000011	11000000	00000000
05	00000000	00000111	11100000	00000000
06	00000000	00000111	11100000	00000000
07	00000000	00001111	11110000	00000000
08	00000000	00001111	11110000	00000000
09	00000000	00011111	11111000	00000000
10	00000000	00011111	11111000	00000000
11	00000000	00111111	11111100	00000000
12	11111111	11111111	11111111	11111111
13	01111111	11111111	11111111	11111110
14	00111111	11111111	11111111	11111100
15	00011111	11111111	11111111	11111000
16	00001111	11111111	11111111	11110000
17	00000111	11111111	11111111	11100000
18	00000011	11111111	11111111	11000000
19	00000001	11111111	11111111	10000000
20	00000000	11111111	11111111	00000000
21	00000001	11111111	11111111	10000000
22	00000001	11111111	11111111	10000000
23	00000011	11111111	11111111	11000000
24	00000011	11111110	01111111	11000000
25	00000111	11111100	00111111	11100000
26	00000111	11110000	00001111	11100000
27	00001111	11100000	00000111	11110000
28	00001111	10000000	00000001	11110000
29	00011111	00000000	00000000	11111000
30	00011100	00000000	00000000	00111000
31	00111000	00000000	00000000	00011100
32	00110000	00000000	00000000	00001100

Figure 9-1 Star-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.

```
ESC*t#R
Decimal: 027 042 116 # 082
Hex:     1B 2A 74 # 52

#: 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 IntelliBar has 300 dots-per-inch print resolution. The IntelliBar automatically expands raster graphics transferred at resolutions less than 300 dots-per-inch to 300 dots-per-inch during printing.

Figure 9-2 illustrates a single bit translated into the corresponding printed dots in each of the four resolutions:

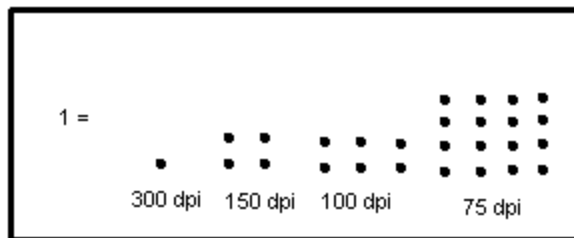


Figure 9-2 *Dot Translation*

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.

Raster Graphics Presentation

```
ESC*r0F (prints in orientation of logical page)
Decimal: 027 042 114 048 070
Hex:     1B 2A 72 30 46

ESC*r3F (raster image prints along the width of the physical page)
Decimal: 027 042 114 051 070
Hex:     1B 2A 72 33 46
```

This command specifies the orientation of the raster image on the logical page.

A value of 0 means that a raster row prints in the positive X-direction of the PCL coordinate system. (The print direction translates the PCL coordinate system.)

A value of 3 means that the raster graphics prints along the width of the physical page, regardless of the logical page orientation.

The IntelliBar prints raster graphics along the width of the physical page, regardless of addressable print area orientation. In portrait orientation, a raster row will be 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 will be 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. Figure 9-3 illustrates a master graphics representation.

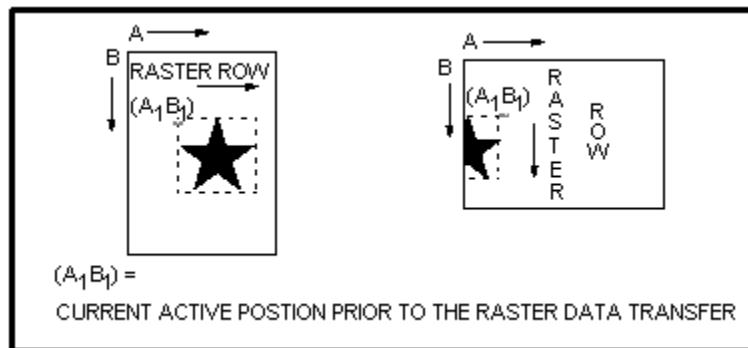


Figure 9-3 Raster Graphics Presentation

Raster Height Command

ESC*r#T

Decimal: 027 042 114 #..# 084

Hex: 1B 2A 72 #..# 54

#: height in raster rows

Range = 0 to (logical page length – current Y-position of the 0, cursor)

This command specifies the height in raster rows of the raster area. Height is the direction perpendicular to the direction that raster rows are laid down; height is therefore subject to the current raster presentation mode and print direction (see “Transfer Raster Data” and “Start Raster Data” for further information. Unspecified data maps to either white or transparent, depending on the source transparency mode (see “Select Source Transparency Mode”).

This command fills the raster area to the full raster height with zeroed rows. Only raster data appearing within the intersection of the logical page, the printable area, and if set, the raster width and height, is printed. Data outside the intersection is clipped.

Raster Width Command

ESC*r#S

Decimal: 027 042 114 #.# 083

Hex: 1B 2A 72 #.# 53

#: width in pixels of the specified resolution

Default = depends on the raster presentation mode setting

0: width = width of logical page – left graphics margin

3: width = dimension of logical page along paper length – left graphics margin

Range = 0 to (logical page length – left graphics margin)

This command the width in pixels of the raster area. Width is the direction that the raster rows are laid down; height is therefore subject to the current raster presentation mode and print direction (see “Transfer Raster Data” and “Start Raster Data” for further information).

This command allows you to tell the printer to pad raster rows that are not specified for the full raster width with zeroes. Unspecified data maps to either white or transparent, depending on the source transparency mode (see “Select Source Transparency Mode”).

Only raster data appearing within the intersection of the logical page, the printable area, and if set, the raster width and height, is printed. Data outside the intersection is clipped.

Start Raster Graphics

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

ESC*r#A

Decimal: 027 042 114 48 065 (left raster graphics margin)

Hex: 1B 2A 72 30 41 (left raster graphics margin)

Decimal: 027 042 114 49 065 (current cursor)

Hex: 1B 2A 72 31 41 (current cursor)

#: 0 = left graphics margin location is x-position 0.

1 = left graphics margin at the current x-position (current cursor position)

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 (the current cursor position).

Once a start raster graphics command is received by the printer, raster graphics resolution, raster graphics presentation mode, raster height, raster width, and left raster graphics margins are fixed until an end raster graphics command is received.

Raster Y Offset Command

ESC*b#Y

Decimal: 027 042 098 #..# 089

Hex: 1B 2A 62 #..# 59

= number of raster lines of vertical movement

Range = 0 - 32767

This command moves the cursor position vertically the specified number of raster lines from the current raster position in the raster area.

This command is recognized only while in raster graphics mode and only within the raster area.

Set Compression Method Command

ESC*b0M (uncoded - no compression)

Decimal: 027 042 098 048

Hex: 1B 2A 62 30 41

ESC*b1M (run-length encoded)

Decimal: 027 042 098 049 077

Hex: 1B 2A 62 31 41

ESC*b2M (TIFF - not supported by IntelliBar)

Decimal: 027 042 098 050 077

Hex: 1B 2A 62 32 41

ESC*b3M (delta row)

Decimal: 027 042 098 051 077

Hex: 1B 2A 62 33 41

ESC*b4M (reserved)

Decimal: —

Hex: —

ESC*b5M (adaptive compression)

Decimal: 027 042 098 053 077

Hex: 1B 2A 62 35 41

This command allows you to code raster data in one of four compressed formats:

- run-length encoding
 - tagged imaged file format (TIFF)
-

- delta row compression
- adaptive compression

The choice of compression methods affects both the amount of code needed to generate a raster graphics image and the efficiency with which the image is printed. Compressed data formats allow for efficient transfer of data from the host system to the printer. However, compressed data formats do not reduce the amount of printer memory required to produce an image.

Transfer Raster Data

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

```
ESC*b#W [raster data]
Decimal: 027 042 098 # 087
Hex:     1B 2A 62 # 57
```

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.

End Raster Graphics

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

```
ESC*rB
Decimal: 027 042 114 066
Hex:     1B 2A 72 42
```

RASTER GRAPHICS EXAMPLE

To transfer a raster graphic image (see Figure 9-4) in the shape of an star, perform the following steps:

1. Position the cursor:

```
ESC*p300x400Y
```

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

2. Specify the raster graphics resolution:

```
ESC*t75R
```

This sets the raster graphics resolution to 75 dots-per-inch.

3. Specify the left raster graphics margin:

```
ESC*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 .

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

```
ESC*rB
```

Dot Row	byte 1	byte 2	byte 3	byte 4	Decimal Equivalent
01	00000000	00000001	10000000	00000000	Esc*b4W[0, 1, 128, 0]
02	00000000	00000001	10000000	00000000	Esc*b4W[0, 1, 128, 0]
03	00000000	00000011	11000000	00000000	Esc*b4W[0, 3, 192, 0]
04	00000000	00000011	11000000	00000000	Esc*b4W[0, 3, 192, 0]
05	00000000	00000111	11100000	00000000	Esc*b4W[0, 7, 224, 0]
06	00000000	00000111	11100000	00000000	Esc*b4W[0, 7, 224, 0]
07	00000000	00001111	11110000	00000000	Esc*b4W[0, 15, 240, 0]
08	00000000	00001111	11110000	00000000	Esc*b4W[0, 15, 240, 0]
09	00000000	00011111	11111000	00000000	Esc*b4W[0, 31, 248, 0]
10	00000000	00011111	11111000	00000000	Esc*b4W[0, 31, 248, 0]
11	00000000	00111111	11111100	00000000	Esc*b4W[0, 63, 252, 0]
12	11111111	11111111	11111111	11111111	Esc*b4W[255, 255, 255, 255]
13	01111111	11111111	11111111	11111110	Esc*b4W[127, 255, 255, 254]
14	00111111	11111111	11111111	11111100	Esc*b4W[63, 255, 255, 252]
15	00011111	11111111	11111111	11111000	Esc*b4W[31, 255, 255, 248]
16	00001111	11111111	11111111	11110000	Esc*b4W[15, 255, 255, 240]
17	00000111	11111111	11111111	11100000	Esc*b4W[7, 255, 255, 224]
18	00000011	11111111	11111111	11000000	Esc*b4W[3, 255, 255, 192]
19	00000001	11111111	11111111	10000000	Esc*b4W[1, 255, 255, 128]
20	00000000	11111111	11111111	00000000	Esc*b4W[0, 255, 255, 0]
21	00000001	11111111	11111111	10000000	Esc*b4W[1, 255, 255, 128]
22	00000001	11111111	11111111	10000000	Esc*b4W[1, 255, 255, 128]
23	00000011	11111111	11111111	11000000	Esc*b4W[3, 255, 255, 192]
24	00000011	11111110	01111111	11000000	Esc*b4W[3, 254, 127, 192]
25	00000111	11111100	00111111	11100000	Esc*b4W[7, 252, 63, 224]
26	00000111	11110000	00001111	11100000	Esc*b4W[7, 240, 15, 224]
27	00001111	11100000	00000111	11110000	Esc*b4W[15, 224, 7, 240]
28	00001111	10000000	00000001	11110000	Esc*b4W[15, 128, 1, 240]
29	00011111	00000000	00000000	11111000	Esc*b4W[31, 0, 0, 248]
30	00011100	00000000	00000000	00111000	Esc*b4W[28, 0, 0, 56]
31	00111000	00000000	00000000	00011100	Esc*b4W[56, 0, 0, 28]
32	00110000	00000000	00000000	00001100	Esc*b4W[48, 0, 0, 12]

Raster Image	Raster Data Command
--------------	---------------------

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

Figure 9-4 Example of Raster Graphic Image Data

This prints the star as shown in Figure 9-5.

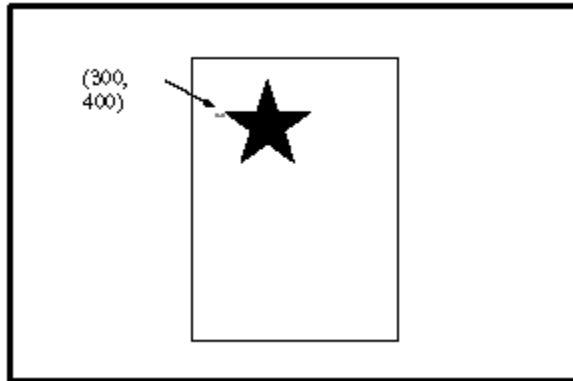


Figure 9-5 Example of Raster Graphic Image Transfer

FILL GRAPHICS

PCL includes sequences for filling or shading rectangular areas with pre-defined patterns. Rectangular areas are printed in the orientation of the addressable area. 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 sequence specifies the rectangle width in decipoints.

ESC*c#H

Decimal: 027 042 099 # 072

Hex: 1B 2A 63 # 48

#: Number of decipoints (1/720 inch)

The value field (#) is valid to four 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 printer, 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.

ESC*c#A
Decimal: 027 042 099 # 065
Hex: 1B 2A 63 # 41

#: Number of dots

The factory default horizontal rectangle size is 0.

Vertical Rectangle Size

This vertical rectangle size sequence specifies the rectangle height in decipoints.

ESC*c#V
Decimal: 027 042 099 # 066
Hex: 1B 2A 63 # 42

#: Number of decipoints (1/720 inch)

The value field (#) is valid to four 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 printer, is converted to 3 dots.

The factory default vertical rectangle size is 0.

Vertical Rectangle Size (Dots)

This vertical rectangle size sequence specifies the rectangle height in dots.

ESC*c#B
Decimal: 027 042 099 # 066
Hex: 1B 2A 63 # 42

#: Number of dots

The factory default vertical rectangle size is 0.

Area Fill (Pattern ID)

This sequence specifies the level of shading or type of pattern fill to be used when filling a rectangular area.

ESC*c#G

Decimal: 027 042 099 # 071

Hex: 1B 2A 63 # 47

The value field (#) identifies the level of shading or type of HP-defined pattern. Eight shading levels are defined within PCL. To specify a shading level use any value between 1 and 100. Use a value within the range indicated in Figure 9-6 for the desired shading level.

Six HP-defined fill patterns are defined within PCL. To specify a fill pattern type use any value between 1 and 6. Use a value indicated in Figure 9-7 for the desired fill pattern. Note that the patterns are not rotated when the orientation changes.

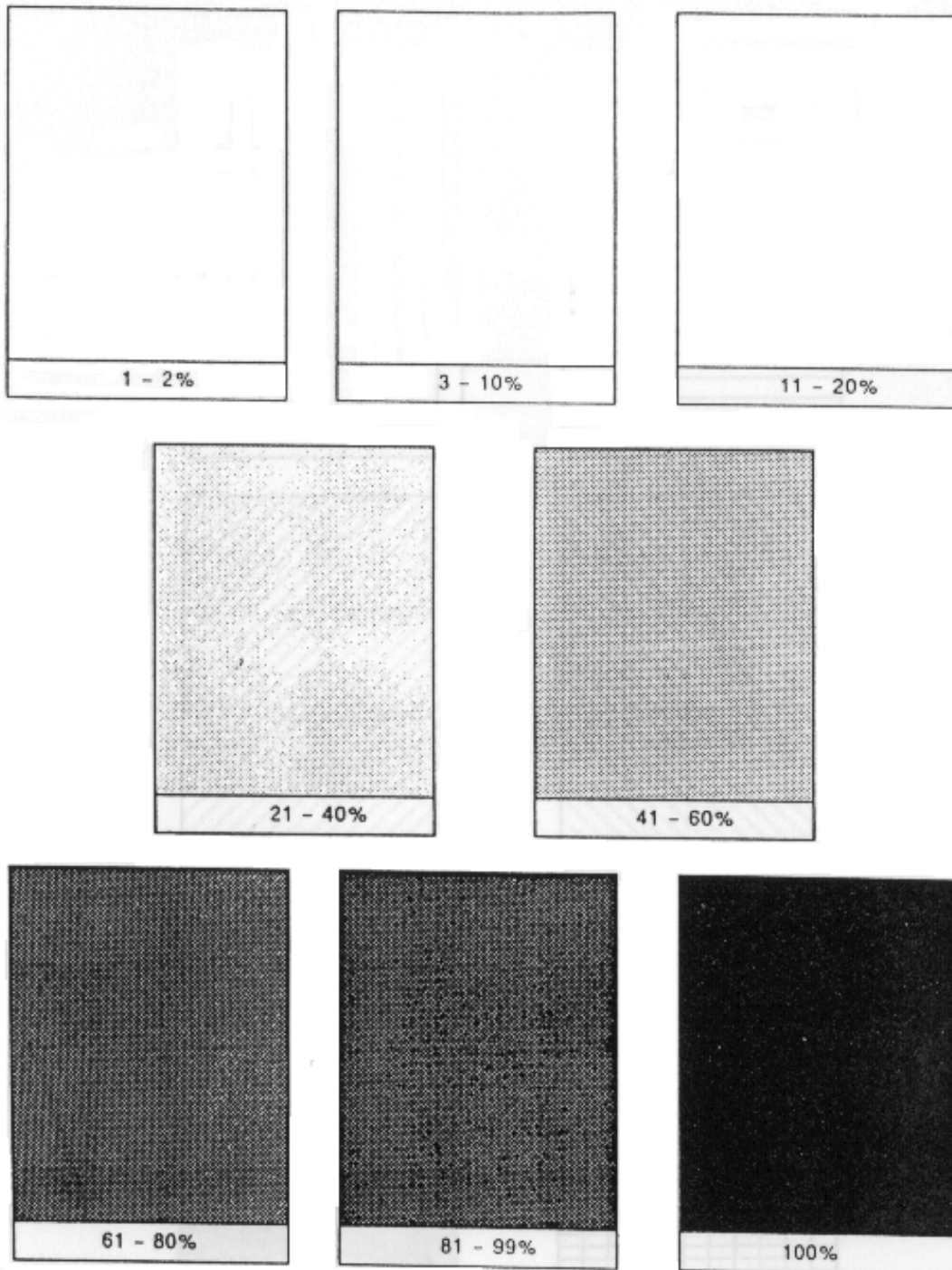


Figure 9-6 Shading Levels

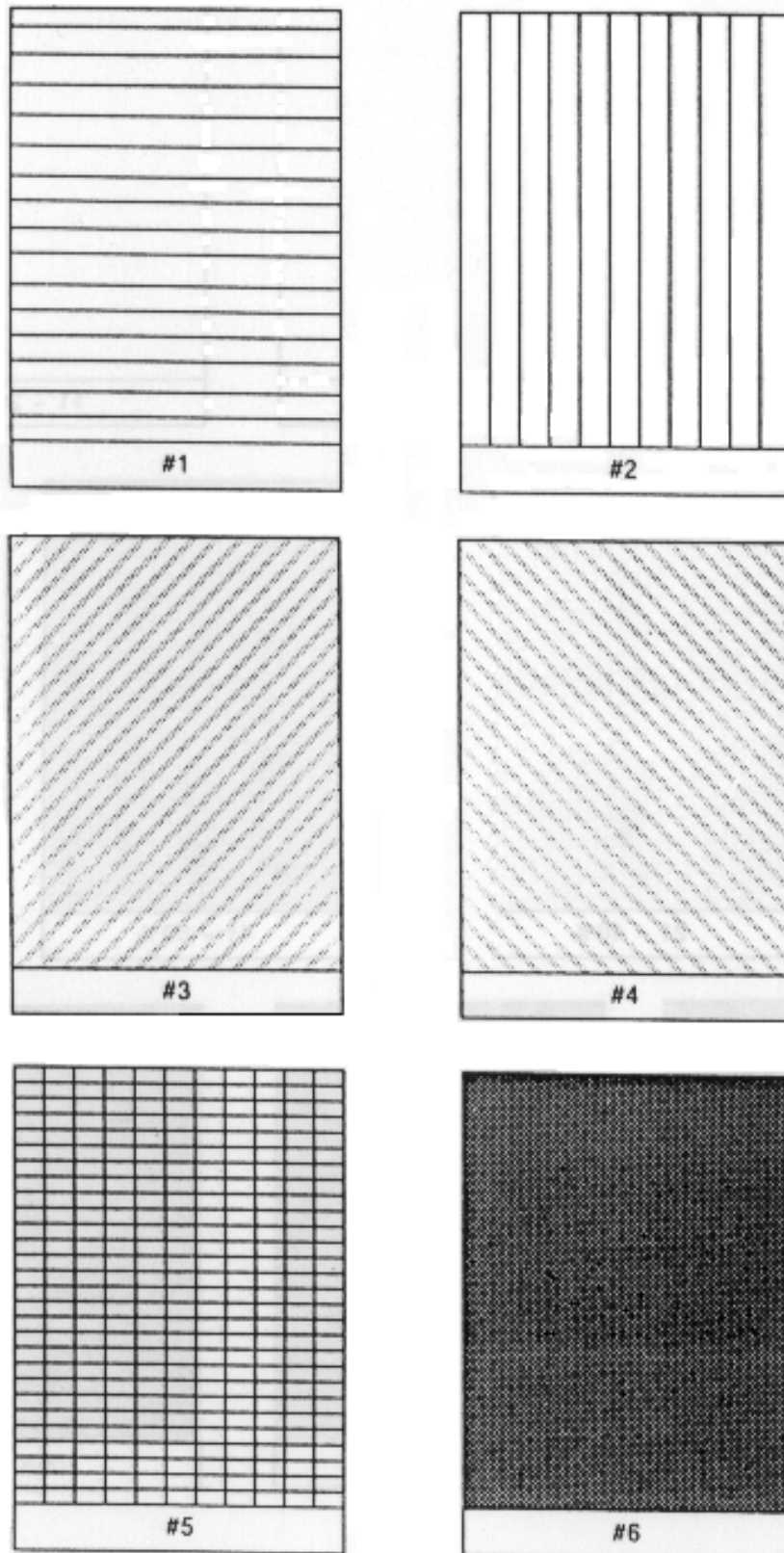


Figure 9-7 *Fill Patterns*

Fill Rectangle Area

This sequence fills a rectangular area of the specified width and height.

ESC*c#P

Decimal: 027 042 099 #.# 080 (#.# = 48 through 53)

Hex: 1B 2A 63 #.# 50 (#.# = 30 through 35)

- #:
- 0 = Solid fill
 - 1 = Erase (Solid white area fill)
 - 2 = Shaded fill
 - 3 = HP defined pattern fill
 - 4 = User defined pattern fill
 - 5 = Current pattern 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 addressable area; rectangular areas that extend outside the area are clipped.

Rectangle Area Fill Examples

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

1. Position the cursor:

ESC*p300x400Y

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

2. Specify the width of the rule:

ESC*c900A

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

3. Specify the height of the rule:

ESC*c1500B

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

4. Print the rule:

ESC*c0P

This example prints the following (see Figure 9-8):

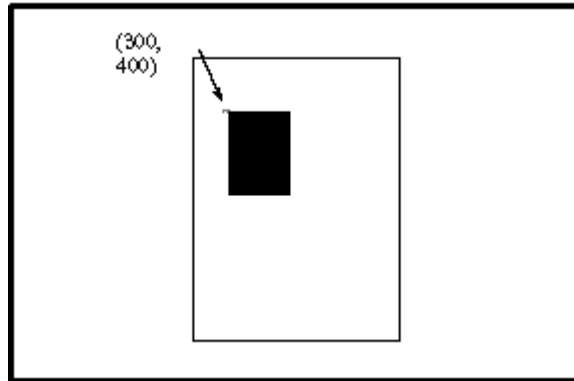


Figure 9-8 Solid Fill Example

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

1. Position the cursor:

ESC*p300x400Y

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

2. Specify the width of the rectangle:

ESC*c900A

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

3. Specify the height of the rectangle:

ESC*c1500B

This sets the rectangle to 1500 dots (5 inches).

4. Specify the area fill ID:

ESC*c25G

This sets the area fill ID to 25.

5. Print the rectangular shaded area:

ESC*c2P

This example prints the following (see Figure 9-9):

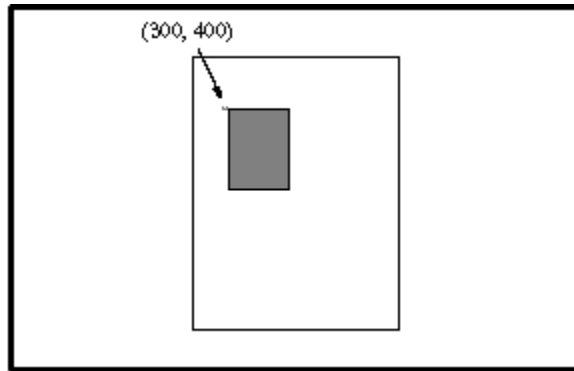


Figure 9-9 Shaded Fill Example

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

1. Position the cursor:

```
ESC*p300x400Y
```

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

2. Specify the width of the rectangle:

```
ESC*c900A
```

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

3. Specify the height of the rectangle:

```
ESC*c1500B
```

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

4. Specify the area fill ID:

```
ESC*c1G
```

This sets the area fill ID to 1.

5. Print the rectangular pattern-filled area:

```
ESC*c3P
```

This example prints the following (see Figure 9-10):

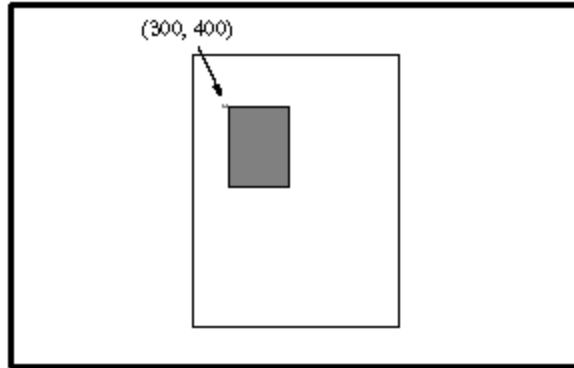


Figure 9-10 *Patterned Fill Example*

PCL PRINT MODEL

The Print Model feature allows images and characters to be filled with any of the printer's pre-defined shading or cross-hatched patterns. Images include any raster graphic, such as those described previously in this section (see "Raster Graphics"), a rectangular fill area (see "Fill Graphics"), or a character or characters selected from a font.

Print Model operations define a pattern, source image, and destination image. These are applied to each other using the Print Model's transparent and opaque modes to produce an image that is a combination of the others (see Figure 9-11).

- **pattern**

The pattern is the design that is painted through the black ("1" bits) area of the source image onto the destination image. For patterns, Print Model uses one of the printer's internal pre-defined eight shading patterns, one of six cross-hatch patterns, or a user defined pattern.

- **source image**

The source image is an image in which the black ("1" bits) are replaced by the specified pattern. This is like a stencil through which the pattern is applied to the destination image. The source image may be defined as a rectangular fill area, a raster graphics image, or characters.

- **destination image**

The destination image is the image onto which the source image/pattern combination is placed. The destination image is the result of any previous operations.

- source transparency mode

Source transparency mode is the transparency or opacity of the source image's white pixels (the "0" bits) as they are applied to the destination image. Setting the source transparency mode to 1 (opaque) applies the source image white pixels to the destination image; with a setting of 0 (transparent), these pixels have no effect on the destination.

- pattern transparency mode

Pattern transparency mode is the transparency or opacity of the white pixels in the pattern. When set to 0 (transparent), these pixels have no effect on the destination; when set to 1 (opaque), they are applied through the black pixels of the source pattern to the destination.

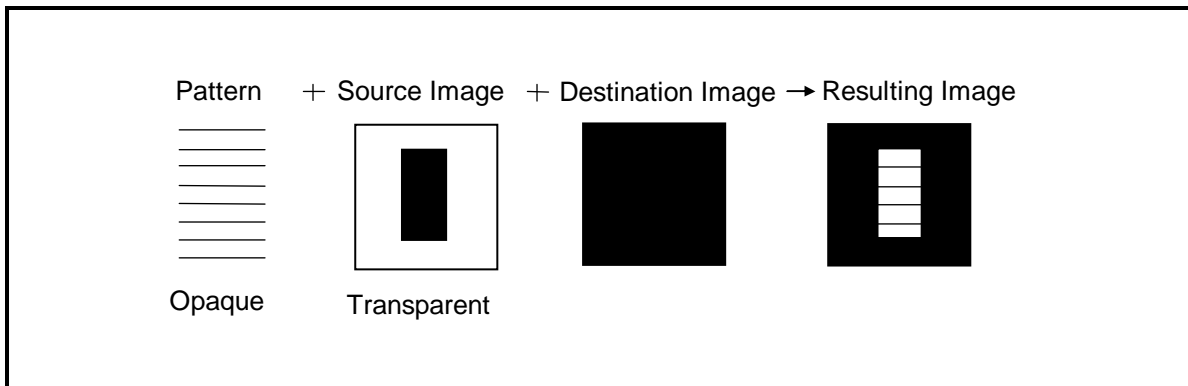


Figure 9-11 Print Model Imaging

Select Source Transparency Mode

ESC*v0N (transparent)
 Decimal 027 042 118 048 078
 Hex: 1B 2A 76 30 42

ESC*v1N (opaque)
 Decimal 027 042 118 049 078
 Hex: 1B 2A 76 31 42

This command sets the source image's transparency mode to transparent or opaque. A transparency mode of "0" (transparent) means that the white regions of the source image are not copied onto the destination. A transparency mode of "1" (opaque) means that the white pixels in the source image are applied directly onto the destination.

Select Pattern Transparency Mode

ESC*v0O (transparent)
Decimal 027 042 118 048 079
Hex: 1B 2A 76 30 43

ESC*v1O (opaque)
Decimal 027 042 118 049 079
Hex: 1B 2A 76 31 43

This command sets the pattern's transparency mode to transparent or opaque. A transparency mode of "0" (transparent) means that the white regions of the pattern image are not copied onto the destination. A transparency mode of "1" (opaque) means that the white pixels in the pattern are applied directly onto the destination.

Select Pattern Command

ESC*v#T
Decimal: 027 042 118 ### 084 (### = 048 through 051)
Hex: 1B 2A 76 ## 54 (## = 30 through 32)

#: 0 = Solid black (default)
1 = Solid white
2 = HP-defined shading pattern
3 = HP-defined cross-hatch pattern

This command identifies the type of pattern to be applied onto the destination. Use this command for selecting or changing the current pattern.

VECTOR GRAPHICS

The following are vector graphics commands within the PCL context.

HPGL/2 Plot Horizontal Size

ESC*C#K
Decimal: 027 042 #.# 075
Hex: 1B 2A 63 #.# 4B

= horizontal size in inches

Default = width of the currently selected picture frame
Range = 0 to 32767 (valid to 4 decimal places)

This command specifies the horizontal size of the HPGL/2 drawing being imported.

The horizontal HPGL/2 plot size determines the horizontal scaling factor used to fit the drawing into the PCL Picture Frame. For example, if the horizontal HPGL/2 plot size is specified as 12 inches and the PCL Picture Frame width is 4 inches, the horizontal scaling factor would be 3:1; the horizontal component of the image would be reduced to one-third its original size to fit into the PCL Picture Frame.

A parameter value of zero or a reset, page length, paper size, or orientation command defaults the HPGL/2 plot size to the width of the currently selected picture frame. This results in no scaling.

HPGL/2 Plot Vertical Size

ESC*C#L

Decimal: 027 042 #.# 076

Hex: 1B 2A 63 #.# 4C

= vertical size in inches

Default = width of the currently selected picture frame

Range = 0 to 32767 (valid to 4 decimal places)

This command specifies the vertical size of the HPGL/2 drawing being imported.

The vertical HPGL/2 plot size determines the vertical scaling factor used to fit the drawing into the PCL Picture Frame. For example, if the vertical HPGL/2 plot size is specified as 7 inches and the PCL Picture Frame height is 14 inches, the vertical scaling factor would be 1:2; the vertical component of the image would be enlarged to twice its original size to fit into the PCL Picture Frame.

A parameter value of zero or a reset, page length, paper size, or orientation command defaults the HPGL/2 plot size to the height of the currently selected picture frame. This results in no scaling.

Set Picture Frame Anchor Point

ESC*c0T

Decimal: 027 042 099 048 084

Hex: 1B 2A 63 30 54

Default = 0

Range = 0

This command sets the location of the PCL Picture Frame anchor point to the PCL cursor position.

The position of the picture frame anchor point defines the location of the upper left corner of the PCL Picture Frame. The “upper left” refers to the corner for which X and Y coordinates are minimized when the print direction is 0.

A parameter value of 0 (ESC*c0T) specifies that the picture frame anchor point should be set to the cursor position. Sending a cursor move command prior to sending this command places the picture frame anchor in the desired location. All parameter values other than zero are ignored, but if you do not send a Set Picture Frame Anchor Point command, the printer defaults the anchor point to the left edge of the logical page and the default top margin.

NOTE: The print direction command does not affect the physical location of the anchor point or the picture frame.

Using this command defaults the location of P1 and P2, resets the soft-clip window to the PCL Picture Frame boundaries, clears the polygon buffer, and updates the HPGL/2 pen position to the lower left corner of the picture frame (if entered with ESC%0B) as viewed from the current orientation.

Picture Frame Horizontal Size (Decipoints)

ESC*C#X

Decimal: 027 042 99 #.# 088

Hex: 1B 2A 63 #.# 58

= horizontal size in decipoints (1/720th inch)

Default = width of the current logical page

Range = 0 to 32767 (valid to 4 decimal places)

This PCL command specifies the horizontal dimension of the window to be used for printing an HPGL/2 plot.

NOTE: The horizontal dimension specified is parallel to the PCL X-axis when the print direction is set to 0 degrees (the default).

Using this command defaults the location of P1 to the lower left corner of the picture frame (and P2 to the upper right corner of the picture frame). This command also resets the soft-clip window to the PCL Picture Frame boundaries, clears the polygon buffer, and updates the HPGL/2 pen position to the lower left corner of the picture frame (P1) as viewed from the current orientation.

If no horizontal picture frame size command is used, the printer defaults the picture frame size to the logical page width. A parameter of 0 or the PCL reset, UEL, page length, paper size, or orientation commands default the horizontal picture frame size.

If an HPGL/2 plot size is specified, the horizontal picture frame size is used to determine the horizontal scaling factor used for scaling the image to fit in the picture frame.

Picture Frame Vertical Size (Decipoints)

ESC*C#Y

Decimal: 027 042 99 #.# 089

Hex: 1B 2A 63 #.# 59

= vertical size in decipoints (1/720th inch)

Default = distance between the default top and bottom margins (the default text length)

Range = 0 to 32767 (valid to 4 decimal places)

This PCL command specifies the vertical dimension of the window to be used for printing an HPGL/2 plot.

NOTE: The vertical dimension specified is parallel to the PCL Y-axis when the print direction is set to 0 degrees (the default).

HPGL/2 GRAPHICS

The IntelliBar provides the ability to print vector graphics using the HPGL/2 graphics language. HPGL/2 graphics may be created within application software or imported from existing applications. For various types of images, it is advantageous to use HPGL/2 vector graphics instead of the raster graphics described previously in this section. The advantages include faster I/O transfer of large images and smaller disk storage requirements.

Printing with HPGL/2 requires leaving the PCL printer language mode and entering HPGL/2 mode. Switching between modes involves only a few commands, and software applications may easily switch between the two modes as needed.

Enter HPGL/2 Mode

ESC %#B

Decimal: 027 037 ### 066 (### = 048 through 049)

Hex: 1B 25 ## 42 (## = 30 through 31)

#: 0 = Position pen at previous HPGL/2 pen position
1 = Position pen at current PCL cursor position

This command causes the printer to interpret subsequent commands as HPGL/2 commands, instead of PCL language commands. As soon as the printer receives this command, it switches to HPGL/2 mode, interpreting commands as HPGL/2 commands until it receives an Enter PCL Mode command, a Reset (ESC E) command, or until power is turned off and on.

Enter PCL Mode

ESC%0A (use previous PCL cursor position)

Decimal: 027 037 048 65

Hex: 1B 25 30 41

ESC%1A (use current HPGL/2 pen position for cursor position)

Decimal: 027 037 049 65

Hex: 1B 25 31 41

This command causes the printer to return to PCL mode from HPGL/2 mode. Sending this command causes the printer to stop interpreting the incoming data as HPGL/2 commands and to begin interpreting the data as PCL commands.

Line and Fill Attributes Group

The HPGL/2 commands described below allow you to

- enhance your drawings with various line types
- enhance your drawing with various fill types
- position fill type patterns

Line Type (LT)

LT line type[,*pattern length*[,*mode*;] or LT [;] or LT99 [;]

This command specifies the line pattern to be used when drawing lines. Use LT to vary lines and enhance your plot. Note that the ends of dashed line segments in a line pattern are affected by current line attributes (see the LA command).

Table 9-1 Line Type Command Parameters

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

The LT command applies to lines drawn by the AA, AR, AT, CI, EA, ER, EW, FP, PA, PD, PE, PR, RA, RR, RT, and WG commands. Line types are drawn using the current line attributes set by the line attribute (LA) command. For example, if you have used LA to specify rounded ends, the printer draws each dash in a dashed line pattern with rounded ends.

If no parameters are entered, the LT command defaults the line type to solid and saves the previous line type, pattern length, and any unused portion of the pattern (residue). LT99 restores the previous line type (and residue if it is a fixed-line type).

Line Attributes (LA)

LA *kind*, *value*[,*kind*,*value*[,*kind*,*value*;]] or LA [;]

This command specifies how line ends and line joins are physically shaped. Use this command when drawing lines thicker than 0.35 mm.

Table 9-2 Line Attributes Command Parameters

Parameter	Format	Functional Range	Default
kind	clamped integer	1 through 3	1
value	clamped integer	Kind 1: 1 - 4	1 (butt)
	clamped integer	Kind 2: 1 - 6	1 (mitered)
mode	clamped real	Kind 3: 1 to 32,767	5

There are three line attributes: *line ends*, *line joins*, and the *miter limit*. The LA command parameters are used in pairs: the first parameter, *kind*, selects a line attribute; the second, *value*, defines the appearance of that attribute. The printer uses the current line attribute when the optional parameter pairs are omitted.

No parameters - Defaults the line attributes to butt ends, mitered joins, and a miter limit of 5. Equivalent to (LA1,1,2,1,3,5).

Kind - Specifies the line attribute for which you are setting a value.

Value - Defines the characteristics of the attribute specified by the kind parameter.

Number of Pens (NP)

NP [*n*;

n: 2, 4, or 8

This command is not supported in the Intellibar.

Pen Width (PW)

PW *width*[,*pen*;] or PW [;]

This command specifies a new width for the logical pen. Subsequent lines are drawn in this new width. Use the PW command to vary your lines and enhance your drawings. Pen width can be specified as a fixed value or relative to the distance between P1 and P2. The pen width units are selected by means of the WU command (the default is metric - millimeters).

Table 9-3 Pen Width Command Parameters

Parameter	Format	Functional Range	Default
width	clamped real	-32768 to 32767	Dependent*
pen	integer	0 or 1	1 (black)

*Dependent on the mode set by the Pen Width Unit Selection (WU) command; if mode is metric, default width is 0.35 mm, if mode is relative, default width is 0.1% of the diagonal distance from P1 to P2.

Pen Width Unit Selection (WU)

WU *type*[;] or WU [;]

This command specifies how the width parameter of the pen width (PW) command is interpreted (whether metric or relative units).

Table 9-4 Pen Width Unit Selection Command Parameters

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

Since using WU, with or without parameters, defaults all pen widths, send the WU command *before* a PW command (which sets a new pen width).

No parameters - Defaults type parameter to 0 (metric) and all pen widths to 0.35 mm.

Type - Specifies how the width parameter of the pen width (PW) command is interpreted.

- 0: Metric. Interprets the pen width parameter in millimeters. Specifying type 0 defaults all pen widths to 0.35 mm.
- 1: Relative. Interprets the pen width parameter as a percentage of the diagonal distance between P1 and P2. Specifying type 1 defaults all pen widths to 0.1% of the diagonal distance from P1 to P2.

If the specified type parameter is not 0 or 1, the printer ignores the command.

Select Pen (SP)

SP pen number[:] or *SP* [:]

This command selects the printer's "logical pen" for subsequent plotting. An SP command must be included at the beginning of each command sequence to enable the printer to draw.

Table 9-5 Select Pen Command Parameters

Parameter	Format	Functional Range	Default
pen number	integer	0 to 1	No pen

Although your printer does not have physical pens, for the purpose of compatibility it has a "logical" pen which you must select to print your drawing.

No parameters - Cancels pen selection; subsequent plotting commands are not drawn. Equivalent to (SP0).

Pen number - Selects the printer's "logical" pen. The printer will not draw unless and SP is sent.

- 0: Selects the white pen. To see a white pen on a non-white background, you must set the transparency mode to off (TR0;).
- 1: Selects the black pen; numbers greater than 1 are also interpreted as 1.

Use the pen width (PW) command to change the line width. You may change line widths as often as you like without sending an SP command again.

NOTE: If you are not using the transparency mode (TR) command, white is always transparent. For more information on the transparency mode command, see the TR command later in this section.

Symbol Mode (SM)

SM *character*[:] or SM [:]

This command draws the specified symbol at each X, Y coordinate point using the PA, PD, PE, PR, and PU commands. Use the SM command to create scattergrams, indicate points on geometric drawings, and differentiate data points on multiline graphs.

Table 9-6 Symbol Mode Command Parameters

Parameter	Format	Functional Range	Default
character	label (text)	Most printing characters (decimal codes 33 to 58, 60 to 126, 161, and 254)	—

The SM commands draws the specified symbol at each X, Y coordinate point for subsequent PA, PD, PE, PR, and PU commands. The SM command includes an automatic pen down; after the symbol is drawn, the pen position and any dashed-line residue are restored.

No parameter - Terminates symbol mode.

Character - Draws the specified character centered at each subsequent X, Y coordinate. The symbol is drawn in addition to the usual function of each HPGL/2 command.

The character is drawn in the font selected at the time the vectors are drawn. If you change to a new symbol set, the character changes to the corresponding character from the new symbol set. The size (SI and SR), slant (SL), and direction (DI and DR) commands affect how the character is drawn. Specifying a non-printing character cancels symbol mode.

An SM command remains in effect until another SM command is executed or the printer is initialized or set to the default conditions.

Fill Type (FT)

FT *fill type*[,*option1*[,*option2*;]] or FT [;]

This command selects the shading pattern used to fill polygons (FP), rectangles (RA or RR), wedges (WG), or characters (CF). Use the FT command to enhance drawings using solid fill, shaded fill, parallel lines (hatching), cross-hatch, patterned (raster) fill, or PCL user-defined patterns.

Table 9-7 Fill Type Command Parameters

Parameter	Format	Functional Range	Default
fill type	clamped integer	1 - 4, 10, 11, 21, 22	1
option1, option2	clamped real	type dependent	type dependent

There are eight forms of fill types. The type parameter tells the printer which form you are using. If the fill type is specified but the option1 and/or option2 parameter is omitted, values previously given for the specified fill type are assumed, or the defaults are assumed if none is specified.

No parameters - Defaults all FT parameters and sets the fill type to solid fill. Equivalent to (FT1).

Type - Selects the fill pattern (see Table J-8).

Option1, Option2 - The definition of these optional parameters depends on the type of fill selected. Table 9-8 lists the options available for each fill type.

Table 9-8 Fill Patterns and Options

Fill Type	Description	Option1	Option2
1 and 2	Solid black	Ignored	Ignored
3	Hatching (parallel lines)	Spacing of lines	Angle of lines
4	Cross-hatch	Spacing of lines	Angle of lines
10	Shading	Shading level	Ignored
11	HPGL/2 user-defined	Raster-fill index	Ignored
21	PCL cross-hatch patterns	Pattern type	Ignored
22	PCL user-defined	Pattern ID	Ignored

Anchor (AC)

AC X,Y[:] or AC [:]

This command positions the starting point of any fill pattern. Use AC to ensure that the selected fill pattern is positioned as expected within the figure.

Table 9-9 Anchor Command Parameters

Parameter	Format	Functional Range	Default
X, Y coordinates	currents units	-2^{30} to $2^{30} - 1$	None

The 'anchor corner' is the point at which any fill pattern starts. Setting the anchor corner guarantees that a corner point of the selected fill pattern is at the specified coordinate, aligned vertically and horizontally.

No parameters - Defaults the anchor corner to the lower-left corner of the PCL Picture Frame (relative to the current coordinate system). Equivalent to (AC0,0).

X, Y coordinates - The coordinate position defines the position of the starting point for any fill pattern.

Raster Fill Definition (RF)RF *index,width,height,pen number*[, ... *pen number*,] or RF *index[:]* or RF [:]

This command defines a rectangular pattern that may be used as area fill and for screened vectors (see the SV command) later in this section. Use the RF command to create your own fill types and screen patterns.

Table 9-10 Raster Fill Definition Command Parameters

Parameter	Format	Functional Range	Default
index	clamped integer	1 to 8	1 (solid)
width	clamped integer	1 to 255	–
height	clamped integer	1 to 255	–
pen number	integer	0 or 1	–

The RF command does not *select* a fill type; use the fill type (FT) command with a type parameter of 11 and the corresponding raster fill index number for the second parameter (for example, [FT11,3]) for an index number of 3.

No parameters - Defaults all raster fill patterns to solid fill.

Index - Specifies the index number of the pattern being defined. Eight patterns can exist concurrently. When you send RF with an index parameter only (Rfn), the corresponding pattern is defaulted to solid fill.

Width, Height - Specifies the width and height (in pixels) of the pattern being defined.

Pen number - Represents a pixel in the pattern being defined and indicates its color (black or white)

0: white

>0: black

The pen number parameter defines pixels left to right, top to bottom. The total number of pen number parameters should be equal to the width time height parameters. For example, to define a pattern that is 8 x 16 pixels, you need 128 pen number parameters. If you do not include enough pen number parameters, the rest of the pixels are assumed to be white (zero). Patterns are printed in rows parallel to the plotter-unit X-axis.

User Defined Line Type (UL)

UL index [,gap1, ... ,gap20;] or UL [:]

This command creates line types by specifying gap patterns that define the lengths of spaces and lines comprising a line type.

Table 9-11 User-Defined Line Type Command Parameters

Parameter	Format	Functional Range	Default
index	clamped integer	1 through 8	–
gaps	clamped real	0 through 32767	Default line types

The UL command allows you to define and store your own line types, This command does not itself select a line type. Use the line type (LT) command to select the line type once you have defined it with the UL command.

No parameters - Defaults all line types (refer to the LT command in this section).

Index - Identifies the number of the line type to be defined. Specifying an index number without gap parameters sets the line type identified by the index to the default pattern for that number. The index number may not be 0.

The index parameter uses absolute values; therefore, (UL-n) is the same as (ULn). Redefining a standard fixed line type automatically redefines the corresponding adaptive line type.

Gaps - Specifies alternate pen-down and pen-up stretches in the line type pattern; if gaps are numbered starting with 1, odd numbered gaps are pen-down moves, even numbered gaps are pen-up moves. The first gap is a pen-down move. Gap values are converted to percentages of the LT command's pattern length parameter. A maximum of 20 gaps are allowed for each user-defined line type.

Screened Vectors (SV)

SV [*screen_type*[,*shading*[,*index*]]][;] or SV [;]

screen_type: selects the types of screening as follows

- 0 - No screening
- 1 - Shaded fill
- 2 - HPGL/2 user-defined raster fill (RF command)
- 21- Pre-defined PCL cross-hatch patterns
- 22 - PCL user-defined raster fill (RF command)

This command selects the type of screening area (area fill) to be applied to vectors. Options include lines, hatching patterns (fill types 3 and 4), arcs, circles, edges of polygons, rectangles, wedges, and PCL user-defined patterns. The SV command does not affect solid fill types, stroked characters, or edges of characters.

There are four types of screen fill: shaded fill, HPGL/2 user-defined raster fill, pre-defined PCL cross-hatch patterns, and PCL user-defined patterns.

The SV command defaults to no parameters (no screening or solid fill, which is equivalent to SV0;). All parameters are optional. If all parameters are omitted, screening is turned off (the vectors are solid).

Table 9-12 Screened Vector Parameters

Parameter	Format	Functional Range	Default
screen_type	clamped integer	0, 1, 2, 21, 22	No screening (solid)
shading	clamped integer	type dependent	type dependent

For type 1 (shaded fill), specify the shading percentage using a number from 0 to 100. For example, to print vectors that are shaded 15%, specify (SV1,15;).

For type 2, (HPGL/2 user-defined raster fill), specify the index number of the fill pattern using the RF (raster fill definition) command.

Transparency Mode (TR)TR [*n*][;] or TR [;]*n*: 0 - Transparency mode is off

1 - Transparency mode is on

No parameter - Defaults to transparency mode = on. Equivalent to (TR1;).

This command defines how the white areas of the source graphics image affect the destination graphics image.

Table 9-13 Transparency Mode Parameters

Parameter	Format	Functional Range	Default
n	clamped integer	0 or 1	1 (on)

When transparency mode is on (default), the portion of a source image which is defined by white pixels does not affect the destination; whatever was already written to the page “shows through” the white areas in the new image.

When transparency mode is off, all source pixels are written to the destination, obscuring any underlying images.

The transparency mode is defaulted by the ESC E (reset), IN (initialize), and DF (default values) commands.

Vector Group Commands

The HPGL/2 vector group commands described below enable you to achieve the following results in your programs

- use absolute and relative coordinates when plotting
- draw lines and arcs
- encode coordinates to increase your printer's throughput.

Arc Absolute (AA)

AA $X_{center}, Y_{center}, sweep\ angle[, chord\ angle;]$

This command draws an arc using absolute coordinates which starts at the current pen location and pivots around the current center point.

Table 9-14 Arc Absolute Command Parameters

Parameter	Format	Functional Range	Default
X_{center}, Y_{center}	currents units	-2^{30} to $2^{30} - 1$	None
sweep angle	clamped real	-32768 to 32767	None
chord angle	clamped real	0.5° to 180°	5°

The AA command draws an arc starting at the current pen location using the current pen up/down status, line type, and attributes. After drawing the arc, the pen location remains at the end of the arc.

Arc Relative (AR)

AR $X_{increment}, Y_{increment}, sweep\ angle[, chord\ angle;]$

This command draws an arc using relative coordinates which starts at the current pen location and pivots around the current center point.

Table 9-15 Arc Relative Command Parameters

Parameter	Format	Functional Range	Default
$X_{increment}, Y_{increment}$	currents units	-2^{30} to $2^{30} - 1$	None
sweep angle	clamped real	-32768 to 32767	None
chord angle	clamped real	0.5° to 180°	5°

The AR command draws an arc starting at the current pen location using the current pen up/down status, line type, and attributes. After drawing the arc, the pen location remains at the end of the arc.

Absolute Arc Three Point (AT)

AT $X_{inter}, Y_{inter}, X_{end}, Y_{end}[, chord\ angle;]$

This command draws an arc segment using absolute coordinates from a starting point, through an intermediate point, to an end point. Use the AT command when you know these three points of arc.

Table 9-16 Absolute Arc Three Point Command Parameters

Parameter	Format	Functional Range	Default
X_{inter}, Y_{inter}	currents units	-2^{30} to $2^{30} - 1$	None
X_{end}, Y_{end}	current units	-32768 to 32767	None
chord angle	clamped real	0.5° to 180°	5°

The AT command uses the current pen location and two specified points to calculate a circle and draw the appropriate arc segment of its circumference. The arc starts at the current pen location using the current pen, line type, line attributes, and pen up/down status. You specify the intermediate and end points. After drawing the arc, the pen location remains at the end of the arc.

Plot Absolute (PA)

PA X,Y [, ... ;] or PA[;]

This command establishes absolute plotting and moves the pen to the specified absolute coordinates from the current pen position.

Table 9-17 Plot Absolute Command Parameters

Parameter	Format	Functional Range	Default
X, Y coordinates	currents units	-2^{30} to $2^{30} - 1$	None

The printer interprets the parameters as follows:

No parameters - Establishes absolute plotting for subsequent commands.

X, Y coordinates - Specifies the absolute location to which the pen moves. When you include more than one coordinate pair, the pen moves to each point in the order given using the current pen up/down status. If the pen is up, PA moves the pen to the point; if the pen is down, PA draws a line to the point. Lines are drawn using the current line width, type, and attributes.

Coordinates are interpreted in current units: as user-units when scaling is on; as plotter units when scaling is off.

Plot Relative (PR)

PR X,Y [, ... ;] or PR[;]

This command establishes relative plotting and moves the pen to the specified points, with each move relative to the current pen position.

Table 9-18 Plot Relative Command Parameters

Parameter	Format	Functional Range	Default
X, Y (increments)	currents units	-2^{30} to $2^{30} - 1$	None

The PR (and PE) command has extended ranges of -2^{30} to $2^{30} - 1$ plotter units. If the current pen position goes out of this range, the printer ignores HPGL/2 commands until it receives an absolute PA (or PE) coordinate within the extended range.

The printer interprets the parameters as follows:

No parameters - Defaults to relative plotting mode for subsequent commands.

X, Y coordinates - Specifies incremental moves relative to the current pen location. When you include more than one relative coordinate pair, the pen moves to each point in the order given (relative to the previous point) using the current pen up/down status. If the pen is up, PR moves the pen to the point; if the pen is down, PR draws a line to the point. Lines are drawn using the current line width, type, and attributes.

Coordinates are interpreted in current units: as user-units when scaling is on; as plotter units when scaling is off.

Pen Down (PD)

PD X,Y [... ;] or PD [;]

This command lowers the printer’s “logical pen” and draws subsequent graphics commands.

Table 9-19 Pen Down Command Parameters

Parameter	Format	Functional Range	Default
X, Y coordinates/increments	currents units	-2 ³⁰ to 2 ³⁰ - 1	None

This command emulates a pen plotter that must lower the pen to draw lines on the page.

The printer interprets the parameters as follows:

No parameters - Prepares the printer to draw subsequent graphics commands.

X, Y coordinates - Draws (in current units) to the point specified. You can specify as many X, Y coordinates as you want. When you include more than one coordinate pair, the printer draws each point in the order given.

Coordinates are interpreted in current units: as user-units when scaling is on; as plotter units when scaling is off.

Whether the PD command uses coordinates or increments depends on the most recently executed PA or PR command. If no PA or PR command is issued, absolute plotting (PA) is used.

Pen Up (PU)

PU X,Y [... ;] or PU [;]

This command moves to subsequent points without drawing. Use the PU command to move to another location without drawing a connecting line.

Table 9-20 Pen Up Command Parameters

Parameter	Format	Functional Range	Default
X, Y coordinates/increments	currents units	-2^{30} to $2^{30} - 1$	None

This command emulates a pen plotter that must raise the pen to prevent drawing stray lines on the page.

The printer interprets the parameters as follows:

No parameters - Prevents drawing subsequent graphics commands (unless the command contains an automatic pen down).

X, Y coordinates - Moves to the point(s) specified. You can specify as many X, Y coordinates as you want. When you include more than one coordinate pair, the printer moves to each point in the order given.

Coordinates are interpreted in current units: as user-units when scaling is on; as plotter units when scaling is off.

Whether the PU command uses absolute coordinates or relative coordinates (increments) depends on the most recently executed PA or PR command. If no PA or PR command is issued, absolute plotting (PA) is used.

Relative Arc Three Point (RT)

RT $X_{incr\ inter}, Y_{incr\ inter}, X_{incr\ end} Y_{incr\ end}$ [, *chord angle*];

This command draws an arc segment using relative coordinates from a starting point, through an intermediate point, to an end point. Use the RT command when you know these three points of arc.

Table 9-21 Relative Arc Three Point Command Parameters

Parameter	Format	Functional Range	Default
$X_{incr\ inter}, Y_{incr\ inter}$	currents units	-2^{30} to $2^{30} - 1$	None
$X_{incr\ end}, Y_{incr\ end}$	current units	-32768 to 32767	None
chord angle	clamped real	0.5° to 180°	5°

The RT command uses the current pen location and two specified points to calculate a circle and draw the appropriate arc segment of its circumference. The arc starts at the current pen location using the current pen, line type, line attributes, and pen up/down status. You specify the intermediate and end points. After drawing the arc, the pen location remains at the end of the arc.

Polyline Encoded (PE)

PE [*flag*[*value*]]*coord_pair* ... [*flag*[*value*]]*coord_pair* ; or PE;

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

Table 9-22 Polyline Encoded Command Parameters

Parameter	Format	Functional Range	Default
flag	character	':', '<', '>', '=', or '7'	None
value	character	flag dependent	
coordinate pair	character	-2^{30} to $2^{30} - 1$	None

NOTE: Parameter values are self-terminating. Do not use commas with this command. Also, you must use a semicolon to terminate the PE command.

No parameters - Updates the Carriage Return point. The PE command without parameters does not affect the pen's current location or up/down status.

Flag - Indicates how the printer interprets subsequent values. Flags are ASCII characters and are not encoded. The printer disregards the eighth bit of a flag.

Flag	Meaning
:	Select pen
<	Pen up
>	Fractional data
=	Absolute
7	7-bit mode

NOTE: Because the select pen (SP) command is not allowed in ploygon mode, if you select a pen with PE while in polygon mode, the SP command is ignored (see the following subsection for polygon group commands).

Value - Specifies data according to the preceding flag. For example, a value following a select-pen flag should be a pen number.

Table 9-23 Polyline Encoded Command Value Parameters

Value	Format	Range
pen number	integer	0 to 1
number of fractional binary bits	integer	-26 to 26

X, Y coordinates - Specifies a coordinate pair encoded into a base 64 (default) or base 32 equivalent. Use base 64 if the system sends 8 bits of data without parity; use 7-bit mode and base 32 coordinate values if the system requires a parity bit.

Polygon Group Commands

The polygon group commands described below use the polygon buffer, which is a temporary data storage area in printer memory. The polygon group commands enable you to achieve the following results in your program:

- draw circles, wedges, and rectangles
- use polygon mode for drawing polygons, subpolygons, and circles.

Circle (CI)

CI radius[,*chord angle*;]

This command draws the circumference of a circle using the specified radius and chord angle. If you want a filled circle, refer to the WG or PM commands described later in this section.

Table 9-24 Circle Command Parameters

Parameter	Format	Functional Range	Default
radius	currents units	-2^{30} to $2^{30} - 1$	None
chord angle	clamped real	0.5° to 180°	5°

The CI command includes an automatic pen down. When a CI command is received, the pen lifts, moves from the center of the circle (the current pen location) to the starting point on the circumference, lowers the pen, draws the circle, then returns with the pen up to the center of the circle. After the circle is drawn, the previous pen up/down status is restored. To avoid leaving a dot at the center of the circle, move to and from the circle's center with the pen up

Radius - Measured from the current pen location. Coordinates are interpreted in current units: as user-units when scaling is on; as plotter units when scaling is off.

Chord angle - Specifies the chord angle used to draw the arc. The default chord angle is 5°. The chord angle specifies, in degrees, the maximum angle created when lines from each of the chord intersect the center point of the circle. The smaller the chord angle, the smoother the curve.

Edge Rectangle Absolute (EA)

EA X,Y[;]

This command defines and outlines a rectangle using absolute coordinates. Use the EA command when drawing charts or schematic diagrams that require rectangles.

Table 9-25 Edge Rectangle Absolute Command Parameters

Parameter	Format	Functional Range	Default
X, Y coordinates	currents units	-2^{30} to $2^{30} - 1$	None

The EA command defines the edges of a rectangle using absolute coordinates and the current pen, line type, and line attributes. The EA command performs an automatic pen down. When command execution completes, the original pen location and up/down status are restored.

The X, Y coordinates specify the opposite corner of the rectangle from the current pen location. The current pen location is the starting point of a rectangle. Coordinates are interpreted in current units: as user-units when scaling is on; as plotter units when scaling is off.

The only difference between the EA command and the RA (fill rectangle absolute) command is that the EA command produces an outlined rectangle; RA produces a filled rectangle.

Fill Rectangle Absolute (RA)

RA X,Y[;]

This command defines and fills a rectangle using absolute coordinates. Use the RA command to fill rectangular shapes in drawings. (To outline a rectangle using absolute coordinates, use the EA command).

Table 9-26 Fill Rectangle Absolute Command Parameters

Parameter	Format	Functional Range	Default
X, Y coordinates	currents units	-2^{30} to $2^{30} - 1$	None

The RA command defines and fills a rectangle using absolute X, Y coordinates and the current pen, current line, and current fill types. The RA command performs an automatic pen down. When command execution completes, the original pen location and up/down status are restored.

The X, Y coordinates specify the opposite corner of the rectangle from the current pen location. The current pen location is the starting point of a rectangle. Coordinates are interpreted in current units: as user-units when scaling is on; as plotter units when scaling is off.

The only difference between the RA command and the EA (edge rectangle absolute) command is that the RA command produces a filled rectangle; EA produces an outlined rectangle.

Fill Rectangle Relative (RR)

RR X,Y[,:]

This command defines and fills a rectangle using relative coordinates (increments). Use the RA command to fill rectangular shapes in drawings. (To outline a rectangle using relative coordinates, use the ER command).

Table 9-27 Fill Rectangle Relative Command Parameters

Parameter	Format	Functional Range	Default
X, Y increments	currents units	-2^{30} to $2^{30} - 1$	None

The RR command defines and fills a rectangle using relative X, Y coordinates and the current pen, current line, and current fill types. The RR command performs an automatic pen down. When command execution completes, the original pen location and up/down status are restored.

The X, Y coordinates specify the opposite corner of the rectangle from the current pen location. The current pen location is the starting point of a rectangle. Coordinates are interpreted in current units: as user-units when scaling is on; as plotter units when scaling is off.

The only difference between the RR command and the ER (edge rectangle relative) command is that the RR command produces a filled rectangle; ER produces an outlined rectangle.

Edge Rectangle Relative (ER)

ER X,Y[:]

This command defines and outlines a rectangle using relative coordinates (increments). Use the ER command when drawing charts or schematic diagrams that require rectangles.

Table 9-28 Edge Rectangle Relative Command Parameters

Parameter	Format	Functional Range	Default
X, Y increments	currents units	-2^{30} to $2^{30} - 1$	None

The ER command defines and edges a rectangle using relative X, Y coordinates and the current pen, line type, and line attributes. The ER command performs an automatic pen down. When command execution completes, the original pen location and up/down status are restored.

The X, Y coordinates specify the opposite corner of the rectangle from the current pen location. The current pen location is the starting point of a rectangle. Coordinates are interpreted in current units: as user-units when scaling is on; as plotter units when scaling is off.

The only difference between the ER command and the RR (fill rectangle relative) command is that the ER command produces an outlined rectangle; RR produces a filled rectangle.

Fill Wedge (WG)

This command defines and fills any wedge. Use the WG command to draw filled sections of a pie chart.

WG radius,start angle,sweep angle[,chord angle;]

Table 9-29 Fill Wedge Command Parameters

Parameter	Format	Functional Range	Default
radius	currents unit	-2^{30} to $2^{30} - 1$	–
start angle	clamped real	-32768 to 32767	–
sweep angle	clamped real	$\pm 360^\circ$	–
chord angle	clamped real	0.5° to 180°	5°

The WG command defines and fills a wedge using the current pen, fill type, and line types. The WG command includes an automatic pen down. When the operation completes, the original pen location and up/down status are restored.

The only difference between the WG command and the EW (edge wedge) command is that the WG command produces a filled wedge, and the EW command produces an outlined wedge.

Edge Wedge (EW)

This command outlines any wedge. Use the EW command to draw sections of pie charts.

EW radius,start angle,sweep angle[,chord angle;]

Table 9-30 Edge Wedge Command Parameters

Parameter	Format	Functional Range	Default
radius	currents unit	-2^{30} to $2^{30} - 1$	None
start angle	clamped real	-32768 to 32767	None
sweep angle	clamped real	$\pm 360^\circ$	None
chord angle	clamped real	0.5° to 180°	5°

The EW command defines and edges a wedge using the current pen, fill type, and line types. The EW command includes an automatic pen down. When the operation completes, the original pen location and up/down status are restored.

The only difference between the EW command and the WG (fill wedge) command is that the EW command produces an outlined wedge, and the WG command produces a filled wedge.

Polygon Mode (PM)

This command enters polygon mode for defining shapes, such as block letters or any unique area, and exits for subsequent filling and/or edging. Fill polygons using the fill polygon (FP) command; outline polygons using the edge polygon (EP) command.

PM polygon definition [;] or PM[;]

Table 9-31 Polygon Mode Command Parameters

Parameter	Format	Functional Range	Default
polygon definition	clamped integer	0, 1, and 2	0

In polygon mode, you define the area of the polygon(s) using graphics commands. These commands (and associated X, Y coordinates) are stored in the polygon buffer. The polygon is not printed until you exit polygon mode and fill and/or outline the area.

No parameters - Clears the polygon buffer and enters polygon mode. Equivalent to (PM0).

Polygon definition - Defines polygon mode status as follows:

- 0: Clears the polygon buffer and enters polygon mode
- 1: Closes the current polygon (or subpolygon) and remains in polygon mode; all commands sent following PM1 but before PM2 (or the next PM1) are stored as one subpolygon.
- 2: Closes the current polygon (or subpolygon) and exits polygon mode.

Fill Polygon (FP)

This command fills the polygon currently in the polygon buffer. Use the FP command to fill polygons defined in polygon mode or with edge rectangle or edge wedge commands (ER, EW, RA, RR, or WG).

FP *fill method* [:] or FP [:]

Table 9-32 Fill Polygon Command Parameters

Parameter	Format	Functional Range	Default
polygon definition	clamped integer	0 or 1	0 (odd-even fill)

Fill method - Specifies the algorithm used to determine which portions of a polygon are “inside” the polygon and therefore are to be filled:

- 0: Even/odd fill algorithm (default)
- 1: Non-zero winding fill algorithm

The FP command fills any polygon that is currently in the polygon buffer. FP accesses the data in the polygon buffer but does not clear the buffer or change the data in any way.

The FP command fills between points defined with either the pen down or the pen up. The polygon is filled using the current pen, fill type, line type, and attributes (if the fill type is not raster). The FP command includes an automatic pen down. When command execution completes, the original pen location and up/down status are restored.

Edge Polygon (EP)

This command outlines the polygon currently stored in the polygon buffer. Use the EP command to edge polygons defined in polygon mode or with fill rectangle and wedge commands (RA, RR, and WG).

EP [;]

The EP command fills any polygon that is currently in the polygon buffer. EP accesses the data in the polygon buffer. This includes wedges and rectangles defined using the EA, ER, EW, RA, RR, and WG commands.

EP accesses the data in the polygon buffer but does not clear the buffer or change the data in any way.

The EP command only edges between points defined with the pen down. When command execution completes, the original pen location and up/down status are restored.

Configuration and Status Group

The configuration and status group commands help you:

- establish default conditions and values for HPGL/2 features
- scale images in the dimensional units you want to use
- enlarge/reduce images for different media sizes
- establish a window (soft-clip limits)
- draw equal-sized and mirror-imaged drawings
- rotate the HPGL/2 coordinate system
- add comments to your HPGL/2 command sequence.

Scale (SC)

This command establishes a user-unit coordinate system by mapping user-defined coordinate values onto the scaling points P1 and P2. The SC command determines the number of user-units along the X- and Y-axes between P1 and P2. The actual size of the units depends on the locations of P1 and P2 and the range of user-units set up by the SC command.

SC $X_{MIN}X_{MAX}Y_{MIN}Y_{MAX}$ [,type[,left,bottom;]] or
SC $X_{MIN}X_{FACTOR}Y_{MIN}Y_{FACTOR}$ [,type[;]] or
SC [;]

Table 9-33 Scale Command Parameters

Parameter	Format	Functional Range	Default
$X_{MIN}X_{MAX}$,	real	-2^{30} to $2^{30} - 1$	None
$Y_{MIN}Y_{MAX}$	real	-2^{30} to $2^{30} - 1$	None
type	clamped integer	0, 1, or 2	0
left	clamped real	0 to 100%	50%
bottom	clamped real	0 to 100%	50%
X_{FACTOR} , Y_{FACTOR}	real	-2^{30} to $2^{30} - 1$	None

Scaling allows you to establish units of measure with which you are familiar or which are more logical to your drawing. There are three types of scaling: anisotropic (type 0), isotropic (type 1), and point factor (type 2). The type parameter tells the printer which form you are using. If no parameters are entered, scaling is turned off, and subsequent coordinates are in plotter units.

Anisotropic scaling indicates that the size of the units along the X-axis may be different than the size of the units along the Y-axis. Isotropic scaling, then, indicates that the units are the same size on both axes. Point-factor scaling sets up a ratio of plotter units to user units.

The SC command does not change the locations of P1 and P2, only their coordinate values. Also, scaling is not limited to the rectangular area defined by P1 and P2, but extends across the entire printing area within the PCL Picture Frame.

Input Window (IW)

This command defines a rectangular area, or window, that establishes soft-clip limits. Subsequent HPGL/2 drawing is restricted to this area. Use the IW command to restrict printing to a specified area on the page.

IW $X_{LL}Y_{LL}X_{UR}Y_{UR}$ [:] or IW [:]

Table 9-34 Input Window Command Parameters

Parameter	Format	Functional Range	Default
$X_{LL}Y_{LL}$, $X_{UR}Y_{UR}$	current units	-2^{30} to $2^{30} - 1$	PCL Picture Frame

The printer interprets the command parameters as follows.

No parameters - Resets the soft-clip limits to the PCL Picture Frame limits.

X, Y coordinates - Specifies the opposite, diagonal corners of the window area, usually the lower left (LL) and upper right (UR) corners. Coordinates are interpreted in the current units: as user-units when scaling is on; as plotter units when scaling is off.

When scaling is on, subsequent changes to P1 and P2 move the window in relation to the physical page, but keep the same user coordinate locations. However, sending a subsequent SC command binds the window to its equivalent plotter units. The window does not change with any subsequent IP or IR commands.

When you turn on the printer, the window is automatically set to the PCL Picture Frame boundaries. You can define a window that extends beyond this picture frame; however, the printer cannot print vector graphics beyond this effective window. All programmed pen motion restricted to this area.

Input Relative P1 and P2 (IR)

This command establishes new or default locations for the scaling points P1 and P2 relative to the PCL Picture Frame size. P1 and P2 are used by the scale (SC) command to establish user-unit scaling. The IR command can also be used in advanced techniques such as printing mirror-images, enlarging or reducing drawings, enlarging/reducing relative character size, or changing text direction.

`IR X_{P1}, Y_{P1} [X_{P2}, Y_{P2} ;] or IR [;]`

Table 9-35 Input Relative P1 and P2 Command Parameters

Parameter	Format	Functional Range	Default
$X_{P1} Y_{P1}$ [X_{P2}, Y_{P2}]	clamped real	0 to 100%	0,0,100,100%

When P1 and P2 are set using the IR command, the scaled area is page-size independent. As the PCL Picture Frame changes size, P1 and P2 keep the same relative position within the PCL Picture Frame boundaries.

No parameters - Defaults P1 and P2 to the lower left and upper-right corners of the PCL Picture Frame, respectively.

X, Y coordinates - Specifies the location of P1 (and, optionally, P2) as percentages of the PCL Picture Frame limits (specifying P2 is not required). If P2 is not specified, P2 tracks P1; the P2 coordinates change so that the distances of X and Y between P1 and P2 remain the same. This tracking process can cause P2 to locate outside the effective window. Used carefully, however, the tracking function can be useful for preparing more than one equal-sized drawing on a page.

Neither X, Y coordinate of P1 can equal the corresponding coordinate of P2. If either coordinate of P1 equals the corresponding coordinate of P2, the coordinate of P2 is incremented by 1 plotter unit.

Default Values (DF)

This command returns the printer's HPGL/2 settings to the factory default parameters. Use the DF command to return the printer to a known state while maintaining the current locations of P1 and P2 (unlike the IN command described next in this section). When you use the DF command at the beginning of a command sequence, graphics parameters such as character size, slant, or scaling are defaulted.

DF[;]

The DF command resets the printer to the conditions listed in Table 9-36.

Table 9-36 Default Settings

Function	Command	Default Condition
Anchor Corner	AC	Anchor corner (not the same as the picture frame anchor point) set to lower-left corner of PCL Picture Frame, relative to the current coordinate system.
Alternate Font Direction	AD	Stick Font (11.5 point, 9 characters per inch, upright, medium)
Character Fill Mode	CF	Solid fill, no edging
Absolute Direction	DI1,0	Character direction parallel to X-axis
Define Label Terminator	DT	End of text (ETX) and non-printing mode
Define Variable Text Path	DV	Text printed left to right with normal Line Feed
Extra Space	ES	No extra space
Fill Type	FT	Solid fill
Input Window	IW	Set equal to PCL Picture Frame Window
Line Attributes	LA	Butt caps, mitered joins, and miter limit=5
Label Origin	LO1	Standard text printing starting at current location
Line Type	LT	Solid line, relative mode, pattern length = 4% of diagonal distance from P1 to P2
Plotting Mode	PA	Absolute plotting

Table 9-36 Default Settings (cont'd)

Function	Command	Default Condition
Polygon Mode	PM	Polygon buffer cleared
Raster Fill	RF	Solid black
Scalable or Bitmap Fonts	SB0	Scalable fonts only
Scale	SC	User-unit scaling off
Screened Vectors	SV	No screening
Standard Font Definition	SD	Stick Font (11.5 point, 9 characters per inch, upright, medium)
Absolute Character Size	SI	Turns off size transformation
Character Slant	SL	No slant
Symbol Mode	SM	Turns off symbol mode
Select Standard Font	SS	Standard font selected
Transparency Mode	TR1	Transparency mode on
Transparent Data	TD	Normal printing mode
User-defined line type	UL	Defaults all 8 line types

In addition, the printer updates the carriage return point for text printing to the current pen location.

The DF command does not affect the following HPGL/2 conditions:

- locations of P1 and P2
- current pen, its location, width, width unit selection, and up/down position
- HPGL/2 drawing rotation

Initialize (IN)

This command resets all programmable HPGL/2 functions to their default settings. Use the IN command to return the printer to a known HPGL/2 state and to cancel settings that may have been changed by a previous command sequence. (The ESC E reset command issues an automatic IN command.)

IN [;]

NOTE: Once HPGL/2 mode is entered and commands are issued, the HPGL/2 conditions are no longer initialized. To place HPGL/2 into the default state, send the IN command.

The IN command sets the printer to the same conditions as the default (DF) command, plus the following:

- raises the pen (PU)
- returns the pen location to the lower-left corner of the PCL Picture Frame (PA0,0)
- cancels drawing rotation (RO)
- sets P1 and P2 to the lower-left and upper-right corners, respectively, of the PCL Picture Frame (IP).
- sets pen width mode to metric; units are millimeters (WU)
- sets the pen width to 0.35 mm (PW)
- sets number of pens to 2 (black [1] and white [0])

Rotate Coordinate System (RO)

This command rotates the printer's coordinate system relative to the default HPGL/2 coordinate system in the following increments of rotation: 90°, 180°, and 127°. Use the RO command to orient your drawing vertically or horizontally, or to reverse the orientation.

RO *angle*[:] or RO [:]

Table 9-37 Rotate Coordinate System Command Parameters

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

The printer interprets the command parameters as follows:

No parameters - Defaults the orientation of the coordinate system to 0°. Equivalent to (RO0). This is the same as the PCL's current orientation.

Angle - Specifies the degree of rotation:

- 0: Sets the orientation to PCL's current orientation
- 90: Rotates and shifts the coordinate system 90 degrees in a positive angle of rotation from PCL's current orientation.
- 180: Rotates and shifts the coordinate system 180 degrees in a positive angle of rotation from PCL's current orientation.
- 270: Rotates and shifts the coordinate system 270 degrees in a positive angle of rotation from PCL's current orientation.

Advance Full Page (PG)

This HPGL/2 command is ignored by the printer since it could cause undesirable results when importing plots. A page eject can be accomplished only from the PCL printer language mode.

The following PCL commands cause a conditional page eject, meaning that a page is ejected if there is any printable data in the print buffer:

- ESC E (reset)
- UEL (Universal Exit Language)
- Flush All Pages
- Page Length
- Page Size
- Orientation
- Paper Source

When a page is ejected using one of the above commands, the PCL cursor position is set to the top of form on the new page.

An alternative method of ejecting a page from PCL is the Form Feed control code. A Form Feed causes an unconditional page eject and advances the current active cursor position to the top of form on the next page. The horizontal cursor position remains the same as before the page eject.

NOTE: The HPGL/2 pen position is not affected by the Form Feed; it occupies the same position on the next page.

Replot (RP)

This command is ignored by the printer; to eject a page, the printer must be in the PCL printer language mode. The following commands cause a conditional page eject, meaning that a page is ejected if there is any printable data in the print buffer:

- ESC E (reset)
- UEL (Universal Exit Language)
- Flush All Pages
- Page Length
- Page Size
- Orientation
- Paper Source

The PCL Form Feed control code causes an unconditional page eject and advances the current active cursor position to the top of form on the next page.

A page eject caused by any of the above commands except paper source defaults the HPGL/2 pen position.

To print more than one plot, use the Number of Copies command described in Section 3.

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Section 10

HP PCL Macro Commands and Programming Hints

Your printer uses several commands during a typical print operation. During some operations the same print routine may be repeated several times. PCL provides a macro feature so you can reduce the number of commands sent to the printer. A macro is a collection of escape sequences, control codes, and data downloaded to the printer that can be initiated through a single command.*

CREATING A MACRO

Each macro needs a unique identification (ID) number that must be assigned before you define the macro. If you assign an existing macro's number to a new macro, the existing macro is overwritten in the user memory as you define the new macro. All subsequent macro operations are performed by using the macro ID number.

You create a macro in three steps.

- first, send an escape sequence to the printer that indicates the start of a macro definition.
- second, send the escape codes, control codes, and data that you want in the macro. These items must be sent in the intended order of execution.
- third, send an escape code to the printer that indicates the end of the macro definition.

CONTROLLING A MACRO

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

You can use three different ways to invoke a macro:

- execute
 - call
 - overlay.
-

When a macro is executed, the macro starts its routine using the modified print environment. Any parameter changes made during the execution are recorded in the modified print environment. The changes remain after the macro routine has finished execution.

When a macro is called, the macro starts its routine using the modified print environment. Any parameter changes made during the call are recorded in the modified print environment but the changes do not remain after the call is completed. The previously existing modified print environment is restored.

When a macro is invoked for automatic overlay, the macro routine will be the final operation each time a page is printed. Before the macro is executed, the current modified print environment is recorded and replaced by the overlay print environment.

The overlay print environment is a combination of the user default and current modified print environments. Any parameter changes made during a macro overlay are recorded in the modified print environment. The changes do not remain after the overlay routine is complete. The previously existing modified is restored.

The overlay environment uses the current settings for the following parameters (all other parameters are set to the user default values):

- Page Length
- Paper source
- Page size
- Number of copies
- Orientation
- Cursor position stack.

NOTE: The current active print position is not part of the modified print environment. Cursor position is neither saved when a macro is invoked or restored after the routine has finished. Use the push/pop cursor position escape sequence to save and recall a cursor position.

TEMPORARY/PERMANENT MACROS

A macro is automatically defined as temporary, and deleted from user memory during a printer reset. You can designate a macro to be permanent so it will not be deleted during a printer reset. Macro status is designated through a sequence that references the macro ID number.

NOTE: Temporary and permanent macros are deleted from the printer memory any time power to the printer is turned off.

MACRO ID

The macro ID sequence specifies an identification number for use in subsequent macro routines.

ESC &f#Y

Decimal: 027 038 102 # 089

Hex: 1B 26 66 # 59

#: macro ID number = 0 to 32767

The factory default macro ID is 0.

If you want to use 7 as an identification number, for example, send:

ESC &f7Y

MACRO CONTROL

The macro control sequence contains the commands to define, invoke, and delete macros.

ESC &f#X

Decimal: 027 038 102 # 088

Hex: 1B 26 66 # 58

- #:
- 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: A macro may call or execute another macro that in turn can call or execute another macro. Two levels of macros can be “nested” in this manner.

Other than call and execute, you can not place macro control statements within a macro.

You cannot use a printer reset command in a macro.

Do not place font management commands in a macro. You cannot download, delete, or make a font permanent in a macro.

MACRO EXAMPLE

This example shows the definition of a macro used for a company letterhead.

ESC&f4Y	Specify the macro ID as 4
ESC&f0X	Start macro definition
ESC&a540h780V coordinate system	Places letterhead at decipoints 540, 780 in the PCL
ESC*t300R	Set graphics resolution to 300 dots-per-inch
ESC(1X	Select font with ID of 1
Master Printer Inc. Text 20 Raster Way Text Downtown, NY 12664	Text
ESC&a540h960V	Position first rule at decipoints 540, 960
ESC*c10v4680H	Set rule height and width
ESC*c0P	Print the first rule
ESC&a540h980V	Position the second rule at decipoints 540, 980
ESC*c0P	Print the second rule
ESC&540h1200V	Position for the first line of text at decipoints 540, 1200
ESC&f1X	Stop macro definition

The macro can be executed, called, or invoked for automatic overlay.

PROGRAMMING HINTS

The following paragraphs provide information for use during PCL software development.

End of Line Wrap

ESC&s0C (enabled)

Decimal: 027 038 115 048 067

Hex: 1B 26 73 30 43

ESC&s1C (disabled)

Decimal: 027 038 115 049 067

Hex: 1B 26 73 31 43

This command defines the action that occurs when a line of text reaches the right margin.

When end-of-line wrap is enabled, a character or space that moves the cursor to the right margin executes a CR-LF (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 margin may be clipped. When a character is clipped, the cursor is set to the right margin.

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

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

Display Functions Mode

ESCY (enables display function mode)

Decimal: 027 089

Hex: 1B 59

ESCZ (disables display functions mode)

Decimal: 027 090

Hex: 1B 5A

This command allows all escape sequences and control codes to be printed instead of executed.

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.
- ESCZ 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.

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Section 11

IntelliBar SAP Device Types

This section describes IntelliBar Device Types developed for SAP R/3 and later. SAP uses a proprietary printer spool and print system that provides a uniform user printing interface that supports a multiplicity of printers. A specific SAP printer Device Type provides the interface between the SAP Spooler and a particular printer. IntelliTech has developed SAP Device Types for IntelliBar printers that provide bar code label printing capability for a wide range of media.

SAP PRINTING WITH INTELLIBAR PCL COMMAND EXTENSIONS

Standard Series IntelliBar printers use the Hewlett Packard Printer Control Language level 5, HP PCL 5, for raster image processing tasks. Hewlett Packard LaserJet III (LJIII) printers use HP PCL5. Thus, IntelliBar printers appear as an LJIII to a host system. LJIII printers operate in the SAP environment by using the standard SAP HPLJIIID Device Type.

IntelliBar printers operate in the SAP environment by using custom “Z type” Device Types that are derived from the HPLJIIID Device Type. IntelliBar Device Types use HPLJIIID ABAP List Format Types. The IntelliBar Device Types and their ABAP List Format Types are described below.

INTELLIBAR SAP DEVICE TYPES

There are three custom device types for the IntelliBar Standard printer series:

<u>SAP Device Type</u>	<u>IntelliBar Standard Printer Series</u>
■ ZITC_48	M48
■ ZITC_412	M412
■ ZITC_88	M88

INSTALLATION OF INTELLIBAR SAP DEVICE TYPES

To install IntelliBar Device Types, download the required Device Type from the IntelliTech International web site at <http://www.intellitech-intl.com/portasp/drivers.asp>. Copy the Device Type onto the target SAP host system by using the SAP RSTXSCRIP report. Assign the Device Type to the IntelliBar printer using the SAP administrative dialog.

INTELLIBAR ABAP LIST AND SAPSCRIPT FORMAT TYPES

Eight ABAP List Format Types for the IntelliBar Device Types are directly inherited from the HPLJIID Device Type.

All SAPScript Format Types for IntelliBar Device Types are customized.

The printer initialization (Default) Format Types are described in Table 11-1 below:

Table 11-1 IntelliBar Initialization Format Types

Format Type	Value
Variable Form Length	See Table 11-2 below for Type and Value.
Print Speed	See Table 11-3 below for Value
Print Density	Value = 0
Print and Tear Frequency	Value = 1
Print and Cut Frequency	Value = 1

Table 11-2 IntelliBar Device Type Variable Form Length Command Values

SAPScript Format Type	Value in scan lines (@300 lines/inch)
DINA4	3508 (= 11.69 inches/297 mm)
DINA5	2480 (= 8.27 inches/210 mm)
EXECUTIV	3140 (= 10.47 inches/267 mm)
INCH11	3300 (= 11 inches/279 mm)
INCH12	3600 (= 12 inches/305 mm)
INCH4	1200 (= 4 inches/102 mm)
INCH4C	1200 (= 4 inches/102 mm)
INCH6	1800 (= 6 inches/152 mm)
INCH7	2100 (= 7 inches/178 mm)
INCH8	2400 (= 8 inches/203 mm)

LEGAL	4200 (= 14 inches/356 mm)
LETTER	3300 (= 11 inches/279 mm)
LINE_21	1050 (= 3.5 inches/89 mm)
LINE_22	1100 (= 3.67 inches/93 mm)

Table 11-3 IntelliBar Device Type Default Print Speed Command Values

IntelliBar Device Type	Default Print Speed Command Value (mm/second)
ZITC_412	300 (= 300 mm or 12 inches/second)
ZITC_48	200 (= 200 mm or 8 inches/second)
ZITC_88	200 (= 200 mm or 8 inches/second)

SAP STANDARD BAR CODE PRINT CONTROLS

The HPLJIID Device Type supports twelve standard SAP bar codes used with ABAP lists. These codes are also supported by the IntelliBar ZITC_XXX Device Types. The standard SAP HPLJIID bar codes are implemented through the Print Control commands listed in Table 11-4 below:

Table 11-4 Standard SAP Bar Code Commands

Command Code	Description
ARTNR	Article number, Technical bar code type: Code 128
AUFNR	Request number, Technical bar code type: Code 128
BARCLVS	Test bar code in LVS, Technical bar code type: Code 39, no check digit
BC_CD39	Technical bar code type: Code 39, no check digit, no text, height 13 mm
BC_ESC	ESC character (hex 1B)
KUNAUNR	Customer request number, Technical bar code type: Code 128
KUNAUPS	Customer request item, Technical bar code type: Code 128
MBBARC	Test bar code for inventory management, Technical bar code type: Code 128
MBBARC1	Test Bar code 1 for inventory management, Technical bar code type: EAN-8
RSNUM	Reservation number, Technical bar code type: Code 128
RSPOS	Reservation item, Technical bar code type: Code 128

RUECKNR	Completion confirmation number, Technical bar code type: Code 128
---------	-------------------------------------------------------------------



NOTE: SAP specifies the maximal data lengths for the twelve HPJLIIID bar codes. For example, for the ARTNR Command SAP specifies the length parameters as a minimum of 1 symbol and maximum of 10 symbols. To print ARTNR with a length less than 10 symbols (ex., 8 symbols), the appropriate parameter in the PCL escape sequence must be changed to the appropriate value. In the PCL escape sequence, "\e!b8C\e!b142J\e!b2N\e!10W", change the segment that specifies ten symbols, "\e!10W", to "\e!##W", where ## equals the number of symbols needed. In this example the change to "8" would be "\e!b8C\e!b142J\e!b2N\e!8W". For additional information about SAP standard bar codes go to: http://help.sap.com/saphelp_webas610/helpdata/en/d9/4a94e251ea11d189570000e829fbbd/content.htm

INTELLIBAR SAP DEVICE TYPE PRINT CONTROL COMMANDS

In addition to the standard HP PCL5 commands supported by the IntelliBar ZITC_XXX Device Types, IntelliBar printers use custom PCL Command extensions that enable thermal label printing functions and provide access to internal printer resident bar code fonts. In the SAP environment these Command extensions are accessed through custom SAP “Z” print commands. Table 11-5 below lists the IntelliBar custom SAPScript Format Types, a description of the Command and the corresponding PCL5 command extension in escape code sequence.

NOTE: For greater detail about IntelliBar PCL command extensions, as well as standard HP PCL commands, refer to the relevant portion of Section 2 of the IntelliBar Programmer’s Reference Manual.

Table 11-5 IntelliBar PCL Command Extensions Cross Reference to SAP Z Print Control Command Codes

Sap “Z” Print Command Code	Function	PCL Escape Command Code
Setting/Disabling Variable Form Length		
 NOTE: The Variable Form Length command allowable range = 300 to 29,700 scan lines (= 1" to 99"/ 2.5 cm to 252 cm) in increments of 300 scan lines (= 1"/ 2.5 cm). Use the next longer full inch form length for form lengths that have fractional inches. For example, if form length = 8.5" then use the 9" form length command, “ZSF09”.		
ZSFVL	Set Variable Form Length = the last selected value	ESC!f1Z
ZSF01	Set Variable Form Length = 1"	ESC!f300Z
through		through
ZSF99	Set Variable Form Length = 99"	ESC!f29700Z
ZDFVL	Disable Variable Form Length	ESC!f0Z
Setting Print Speed		
 NOTE: The default Set Print Speed command is printer model dependent.		
ZPS01	Set Print Speed = 0.6" (15 mm)/sec	ESC!p15S
ZPS02	Set Print Speed = 0.8" (20 mm)/sec	ESC!p20S
ZPS03	Set Print Speed = 1.2" (30 mm)/sec	ESC!p30S
ZPS04	Set Print Speed = 1.6" (40 mm)/sec	ESC!p40S
ZPS05	Set Print Speed = 2.4" (60 mm)/sec	ESC!p60S
ZPS06	Set Print Speed = 3.2" (80 mm)/sec	ESC!p80S
ZPS07	Set Print Speed = 4" (100 mm)/sec	ESC!p100S

ZPS08	Set Print Speed = 5" (120 mm)/sec	ESC!p120S
ZPS09	Set Print Speed = 6" (150 mm)/sec	ESC!p150S
ZPS10	Set Print Speed = 8" (200 mm)/sec	ESC!p200S
ZPS11	Set Print Speed = 10" (250 mm)/sec	ESC!p250S
ZPS12	Set Print Speed = 12" (300 mm)/sec	ESC!p300S

Setting Print Density

ZPD00	Set Print Density to 0, Default	ESC&d0A
ZPD01	Set Print Density to 1	ESC&d1A
ZPD02	Set Print Density to 2	ESC&d2A
ZPD03	Set Print Density to 3	ESC&d3A
ZPD04	Set Print Density to 4	ESC&d4A
ZPD05	Set Print Density to 5	ESC&d5A
ZPD06	Set Print Density to 6	ESC&d6A
ZPD07	Set Print Density to 7	ESC&d7A
ZPD08	Set Print Density to 8	ESC&d8A
ZPD09	Set Print Density to 9	ESC&d9A
ZPD10	Set Print Density to 10	ESC&d10A
ZPD11	Set Print Density to 11	ESC&d11A
ZPD12	Set Print Density to 12	ESC&d12A
ZPD13	Set Print Density to 13	ESC&d13A
ZPD14	Set Print Density to 14	ESC&d14A
ZPD15	Set Print Density to 15	ESC&d15A
ZPD16	Set Print Density to -15	ESC&d-15A
ZPD17	Set Print Density to -14	ESC&d-14A
ZPD18	Set Print Density to -13	ESC&d-13A
ZPD19	Set Print Density to -12	ESC&d-12A
ZPD20	Set Print Density to -11	ESC&d-11A
ZPD21	Set Print Density to -10	ESC&d-10A
ZPD22	Set Print Density to -9	ESC&d-9A
ZPD23	Set Print Density to -8	ESC&d-8A
ZPD24	Set Print Density to -7	ESC&d-7A
ZPD25	Set Print Density to -6	ESC&d-6A
ZPD26	Set Print Density to -5	ESC&d-5A
ZPD27	Set Print Density to -4	ESC&d-4A
ZPD28	Set Print Density to -3	ESC&d-3A
ZPD29	Set Print Density to -2	ESC&d-2A
ZPD30	Set Print Density to -1	ESC&d-1A

Setting Print and Tear Frequency



NOTE: The Set Print and Tear Frequency command allowable range = 1 to 99.

ZPT01	Print and Tear Frequency = 1, Default	ESC!n1T
ZPT02	Print and Tear Frequency = 2	ESC!n2T
through		through
ZPT99	Print and Tear Frequency = 99	ESC!n99T

Setting Print and Cut Frequency

NOTE: The Set Print and Cut command allowable range = 1 to 99.

ZPC01	Print and Cut frequency = 1	ESC!n1C
ZPC02	Print and Cut frequency = 2	ESC!n2C
through		through
ZPC99	Print and Cut frequency = 99	ESC!n99C

Setting Bar Code Type

ZBT00	Set Bar Code Type = 0, only print text, Default	ESC!b0C
ZBT01	Set Bar Code Type = 1, UPC-A	ESC!b1C
ZBT02	Set Bar Code Type = 2, UPC-E	ESC!b2C
ZBT03	Set Bar Code Type = 3, EAN/JAN-13 (with or without 2 or 5 digit supplements)	ESC!b3C
ZBT04	Set Bar Code Type = 4, EAN/JAN-8 (with or without 2 or 5 digit supplements)	ESC!b4C
ZBT05	Set Bar Code Type = 5, 3 of 9 (Code 39)	ESC!b5C
ZBT06	Set Bar Code Type = 6, Extended 3 of 9	ESC!b6C
ZBT07	Set Bar Code Type = 7, Interleaved 2 of 5	ESC!b7C
ZBT08	Set Bar Code Type = 8, Code 128	ESC!b8C
ZBT09	Set Bar Code Type = 9, Codabar	ESC!b9C
ZBT10	Set Bar Code Type = 10, Zip + 4 Postnet	ESC!b10C
ZBT11	Set Bar Code Type = 11, MSI Plessey	ESC!b11C
ZBT12	Set Bar Code Type = 12, Code 93	ESC!b12C
ZBT14	Set Bar Code Type = 14, UCC-128	ESC!b14C
ZBT15	Set Bar Code Type = 15, HIBC	ESC!b15C
ZBT16	Set Bar Code Type = 16, UPC/EAN extension (2 or 5 digit supplemental)	ESC!b16C
ZBT17	Set Bar Code Type = 17, PDF 417	ESC!b17C

Setting Bar Code Height in Decipoints

NOTE: The Set Bar Code Height in Decipoints command allowable range = 0.1" to 6.0" in increments of 0.1" (in multiples of 72 decipoints, 1 decipoint = 1/720 inch).

ZHC01	Set Bar Code Height (Decipoints) = 0.1" (72 Decipoints)	ESC!b72H
ZHC02	Set Bar Code Height (Decipoints) = 0.2" (144 Decipoints)	ESC!b144H
through		
ZHC60	Set Bar Code Height (Decipoints) = 6.0" (4320 Decipoints)	ESC!b4320H

Setting Bar Code Height in Dots

NOTE: 1 Dot = 1/300 inch. The Set Bar Code Height in Dots command allowable range = 0.1" to 6.0" (2.54 mm to 152.4 mm/30 dots to 1800 dots) in increments of 0.1" (2.54 mm/ 30 Dots).

ZHD01	Set Bar Code Height (Dots) = 0.1" (30 Dots)	ESC!b30J
ZHD02	Set Bar Code Height (Dots) = 0.2" (60 Dots)	ESC!b60J
through		
ZHD60	Set Bar Code Height (Dots) = 6.0" (1800 Dots)	ESC!b1800J

Setting Bar Code Width in Dots

NOTE: 1 Dot = 1/300 inch. The Set Bar Code Width command allowable range = 1 to 6 Dots.

ZBCW1	Set Bar Code Width (Dots) = 1	ESC!b1N
ZBCW2	Set Bar Code Width (Dots) = 2 Default	ESC!b2N
ZBCW3	Set Bar Code Width (Dots) = 3	ESC!b3N
ZBCW4	Set Bar Code Width (Dots) = 4	ESC!b4N
ZBCW5	Set Bar Code Width (Dots) = 5	ESC!b5N
ZBCW6	Set Bar Code Width (Dots) = 6	ESC!b6N

Setting Bar Code Ratios (Code 39, Extended 3 of 9, and Interleaved 2 of 5)

ZBCR1	Set Bar Code Ratio, Ratio of 2 to 1	ESC!b1R
ZBCR2	Set Bar Code Ratio, Ratio of 5 to 2	ESC!b2R
ZBCR3	Set Bar Code Ratio, Ratio of 3 to 1, Default	ESC!b3R

Setting Bar Code 128 Subset Mode

ZBSM0	Set Bar Code 128 Subset Mode 0, Automatic subset switching, Default	ESC!b0S
ZBSM1	Set Bar Code 128 Subset Mode 1, Subset A (upper case/control characters)	ESC!b1S
ZBSM2	Set Bar Code 128 Subset Mode 2, Subset A (upper and lower case characters)	ESC!b2S
ZBSM3	Set Bar Code 128 Subset Mode 3, Subset A (double density numbers)	ESC!b3S

Setting UPC-E Bar Code Method

ZBCM0	Set UPC-E Bar Code Method 0, Requires 11 digits to print 6 digit bar code, Default	ESC!b0E
ZBCM1	Set UPC-E Bar Code Method 1, System 0, 6 digit input string	ESC!b1E
ZBCM2	Set UPC-E Bar Code Method 2, System 1, 6 digit input string	ESC!b2E

Setting Print Position for Human-Readable Text

ZTXT0	Print Human-Readable Text = 0 Disable, Default	ESC!b0T
ZTXT1	Print Human-Readable Text, Position = 1, below barcode with check digit	ESC!b1T
ZTXT2	Print Human-Readable Text, Position = 2, below bar code without check digit	ESC!b2T
ZTXT3	Print Human-Readable Text, Position = 3, above bar code with check digit	ESC!b3T
ZTXT4	Print Human-Readable Text, Position = 4, above bar code without check digit	ESC!b4T
ZTXT5	Print Human-Readable Text, Position = 5, in notched bar code with check digit	ESC!b5T
ZTXT6	Print Human-Readable Text, Position = 6, in notched bar code without check digit	ESC!b6T

Setting Optional Check Digit Calculation		
ZCOC0	Calculate Optional Check Digit, 0 Disable, Default	ESC!b0K
ZCOC1	Calculate Optional Check Digit, 1 Enable	ESC!b1K
ZCOC2	Calculate Optional Check Digit, 2 Enable optional second check digit	ESC!b2K
Setting Print Text String Characters as Bar Code		
NOTE: Allowable Range = 4 to 99 characters.		
ZPR04	Print Bar Code, Length=4 characters	ESC!b4W
ZPR05	Print Bar Code, Length=5 characters	ESC!b5W
	through	
ZPR99	Print Bar Code, Length=99 characters	ESC!b99W
Setting PDF417 Enable/Disable Binary Only Mode		
Z17B0	PDF417: Disable Binary Only Mode, Default	ESC!b0B
Z17B1	PDF417: Enable Binary Only mode (determinant symbol size)	ESC!b1B
Setting PDF417 Resolution for Encoding Data to Printer		
Z17D0	PDF417: Set Resolution 75	ESC!b75D
Z17D1	PDF417: Set Resolution 100, Default	ESC!b100D
Z17D2	PDF417: Set Resolution 150	ESC!b150D
Z17D3	PDF417: Set Resolution 300	ESC!b300D
Setting PDF417 Enable/Disable Truncated PDF Symbol Mode		
Z17F0	PDF417: Disable Truncated Mode, Default	ESC!b0F
Z17F1	PDF417: Enable Truncated Mode	ESC!b1F
Setting PDF417 Error Correction Code Level		
Z17L0	PDF417: ECC Level = 0, Default (=Use Percentage Command)	ESC!b0L
Z17L1	PDF417: ECC Level = 1	ESC!b1L
Z17L2	PDF417: ECC Level = 2	ESC!b2L
Z17L3	PDF417: ECC Level = 3	ESC!b3L
Z17L4	PDF417: ECC Level = 4	ESC!b4L
Z17L5	PDF417: ECC Level = 5	ESC!b5L
Z17L6	PDF417: ECC Level = 6	ESC!b6L
Z17L7	PDF417: ECC Level = 7	ESC!b7L
Z17L8	PDF417: ECC Level = 8	ESC!b8L

Setting PDF417 Error Correction Code as a Percentage of Data Words


 NOTE: The Set PDF417 Error Correction Code as a Percentage of Data Words command allowable range = 0 through 400.

Z7000	PDF417: ECC Level as a Percentage = 0	ESC!b10P
Z7001	PDF417: ECC Level as a Percentage = 1	ESC!b11P
Z7002	PDF417: ECC Level as a Percentage = 2	ESC!b12P
through		
Z7400	PDF417: ECC Level as a Percentage = 400	ESC!b400P

Setting PDF417 Mode for Stripping Bits to Compensate for Bleeding


Z17Q0	PDF417: no reduction, Default	ESC!b0Q
Z17Q1	PDF417: reduce Bar Height	ESC!b1Q
Z17Q2	PDF417: reduce Bar Width	ESC!b2Q
Z17Q3	PDF417: reduce both Bar Height and Bar Width	ESC!b3Q

Setting PDF417 Row Count for Sizing a PDF Symbol

 NOTE: The Set PDF417 Row Count for Sizing a PDF Symbol command allowable Range = 0, 3 through 90.

Z7U00	PDF417: Set Row count = 0 (Default)	ESC!b0U
Z7U03	PDF417: Set Row count = 3	ESC!b3U
Z7U04	PDF417: Set Row count = 4	ESC!b4U
through		
Z7U90	PDF417: Set Row count = 90	ESC!b90U

Setting PDF417 Column Count for Symbol Sizing the PDF

 NOTE: The Set PDF417 Column Count for Symbol Sizing the PDF command allowable range = 0 through 30.

Z7V00	PDF417: Set Column count = 0 (Default)	ESC!b0V
Z7V01	PDF417: Set Column count = 1	ESC!b1V
Z7V02	PDF417: Set Column count = 2	ESC!b2V
through		
Z7V30	PDF417: Set Column count = 30	ESC!b30V

Setting PDF417 X Scale

NOTE: The Set PDF417 X Scale command allowable range = 1 through 20.

Z7X01	PDF417: Set X Scale = 1	ESC!b1X
Z7X02	PDF417: Set X Scale = 2	ESC!b2X
through		
Z7X20	PDF417: Set X Scale = 20	ESC!b20X

Setting PDF417 Y Scale

NOTE: The Set PDF417 Y Scale command allowable range = 1 through 10.

Z17Y1	PDF417: Set Y Scale, 1	ESC!b1Y
Z17Y2	PDF417: Set Y Scale, 2	ESC!b2Y
Z17Y3	PDF417: Set Y Scale, 3, Default	ESC!b3Y
Z17Y4	PDF417: Set Y Scale, 4	ESC!b4Y
Z17Y5	PDF417: Set Y Scale, 5	ESC!b5Y
Z17Y6	PDF417: Set Y Scale, 6	ESC!b6Y
Z17Y7	PDF417: Set Y Scale, 7	ESC!b7Y
Z17Y8	PDF417: Set Y Scale, 8	ESC!b8Y
Z17Y9	PDF417: Set Y Scale, 9	ESC!b9Y
Z17Y0	PDF417: Set Y Scale, 10	ESC!b10Y

Setting Auto Incrementing Fields

NOTE: The Set Auto Incrementing Fields command allowable range = 0 to 999.

ZI000	Disables incrementing fields = 0, Default	ESC!b0I
ZI001	Enables incrementing fields = 1	ESC!b1I
ZI002	Enables incrementing fields = 2	ESC!b2I
through		
ZI999	Enables incrementing fields = 999	ESC!b999I

Setting Auto Decrementing Fields

NOTE: The Set Auto Decrementing Fields command allowable range = 0 to -999.

ZD000	Disables decrementing fields = 0, Default	ESC!b0I
ZD001	Enables decrementing fields = -1	ESC!b-1I
ZD002	Enables decrementing fields = -2	ESC!b-2I
through		
ZD999	Enables decrementing fields = -999	ESC!b-999I

Setting Auto Increment/Decrement Enable/Disable Print Leading Zeros

ZPLZ0	Auto Inc/Dec: Enable/Disable printing lead zeroes = 0, Disable, Default	ESC!b0Z
ZPLZ1	Auto Inc/Dec: Enable/Disable printing lead zeroes = 1, Enable	ESC!b1Z

*** End of Section 11 ***

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