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	01
*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	ü
	Spanish*	1S	#	$	@	¡	Ñ	¿	°	'	{	ñ	}	~
17	ISO Spanish	2S	£	$	§	¡	Ñ	¿	^	'	°	ñ	ç	~
85	ISO Spanish:*	6S	#	$	·	¡	Ñ	Ç	¿	'	´	ñ	ç	¨
16	ISO Portuguese*	4S	#	$	§	Ã	Ç	Õ	^	'	ã	ç	õ	°
84	ISO Portuguese:*	5S	#	$	´	Ã	Ç	Õ	^	`	ã	ç	õ	~
60	ISO Norwegian v1	0D	#	$	@	Æ	Ø	Å	^	'	æ	ø	å	‾
61	ISO Norwegian v2*	1D	§	$	@	Æ	Ø	Å	^	'	æ	ø	å	|

* 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&l#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 - Bipmap 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 Ø)	clamped real	-32768 to 32767	1
rise (or sin Ø)	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 Ø - Specifies the X-component of the text printing direction.

Rise or Sin Ø - 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

Ø = the angle measured in degrees

sin Ø/cos Ø = rise/run

$Ø = \tan^{-1} (\text{rise/run})$

and

tan Ø = sin Ø/cos Ø

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:

actual width = (width parameter/100 x $(P2_X - P1_X)$

actual height = (height parameter/100 x $(P2_Y - P1_Y)$

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 Ø 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 specifed 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 similiar 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 specifed 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 cuase 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 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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