

CHAPTER 2

PCL PRINTER CONTROL LANGUAGE

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2. INTRODUCTION

This laser printer provides a complete emulation of the supported Hewlett Packard LaserJet printer. Features include raster and vector graphics, support for bitmap and scalable fonts and page control. There are many resident fonts in the printer and you can gain access to more by inserting a font cartridge/card or the storage device into the printer or by downloading fonts from your computer.

3. CONTROLLING THE PRINTER

3.1. Control Codes

Control codes are ASCII codes that tell the printer to perform a given function, such as a carriage return. You can send these codes to the printer as part of a program.

3.1.1. Backspace (08) <08h>

ASCII code 8. This code moves the cursor one column to the left.

3.1.2. Line feed (10) <0Ah>

ASCII code 10. This code performs a line feed.

3.1.3. Form feed (12) <0Ch>

ASCII code 12. This code ejects the most recently printed page from the printer.

3.1.4. Carriage return (13) <0Dh>

ASCII code 13. This code performs a carriage return.

3.1.5. Select primary font (14) <0Eh>

ASCII code 15. When you send this code to the printer subsequent characters will be printed in the current primary font. This is explained further in the sub-section entitled "Using fonts".

3.1.6. Select secondary font (15) <0Fh>

ASCII code 14. When you send this code to the printer subsequent characters will be printed in the current secondary font. This is explained further in the sub-section entitled "Using fonts".

3.1.7. Escape (27) <1Bh>

ASCII code 27. You must use this character code to start every instruction sequence that you send to the printer.

3.1.8. Horizontal tab (09) <09h>

ASCII code 9. This code moves the cursor one tab position to the right. The tab positions are at the left margin and at the left edge of every 8th column as defined by the horizontal motion index (HMI) described in the next section, entitled "The Page".

3.1.9. Space (32) <20h>

ASCII code 32. This code moves the cursor one column to the right.

3.2. Escape Sequences

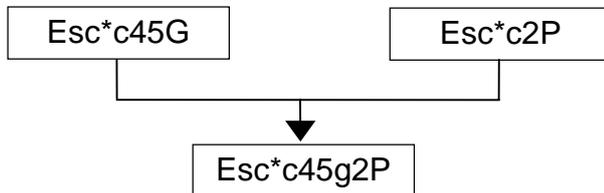
Escape sequences, also known as PCL (Printer Control Language) commands, tell the printer which operations to perform. An escape sequence consists of the *Esc* character followed by a string of characters which define the operation to be performed. Some escape sequences require parameter values. These are included in the sequence as numeric characters. The final letter of an escape sequence must be uppercase: all others must be lowercase.

You can send the printer instructions by embedding escape sequences in programs or in word processed documents.

In this manual escape sequences are shown as they would be entered, except that the character # in a sequence indicates that a number should be included at that point in the sequence. If no number is included, the printer interprets that parameter's value as 0.

When downloading fonts or sending raster scan images to the printer the final uppercase character of the sequence is followed by the relevant data.

Two escape sequences can be combined into one if the first three characters of each sequence (including the *Esc* character itself) are the same. Hence, **Esc*c45G** and **Esc*c2P** may be combined to give **Esc*c45g2P**. The uppercase 'G' which terminated the first sequence becomes a lowercase character in the combined sequence. Combined escape sequences are executed left to right, so be careful to place commands in the order in which you want them to be executed.



3.2.1. Line termination

You can set the carriage return, line feed and form feed control codes to perform compound functions. You can either do this using the printer's control panel (see the User Guide) or by sending the printer the following escape sequence:

Esc&k#G (27) (38) (107) # (71) <1Bh><26h><6Bh>#<47h>

- 0 = Carriage return, line feed and form feed perform their normal functions.
- 1 = Carriage return performs carriage return/line feed, line feed and form feed perform their normal functions.
- 2 = Carriage return performs its normal function, line feed performs carriage return/line feed and form feed performs carriage return/form feed.
- 3 = Carriage return performs carriage return/line feed, line feed performs carriage return/line feed and form feed performs carriage return/form feed.

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

3.2.2. End-of-line wrap

If the printer tries to print a line of text that is longer than the width of the text area, the end of the line will normally be lost. However, you can set the printer to flow text onto the next line so that text is not lost.

You can turn on the automatic text wrap feature either from the printer's control panel (see the User Guide) or by sending the printer the following escape sequence:

Esc&s0C (27) (38) (115) (48) (67) <1Bh><26h><73h><30h><43h>

To turn off the facility send:

Esc&s1C (27) (38) (115) (49) (67) <1Bh><26h><73h><31h><43h>

3.2.3. Display functions mode

You can choose to make the printer print escape sequences instead of executing them. Send the printer the following sequence:

EscY (27) (89) <1B><59>

Now the printer prints out escape sequences and prints the characters of the control codes. It does not execute them. The only exceptions to this are CR, the carriage return code, which causes a carriage return and line feed to be performed, and the EscZ escape sequence which turns the mode off.

To turn the display functions mode off and enable escape sequences to be executed again send:

EscZ (27) (90) <1B><5A>

The printer exits the display function mode after printing a character of code 1B Hex and the letter "Z". All subsequent escape sequences and control codes are executed normally and not printed literally.

3.3. Environments

3.3.1. Factory default environment

The factory default environment is the collection of printer settings programmed into the printer before it leaves the factory. You can restore the factory default environment using the printer's control panel.

See the User's Guide to find how to reset the printer from the printer's control panel.

Some settings cannot be restored to the factory default environment with the RESET operation from the printer's control panel.

3.3.2. User default environment

The user default environment is a combination of factory default settings and settings which the user has made from the printer's control panel or remote printer console. You can store user default setting(s) in the printer by using the printer control panel. You can restore the user default environment either by sending the reset escape sequence to the printer, EscE, or by performing a reset from the printer's control panel. On some models, there are multiple User settings available, refer to your printer User Guide to see if your printer supports these.

3.3.3. Modified print environment

The modified print environment is made up of all the current printer settings. If you call a macro or go into HP-GL/2 graphics language the modified print environment settings are saved. When the macro has been executed, or when you quit HP-GL/2, these saved settings are restored. The modified print environment consists of settings for the following features:

Page length	Primary font characteristics	Raster graphics presentation mode
Page size	Secondary font characteristics HMI	Raster graphics left margin
Orientation	Primary font	Pattern ID
Left registration	Secondary font	Current pattern
Top registration	Font ID	Source transparency mode
Paper source	Character code Macro ID	Pattern transparency mode
Number of copies	VMI/Line spacing	Print direction
Margins	Horizontal rectangle size	Raster graphics compression mode
Perforation skip mode	Vertical rectangle size	Underline mode
Line termination mode	Area fill ID	Raster graphics height
End-of line wrap	Raster graphics resolution	Raster graphics width
Current font		

3.3.4. Macro overlay environment

The macro overlay environment is a combination of the user default environment and the current modified print environment. The overlay environments settings take effect when a macro is enabled for automatic overlay. This is detailed in the section of this manual in which macros are described.

4. JOB CONTROL

4.1.1. Page size

Esc&l#A (27) (38) (108) # (65) <1Bh><26h><6Ch>#<41h>

stands for the type of paper or envelope to be used.

Values for # correspond to the paper or envelope sizes shown in the table. Envelopes sizes are shown in the shaded part of the table.

Model	HL-1050/ 1070	HL-1250/ 1270N/ P2500	HL-1660e/ 2060	HL-2400C/ 2400Ce	HL-3400CN	HL-1450/ 1470N	HL-1650/ 1670N	HL-3260N
1	Executive	○	○	○	○	○	○	○
2	Letter	○	○	○	○	○	○	○
3	Legal	○	○	○	○	○	○	○
6	Ledger				○			○
25	A5		○			○	○	○
26	A4	○	○	○	○	○	○	○
27	A3				○			○
45	B5 (JIS)		○		○	○	○	
46	B4 (JIS)				○			○
100	B5	○	○	○	○	○	○	○
101	Free size					○		○
1024	B6	○		○			○	
1025	A5	○	○	○				
1026	A6	○	○	○		○	○	○
1028	13"X19"				○			
2048	16"	○	○			○		
80	Monarch	○	○	○	○	○	○	○
81	COM-10	○	○	○	○	○	○	○
90	International DL	○	○	○	○	○	○	○
91	International C5	○	○	○		○	○	○

Model	HL- 2460	HL- 7050	HL-1850/1870N/5040/5050/5070N/ 5140/5150D/5170DN/6050/6050D/ 6050DN/2070N/5240/5250DN/5270D N/5280DW	HL- 2600CN	HL- 3450CN	HL- 8050N	HL- 2700CN
1	Executive	○	○	○	○	○	○
2	Letter	○	○	○	○	○	○
3	Legal	○	○	○	○	○	○
6	Ledger				○		
25	A5	○	○	○			○
26	A4	○	○	○	○	○	○
27	A3				○		
45	B5 (JIS)	○	○	○	○	○	○
46	B4 (JIS)				○		
71	POSTCARD			○			
100	B5	○	○	○	○	○	○
101	Free size	○	○	○	○		○
1024	B6	○	○	○			○
1025	A5		○	○			
1026	A6	○		○		○	
1028	13"X19"				○		
1033	Organizer J			○			
1034	Organizer K			○			
1035	Organizer L			○			
1036	Organizer M			○			
1038	Folio			○			
2048	16"(A4 Long)	○	○	○			
80	Monarch	○	○	○		○	
81	COM-10	○	○	○	○	○	○
90	International DL	○	○	○	○	○	○
91	International C5	○	○	○		○	
1037	International DL Long Edge Feed			○			

- When the printer receives this command any unprinted pages are printed and the left, right and top margins and the text length are set to their factory defaults for the new page size.
- The cursor is moved to the top left of the text area on the new page.
- Depending on your model, you may also set the page size from the printer's control panel or remote printer console program (see the User Guide).
- If the paper size you select differs from the size of the currently loaded paper, a message appears in the control panel prompting you to load the selected size of paper (for HL-1660e, 2060, 2400C/Ce, 3400CN, 3260N 2460, 7050, 1850, 1870N and 2700CN).

Example)

Select letter size: Esc&l2A <1Bh><26h><6Ch><32h><41h>

Select the width of free size paper: Esc&l#G (1/720 inch unit; for HL-3260N, 2460, 7050, 1850, 1870N, 5040, 5050, 5070N, 5140, 5150D, 5170DN, 2600CN, 3450CN, 2700CN, 2070N, 5240, 5250DN, 5270DN, and 5280DW)

Select the height of free size paper: Esc&l#F (1/720 inch unit; for HL-3260N, 2460, 7050, 1850, 1870N, 5040, 5050, 5070N, 5140, 5150D, 5170DN, 2600CN, 3450CN, 2700CN, 2070N, 5240, 5250DN, 5270DN, and 5280DW)

4.1.2. Media type selection

Esc&n# (27) (38) (110) # <1Bh><26h><6Eh>#

stands for the media type of paper to be used.

Values for # correspond to the media type shown in the table. (For HL-2070N, 5240, 5250DN, 5270DN, 5280DW)

6WdPlain	Set as Plain Paper.
8WdRegular	
5WdThin	Set as Thin Paper.
6WdThick	Set as Thick Paper.
7WdThick2	Set as Thicker Paper.
5WdBond	Set as Bond Paper.
13WdTransparency	Set as Transparent Paper.
10WdEnvelopes	Set as Envelope.
9WdEnvthick	Set as Thick Envelope.
8WdEnvthin	Set as Thin Envelope.
9WdRecycled	Set as Recycled Paper.

4.1.3. Output tray

Esc&l#G (27) (38) (108) # (71) <1Bh><26h><6Ch>#<47h>

denotes the output tray.

- 1: Select the printer output tray.
- 3: Select #1 bin. (CT:HL-8050N)
- 4: Select #2 bin.
- 5: Select #3 bin.
- 6: Select #4 bin.
- 7: Select #5 bin.
- 8: Select #6 bin.
- 9: Select #7 bin.
- 10: Select #8 bin.
- 11: Select #9 bin.
- 12: Select #10 bin.
- 100: Select the finisher tray (HL-3260N)

- This command selects the specified output tray.
- This command is ignored when the specified tray is not available.
- The PJJ OUTBIN command is ignored when this command is executed.

- If the printer has data to print when this command is executed, the command is valid from the next page immediately after the data is printed.

4.1.4. Paper source

Esc&l#H (27) (38) (108) # (72) <1Bh><26h><6Ch>#<48h>

denotes the paper source.

Values for # may be 0, 1, 2, 3, or 4.

- If # = 0 the current page is ejected and the paper source remains the same.
- If # = 1 the current page is printed and the upper cassette becomes the paper source.
- If # = 2 the current page is printed and paper is fed in manually.
- If # = 3 the current page is printed and envelopes are fed in manually.
- If # = 4 the current page is printed and the lower cassette becomes the paper source.
- If # = 4 the current page is printed and the multi-purpose tray becomes the paper source. (HL-1660e/2060/1650/1670N/1850/1870N/5050/5070N/5150D/5170DN/7050/6050/6050D/6050DN/5240/5250DN/5270DN/5280DW)
- If # = 5 the current page is printed and the lower cassette becomes the paper source. (HL-1070/1250/1270N/P2500/1660e/2060/2400C/2400Ce/3400CN/1450/1470N/1650/1670N/3260N/2460/7050/1850/1870N/5040/5050/5070N/5140/5150D/5170DN/2600CN/3450/6050/6050D/6050DN/8050N/2700CN/5240/5250DN/5270DN/5280DW)
- If # = 6 if TRAYCOMMAND is LJ3, the current page is printed and the lower cassette becomes the paper source. (HL-1660e/2060/2400C/2400Ce/3400CN/1650/1670N/3260N/1850/1870N/5040/5050/5070N/5140/5150D/5170DN/2600CN/3450/6050/6050D/6050DN/ 2700CN/5240/5250DN/5270DN/5280DW)
- If # = 7 the current page is printed and the paper source is auto selected.
- If # = 8 the current page is printed and the lower cassette (Tray 3) becomes the paper source. (HL-3400CN/3450CN/3260N/2460/7050/5240/5250DN/5270DN/5280DW)
- If # = 9 the current page is printed and the lower cassette (Tray 4) becomes the paper source. (HL-3260N/2460/7050)
- If # = 100 the current page is printed and the Tray ID 1 becomes the paper source. (HL-2460/7050)
- If # = 101 the current page is printed and the Tray ID 2 becomes the paper source. (HL-2460/7050)
- If # = 102 the current page is printed and the Tray ID 3 becomes the paper source. (HL-2460/7050)
- If # = 103 the current page is printed and the Tray ID 4 becomes the paper source. (HL-2460/7050)
- If # = 1001 the current page is printed and the paper source is fixed tray.
- If # = 1002 the current page is printed and the paper source is auto selection.
- If # = 1 or # = 2 either paper or envelopes may be fed in, depending on the current page size setting.
- The cursor is positioned at the top left of the text area on the next page.

If PJI TRAYCOMMAND is NORMAL;

	HL-1050	HL-1070	HL-1250/1270N/P2500/ 1450/1470N/2400C/Ce	HL-3400CN	HL-1660e/2060/ 1650/1670N	HL-3260N
#=0	Eject	←	←	←	←	←
#=1	Sheet Feeder	Tray 1	←	←	←	←
#=2	Manual Feed	←	←	←	←	←
#=3	N/A	←	Envelope	←	←	←
#=4	N/A	Tray 2	←	←	MP Tray	←
#=5	N/A	Tray 2	←	←	←	←
#=6	N/A	←	←	←	←	←
#=7	Auto selection	←	←	←	←	←
#=8	N/A	←	←	Tray 3	N/A	Tray 3
#=9	N/A	←	←	←	←	Tray 4

If P/L TRAYCOMMAND is NORMAL;

	HL-1850/1870N/ 5050/5070N/ 5150D/5170DN/ 6050/6050D/6050D N	HL- 5240/525 0DN/527 0DN/528 0DW	HL- 5040/ 5140	HL-2070N	HL-2460/ 7050	HL-8050N	HL- 2600CN/ 2700CN	HL-3450CN
#=0	Eject	←	←	←	←	←	←	←
#=1	Tray 1	←	←	←	←	←	←	←
#=2	Manual Feed	←	←	←	←	←	←	←
#=3	Envelope	←	←	←	←	←	←	←
#=4	MP Tray	←	N/A	←	MP Tray	Tray2	←	←
#=5	Tray 2	←	←	N/A	Tray 2	←	←	←
#=6	N/A	←	←	←	←	←	←	←
#=7	Auto selection	←	←	←	←	←	←	←
#=8	N/A	Tray3	N/A	←	←	Tray3	N/A	Tray3
#=9	N/A	←	←	←	←	Tray4	N/A	←
#=100	N/A	←	←	←	Tray ID 1	N/A	←	←
#=101	N/A	←	←	←	Tray ID 2	N/A	←	←
#=102	N/A	←	←	←	Tray ID 3	N/A	←	←
#=103	N/A	←	←	←	Tray ID 4	N/A	←	←
#=1001	Fixed tray	←	←	←	←	←	←	←
#=1002	Auto selection	←	←	←	←	←	N/A	←

If P/L TRAYCOMMAND is SPECIAL;

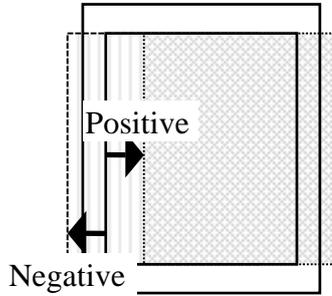
	HL- 1660e/2060/ 1650/1670N	HL- 2400C / Ce	HL- 3400C N	HL- 3260N	HL- 1850/1870N/ 5050/5070N/ 5150D/5170DN/ 6050/6050D/ 6050DN	HL- 5240/52 50DN/5 270DN/ 5280D W	HL- 5040/ 5140	HL- 2070N	HL- 2600CN / 2700CN	HL- 3450CN
#=0	Eject	←	←	←	←	←	←	←	←	←
#=1	Tray 1	←	←	←	←	←	←	←	←	←
#=2	Manual Feed	←	←	←	←	←	←	←	←	←
#=3	Envelope	←	←	←	←	←	←	←	←	←
#=4	Tray 2	←	←	←	←	←	←	N/A	Tray 2	←
#=5	Tray 2	←	←	←	←	←	←	N/A	Tray 2	←
#=6	MP Tray	Tray2	←	MP Tray	←	←	N/A	←	Tray 2	←
#=7	Auto selection	←	←	←	←	←	←	←	←	←
#=8	N/A	←	Tray3	←	N/A	Tray3	N/A	←	←	Tray3
#=9	N/A	←	←	Tray4	N/A	←	←	←	←	←
#=100	N/A	←	←	←	←	←	←	←	←	←
#=101	N/A	←	←	←	←	←	←	←	←	←
#=102	N/A	←	←	←	←	←	←	←	←	←
#=103	N/A	←	←	←	←	←	←	←	←	←
#=1001	N/A	←	←	←	Fixed tray	←	←	←	←	←
#=1002	N/A	←	←	←	Auto selection	←	←	←	N/A	←

4.1.5. Left long-edge offset registration

Esc&l#U (27) (38) (108) # (85) <1Bh><26h><6Ch>#<55h>

stands for the distance in decipoints (1/720") that the left edge of the logical page is to be moved.

- Values for # may be in the range -32,767 to 32,767.
- The distance specified is relative to the logical page's current position.
- # can be positive or negative. Use a positive number to move the logical page to the right on the physical page, and a negative number to move it to the left.

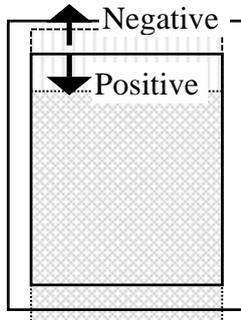


4.1.6. Top offset registration

Esc&l#Z (27) (38) (108) # (90) <1Bh><26h><6Ch>#<5Ah>

stands for the distance in decipoints (1/720") that the top edge of the logical page is to be moved.

- Values for # may be in the range -32,767 to 32,767.
- The distance specified is relative to the logical page's current position.
- # can be positive or negative. Use a positive number to move the logical page downwards on the physical page, and a negative number to move it upwards.



4.1.7. Simplex/duplex printing

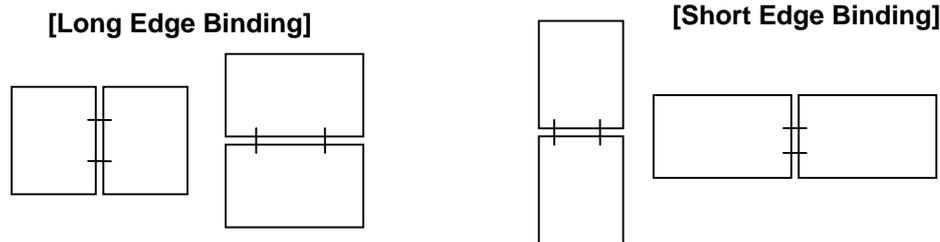
(For HL-1660e/2060/3400CN/1650/1670N/3260N/2460/7050/1850/1870N/5150D/5170DN/5250DN/5270DN/5280DW)

Esc&l#S (27) (38) (108) # (83) <1Bh><26h><6Ch>#<53h>

can be 0, 1, or 2.

- # = 0 indicates Simplex printing.
- # = 1 indicates Duplex - Long edge binding printing.
- # = 2 indicates Duplex - Short edge binding printing.
- If the optional duplex unit is not installed onto the printer, this mode is set to Simplex mode.

This command setting is not saved in the printer's NV-RAM.



4.1.8. Paper side selection

Esc&a#G (27) (38) (97) # (71) <1Bh><26h><61h>#<47h>

can be 0, 1, or 2.

- # = 0 indicates the next side. If there is a page being processed, the printer finishes the processing of that page. If there are no pages being processed, this command is ignored.
- # = 1 indicates the front face.
 - If the currently processing page is an odd page, the printer finishes the processing of that page and attaches a dummy page.
 - If the odd page has already been processed onto the page and the even page has not been processed yet, only a dummy page is attached.
 - If the currently processing page is an even page, the printer finishes the processing of the page.
 - If both an even and odd page have been processed and the next odd page has not been processed yet, this command is ignored.
- # = 2 indicates the back face.
 - If the currently processing page is an odd page, the printer finishes the processing of the page.
 - If the odd page has already been processed onto the page and the even page has not been processed yet, this command is ignored.
 - If the currently processing page is an even page, the printer finishes the processing of the page and attaches a dummy (white) page.
 - If both an even and odd page have been processed and the next odd page has not been processed yet, only a dummy (white) page is attached.

4.1.9. Job separation command

(For HL-3260N/2460/6050/6050D/6050DN/8050N)

Esc&l1T (27) (38) (108) (49) (84) <1Bh><26h><6Ch><31h><54h>

It is recommended to insert this command at the end of each job.

4.1.10. Reset

EscE (27) (69) <1Bh><45h>

- A printer reset restores the user default environment, deletes any temporary fonts and temporary macros.
- Any pages that have been transmitted are printed out.

- You can also perform a printer reset using the printer's control panel or remote printer console program (see the User Guide).

4.1.11. Reset to factory default settings

EscCRFD (27) (13) (70) (68) <1Bh><0Dh><46h><44h>

- This command causes a factory reset to be performed, restoring all the printer's factory default settings. See the section "Factory default environment" for a list of the factory default settings.
- You can also perform a factory reset using the printer's control panel or remote printer console program (see the User Guide).

4.1.12. Reset to user settings

EscCR!#R (27) (13) (33) # (82) <1Bh><0Dh><21h>#<52h>

- # can be 0, 1 or 2.
- #0 indicates the current settings are restored. Unlike the Esc E reset command, the Esc CR!0R command resets the input buffer.
- #1 indicates the user settings 1 are restored, if the printer supports multi user settings.
- #2 indicates the user settings 2 are restored, if the printer supports multi user settings (Except for HL-7050).
- Depending on the model, you may be able to lock the control panel settings ("SETTING LOCK=ON"). In that case, parameters 1 and 2 are ignored.

4.1.13. Printer self test

Escz (27) (122) <1Bh><7Ah>

A printer self test causes a test sheet to be printed out to show that the machine is working properly. Depending on the model, you may also see the test pattern for HRC setting.

4.1.14. Exit current emulation mode

Esc%-12345X (27) (37) (45) (49) (50) (51) (52) (53) (88)
<1Bh><25h><2Dh><31h><32h><33h><34h><35h><58h>

- When the printer receives this command, all page data already received is printed out.
- All settings are reset to the user settings.
- Exits the current emulation mode.

4.1.15. Change emulation mode

EscCRGL (27) (13) (71) (76) <1Bh><0Dh><47h><4Ch>

This command changes the emulation mode to HP-GL mode.

EscCRAB (27) (13) (65) (66) <1Bh><0Dh><41h><42h>

This command changes the emulation mode to BR-Script Batch mode.

EscCRAI (27) (13) (65) (73) <1Bh><0Dh><41h><49h>

This command changes the emulation mode to BR-Script Interactive mode.

EscCRI (27) (13) (73) <1Bh><0Dh><49h>

This command changes the emulation mode to IBM Proprinter XL mode.

EscCRE (27) (13) (69) <1Bh><0Dh><45h>

This command changes the emulation mode to Epson FX-850 mode.

Depending on the model, you can also switch between emulation modes using the printer's control panel (see the User Guide).

Emulations available for each model are listed below.

	PCL	HP-GL	BR-Script2	BR-Script3	Epson FX-850	IBM Proprinter XL
HL-1050	○				○	○
HL-1070	○		○		○	○
HL-1250	○				○	○
HL-1270N	○		○		○	○
HL-P2500	○					
HL-1660e	○	○	○		○	○
HL-2060	○	○	○		○	○
HL-2400C	○	○	○		○	○
HL-2400Ce	○	○	○		○	○
HL-3400CN	○	○	○		○	○
HL-1650/1670N	○			○	○	○
HL-3260N	○	○		○	○	○
HL-2460	○	○		○	○	○
HL-1450	○				○	○
HL-1470N	○		○		○	○
HL-7050	○	○		○	○	○
HL-1850/1870N	○			○	○	○
HL-5040/5140	○					
HL-2070N	○				○	○
HL-5050/5070N/ 5150D/5170DN	○			○	○	○
HL-2600CN	○	○		○	○	○
HL-3450CN	○	○		○	○	○
HL-6050/6050D/ 6050DN	○			○	○	○
HL- 5240/5250DN/527 0DN/5280DW	○			○	○	○
HL-8050N	○	○		○	○	○
HL-2700CN	○	○		○	○	○

4.2. The Page

4.2.1. Physical page

The physical page refers to the size of the paper or envelope currently in use: A4, Letter, B5, JIS B5, Legal and Executive are the permitted paper sizes: Monarch, COM-10, International DL and International C5 are the allowable envelope sizes.

4.2.2. Printable area

The printable area is a rectangular area of the physical page on which the printer can print. Its edges are approximately 1/6" in from the edges of the physical page, please refer to the printer User Guide for the exact measurement for each model.

4.2.3. Logical page

The logical page is the area of the physical page where the cursor can be positioned. (Although the printer does not really have a cursor, we refer to the position on the page from which the printing of a character or graphic starts as the cursor position). You can alter the size of the logical page using the left offset registration and top offset registration commands. The logical page is also called the PCL (printer control language) addressable area.

4.2.4. Text area

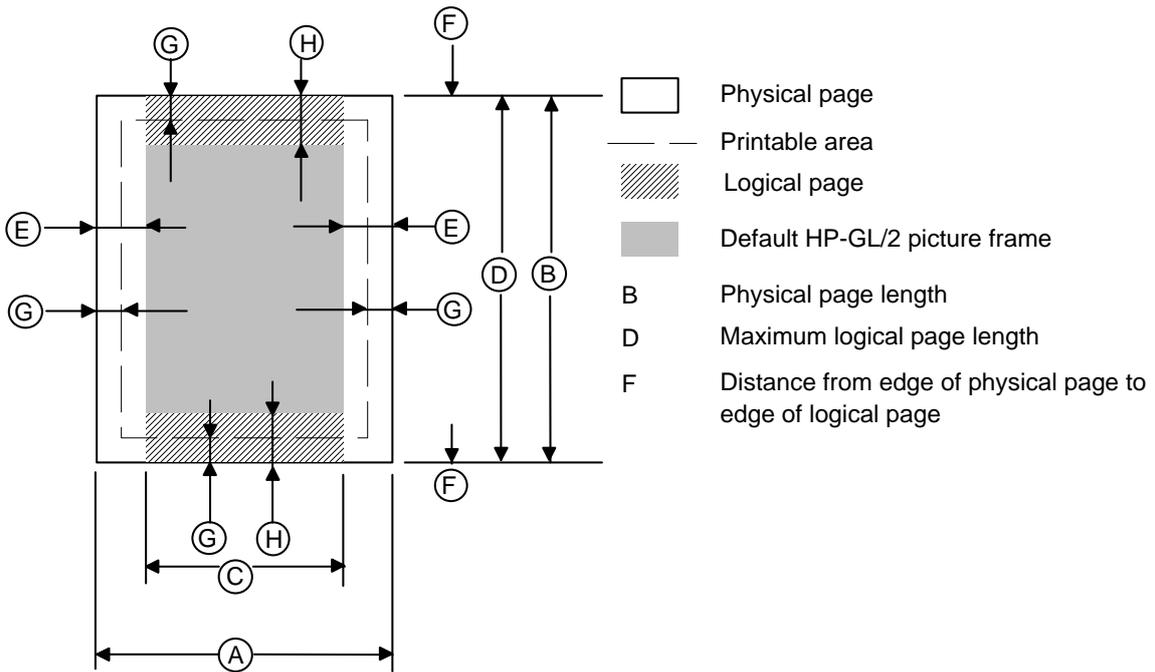
The text area is the area of the physical page on which text can be printed, and is determined by the left, right and top margin settings, the text length and whether the perforation skip facility is on or off. All these settings can be made either from the printer's control panel (see the User Guide) or using PCL commands.

4.2.5. HP-GL/2 graphics window

The HP-GL/2 graphics window is the area of the physical page on which images can be printed using HP-GL/2 commands. This is described in the HP-GL/2 section of this manual. The default graphics window is bound by the left and right edges of the logical page and horizontal boundaries half an inch below the top and above the bottom of the logical page.

4.2.6. Portrait page dimensions

(DEFAULT VALUES)

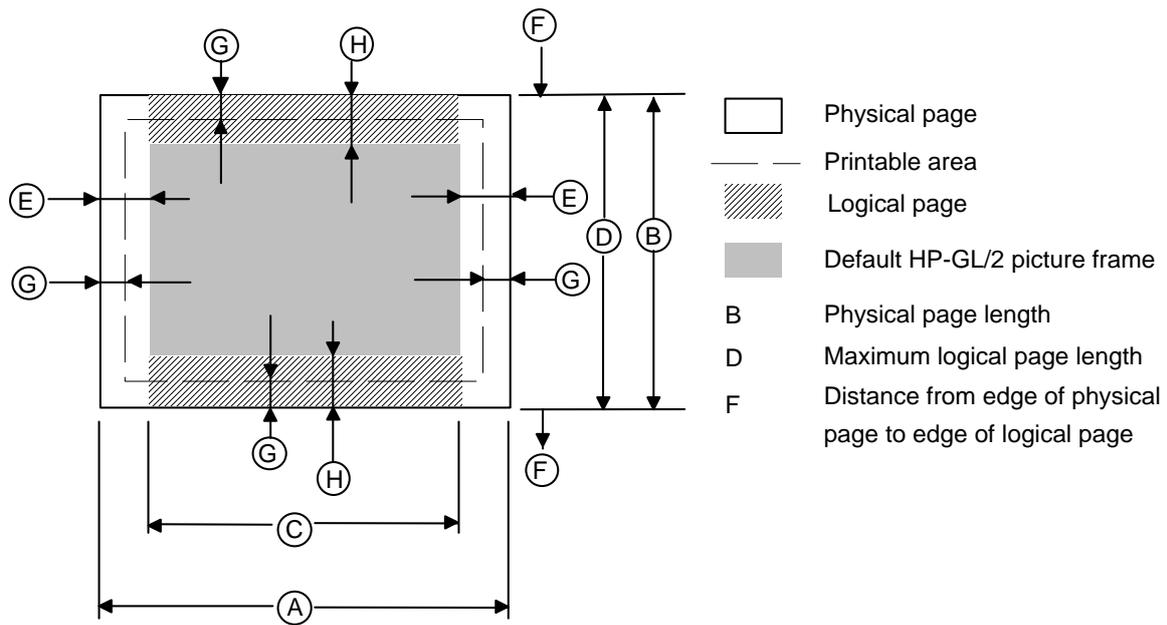


PAPER SIZE	A	B	C	D	E	F	G	H
LETTER	2550	3300	2400	3300	75	0	50	150
LEGAL	2550	4200	2400	4200	75	0	50	150
EXECUTIVE	2175	3150	2025	3150	75	0	50	150
A4	2480	3507	2338	3507	71	0	50	150
B5	2078	2952	1936	2952	71	0	50	150
JIS B5	2148	3030	2010	3030	69	0	50	150
B6	1476	2078	1334	2078	71	0	50	150
A5	1754	2480	1612	2480	71	0	50	150
A6	1240	1754	1098	1754	71	0	50	150
A4 80 character	2480	3507	2400	3507	40	0	40	150
A4 long	2480	4783	2400	4783	40	0	40	150
COM-10	1237	2850	1087	2850	75	0	50	150
MONARCH	1162	2250	1012	2250	75	0	50	150
C5	1913	2704	1771	2704	71	0	50	150
DL	1299	2598	1157	2598	71	0	50	150
A3	3507	4960	3365	4960	71	0	50	150
13"X19"	3900	5700	3750	5700	75	0	50	150
JIS B4	3035	4298	2893	4298	71	0	50	150
Ledger	3300	5100	3150	5100	75	0	50	150

All measurements are in 1/300" units

4.2.7. Landscape page dimensions

(DEFAULT VALUES)



PAPER SIZE	A	B	C	D	E	F	G	H
LETTER	3300	2550	3180	2550	60	0	50	150
LEGAL	4200	2550	4080	2550	60	0	50	150
EXECUTIVE	3150	2175	3030	2175	60	0	50	150
A4	3507	2480	3389	2480	59	0	50	150
B5	2952	2078	2834	2078	59	0	50	150
JIS B5	3030	2148	2910	2148	60	0	50	150
B6	2078	1476	1960	1476	59	0	50	150
A5	2480	1754	2362	1754	59	0	50	150
A6	1754	1240	1636	1240	59	0	50	150
A4 long	4783	2480	4665	2480	59	0	50	150
COM-10	2850	1237	2730	1237	60	0	50	150
MONARCH	2250	1162	2130	1162	60	0	50	150
C5	2704	1913	2586	1913	59	0	50	150
DL	2598	1299	2480	1299	59	0	50	150
A3	4960	3507	4842	3507	59	0	50	150
13"X19"	5700	3900	5580	3900	60	0	50	150
JIS B4	4298	3035	4180	3035	59	0	50	150
Ledger	5100	3300	4980	3300	60	0	50	150

All measurements are in 1/300" units

4.2.8. Coordinates

The printer control language coordinate system has its origin at the intersection of the left edge of the logical page and the top margin. The x-coordinate value of the current cursor position increases as the cursor moves from left to right, the y-coordinate value increases as the cursor moves down the page. The cursor can be explicitly positioned anywhere on the current logical page using the PCL coordinate system. In addition, the cursor's coordinate position will change as text and graphics are printed.

4.2.9. Units

You can specify cursor movement within the PCL coordinate system using one of three different unit systems.

Decipoints

A decipoint is one-tenth of a typographic point measurement = 1/720".

Rows and columns

Using the horizontal motion index (HMI) (Esc&k#H) and vertical motion index (VMI)(Esc&l#C) commands you can set the width of a column and the height of a row. You can then use the column width and row height as the units of the coordinate system. The line-spacing command is an alternative to the VMI command.

Units

The unit of measurement used must be defined by the unit of measure command as described in 4.2.10.

4.2.10. Unit of measure

Esc&u#D (27) (38) (117) # (68) <1Bh><26h><75h>#<44h>

- # value can be 96, 100, 120, 144, 150, 160, 180, 200, 225, 240, 288, 300, 360, 400, 450, 480, 600, 720, 800, 900, 1200, 1440, 1800, 2400, 3600, 7200.
- # stands for the unit of measurement in dots per inch.
- The value set by this command is used as the unit setting for use by other setting commands such as ESC*p#X.
- The default value of # is 300.

Example)

Esc&u300D Esc*p+100x+200Y

move cursor 100/300 inch right and 200/300 inch down.

Esc&u600D Esc*p+100x+200Y

move cursor 100/600 inch right and 200/600 inch down.

4.2.11. Setting the left and right margins

Esc&a#L (27) (38) (97) # (76) <1Bh><26h><61h>#<4Ch>

stands for the distance between the left edge of the logical page and the left margin in columns.

Esc&a#M (27) (38) (97) # (77) <1Bh><26h><61h>#<4Dh>

stands for the distance between the left edge of the logical page and the right margin in columns.

- The column width is as defined by the HMI. If you subsequently change the HMI, the margin positions that you have set do not change - that is, when you specify margin positions they remain fixed physically until you specify new ones or reset them to default values.
- You cannot specify a value for the left margin that is greater than the value of the current right margin.
- If the current cursor position is to the left of your new left margin setting, the cursor will be moved to the new left margin.
- You cannot set the right margin further right than the right edge of the logical page.

- If the current cursor position is to the right of your new right margin setting, the cursor will be moved to the new right margin.
- The factory default left and right margin settings are at the left and right edges of the logical page respectively.
- Depending on your model, margin settings can be made from the printer's control panel (see the User Guide).

```

10 REM ***** SET AND CLEAR SIDE MARGINS *****
20 ESC$=CHR$(27)
30 WIDTH "LPT1:",255
40 REM --- END OF LINE WRAP ON ---
50 LPRINT ESC$+"&s0C";
60 REM --- LEFT MARGIN SET TO 10 COLUMNS ----
70 LPRINT ESC$+"&a10L";
80 REM --- RIGHT MARGIN SET TO 70 COLUMNS ----
90 LPRINT ESC$+"&a70M";
100 REM --- PRINT "0123456789" 10 TIMES
110 FOR I=1 TO 10
120 LPRINT "0123456789";
130 NEXT
140 LPRINT
150 REM --- CLEAR SIDE MARGIN ----
160 LPRINT ESC$+"9";
170 REM --- PRINT "0123456789" 10 TIMES
180 FOR I=1 TO 10
190 LPRINT "0123456789";
200 NEXT
210 REM --- PAPER EJECT ----
220 LPRINT CHR$(12);
230 END

```

4.2.12. Resetting the horizontal margins

Esc9 (27) (39) <1Bh><39h>

This command resets the left and right margins to the left and right edges of the logical page respectively.

4.2.13. Setting the top margin

Esc&1#E (27) (38) (108) # (69) <1Bh><26h><6Ch>#<45h>

stands for the distance between the top of the logical page and the top margin in rows.

- The row height is as defined by the VMI. If you subsequently change the VMI (or the line spacing) the top margin position that you have set does not change - that is, when you specify the top margin position it remains fixed physically until you specify a new one or reset it to a default value.
- The top margin command is ignored if you try to set a margin greater than the current length of the logical page.
- The top margin command is ignored if the current VMI is 0.
- The factory default top margin setting is half an inch below the top of the logical page.
- Depending on your model, the top margin can be set from the printer's control panel (see the User Guide).

```

10 REM ***** SET TOP MARGIN TO 10 LINES *****
20 REM
30 ESC$=CHR$(27)
40 LPRINT ESC$+"&l10E";
50 LPRINT "10 LINES "
60 LPRINT CHR$(12);
70 END

```

4.2.14. Setting the vertical motion index (VMI)

Esc&l#C (27) (38) (108) # (67) <1Bh><26h><6Ch>#<43h>

stands for the height of one row in 1/48".

- # can have any value in the range 0-32767.
- The distance specified by the VMI is the vertical distance moved down the page when the printer performs a line feed. The VMI is also sometimes referred to as the line pitch.
- If you try to set a VMI that is greater than the current length of the logical page the command is ignored.
- Changing the VMI setting does not affect the position of the top margin.
- The factory default setting is 8 - that is, the printer will print six lines of text per inch.
- Depending on your model, you can change the number of lines per page setting from the printer's control panel or remote printer console. If you change its setting, the VMI will change automatically.

```

10 REM ***** SETTING THE LINE PITCH *****
20 ESC$=CHR$(27)
30 REM
40 REM --- SET LINE PITCH TO 1/48 INCH ---
50 LPRINT ESC$+"&l1C";
60 FOR I=1 TO 10
70 LPRINT "I can't read."
80 NEXT
90 LPRINT ESC$+"&l8C";
100 LPRINT
110 LPRINT
120 REM --- SET LINE PITCH TO 1/12 INCH ----
130 LPRINT ESC$+"&l4C";
140 LPRINT "line pitch is 1/12 inch"
150 REM --- SET LINE PITCH TO 1/8 INCH ----
160 LPRINT ESC$+"&l6C";
170 LPRINT "line pitch is 1/8 inch"
180 REM --- SET LINE PITCH TO 1/6 INCH ----
190 LPRINT ESC$+"&l8C";
200 LPRINT "line pitch is 1/6 inch"
210 REM --- SET LINE PITCH TO 1/4 INCH ----
220 LPRINT ESC$+"&l12C";
230 LPRINT "line pitch is 1/4 inch"
240 LPRINT "line pitch is 1/4 inch"
250 REM --- PAPER EJECT ----
260 LPRINT CHR$(12);
270 END

```

<Sample file 1>

4.2.15. Setting the horizontal motion index (HMI)

Esc&k#H (27) (38) (107) # (72) <1Bh><26h><6Bh>#<48h>

stands for the width of one column in 1/120".

- # can have any value in the range 0-32767 and can have up to four decimal places.
- If you are using a fixed space font the HMI is the horizontal distance moved across the page when the printer prints one character.
- If you are using a proportionally spaced font the HMI is the horizontal distance moved across the page when the printer receives a space control code <20h>.
- If any font characteristics are changed, or a Select Primary Font or Select Secondary Font control code is sent to the printer, the HMI is set to correspond to the default pitch value of the newly selected font.
- Changing the HMI setting does not affect the positions of the left and right margins.
- The factory default setting is 12 - that is, the printer will print ten characters of fixed pitch text per inch.

```

10 REM ***** SETTING THE CHARACTER PITCH *****
20 ESC$=CHR$(27)
30 REM --- DEFAULT IS 10 CPI PITCH ---
40 LPRINT "10 PITCH "
50 REM --- SET 5 CPI PITCH ---
60 LPRINT ESC$+"&k24H";
70 LPRINT "AAA"
80 REM --- SET 6 CPI PITCH ---
90 LPRINT ESC$+"&k20H";
100 LPRINT "AAA"
110 REM --- SET 8 CPI PITCH ---
120 LPRINT ESC$+"&k15H";
130 LPRINT "AAA"
140 REM --- SET 10 CPI PITCH ---
150 LPRINT ESC$+"&k12H";
160 LPRINT "AAA"
170 REM --- SET 12 CPI PITCH ---
180 LPRINT ESC$+"&k12H";
190 LPRINT "AAA"
200 REM --- SET 0 CPI PITCH ---
210 LPRINT ESC$+"&kH";
220 LPRINT "I CAN'T READ"
230 REM --- PAPER EJECT ----
240 LPRINT CHR$(12);
250 END

```

<Sample file 2>

4.2.16. Setting line spacing

Esc&1#D (27) (38) (108) # (68) <1Bh><26h><6Ch>#<44h>

stands for the number of lines to be printed per inch.

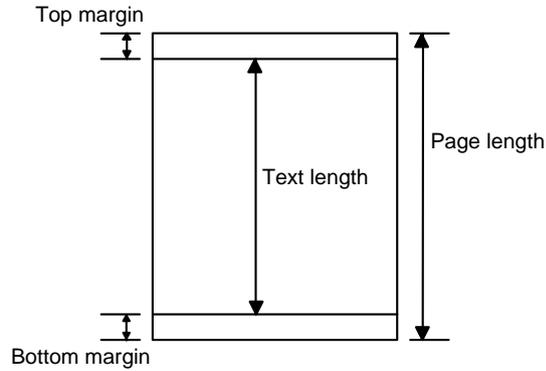
- # can have any of the following values: 1, 2, 3, 4, 6, 8, 12, 16, 24 or 48.
- This command performs the same function as the VMI command.
- Changing the line spacing setting does not affect the position of the top margin.
- The factory default setting is 6 - that is, the printer will print six lines of text per inch.
- Depending on your printer model, the number of lines per page can also be set from the printer's control panel or remote printer console (see the User Guide).

4.2.17. Text length

Esc&1#F (27) (38) (108) # (70) <1Bh><26h><6Ch>#<46h>

stands for the number of lines of text (at the current VMI) to be printed on each page.

- Values for # should be within the value (Logical Page length-Top margin).
- Text is printed from the top margin downwards.
- If you specify a value that would cause the text area to extend beyond the end of the logical page, the command is ignored.



4.2.18. Page length

Esc&1#P (27) (38) (108) # (80) <1Bh><26h><6Ch>#<50h>

stands for the length of the logical page in lines (at the current VMI).

- If you specify a page length greater than is allowed by the physical size of the paper in the currently installed paper tray, a control panel message prompts you to load paper of the appropriate size.
- When the printer receives this command any unprinted pages are printed and the left, right and top margins and the text length are set to their user defaults.
- If you specify a page length greater than is allowed by any of the supported paper sizes, the command is ignored.
- If the current VMI is 0 the command is ignored.
- For the USA, the factory default page size is letter, for which the default page length is 66 lines (11 inches at 6 lines per inch). For Europe, the factory default page size is A4, for which the default page length is 70 lines (11.6 inches at 6 lines per inch). The default lengths for other paper sizes are: Legal - 84 lines, Executive - 63 lines (all at 6 lines per inch).
- Depending on your printer model, you can also set the page length from the printer's control panel or remote printer console by setting LINES to the required number of lines per page in the PAGE FORMAT mode (see the User Guide).

```

10 REM ***** SETTING THE PAGE LENGTH TO 66 LINES *****
20 REM
30 ESC$=CHR$(27)
40 LPRINT ESC$+"&l66P";
50 FOR I=1 TO 67
60 LPRINT STR$(I)
70 NEXT
80 LPRINT CHR$(12);
90 END

```

4.2.19. Perforation skip

You can set the printer to flow text from one page to the next when it encounters a line feed (or half line feed) that would otherwise move the cursor position to below the bottom of the text area. When perforation skip is enabled the cursor is automatically moved to the top left hand corner of the text area on the next page and printing continues.

Esc&1#L (27) (38) (108) # (76) <1Bh><26h><6Ch>#<4Ch>

is either 0 or 1.

- # = 0 turns the perforation skip feature off.
- # = 1 turns the perforation skip feature on.
- The factory default mode is perforation skip on.
- Whenever the perforation skip mode is changed, the top margin and page length values are reset to their default values.

4.2.20. Positioning the cursor

You can position the cursor anywhere on the logical page. In addition, the cursor position is automatically changed when text or graphics are printed. You can either position the cursor using absolute PCL coordinate values or position it relative to the current cursor position, using dots, decipoints or rows and columns as units. In case of using dots, the units value is defined by the ESC & u # d command. The commands for positioning the cursor are listed below.

4.2.21. Vertical positioning

Vertical cursor positioning - rows

Esc&a#R (27) (38) (97) # (82) <1Bh><26h><61h>#<52h>

= number of rows

- A plus or minus sign preceding the number of rows parameter indicates that the cursor is to be positioned relative to its current position. A signed positive parameter value signifies that the cursor is to be repositioned vertically downwards on the page, a negative value means that it will be moved upwards.
- An unsigned number as the parameter signifies that the vertical repositioning is absolute - the cursor will be repositioned the specified number of rows below the top margin, the PCL coordinate system's x-axis.
- The parameter value can have up to two decimal places.
- The cursor's horizontal position remains unchanged.
- If you attempt to move the cursor to a position that is outside the boundaries of the logical page, the cursor will be positioned at either the top or bottom of the logical page as appropriate.

Vertical cursor positioning - units

Esc*p#Y (27) (42) (112) # (89) <1Bh><2Ah><70h>#<79h>

= number of units

- Units value is defined by the Esc & u # D command.
- A plus or minus sign preceding the number of dots parameter indicates that the cursor is to be positioned relative to its current position. A signed positive parameter value signifies that the cursor is to be repositioned vertically downwards on the page, a negative value means that it will be moved upwards.
- An unsigned number as the parameter signifies that the vertical repositioning is absolute - the cursor will be repositioned the specified number of dots below the top margin, the PCL coordinate system's x-axis.
- The cursor's horizontal position remains unchanged.
- If you attempt to move the cursor to a position that is outside the boundaries of the logical page, the cursor will be positioned at either the top or bottom of the logical page as appropriate.

Vertical cursor positioning - decipoints

Esc&a#V (27) (38) (97) # (86) <1Bh><26h><61h>#<56h>

= number of decipoints in 1/720"

- A plus or minus sign preceding the number of decipoints parameter indicates that the cursor is to be positioned relative to its current position. A signed positive parameter value signifies that the cursor is to be repositioned vertically downwards on the page, a negative value means that it will be moved upwards.
- An unsigned number as the parameter signifies that the vertical repositioning is absolute - the cursor will be repositioned the specified number of decipoints below the top margin, the PCL coordinate system's x-axis.
- The cursor's horizontal position remains unchanged.
- If you attempt to move the cursor to a position that is outside the boundaries of the logical page, the cursor will be positioned at either the top or bottom of the logical page as appropriate.

4.2.22. Horizontal position

Horizontal cursor positioning - columns

Esc&a#C (27) (38) (97) # (67) <1Bh><26h><61h>#<43h>

= number of columns

- A plus or minus sign preceding the number of columns parameter indicates that the cursor is to be positioned relative to its current position. A signed positive parameter value signifies that the cursor is to be repositioned to the right on the page, a negative value means that it will be moved to the left.
- An unsigned number as the parameter signifies that the horizontal repositioning is absolute - the cursor will be repositioned the specified number of columns to the right of the left edge of the logical page, the PCL coordinate system's y-axis.
- The parameter value can have up to two decimal places.
- The cursor's vertical position remains unchanged.
- If you attempt to move the cursor to a position that is outside the boundaries of the logical page, the cursor will be positioned at either the left or right edge of the logical page as appropriate.

```

10 REM ***** HORIZONTAL CURSOR POSITIONING *****
20 ESC$=CHR$(27)
30 REM
40 REM --- POSITIONING CURSOR AT COLUMN 10 ---
50 LPRINT ESC$+"&a10C";
60 LPRINT "A";
70 REM --- MOVING CURSOR 5 COLUMNS TO THE LEFT ---
80 LPRINT ESC$+"&a-5C";
90 LPRINT "B";
100 REM --- MOVING CURSOR 10 COLUMNS TO THE RIGHT ---
110 LPRINT ESC$+"&a+10C";
120 LPRINT "C";
130 REM --- PAPER EJECT ---
140 LPRINT CHR$(12);
150 END

```

<Sample file 3>

Horizontal cursor positioning - units

Esc*p#X (27) (42) (112) # (88) <1Bh><2Ah><70h>#<58h>

= number of units

- The Units value is defined by the **Esc & u # D** command.
- A plus or minus sign preceding the number of dots parameter indicates that the cursor is to be positioned relative to its current position. A signed positive parameter value signifies that the cursor is to be repositioned to the right on the page, a negative value means that it will be moved to the left.
- An unsigned number as the parameter signifies that the horizontal repositioning is absolute - the cursor will be repositioned the specified number of dots to the right of the left edge of the logical page, the PCL coordinate system's y-axis.
- The cursor's vertical position remains unchanged.
- If you attempt to move the cursor to a position that is outside the boundaries of the logical page, the cursor will be positioned at either the left or right edge of the logical page as appropriate.

```

10 REM ***** HORIZONTAL CURSOR POSITIONING *****
20 ESC$=CHR$(27)
30 REM
40 REM --- POSITIONING CURSOR AT 1 INCH ---
50 LPRINT ESC$+"*p300X";
60 LPRINT "A";
70 REM --- MOVING CURSOR 0.5 INCHES TO THE LEFT ---
80 LPRINT ESC$+"*p-150X";
90 LPRINT "B";

```

```

100 REM --- MOVING CURSOR 1 INCH TO THE RIGHT ---
110 LPRINT ESC$+"*p+300X";
120 LPRINT "C";
130 REM --- PAPER EJECT ---
140 LPRINT CHR$(12);
150 END

```

<Sample file 4>

Horizontal cursor positioning - decipoints

Esc&a#H (27) (38) (97) # (72) <1Bh><26h><61h>#<48h>

= number of decipoints 1/720"

- A plus or minus sign preceding the number of decipoints parameter indicates that the cursor is to be positioned relative to its current position. A signed positive parameter value signifies that the cursor is to be repositioned to the right on the page, a negative value means that it will be moved to the left.
- An unsigned number as the parameter signifies that the horizontal repositioning is absolute - the cursor will be repositioned the specified number of decipoints to the right of the left edge of the logical page, the PCL coordinate system's y-axis.
- The cursor's vertical position remains unchanged.
- If you attempt to move the cursor to a position that is outside the boundaries of the logical page, the cursor will be positioned at either the left or right edge of the logical page as appropriate.

```

10 REM ***** HORIZONTAL CURSOR POSITIONING *****
20 ESC$=CHR$(27)
30 REM
40 REM --- POSITIONING CURSOR AT 1 INCH ---
50 LPRINT ESC$+"&a720H";
60 LPRINT "A";
70 REM --- MOVING CURSOR 0.5 INCHES TO THE LEFT ---
80 LPRINT ESC$+"&a-360H";
90 LPRINT "B";
100 REM --- MOVING CURSOR 1 INCH TO THE RIGHT ---
110 LPRINT ESC$+"&a+720H";
120 LPRINT "C";
130 REM --- PAPER EJECT ---
140 LPRINT CHR$(12);
150 END

```

<Sample file 5>

4.2.23. Positioning the cursor using control codes

The carriage return, space, horizontal tab and backspace control codes can also be used to reposition the cursor using the current VMI and HMI settings.

4.2.24. Using the cursor position stack

You can save and retrieve up to 20 cursor positions using the cursor position stack.

Esc&f#S (27) (38) (102) # (115) <1Bh><26h><66h>#<73h>

= 0 or 1

- Setting # to 0 stores the current cursor position on the stack.
- Setting # to 1 retrieves the cursor position currently on the top of the stack and makes it the current cursor position.
- Resetting the printer deletes all the positions from the stack.

4.2.25. Half line feed

Esc = (27) (61) <1Bh><3Dh>

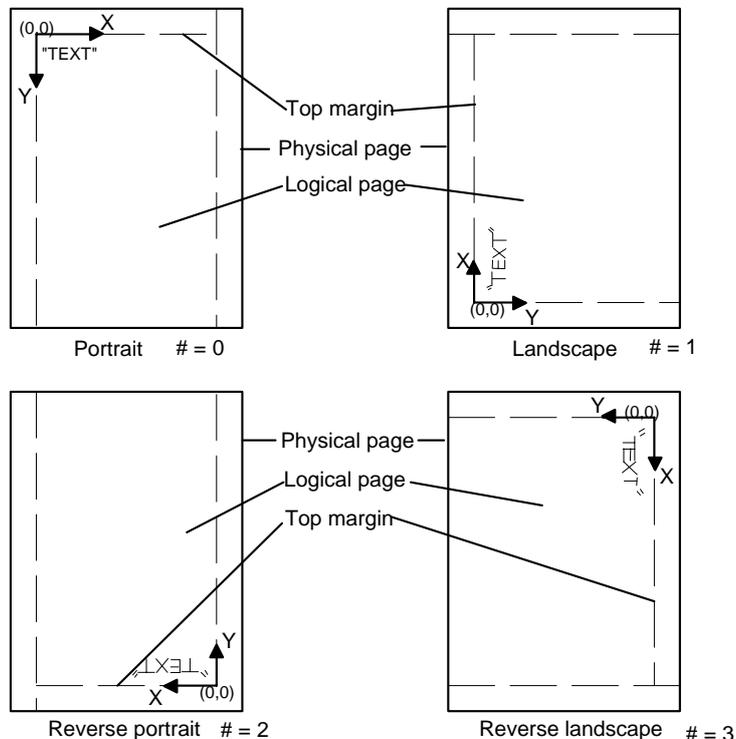
This command moves the cursor down half a row as defined by the last VMI or line spacing command (Esc&l#C).

4.2.26. Logical page orientation

Esc&l#O (27) (38) (108) # (79) <1Bh><26h><6Ch>#<4Fh>

= 0, 1, 2 or 3

- This command sets the orientation of the logical page relative to the physical page.
- Values of # produce orientations as follows: 0 = portrait, 1 = landscape, 2=reverse portrait and 3 = reverse landscape.
- Sending this command to the printer causes the page length, text length, top, left and right margins to be set to their user default values. Any previously transmitted data is printed out and the cursor is positioned at the top left hand corner of the text area on the next page.
- Portrait or Landscape orientation can also be selected from the printer's control panel.
- The factory default orientation is portrait.



4.2.27. Text direction

Esc&a#P (27) (38) (97) # (80) <1Bh><26h><61h>#<50h>

= 0, 90, 180 or 270.

- This command changes the orientation of the logical page relative to the physical page, but without the side effects of the logical page orientation command. Hence you can print text in different directions on the same page.
- Values of # have the following effects: 0 = portrait, 90 = landscape, 180= reverse portrait and 270 = reverse landscape. The value specifies the angle through which the text direction is rotated counterclockwise.
- The cursor position remains at the same physical page position.

- All subsequent text is printed in the newly selected orientation.
- The PCL coordinate system and margin settings are rotated through the specified angle. Hence the cursor coordinates will change.
- HP-GL/2 graphics images cannot be rotated using this command.
- The factory default orientation is portrait.

```

10 WIDTH "LPT1:",255
20 REM --- PRINTER RESET ---
30 LPRINT CHR$(27);"E";
40 REM --- MOVING CURSOR TO X=500, Y=500 ---
50 LPRINT CHR$(27);"*p500X";
60 LPRINT CHR$(27);"*p500Y";
70 REM --- 0 deg ---
80 LPRINT CHR$(27);"&a0P";
90 LPRINT "BROTHER ";
100 REM --- 90 deg ---
110 LPRINT CHR$(27);"&a90P";
120 LPRINT "BROTHER ";
130 REM --- 180 deg ---
140 LPRINT CHR$(27);"&a180P";
150 LPRINT "BROTHER ";
160 REM --- 270 deg ---
170 LPRINT CHR$(27);"&a270P";
180 LPRINT "BROTHER ";
190 REM --- PAPER EJECT ---
200 LPRINT CHR$(12)
210 END

```

5. USING FONTS

5.1. Introduction

A font is a collection of characters that have common characteristics, such as size, style and typeface, and which ranges over a given set of symbols. For example, 12 point Tennessee Bold in the Roman-8 symbol set is a typical HL Series font. Different sorts of fonts are used to create various typographic effects. Traditionally, large point size *sans serif* typeface fonts, like Helsinki and Utah are used for document headlines while smaller fonts with *serif* typefaces, like Tennessee and Portugal are used for body text. In LaserJet mode you can have access to a large range of fonts that are already built in to the printer's ROM, plus the facility for downloading more fonts from a personal computer or plugging in font cards/cartridges or the storage device. When you select a font for printing you will specify a number of characteristics which identify the font you require. The laser printer does its best to print using the font you specified, but if amongst all its available fonts it does not have the exact one that you specified, it will compromise and give you what it regards as the closest available font. Sometimes the results will not be what you expected and you should exercise care in selecting fonts for printing. In most instances the selection of a font will be handled automatically from your word processing software or other applications package. In these cases you need only ensure that the correct font is available (that is, as a standard font in the ROM, on cartridge/card or downloaded) and the application will do the rest. You do not need to concern yourself with sending any escape sequences.

As well as using software commands you can also select fonts using the printer's control panel. Consult the printer User Guide for details.

5.1.1. Font types

There are two types of fonts supported by the HL Series printers in LaserJet mode - bitmap fonts and scalable fonts.

5.1.2. Bitmap fonts

The characters which make up a bitmap font are raster bit images of the relevant symbols. When text is printed using the font it is nearly always monospaced and when you select the font you specify it by its typeface, pitch (the number of characters printed per inch), height (point size) and symbol set.

5.1.3. Scalable fonts

The printer has many scalable fonts available as standard. The following table shows scalable fonts available for models HL-1050/1070/1250/1270N/1450/1470N/P2500/1660e/2060/2400C/2400Ce/3400CN/1650/1670N/2460/7050/1850/1870N/5040/5050/5070N/5140/5150D/5170DN/2600CN/3450CN/6050/6050D/6050DN/8050N/2700CN/2070N. (For the other models' resident fonts, please see the printer User's Guide.)

Intellifont Compatible Fonts:

		HL-1050/1070/1250/1270N/1450/1470N/P2500/1660e/ 2060/2400C/2400Ce/3400CN/1650/1670N/3260N/ 2460/7050/1850/1870N/5040/5050/5070N/5140/ 5150D/5170DN/2600CN/3450CN/6050/6050D/ 6050DN/8050N/2700CN/2070N/5240/5250DN/5270 DN/5280DW
Alaska	Medium, Extra Bold	✓
Antique Oakland	Medium, Oblique, Bold	✓
PcBrussels	Light, Light italic, Demi, Demi italic	✓
Oklahoma	Medium, Oblique, Bold, BoldOblique	✓
Cleveland Condensed		✓
Connecticut		✓
Brougham	Medium, Oblique, Bold, Bold oblique	✓
Guatemala	Antique, Italic, Bold, Bold italic	✓
LetterGothic	Medium, Oblique, Bold	✓
Maryland		✓
PcTennessee	Roman, Italic, Bold, Bold italic	✓
PcBrussels	Light, Demi, LightItalic, DemiItalic	✓
Utah	Medium, Oblique, Bold, BoldOblique	✓
Utah Condensed	Medium, Oblique, Bold, Bold oblique	✓

Microsoft Windows 3.1 TrueType Compatible Fonts:

		HL-1050/1070/1250/1270N/1450/1470N/P2500/ 1660e/2060/2400C/2400Ce/3400CN/1650/1670N/ 3260N/2460/7050/1850/1870N/5040/5050/5070N/ 5140/5150D/5170DN/2600CN/3450CN/6050/ 6050D/6050DN/ 8050N/2700CN/2070N5240/5250DN/5270DN/5280 DW
Tennessee	Roman, Italic, Bold, Bold Italic	✓
Helsinki	Medium, Oblique, Bold, Bold Oblique	✓
BR Symbol		✓
W Dingbats		✓

BR-Script Fonts:

		HL-1050/1070/1250/1270N/1450/1470N/P2500/ 1660e/2060/2400C/2400Ce/3400CN/1650/1670N/ 3260N/2460/7050/1850/1870N/5050/5070N/ 5150D/5170DN/2600CN/3450CN/6050/6050D/ 6050DN/8050N/2700CN5240/5250DN/5270DN/528 0DW
Atlanta	Book, Book Oblique, Demi, Demi Oblique	✓
Copenhagen	Roman, Italic, Bold, Bold italic	✓
Portugal	Roman, Italic, Bold, Bold italic	✓
Calgary	Medium Italic	✓

Brother Original Fonts:

		HL-1050/1070/1250/1270N/1450/1470N/P2500/ 1660e/2060/2400C/2400Ce/3400CN/1650/1670N/ 3260N/2460/7050/1850/1870N/5040/5050/5070N/ 5140/5150D/5170DN/2600CN/3450CN/6050/ 6050D/6050DN/8050N/2700CN/2070N5240/5250D N/5270DN/5280DW
Bermuda Script		✓
German		✓
US Roman		✓
San Diego		✓

You can select a font in any of these typefaces, specifying height (point size) and symbol set. Characters printed in scalable fonts are always proportionally spaced - that is, the spacing between characters on a line depends on their shapes. To add to the number of fonts available, you can buy scalable typeface cartridges/cards which you can insert into the printer's cartridge/card slots and scalable typeface disks from which you can copy the typefaces into the printer's memory. You can also create your own downloadable scalable typefaces, using software commands.

5.1.4. Bound fonts

Bound fonts are fonts which have only a single symbol set.

5.1.5. Unbound fonts

Unbound fonts are fonts which have a large amount of symbols selected from a complementary symbol index (intellifont) or unicode symbol index (TrueType).

5.1.6. Font sources

Depending on your printer model, fonts available to the printer can be in one of three places, either in the printer's ROM as supplied from the factory, on a cartridge/card, on the storage device, or in the printer's RAM. RAM fonts are downloaded from a personal computer.

5.1.7. Internal fonts

The printer comes with some bitmap fonts contained in its ROM and many scalable typefaces which can be used to create scalable fonts.

5.1.8. Card/cartridge fonts

You can buy cartridge/card -based bitmap fonts and scalable typefaces. Plug the cartridge/card into one of the printer's cartridge/card slots and then select any font from them as if it were in the printer's ROM. Depending on your model, you can also save bitmap fonts and scalable typeface in the flash ROM memory, installed optional storage device and you can use any of these as if they were a font card.

5.1.9. Downloadable fonts

You can buy diskettes containing fonts which can be copied directly to the printer using the DOS COPY command. You can also design your own fonts and download them to the printer.

One disadvantage of downloaded fonts is that they reside in the printer's RAM memory. The printer also uses this memory for composing the text and graphic output that it prints on the page. If the memory contains too many fonts the printer may run out of memory. Since downloaded fonts are stored in the printer's RAM they are lost when the printer is switched off, and you must download them again before you can use them.

5.1.10. Primary and secondary fonts

The printer maintains two sets of font characteristics which define its primary and secondary fonts. The primary font is the one it will use by default, the secondary font can be selected instead. This facility enables you to have two parallel font definitions that you can switch between easily without invoking long escape sequences. You can select the primary and secondary fonts using PCL commands.

Depending on your model, you can also set any available fonts to be the printer's user default primary and secondary fonts using the printer's control panel. Refer to the User Guide for instructions on how to do this.

The factory default settings for both primary and secondary fonts are Brougham 12 point, 10 cpi Roman 8.

5.1.11. Specifying the primary font

When you specify primary font characteristics you send escape codes with '(' as the second character of the sequence. This tells the printer that the font characteristic you are specifying applies to the primary font.

5.1.12. Specifying the secondary font

When you specify secondary font characteristics you send escape codes with ')' as the second character of the sequence. This tells the printer that the font characteristic you are specifying applies to the secondary font.

5.1.13. Selecting the default fonts

To set the primary font settings to those of the printers default font and discard all the software settings you have made in the meantime, send the printer the following escape sequence:

```
Esc (3@ (27) (40) (51) (64) <1Bh><28h><33h><40h>
```

To set the secondary font settings to those of the printers default font send:

```
Esc )3@ (27) (41) (51) (64) <1Bh><29h><33h><40h>
```

5.1.14. Switching between the primary and secondary fonts

To select the primary font as the font for printing send the printer the SI control code:

```
SI (15) (0F)
```

To select the secondary font as the font for printing send the printer the SO control code:

```
SO (14) (0E)
```

5.1.15. Criteria for font selection

The printer will try to match your stated font requirements as best it can with the fonts available to it in any of the three possible font locations. In most cases you will be specifying a font you know to be present in one of the locations and the resulting printed text will appear exactly as you envisaged. However, if you specify a particular combination of font characteristics that is not possible, the printer will produce the closest possible match that it can by satisfying the following specifications in the following order: symbol set / spacing type / pitch (for monospaced fonts) / height / stroke weight / style.

The meanings of each of these are explained in the following sub-sections. Likewise, if you simply specify a font attribute that is not available, for example if you request a Utah Light font when only Utah Medium and Utah Bold are available in the font locations, the printer will simply ignore the requirement (light stroke weight, in this case) that it cannot fulfill.

5.1.16. Symbol set

The symbol set is the list of symbols that constitute a particular font. Normally, symbol sets contain lower and upper case letters, numbers, punctuation marks and a selection of other commonly used symbols. Some symbol sets are designed for specific needs, for example, for generating text with mathematical expressions. The symbol set has the highest priority of all the characteristics you specify when you designate the font you require. If the symbol set you choose is available, but not in conjunction with any of the other characteristics you specify, the printer will satisfy your symbol set request at the expense of the rest of your designation and the text printed out may well look completely different from what you expected to see.

5.1.17. Symbol collections

The symbol collections contain many symbols and a symbol set is made from symbol collections by selecting the required symbols for unbound fonts. As symbol collections have more symbols than symbol sets, unbound fonts can have more symbols than bound fonts. Due to the compatibility between symbol sets and symbol collections, the printer searches the designated MSL or Unicode number by using a symbol set mapping table.

5.1.18. Type of character spacing

Character spacing is either fixed (monospacing), in which every printed character is allocated the same amount of space on the line, or proportional, where characters are spaced according to their shape and size. For any serious typographic work proportional spacing is essential since fixed spacing is unattractive and hard to read. In general, monospacing is used with bitmap fonts and proportional spacing is used with scalable fonts. However, proportionally spaced bitmap fonts do exist.

5.1.19. Pitch

Pitch is the number of characters that are printed per inch and therefore only applies to monospaced fonts. If you make a pitch selection while using a proportionally spaced font the command will have no immediate effect. However, the new pitch will be stored as part of the primary (or secondary) font designation and applied the next time a monospaced font is selected as the primary (or secondary) font.

The printer's in-built bitmap fonts all have a pitch of either 10, 12 or 16.66 characters per inch.

5.1.20. Height

Height refers to the height in points ($1/72''$) of unaccented capital letters in a font. This is the generally accepted method of defining the height of a font's characters. Scaled fonts can be specified to an accuracy of 0.25 points.

5.1.21. Style

A font's style is defined by its posture (upright or italic), width (condensed, normal or expanded) and structure (solid, outline or shadow). Upright and italic bitmap fonts and scalable typefaces are available in the printer's ROM. However, these are all normal and solid fonts. To print using any of the other styles (for example, using Condensed Helsinki or Outline Tennessee) you would have to download the requisite font or install a font card/cartridge containing it.

5.1.22. Stroke weight

Stroke weight refers to the thickness of the lines which make up the printed characters. Characters of normal line thickness are called medium. Thicker lines are referred to as bold or black and thinner lines as light or thin. You can specify 15 different stroke weights - 0 denotes medium weight, negative values signify thinner strokes, and positive values signify bolder (thicker) strokes. If you have the bold font available that matches your font designation, a stroke weight selection of 1 to 7 will produce bold text. Likewise, for light or thin text you would need to make the requisite light or thin font available for the stroke weight selection to have any effect.

5.1.23. Typeface

Typeface refers to the designed style of the characters. Commonly known typefaces include Times, Helvetica, Univers and Palatino. The printer has its own resident typefaces. When selecting a particular typeface ensure that it meets all your other specified criteria, otherwise the printer will substitute a font of a different typeface that can satisfy the other, higher priority criteria, such as style and stroke weight.

5.2. Font Selection Commands

5.2.1. User-defined symbol sets

User-defined symbol sets can be used with Unbound scalable fonts. Three new commands below are prepared for use to control a user-defined symbol set.

To define a symbol set, its ID code must first be defined.

Next, a list of symbols for the symbol set must be downloaded.

Then, you can use the defined ID code for the symbol set selection.

5.2.2. Symbol set ID code command

Esc*c#R (27) (42) (99) # (82) <1Bh><2Ah><63h>#<52h>

- Value for # can be from 0 to 2047.
- This command defines the ID code for a user-defined symbol set which can be used to control symbol set selection.
- The symbol set ID code defined by this command must be calculated by using the following formula.

$$\text{Symbol Set ID Code} = (\# \times 32) + (\text{ID} - 64)$$
 Symbol set selection values consists of numerical character(s) and an alphabetical character.
 For example, 8U is the symbol set selection value for Roman-8. In this case, the Symbol set ID code is 277 as the result of the following calculation.

$$(8 \times 32) + (85 - 64) = 277$$
- Make sure to select an unused number for a new ID code that you define. If the ID code has been used already, the printer deletes the existing symbol set and defines the new symbol set.

5.2.3. Define symbol set

Esc(f#W[data] (27) (49) (102) # (87) <1Bh><28h><66h>#<57h>

- # value can be from 18 to 32767.
- # stands for number of bytes of data that follow this command.
- If an existing ID code is used for a user-defined symbol set, it is overwritten.
- Up to 2047 downloadable user-defined symbol sets can be stored subject to the printer's memory capacity.
- If a memory full error occurs while downloading the user-defined symbol set, the symbol set which is being downloaded becomes invalid.
- The symbol set which is defined by this command is temporarily stored in the printer memory.
- The data following this command should be in the following format.

	15 MSB	8	7	0 LSB
0 - 1	Header Size (18)			
2 - 3	Encoded symbol set designator			
4 - 5	Format		Symbol Set Type	
6 - 7	First Code			
8 - 9	Last Code			
10 -	Character Requirements			
	Symbol Map [Last Code - First code + 1]			
	(B)	Boolean	(0,1)	
	(UB)	Unsigned Byte	(0 ~ 255)	
	(SB)	Signed Byte	(-128 ~ 127)	
	(UI)	Unsigned Integer	(0 ~ 65535)	
	(SI)	Signed Integer	(- 32768 ~ 32767)	
	(ULI)	Unsigned Long Integer	(0 ~ 2 ³² -1)	
	(SLI)	Signed Long Integer	(-2 ³¹ ~ 2 ³¹ - 1)	
	(ASC**)	ASCII string array	(0 ~ **-1) of characters	

- 0 -1: Header size (UI) - set to 18 or greater.
This value stands for the number of header bytes.
- 2 -3 : Encoded Symbol Set Designator (UI) - should be as same as the ID code which is defined by **ESC*c#R**.
- 4 : Format (UB) - 1 for MSL (Intellifont), 3 for Unicode (TrueType).
- 5 : Symbol Set Type (UB) - 0, 1 or 2.
0 specifies a 7-bit font with character codes 20H to 7FH acceptable.
1 specifies an 8-bit font with character codes 20H to 7FH and 80H to FFH acceptable.
2 specifies 8-bit 256 all character fonts. Only when the printer is set to transparent print mode can the characters 0, 7~15 and 27 be printed.
- 6 - 7: First Code (UI) - indicates the first code of definition data following this header.
- 8 -9: Last Code (UI) - indicates the last code of definition data following this header. This value should be more than the first code value. Also, the data followed this header should have (Last code - first code + 1) bytes.
- 10 - 17: Character Requirement Flag (8 bytes)
Used in conjunction with the character complement field in the header of the font descriptor to decide the compatibility of a symbol set for an unbound font. This flag indicates which symbol collections are necessary to make the required symbol set.
Each bit in this field stands for the selection of each symbol collection. When set to 1, the symbol collection is included and when set to 0, the symbol collection is not included in the unbound scalable font.

Character Requirements for MSL Symbol index

Bit	Value	Designated Use
63	1	Basic Latin required (such as ISO 8859/1 Latin 1)
	0	Basic Latin not required
62	1	East European Latin required (such as ISO 8859/2 Latin 2)
	0	Basic European Latin not required
61	1	Turkish required (such as ISO 8859/9 Latin 5)
	0	Turkish not required
34	1	Math required (such as Math-8)
	0	Math not required
33	1	Semi-graphic required (such as PC-8 D/N)
	0	Semi-graphic not required
32	1	Dingbats required (such as ITC Zapf Dingbats series 100, series 200)
	0	Dingbats not required
2,1,0	000	MSL Symbol index

Character Requirements for Unicode Symbol index

Bit	Value	Designated Use
31	1	ASCII required (such as ISO 6 ASCII)
	0	ASCII not required
30	1	West Europe extensions required (such as ISO 69 French)
	0	West Europe extensions not required
29	1	East Europe extensions required (such as ISO 8859/2 Latin 2)
	0	East Europe extensions not required
28	1	Turkish extensions required (such as ISO 8859/9 Latin 5)
	0	Turkish extensions not required
27	1	Desktop Publishing extensions required (such as Windows 3.1)
	0	Desktop Publishing extensions not required
26	1	Accent extensions required (such as ISO 8859/1 Latin 1)
	0	Accent extensions not required
25	1	PCL extensions required (such as Roman-8)
	0	PCL extensions not required
24	1	Macintosh extensions required (such as MC text)
	0	Macintosh extensions not required
23	1	PostScript extensions required (such as PS Text)
	0	PostScript extensions not required
22	1	Code Page extensions required (such as PC-8)
	0	Code Page extensions not required
2,1,0	001	Unicode Symbol Index

Symbol map (Array of UI)

The symbol map, which has a list of symbol index numbers, is used to define the symbols for the symbol set. This map defines the combinations of symbol index numbers and character codes.

5.2.4. Symbol set control command

Esc*c#S (27) (42) (99) # (83) <1Bh><2Ah><63h>#<53h>

- Values for # can be 0, 1, 2, 4, or 5.
- 0 specifies to delete all temporary and permanent user-defined symbol sets.
- 1 specifies to delete all temporary user-defined symbol sets.
- 2 specifies to delete current user-defined symbol set.
- 4 specifies to make current user-defined symbol set temporary.
- 5 specifies to make current user-defined symbol set permanent.

5.2.5. Selecting the symbol set

Esc(symbol set ID (27) (40) <1Bh><28h>

- This command selects the symbol set (character set) for the primary font.
- Symbol set IDs consist of a number followed by a letter.
- Default symbol set ID is Roman-8. If an invalid default symbol set ID is selected, the symbol set becomes Roman-8.
- The selectable symbol set varies depending on the printer model.

Symbol set	Set primary font	Symbol set	Set primary font
ISO 60 : Norwegian 1	Esc(0D	ISO 57 : Chinese	Esc(2K
ISO 61 : Norwegian 2	Esc(1D	ISO8859-1 (ECMA-94) Latin 1	Esc(0N
ISO 4 : United Kingdom	Esc(1E	Wingdings	Esc(579L
Windows 3.1 Latin 2	Esc(9E	PS Math	Esc(5M
ISO 25 : French	Esc(0F	Ventura Math	Esc(6M
ISO 69 : French	Esc(1F	Math-8	Esc(8M
HP German	Esc(0G	Symbol	Esc(19M
ISO 21 : German	Esc(1G	ISO 8859-2 Latin 2	Esc(2N
ISO 15 : Italian	Esc(0I	ISO 8859-9 Latin 5	Esc(5N
Microsoft Publishing	Esc(6J	ISO 11: Swedish; names	Esc(0S
Desk Top	Esc(7J	PS Text	Esc(10J
HP Spanish	Esc(1S	Ventura International	Esc(13J
ISO 17 : Spanish	Esc(2S	Ventura US	Esc(14J
ISO 10 : Swedish	Esc(3S	ISO 16 : Portuguese	Esc(4S
ISO 14 : JIS ASCII	Esc(0K	ISO 84 : Portuguese	Esc(5S
ISO 85 : Spanish	Esc(6S	Windows 3.1 Latin 5	Esc(5T
PC Turkish	Esc(9T	ISO 6 : ASCII	Esc(0U
Legal	Esc(1U	ISO 2 : IRV	Esc(2U
Roman 8	Esc(8U	Windows 3.0 Latin 1	Esc(9U
PC-8	Esc(10U	PC-8 D/N	Esc(11U
PC-850	Esc(12U	Pi Font	Esc(15U
PC-852	Esc(17U	Windows 3.1 Latin 1	Esc(19U
MC Text	Esc(12J		

User-defined symbol sets are defined by the command ESC (f # W.

Esc) symbol set ID (27) (41) <1Bh><29h>

- This command selects the symbol set (character set) for the secondary font.
- To select any of the above symbol sets for the secondary font simply substitute ')' for '(' in the command shown in the table.

```

10 REM ***** SELECT A CHARACTER SET *****
20 ESC$=CHR$(27)
30 WIDTH "LPT1:",255
40 REM --- ROMAN-8 CHARACTER SET SELECTION -----
50 LPRINT ESC$+"(8U";
60 REM --- PRINT CHARACTERS ----
70 FOR I=160 TO 255
80 LPRINT CHR$(I);
90 NEXT
100 LPRINT
110 REM --- PC-8 CHARACTER SET SELECTION -----
120 LPRINT ESC$+"(10U";
130 REM --- PRINT CHARACTERS ----
140 FOR I=160 TO 255
150 LPRINT CHR$(I);
160 NEXT
170 LPRINT
180 REM --- PAPER EJECT ---
190 LPRINT CHR$(12);
200 END

```

There is a further group of symbol sets that are available for Brother fonts only. You can select these as follows:

Esc(s#C (27) (40) (115) # (67) <1Bh><28h><73h>#<43h>

- This command selects the symbol set (character set) for the primary font.

Esc) s#C (27) (41) (115) # (67) <1Bh><29h><73h>#<43h>

- This command selects the symbol set (character set) for the secondary font.
- Brother symbol set IDs consist of a number only.

Symbol Set	Set primary font	Symbol set	Set primary font
Roman-8	Esc(s1C	Portuguese	Esc(s15C
US ASCII	Esc(s2C	Swiss German	Esc(s16C
German	Esc(s3C	American Spanish	Esc(s17C
UK English	Esc(s4C	Norwegian/Danish	Esc(s18C
French	Esc(s5C	Canadian	Esc(s19C
Dutch	Esc(s6C	Finnish/Swedish	Esc(s20C
Italian	Esc(s7C	South African	Esc(s21C
S. Spanish	Esc(s8C	PC-8 D/N	Esc(s23C
A. English WP	Esc(s9C	PC-8	Esc(s25C
UK ASCII/2	Esc(s10C	PC-850	Esc(s26C
Symbol	Esc(s11C	PC-860	Esc(s27C
International	Esc(s12C	PC-863	Esc(s28C
American English	Esc(s13C	PC-865	Esc(s29C
UK ASCII	Esc(s14C	Japanese English	Esc(s38C

- To select any of the above symbol sets for the secondary font simply substitute ')' for '(' in the command shown in the table.

```

10 REM ***** SELECTING CHARACTER SETS *****
20 ESC$=CHR$(27)
30 WIDTH "LPT1:",255
40 REM --- GERMAN CHARACTER SET SELECTION -----
50 LPRINT ESC$+"(s3C";

```

```

60 REM --- PRINT CHARACTERS ----
70 FOR I=33 TO 127
80 LPRINT CHR$(I);
90 NEXT
100 LPRINT
110 REM --- FRENCH CHARACTER SET SELECTION -----
120 LPRINT ESC$+"(s5C";
130 REM --- PRINT CHARACTERS ----
140 FOR I=33 TO 127
150 LPRINT CHR$(I);
160 NEXT
170 LPRINT
180 REM --- PAPER EJECT ---
190 LPRINT CHR$(12);
200 END

```

5.2.6. Selecting the type of character spacing

Esc (s#P (27) (40) (115) # (80) <1Bh><28h><73h>#<50h>

- This command selects the spacing type for the primary font.

Esc) s#P (27) (41) (115) # (80) <1Bh><29h><73h>#<50h>

- This command selects the spacing type for the secondary font.
- # = 0 selects fixed spacing and # = 1 selects proportional spacing.

```

10 REM ***** SELECTING A PROPORTIONAL OR FIXED SPACE FONT *****
20 ESC$=CHR$(27)
30 WIDTH "LPT1:",255
40 REM --- SELECT A PROPORTIONALLY SPACED FONT ----
50 LPRINT ESC$+"(s1P";
60 FOR I=33 TO 127
70 LPRINT CHR$(I);
80 NEXT
90 LPRINT
100 REM --- SELECT A FIXED SPACE FONT ---
110 LPRINT ESC$+"(s0P";
120 FOR I=33 TO 127
130 LPRINT CHR$(I);
140 NEXT
150 LPRINT
160 REM --- PAPER EJECT ---
170 LPRINT CHR$(12);
180 END

```

5.2.7. Selecting the pitch

Esc (s#H (27) (40) (115) # (72) <1Bh><28h><73h>#<48h>

This command designates the pitch for the primary font.

Esc) s#H (27) (41) (115) # (72) <1Bh><29h><73h>#<48h>

- This command designates the pitch for the secondary font.
- # = the number of characters to be printed per inch. However, the actual size range is defined in combination with the character height.
- The printer's in-built bitmap fonts all have a pitch of either 10, 12 or 16.66 characters per inch, and you can specify any of these as follows:

```

Esc&k0S ( 10 cpi )
Esc&k2S ( 16.66 cpi )
Esc&k4S ( 12 cpi )

```

- The selection will apply to whichever font you are currently specifying (primary or secondary).
- If the printer doesn't have the specified size font, the next largest size font is used. If the printer doesn't have a larger sized font, the next smallest one is used.
- This value is ignored by the printer when a proportional spaced font is selected.

```

10 REM ***** CHARACTER PITCH SELECTION *****
20 ESC$=CHR$(27)
30 WIDTH "LPT1:",255
40 REM --- SELECT A 10 CPI PITCH FONT ---
50 LPRINT ESC$+"(s10H";
60 FOR I=33 TO 127
70 LPRINT CHR$(I);
80 NEXT
90 LPRINT
100 REM --- SELECT A 12 CPI PITCH FONT ---
110 LPRINT ESC$+"(s12H";
120 FOR I=33 TO 127
130 LPRINT CHR$(I);
140 NEXT
150 LPRINT
160 REM --- PAPER EJECT ---
170 LPRINT CHR$(12);
180 END

```

5.2.8. Selecting the height

Esc s#V (27) (40) (115) # (86) <1Bh><28h><73h>#<56h>

This command designates the height of the primary font.

Esc s#V (27) (41) (115) # (86) <1Bh><29h><73h>#<56h>

- This command designates the height of the secondary font.
- # is the size in points (1/72") from 0.25 to 999.75 in 0.25 increments.
- This value is ignored by the printer when a fixed-spaced scalable font is selected.

5.2.9. Scaling the scalable fonts vertically or horizontally

Esc CR!#H (27) (13) (33) # (72) <1Bh><0Dh><21h>#<48h>

This command designates the height of the scalable fonts.

Esc CR!#V (27) (13) (33) # (86) <1Bh><0Dh><21h>#<56h>

This command designates the width of the scalable fonts.

- # can be from 0.25 ~ 3.00 in 0.01 increments.
- # value is set to 0.25 when # is specified less than 0.25, and # value is set to 3.00 when # is specified bigger than 3.00.
- The value set by this command is initialized when the emulation is changed, a printer Reset, Test Print or Macro overlay is executed.

5.2.10. Selecting the style

Esc s#S (27) (40) (115) # (83) <1Bh><28h><73h>#<53h>

- This command designates the style of the primary font.

Esc s#S (27) (41) (115) # (83) <1Bh><29h><73h>#<53h>

- This command designates the style of the secondary font.
- If you select a particular style (for example upright condensed outline) the command will only take effect if the font is available in one of the three font locations.

Value	Font Style
0	Upright & solid
1	Italic
4	Condensed
5	Condensed italic
8	Compressed, or extra condensed
24	Expanded
32	Outline
64	Inline
128	Shadowed
160	Outline shadowed

```

10 REM ***** PRINT IN ITALIC & UPRIGHT STYLE *****
20 ESC$=CHR$(27)
30 WIDTH "LPT1:",255
40 REM --- PRINT USING AN ITALIC FONT ----
50 LPRINT ESC$+"(s1S";
60 REM --- PRINT FONT ----
70 FOR I=33 TO 127
80 LPRINT CHR$(I);
90 NEXT
100 LPRINT
110 REM --- PRINT USING AN UPRIGHT FONT ---
120 LPRINT ESC$+"(s0S";
130 REM --- PRINT FONT ----
140 FOR I=33 TO 127
150 LPRINT CHR$(I);
160 NEXT
170 LPRINT
180 REM -- PAPER EJECT ---
190 LPRINT CHR$(12);
200 END

```

5.2.11. Selecting the stroke weight

Esc (s#B (27) (40) (115) # (66) <1Bh><28h><73h>#<42h>

- This command designates the stroke weight of the primary font.

Esc) s#B (27) (41) (115) # (66) <1Bh><29h><73h>#<42h>

- This command designates the stroke weight of the secondary font
- # is an integer between -7 and 7. A value of 0 signifies a medium stroke weight, negative numbers signify thin or light stroke weights and positive numbers signify bold stroke weights.
- If you select a light or bold stroke weight the command will only have an effect if the font is available in one of the three font locations.

5.2.12. Selecting the typeface

Esc (s#T (27) (40) (115) # (84) <1Bh><28h><73h>#<54h>

- This command designates the typeface of the primary font.

Esc) s#T (27) (41) (115) # (84) <1Bh><29h><73h>#<54h>

- This command designates the typeface of the secondary font.
- If the typeface you specify is not available in any of the three font source locations the printer will substitute a font of a different typeface.

- The available values vary with the printer model. The following table shows the value for each typeface and availability.

Typeface	Set primary font	Set secondary font	HL-1050/ 1250/P2500	HL-1070/1270N/1660e/2060/2400C/ 2400Ce/3400CN/1450/1470N/1650/ 1670N/2460/3260N/7050/1850/1870N/ 5040/5050/5070N/5140/5150D/5170DN/ 2600CN/3450CN/6050/6050D/6050DN/ 8050N/2700CN/2070N/5240/5250DN/527 ODN/5280DW
Alaska	Esc(s4362T	Esc)s4362T	*	*
Antique Oakland	Esc(s4168T	Esc)s4168T	*	*
Brougham	Esc(s4099T	Esc)s4099T	*	*
Cleveland Condensed	Esc(s4140T	Esc)s4140T	*	*
Connecticut	Esc(s4116T	Esc)s4116T	*	*
Guatemala Antique	Esc(s4197T	Esc)s4197T	*	*
LetterGothic	Esc(s4102T	Esc)s4102T	*	*
Maryland	Esc(s4297T	Esc)s4297T	*	*
Oakland	Esc(s4113T	Esc)s4113T	*	*
PC Brussels	Esc(s4143T	Esc)s4143T	*	*
PC Tennessee	Esc(s4101T	Esc)s4101T	*	*
Utah	Esc(s4148T	Esc)s4148T	*	*
BR Symbol	Esc(s16686T	Esc)s16686T	*	*
Helsinki	Esc(s16602T	Esc)s16602T	*	*
Tennessee	Esc(s16901T	Esc)s16901T	*	*
W Dingbats	Esc(s31402T	Esc)s31402T	*	*
Atlanta	Esc(s155T	Esc)s155T		*
Calgary	Esc(s159T	Esc)s159T		*
Copenhagen	Esc(s157T	Esc)s157T		*
Portugal	Esc(s158T	Esc)s158T		*
Letter Gothic16.66	Esc(s130T	Esc)s130T	*	*
Brougham	Esc(s128T	Esc)s128T		
OCR-A	Esc(s104T	Esc)s104T	*	*
OCR-B	Esc(s110T	Esc)s110T	*	*
Bermuda Script	Esc(s134T	Esc)s134T		*
Germany	Esc(s132T	Esc)s132T		*
San Diego	Esc(s133T	Esc)s133T		*
US Roman	Esc(s135T	Esc)s135T		*

5.2.13. Font orientation

The printer's built-in fonts are all portrait fonts. If you switch the orientation of the logical page to landscape and select a font, the printer will automatically create the landscape font in its memory. This saves you having to make the landscape font available by installing a card/cartridge or by downloading the font, but takes up printer memory and may cause the printer to run out of space when trying to compose complex page layouts.

5.2.14. Transparent print data

Esc&p#X (character codes)
 (27) (38) (112) # (88) <1Bh><26h><70h>#<58h>

- This command enables you to print characters which are normally unprintable.
- # is the number of bytes of data that follow the command.
- Each byte of data is interpreted as a character code and the corresponding character in the currently selected symbol set is printed (if there is one). You can use this command to print the symbols in the character set which do not appear on the keyboard.
- If there is no character in the current symbol set corresponding to a specified code, a space is printed.
- The command is useful when using character sets like the IBM All Character Set in which every single code has a corresponding character.
- Any control codes within the data will have no effect. The control code byte is treated as a character code.

5.2.15. Esc&d#D (27)(38)(100)#(68) <1Bh><26h><64h>#<44h>

- This command enables the underline facility.
- # is either 0 or 3. A value of 0 signifies fixed underlining, 3 specifies floating underlining.
- Fixed underlining means that the underline is drawn in the same place for all the characters of a particular font.
- Floating underlining means that the underline is drawn in the same place for all the characters on a particular line.
- The command below disables the underline facility.

Esc&d@ (27) (38) (100) (64) <1Bh><26h><64h><40h>

5.3. Downloadable font manipulation

Fonts that you have bought on diskette can be downloaded to the printer from diskette or hard disk using the DOS COPY command or a font downloading applications program. To create your own fonts you can use PCL commands to send the various blocks of data that comprise a do(wnloadable font. There are also a number of PCL commands that enable you to manage fonts that you have already downloaded (both those that you have bought and those you may have created yourself).

If you are using commercially available fonts consult the documentation that came with them for information on how best to send them to the printer.

5.3.1. Font ID

Esc*c#D (27) (38) (42) (99) # (68) <1Bh><26h><2Ah><63h>#<44h>

- This command identifies the numerical ID of the font on which subsequent operations will be performed.
- # is the font ID number.
- Use this command to specify the ID number of a font that you are about to download, or of a font already in printer memory that you want to perform a particular operation on.
- If you specify the number of a font that already exists in memory and then download a new font from your computer, the new font will overwrite the original font and assume the ID number that you specified.

5.3.2. Operations on downloaded fonts

Esc*c#F (27) (38) (42) (99) # (70) <1Bh><26h><2Ah><63h>#<46h>

- This command performs an operation on one or more downloaded fonts.
- # identifies the operation to be performed.
- # = 0 Delete all downloaded fonts from the printer's memory.
- # = 1 Delete all temporary fonts from the printer's memory.
(Fonts can be made permanent so as to be saved when the printer is reset - see below).
- # = 2 Delete the font (whose ID number was most recently specified) from the printer's memory.
- # = 3 Delete the character (whose character code was most recently specified) from the font (whose ID number was most recently specified).
(The command for specifying a character code is given in the section entitled Creating Downloadable Fonts).
- # = 4 Make the font (whose ID number was most recently specified) temporary
- # = 5 Make the font (whose ID number was most recently specified) permanent
- # = 6 Make/Assign a copy of the current font (primary or secondary) with the last specified ID number.
- # = 1026 Delete the font (whose ID number was most recently specified) from the storage device.
- # = 1028 Delete all download fonts in the storage device.
- # = 1029 Save the font (whose ID number was most recently specified) into the storage device.
(All download fonts in the storage device are permanent fonts.)
- Note: #=1026, 1028, 1029 are available only when a storage device is installed into the printer.

5.3.3. Selecting a downloaded font

Esc (#X (27) (40) # (88) <1Bh><28h>#<58h>

- This command selects a downloaded font as the primary font.

Esc) #X (27) (41) # (88) <1Bh><29h>#<58h>

- This command selects a downloaded font as the secondary font.
- # is the ID number of the downloaded font.

5.4. Creating Downloadable Fonts

5.4.1. Downloading

You can download existing fonts (that is, ones that you have bought or ones that you have created previously) using either a font downloading application program or the DOS command

```
COPY/b <filename> PRN
```

In addition, some word-processing and DeskTop publishing programs will automatically download the fonts that have been used in a document when that document is printed.

Alternatively, you can create a new downloadable font and download the necessary blocks of data that comprise the downloadable font using PCL commands.

To send a font, you must send

- * a font descriptor block followed by the character code
- * a character descriptor
- * data for each character

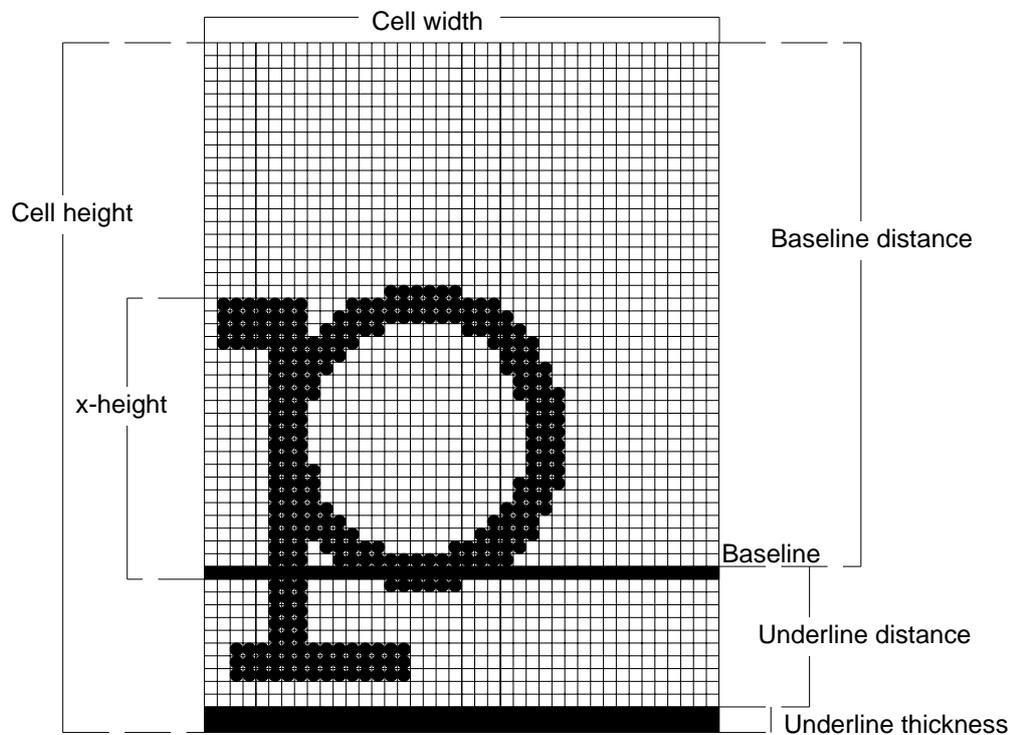
The printer can download 3 types of fonts.

Bitmap fonts, Bound Scalable fonts and Unbound Scalable fonts.

5.4.2. Sending the font descriptor

```
Esc)s#W (font descriptor data) (27)(40)(115)#(58)
<1Bh><28h><73h>#<88h>
```

- This command sends the font descriptor to the printer.
- # should be in the range 0 to 32767.
- # is the number of bytes in the descriptor.
- Characters are designed on a notional grid known as the character cell. The positioning and shape of each character on the grid defines its size, shape and alignment to the other characters in the font.



- The Font descriptor has information for the whole character set. When this font descriptor is sent to the printer with a font header to identify the font ID, the descriptor parameters become the basis of the downloaded fonts.
- The data format for each type of font descriptor block is shown below.

<Bitmap font>

Byte	15 (MSB)	8	7	(LSB) 0
0	Font Descriptor Size (64)			
2	Descriptor Format (0)		Font Type	
4	Style MSB		Reserved	
6	Base Line 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 Distance		Underline 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)			

<Special Bitmap font>

Byte	15 (MSB)	8	7	(LSB) 0
0	Font Descriptor Size (68)			
2	Descriptor Format (20)		Font Type	
4	Style MSB		Reserved	
6	Base Line 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 Distance		Underline 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	X Resolution			
66	Y Resolution		X=Y: 300 or 600	
n	Copyright (Optional)			

<Intellifont Scalable Bound font>

Byte	15 (MSB)	8	7	(LSB) 0
0	Font Descriptor Size (>80)			
2	Descriptor Format (10)		Font Type	
4	Style MSB		Reserved	
6	Base Line 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 Distance		Underline 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	Scale Factor			
66	Master X Resolution			
68	Master Y Resolution			
70	Master Underline Position			
72	Master Underline Thickness (Height)			
74	OR Threshold			
76	Global Italic Angle			
Desc. size	Global Intellifont Data Size			
80	Global Intellifont Data			
n	Copyright (optional)			
	Reserved		Checksum	

<Intellifont Scalable Unbound font>

Byte	15 (MSB)	8	7	(LSB) 0
0	Font Descriptor Size (<88)			
2	Descriptor Format (11)		Font Type (10)	
4	Style MSB		Reserved	
6	Base Line 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 Distance		Underline Thickness	
32	Text Height			
34	Text Width			
36	Reserved			
38	Number of Contours (Characters)			
40	Pitch Extended		Height Extended	
42	Cap Height			
44 - 47	Font Number			
48 - 63	Font Name			
64	Scale Factor			
66	Master X Resolution			
68	Master Y Resolution			
70	Master Underline Position			
72	Master Underline Thickness			
74	OR Threshold			
76	Global Italic Angle			
78-85	Character Complement			
Desc. Size - 2	Global Intellifont Data size			
Desc. size	Global Intellifont Data			
n	Copyright (optional)			
	Reserved		Checksum	

<TrueType Scalable Bound font>

Byte	15 (MSB)	8	7	(LSB) 0
0	Font Descriptor Size (>72)			
2	Descriptor Format (15)		Font Type	
4	Style MSB		Reserved	
6	Base Line 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 Distance		Underline Thickness	
32	Text Height			
34	Text Width			
36	First Code			
38	Last Code / Number of characters			
40	Pitch Extended		Height Extended	
42	Cap Height			
44 - 47	Font Number			
48 - 63	Font Name			
64	Scale Factor			
66	Master Underline position			
68	Master Underline Thickness			
70	Font Scaling Technology		Variety	
72	[additional data may be inserted here]			
Desc. size	Segmented Font data			
# - 2	Reserved		Checksum	

- Attributes are in one of six numerical formats.
 - Unsigned integer (UI) 0 to 65535
 - Unsigned long integer (ULI) 0 to $2^{32}-1$
 - Signed integer (SI) -32768 to 32767
 - Unsigned byte (UB) 0 to 255
 - Signed byte (SB) -128 to 127
 - Boolean 0 or 1
- Font descriptor size (UI) - the size in bytes of the font descriptor block. Minimum size values for each font type are shown in the above figure.
- Descriptor format (UB) - format type of the font.

0	Bitmap font
10	Intellifont bound scalable font
11	Intellifont unbound scalable font
15	TrueType bound scalable font
20	Special bitmap font

- Font type (UB) - specifies type of symbol set.
 - 0 Bound font. A 7-bit font with character codes 20H to 7FH acceptable.
 - 1 Bound font. An 8-bit font with character codes 20H to 7FH and 80H to FFH acceptable.
 - 2 Bound font. 8-bit all character codes are printable. However, 00H, 07H to 0FH and 1BH are printable only when the data is defined as transparent print data.

10 Unbound font. Character codes corresponding to MSL numbers are acceptable.

11 Unbound font. Character codes corresponding to Unicode numbers are acceptable.

When a 7-bit font or 8-bit font is selected, it is possible for codes 00H to FFH to load characters or delete them. It is also possible to print the characters if they are defined as transparent print data.

- Style MSB (UW) - combined with the Style LSB to make the style word. The value of the style word is calculated as follows: style word = posture + (4 width) + (32 structure).

Value	Posture
0	Upright
1	Italic
2	Alternate Italic
3	Reserved

Value	Width
0	Normal
1	Condensed
2	Compressed or Extra Condensed
3	Extra compressed
4	Ultra compressed
5	Reserved
6	Extended or Expanded
7	Extra Extended or Extra Expanded

Value	Structure
0	Solid
1	Outline
2	In-line
3	Contour
4	Solid with Shadow
5	Outline with Shadow
6	Inline with Shadow
7	Contour with Shadow
8-11	Patterned (Complex patterns, subject to type family)
12-15	Patterned with Shadow
16	Inverse
17	Inverse in Open Border
18-30	Reserved
31	Unknown structure

The reserved bits should be set to Zero.

- Baseline position (UI) -
 - Bitmap font - the height in dots from the top of the character cell to the baseline. The units of dots is the same as the defined font resolution. This number can be in the range 0 to (cell height - 1).
 - Intellifont scalable - a Y coordinate in the design cell.
 - TrueType scalable - the height in dots from the top of the character cell to the baseline. This should be set to 0.
- Cell width (UI) - ignored by these printers. The width in dots of the character cell. This can be from 1 to 65535.
- Cell height (UI) - ignored by these printers. The height in dots of the character cell. This can be from 1 to 65535.
- Orientation (UB) - 0(portrait), 1(landscape), 2(reverse portrait) or 3(reverse landscape). Ignored by these printers.
- Spacing (B) - the type of spacing, 0 (fixed pitch) or 1 (proportional spacing).
- Symbol set (UI) - a symbol set ID consists of a number and a letter. The symbol set attribute value is calculated as follows: symbol set = (32 x number) + (ASCII value of letter - 64). For example, Math-8 has the symbol set ID '8M' so it would be encoded as (32 x 8) + (77 - 64) = 269.

Symbol set name	Symbol set ID	Symbol set name	Symbol set ID
Default Set	0@	Math-7	0A
Line Draw-7	0B	HP Large Characters (264x Terminals)	0C
ISO 60: Danish/Norwegian	0D	ISO 61: Norwegian version 2	1D
Roman Extensions	0E	ISO 4: United Kingdom	1E
ISO 25: French	0F	ISO 69: French	1F
HP German	0G	ISO 21: German	1G
Greek-8	8G	Hebrew-7	0H
Hebrew-8	8H	ISO 15: Italian	0I
Microsoft Publishing	6J	DeskTop	7J
Document	8J	PS Text	10J
Ventura International	13J	Ventura US	14J
ISO 14: JIS ASCII	0K	ISO 13: Katakana	1K
ISO 57: Chinese	2K	Kana-8	8K
Korean-8	9K	Line Draw-7 (Same as 0B)	0L
HP Block Characters	1L	Tax Line Draw	2L
Line Draw-8	8L	Math-7 (Same as 0A)	0M
Tech-7	1M	PS Math	5M
Ventura Math	6M	Math-8	8M
ECMA-94 Latin 1 (ISO 8859/1)	0N	ECMA-94 Latin 2 (ISO 8859/2)	2N
ECMA-128 Latin 5 (ISO 8859/9)	5N	ECMA-113/88 Latin/Cyrillic	10N
OCR A	0O	OCR B	1O
OCR M	2O	APL (Typewriter Paired)	0P
APL (Bit Paired)	1P	Specials	xQ
Cyrillic ASCII (ECMA-113/86,	0R	Cyrillic	1R
PC Cyrillic	3R	ISO 11: Swedish for Names	0S
HP Spanish	1S	ISO 17: Spanish	2S
ISO 10: Swedish	3S	ISO 16: Portuguese	4S
ISO 84: Portuguese	5S	ISO 85: Spanish	6S
HP European Spanish	7S	HP Latin Spanish	8S
HP-GL Download	16S	HP-GL Drafting	17S
HP-GL Special Symbols	18S	Turkish-8	8T
Thai-8	0T	ISO 6: ASCII	0U
Legal	1U	ISO 2: International Reference Version	2U
HP-GL Language Set	5U	OEM-1	7U
Roman-8	8U	Windows	9U
PC-8	10U	PC-8 D/N (Danish/Norwegian)	11U
PC-850	12U	PC-852	17U
Pi Font	15U	Arabic (McKay's version)	0V
Arabic-8	8V	3 of 9 Barcode	0Y
Industrial 2 of 5 Barcode	1Y	Matrix 2 of 5 Barcode	2Y
Interleaved 2 of 5 Barcode	4Y	CODABAR Barcode	5Y
MSI/Plessey Barcode	6Y	Code 11 Barcode	7Y
UPC/EAN Barcode	8Y	USPS Zip	15Y

- Pitch (UI) - This value defines the default spacing for each point size in 1/4 dots. Combined with Pitch Extended to specify the pitch of the font in 1/1024 dots. This is available for fixed pitch font characters including the space character, and the space character of proportional spacing fonts.

For example, in case of a 17 cpi font (at 600 dpi),

$$\frac{1 \text{ inch}}{17 \text{ chara.}} \times \frac{600 \text{ dpi}}{1 \text{ inch}} \times \frac{4}{1} = 141.17646$$

the value of Pitch (UI) should be 141.

The remainder of 0.17646 is calculated as pitch extended:

$$\frac{0.17646}{4} \times \frac{256}{1} = 45.17376$$

the value for pitch extended is 45.

For Intellifont-scalable fonts only, the default HMI is calculated as follows.

$$\text{Default HMI (in dots)} = (300 \times \text{master design pitch} \times \text{required point size}) \div \{\text{Master} \times \text{Resolution} \div (\text{height} \times 8)\}$$

$$\text{Default HMI (in dots)} = (300 \times \text{master design pitch} \times \text{required point size}) \div \{72.307 \times \text{scale factor}\}$$

Height (UI) - specifies the height of the font in 1/4 dots. Combined with Height Extended to specify the height of the font in 1/1024 dots. This value can be converted to the point size (1/72").

For example, in case of a 10 point font at 300 dpi,

$$10 \text{ point} \times \frac{1}{72} \times \frac{300 \text{ dots}}{1 \text{ inch}} \times \frac{4}{1 \text{ dots}} = 166.667$$

This value is normally set to 2000 for Intellifont and should be set to zero for TrueType fonts.

- x-height (UI) - ignored by the HL Series printers. This word specifies the height (for Bitmap fonts) or the distance from the baseline (for Scalable fonts) of a lower case 'x' in 1/4 dots.
- Width type (SB) - ignored by the HL Series printers. This byte specifies the font character width according to the table below.

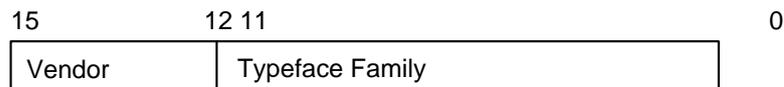
Value	Width type
-5	Ultra compressed
-4	Extra compressed
-3	Compressed or Extra condensed
-2	Condensed
0	Normal
2	Expanded
3	Extra expanded

- Style LSB (UB) - see Style MSB.
- Stroke weight (SB) - valid values are from -7 to +7. 0 denotes the normal (Roman) stroke width, -7 is the lightest possible stroke and 7 is the boldest.

Value	Stroke Weight
-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

- Typeface family (UB) – the typeface. This word is made up of the Typeface MSB and the Typeface LSB and identifies the typeface by number.

Bits 0 to 11 specify the typeface family and bits 12 to 15 specify the vending company.



Value	Vendor
0	Reserved
1	Agfa Division, Miles Inc.
2	Bitstream Inc.
3	Linotype Company
4	The Monotype Corporation plc
5	Adobe Systems Inc.

The Typeface family number can be 0 to 4095. This value is calculated as follows;

(TrueType base value) + (Vendor value x 4096) = Typeface Family

- **Serif style (UB)** -
 Bitmap font - ignored by these printers.
 Scalable font - values for the lower 6 bits are ignored and values for the upper 2 bits indicates the serif style.
 Bit 6 indicates sans serif and bit 7 indicates serif.
- **Quality (UB)** - ignored by these HL Series printers. This byte specifies the fonts quality according to the following table.
- **Placement (SB)** - ignored by these HL Series printers. This byte specifies the placement of characters relative to the baseline according to the following table.
- **Underline distance (SB)** -
 Bitmap fonts - the distance in dots from the baseline to the underline. A positive value places the underline above the baseline, a negative value places it below the baseline. A value of 0 places it on the baseline.
 Scalable fonts - ignored by these printers. This value should be set to 0.
- **Underline height (UB)** - the height of underline itself.
 Bitmap fonts - this value is fixed at 3 dots.
 Scalable fonts - ignored by these printers. This value should be set to 0.
- **Text height (UI)** - ignored by these HL Series printers.
 This word specifies the spacing between successive lines of text in 1/4 dots for bitmap fonts and in design units for scalable fonts. This is normally about 1.2 times the fonts height.
- **Text width (UI)** - ignored by these HL Series printers.
 This word specifies the average width of the fonts lowercase characters in 1/4 dots for bitmap fonts and in design units for scalable fonts.
- **First code (UI)** - ignored by these printers. This word specifies the character code of the first (lowest numbered) printable character in the font.
- **Last code (UI)** - specifies the character code of the last (highest numbered) character in the font. If this value is less than 255, it is recognized as 00FFH.
- **Pitch extended (UB)** - the fractional part of the character pitch. For a 17 cpi font the bytes value would be calculated as follows:
 - $1200/17 = 70.588$ The Pitch byte takes the value 70.
 - $\text{Pitch Extended} = 0.588 \times 256 = 150$ (rounded down).
 (According to HP's manual, this should be set to 0.) This printer ignores the value for scalable fonts.
- **Height extended (UB)** - the fractional part of the height of the font. For a 10 point font the bytes value would be calculated as follows:
 $1200 \times 10/72 = 166.667$, the Height byte takes the value 166
 Height Extended = $0.667 \times 256 = 170$ (rounded down).
 Point size = $(\text{character height} \times 256 + \text{extended character height}) \times 300 / (72 \times 1024)$
 (According to HP's manual, this should be set to 0.) These printers ignore the value for scalable fonts.
- **Cap height data (UI)** - ignored by these HL Series printers. This word specifies for the font the distance between the baseline and the top of an unaccented capital letter (for example, 'H'), as a percentage of the font's em rule, '—'.

- Font number (ULI) - ignored by these HL Series printers. This 4-byte field specifies the number assigned to the font by the vending company. The number is stored as a hexadecimal value in the lower three bytes, bytes 44, 45 and 46.
- Font name (16 bytes) - ignored by these HL Series printers. This 16-byte field can be used to specify a name for the font.
- X-Resolution (UI) - specifies the resolution in the X-scan direction.
This value can be 300 or 600 for bitmap fonts, and is normally set to 2540 for Intellifont scalable fonts. This is used for scaling the X-coordinates of font data to the required point size.
After scaling (in dots) =
 $(300 \times \text{the required point size} \times \text{X-coordinate}) \div \{72.307 \times \text{scale factor (8782)}\}$
After scaling (in dots) =
 $(300 \times \text{the required point size} \times \text{X-coordinate}) \div \{\text{Master X-resolution} \times (\text{Height} \div 8)\}$
- Y-Resolution (UI) - specifies the resolution in the Y-scan direction.
This value should be set to 300 or 600 dpi for special bitmap fonts and is not available for Bitmap fonts and TrueType fonts.
This is normally set to 2540 for Intellifont -scalable fonts and is used for scaling the Y-coordinates of the font data to the required point size.
This value is calculated as:
After scaling (in dots) = $(300 \times \text{the required point size} \times \text{Y-coordinate}) \div (72.307 \times \text{scale factor (8782)})$
After scaling (in dots) = $(300 \times \text{the required point size} \times \text{Y-coordinate}) \div \{\text{Master Y-resolution} \times (\text{Height} \div 8)\}$
- Scale Factor (UI) - specifies the number of design units per Em. This value can be the unit for the metrics of Intellifont / TrueType scalable fonts.
This is normally set to 8782 and is calculated for Intellifont as follows:
- Scale factor $\times 72.307 = \text{resolution} \times \text{height} \div 8$
- This is normally set to 2048 for TrueType fonts.
- Master Underline position (UI) - Specifies the distance from the baseline to the top of the underline in design units and this is an alternative for "Underline Position (bit 30)" only for scalable fonts.
- Master Underline height (UI) - specifies the height of the underline itself in design units and this is an alternative for "Underline Thickness (bit 31)" only for scalable fonts.
- Font Scaling Technology (UB) - specifies the type of font scaling technology for any scalable fonts.
- Variety (UB) - only for TrueType fonts, this value should be set to 0.
- OR (LRE) Threshold (UI) - specifies the pixel size in design units. This is switched on between scaling the font and its rasterization.
- Global Italic Angle (SI) - specifies the italic angle as a tangent relative to the vertical. The value 0 makes upright fonts.
- Global Intellifont Data Size (UI) - indicates the size of the global Intellifont data block.
- Global Intellifont Data - includes the global intellifont data.
- Character Complement (Array of UB) - identifies the symbol set compatibility for unbound fonts used with the Character Requirement flag in the symbol set descriptor.

MSL Symbol Index

Bit Field	Designated Use
58 - 63	Reserved for Latin fonts.
55 - 57	Reserved for Cyrillic fonts.
52 - 54	Reserved for Arabic fonts.
50 - 51	Reserved for Greek fonts.
48 - 49	Reserved for Hebrew fonts.
3 - 47	Miscellaneous uses (South Asian, Armenian, other alphabets, bar codes, OCR, Math, PC Semi-graphics, etc.)
0 - 2	Symbol Index field. 111 - MSL Symbol Index

Unicode Symbol Index

Bit Field	Designated Use
32 - 63	Miscellaneous uses (South Asian, Armenian, other alphabets, bar codes, OCR, Math, etc.)
28 - 31	Reserved for Latin fonts.
22 - 27	Reserved for platform / application variant fonts.
3 - 21	Reserved for Cyrillic, Arabic, Greek and Hebrew fonts.
0 - 2	Symbol Index field. 110 - Unicode Symbol Index

MSL Symbol Index Character Complement bits

Bit Field	Designated Use
63	0 if font is compatible with standard Latin character sets (e.g., Roman-8, ISO 8859-1 Latin 1); otherwise set to 1.
62	0 if font is compatible with East European Latin character sets (e.g., ISO 8859-2 Latin 2); otherwise set to 1.
61	0 if font contains Turkish character sets (e.g., ISO 8859/9 Latin 5); otherwise set to 1.
34	0 if font has access to the math characters of the Math-8, PS Math and Ventura Math character sets; otherwise set to 1.
33	0 if font has access to the semi-graphic character of the PC-8, PC-850, etc. character sets; otherwise set to 1.
32	0 if font is compatible with ITC Zapf Dingbats series 100, 200, etc.; otherwise set to 1.
2,1,0	111 if font is arranged in MSL symbol Index order.

5.4.3. Unicode symbol index character complement bits

Bit Field	Designated Use
31	0 if font is compatible with 7-bit ASCII; otherwise set to 1.
30	0 if font is compatible with ISO 8859/1 Latin 1 (West Europe) character sets; otherwise set to 1.
29	0 if font is compatible with ISO 8859/2 Latin 2 (East Europe) character sets; otherwise set to 1.
28	0 if font is compatible with Latin 5 (Turkish) character sets (e.g., ISO 8859/9 Latin 5, PC-Turkish); otherwise set to 1.
27	0 if font is compatible with Desktop Publishing character sets (e.g., Windows 3.1 Latin 1, DeskTop, MC Text); otherwise set to 1.
26	0 if font is compatible with character sets requiring a wider selection of accents (e.g., MC Text, ISO 8859/1 Latin 1); otherwise set to 1.
25	0 if font is compatible with traditional PCL character sets (e.g., Roman-8, Legal, ISO 4 United Kingdom); otherwise set to 1.
24	0 if font is compatible with the Macintosh character set (MS Text); otherwise set to 1.
23	0 if font is compatible with PostScript Standard Encoding (PS Text); otherwise set to 1.
22	0 if font is compatible with Code Pages (e.g., PC-8, PC-850, PC-Turk, etc.); otherwise set to 1.
2,1,0	110 if font is arranged in Unicode Symbol Index order.

- Checksum - This should be set to a value which, when added to the contents of the 64 bytes of this font descriptor data produces a total of 0.
- Descriptor size - segmented font data.

	MSB 15	8	7	LSB 0
x	First segment, segment identifier			
x + 2	First segment, Segment size			
x + 4	First segment, Data segment			
x + 4 + 1st seg. size	Second segment, segment identifier,		Size, Data segment	
# - 6	Null segment identifier			
# - 4	Null segment size			
# - 2	Reserved		Checksum	

This segment follows just after the font header for TrueType. Each segment is divided into segment identifier, segment size and data segment parts.

*Segment Identifier (UI) -

Each item in the data segment part has an identification number.

Value	Mnemonic	Data Segment
17219	CC	Character Complement
17232	CP	Copyright
18260	GT	Global TrueType Data
20545	PA	Panose Description
22618	XW	X windows font name
65535		Null Segment

*Segment Size (UI) - indicates the size of each item in the data segment.

*Data segment -

AP - Application support segment (reserved)

CC - Character Complement

Function and form are as same as character complement flag in the font descriptor. This is only for unbound fonts.

CP - Copyright

Value should be ASCII data.

GI - Global Intellifont data (reserved)

GT - Global TrueType Data

This segment consists of a table directory and several tables for the TrueType font scaler.

The table directory consists of a 12-byte header and 16 bytes pen entry.

IF - Intellifont Face Data (Reserved)

PA - PANOSE Descriptor

This data segment is used for font selection and substitution.

PF - PS-compatible font name (Reserved)

XW - X-Windows font name

5.4.4. Sending a character code

Esc*c#E (character code) (27) (42) (99) # (69)
<1Bh><2Ah><63h>#<45h>

- This command sends a character code for the bitmap font (MSL number for unbound fonts) to the printer. The font data must follow immediately.
- # is the character code. # can be from 0 to 65535. The specified character is defined by the data which follows the character code.
- Use this command also to designate a character for deletion from a font, using the command for deleting a character from a downloaded font.

5.4.5. Sending a character descriptor and data

Esc(s#W (character descriptor and character data)
(27) (40) (115) # (87) <1Bh><28h><73h>#<57h>

- This command sends a character descriptor block and raster data describing the shape of the character to the printer.
- # is the total number of bytes (descriptor and data) which will follow this command and can be up to 32767. If you need to send more than 32767 bytes to describe a single character you must split it into blocks of 32767 bytes or less and send each block separately.
- The character header for the first block of data describing a character is in the following format.

[Bitmap font]

Byte	Data
0 - 1	Format
2 - 3	Descriptor size
4 - 5	Orientation
6 - 7	Left offset
8 - 9	Top offset
10 - 11	Character width
12 - 13	Character height
14 - 15	Delta X
16 -	Raster Character Data

<Bitmap continuation data>

Byte	Data	
0-1	Format	Continuation
2	Raster Character Data	

- The bytes which follow the header are the raster data that make up the character.
- Attributes are in one of four numerical formats.
 - Unsigned integer (UI) 0 to 65535
 - Signed integer (SI) -32768 to 32767
 - Unsigned byte (UB) 0 to 255
 - Boolean - 0 or 1
- Format (UB) - 4 for bitmap fonts.
- Continuation (B) - signifies whether the character data represents a new character (0) or is a continuation of the character described by the previous character descriptor block and its data (non-zero). If the continuation byte is non-zero the bytes following it are interpreted as character data.
- Descriptor size (UB) - 14 for bitmap fonts.
- Class (UB) - 1 for bitmap fonts, 2 for compressed bitmap fonts. Bitmap fonts are described using uncompressed raster data. Compressed bitmap fonts character data is encoded as follows. The first byte of a line of data contains the number of times that the line is successively repeated. The second byte indicates the number of successive white pixels that start the line and the third byte indicates the number of successive black pixels that follow the white pixels. Subsequent even and odd numbered bytes indicate the number of successive white and black pixels respectively that make up the line. If there are more than 255 successive pixels of a single color this is indicated by a byte set to 255 followed by a byte set to 0 followed by a byte indicating the remaining number of pixels of that color. The width of each line is determined by the character width attribute. All rows must contain the same number of pixels. The total number of pixels on each row must equal the character width attribute.
- Orientation (UB) - the orientation of the character. 0 = portrait, 1 = landscape, 2 = reverse portrait or 3 = reverse landscape. This attribute setting must match the orientation specified in the font descriptor block.
- Left offset (SI) - the distance between the character reference point and the leftmost dot of the character on the grid. The offset can be from -16384 to 16383.
- Top offset (SI) - the distance between the character reference point and the topmost dot of the character on the grid. The offset can be from -16384 to 16383.
- Character width (UI) - the width of the download character in grid dots. This can be in the range 1 to 16384.
- Character height (UI) - the height of the download character in grid dots. This can be in the range 1 to 16384.
- Delta X (UI) - the horizontal distance from the bottom left hand corner of the character's grid that the cursor is moved after the character is printed. The attribute is specified in units of 1/1200" and can be in the range -32768 to 32767.

[Intellifont scalable font data]

Byte	Data	
0-1	Format	Continuation
2 - 3	Descriptor size	Class
4 - 5	Contour Character data	
Last data	Reserved	Checksum

<Intellifont-scalable contour data>

	MSB	LSB
4	Contour Data size	
6	Metric data offset	
8	Character Intellifont data	offset
10	Contour tree offset	
12	XY data offset	
14		
	Metric data	
	Character Intellifont Data	
	Contour tree data	
	XY coordinate data	

<Continuation data for Intellifont scalable contour data>

Byte	Data	
0-1	Format	Continuation
2 - 3	Continuous contour character data	
Last	Reserved	Checksum

<Compound character data of Intellifont scalable font>

Byte	Data	
0-1	Format	Continuation
2 - 3	Descriptor size	Class
4 - 5	Compound character escarpment	
6 - 7	piled character number	ignore
8 - ...	piled character list (6 byte x characters)	
Last	Reserved	checksum

- Format (UB) - specifies the character format.

Value	Format
4	Bitmap font
10	Intellifont-scalable font
15	TrueType scalable font
- Continuation (B) - signifies whether the character data represents a new character (0) or is a continuation of the character described by the previous character descriptor block and its data (non-zero). If the continuation byte is non-zero the bytes following it are interpreted as character data.
- Descriptor size (UB) - specifies the character descriptor size in bytes.
- Class (UB) . indicates the character format.

Value	Class
1	Bitmap
2	Compressed Bitmap
3	Contour (Intellifont scalable)
4	Compound Contour (Intellifont scalable)
15	TrueType Scalable
- Contour data size (UI) - specifies the contour data size.
- Metric Data offset (SI) - relative to the address of the contour data size field.
- Contour Tree Offset (SI) -relative to the address of the contour data size field.
- XY Data Offset (SI) -relative to the address of the contour data size field.
- Metric Data
- Character Intellifont Scalable Data
- Contour Tree Data
- XY Coordinate Data
- Checksum - this value is placed at the end of the character data.
- Compound character escapement (SI)
- Piled character number (UB)
- Piled character list - includes some piled characters. Each of them is 6 bytes.

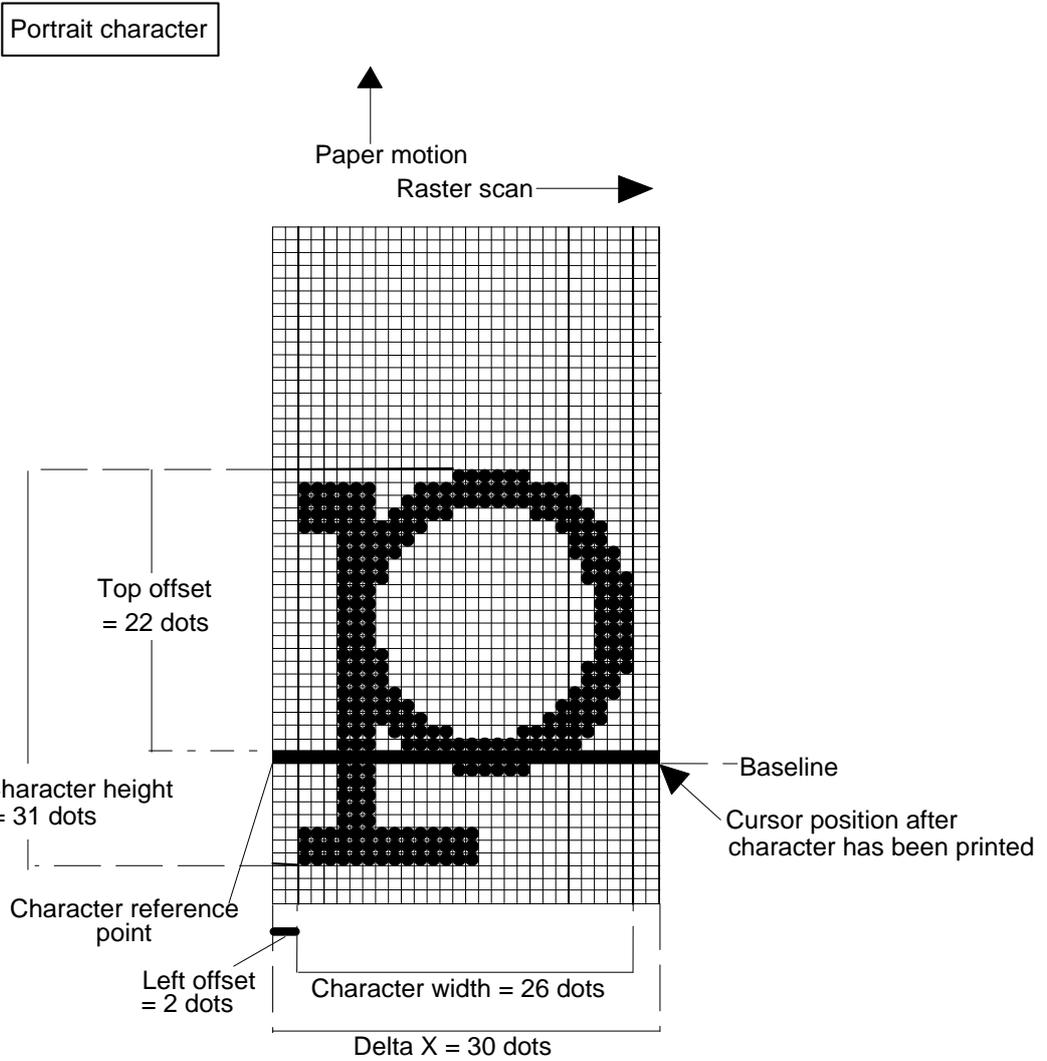
[TrueType scalable font]**<TrueType character descriptor>**

Byte	Data	
0-1	Format (15)	Continuation (0)
2 - 3	Descriptor size	Class (15)
4 ~	Additional descriptor size	
2 + Desc.size	Character Data Size	
4 + Desc. size	Glyph ID	
6 + Desc. size	TrueType Glyph Data	
0-1	Format (15)	Continuation (0)
2 - 3	Descriptor size	Class (15)
4 ~	Additional descriptor size	
2 + Desc.size	Character Data Size	
4 + Desc. size	Glyph ID	
6 + Desc. size	beginning of TrueType Glyph Data	
0-1	Format (15)	Continuation (1)
	TrueType Glyph Data	
Last-2	Reserved	Checksum

- The character data follows these header bytes. Characters are represented as raster data and the data bytes are used to build up an image of the character from left to right and from top to bottom, according to the character width and height settings.
- Format (UB) - 15 specifies TrueType font.
- Continuation (B) - specifies whether the character data represents a new character (0) or is a continuation of the character described by the previous character descriptor block (non-zero). If the continuation byte is non-zero the bytes following it are interpreted as character data.
- Descriptor size (UB) - specifies the character descriptor size in bytes.
- Class (UB) - indicates the character format.

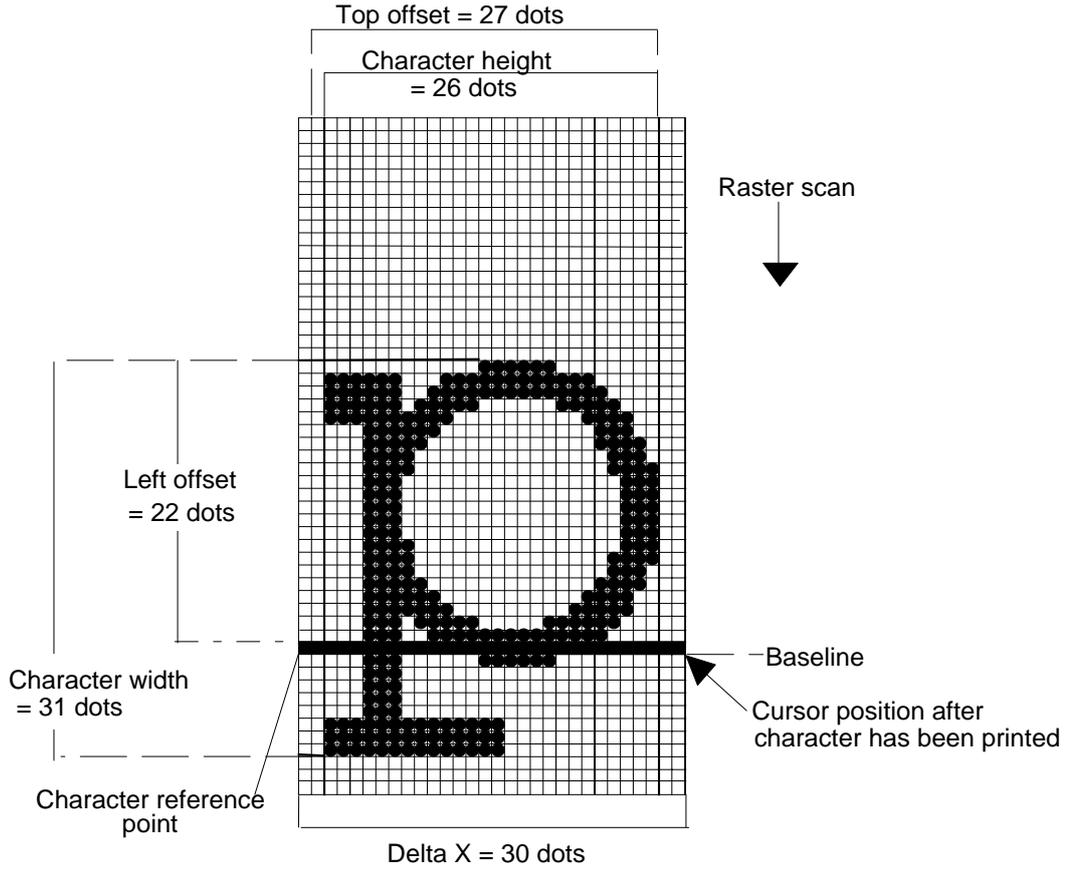
Value	Class
1	Bitmap
2	Compressed Bitmap
3	Contour (Intellifont scalable)
4	Compound Contour (Intellifont scalable)
15	TrueType scalable

- Character data size (UI) - should be the same value as (the character data size + Glyph ID + TrueType Glyph data) size.
- Glyph ID (UI) - specifies the ID number for glyph data, which is used by the TrueType font scaler.
- TrueType Glyph data - includes the data segment which is associated with the given character as found in the glyph table of the original TrueType font file.
- Checksum (UB) - should be a value which, when added to "Character data + Glyph ID + TrueType Glyph data" size, produces a zero result.



Landscape character

Paper motion →



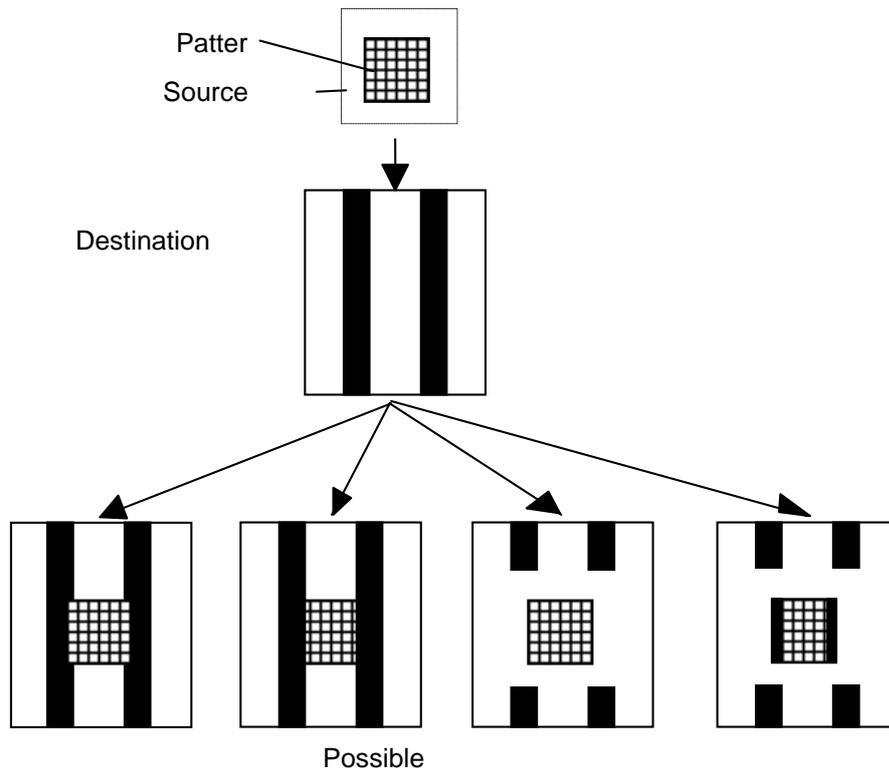
6. USING GRAPHICS

This HL Series printer affords the user considerable flexibility in the creation of graphic images. Vector, raster and rectangle graphics are available, all of which allow a range of shading and filling options. The HP-GL/2 graphics commands that are supported are described in the HP-GL/2 section of this manual.

6.1. Source, Pattern and Destination

We refer to a printing model in which a source image (the image to be drawn) is applied to a destination image (simply the graphics or text that already exist on the page). The source image consists of white space and non-white areas. The non-white areas are covered by a pattern of some description. The pattern may simply be solid black or it may itself consist of white and non-white areas, for example the pattern may consist of vertical spaced lines. You can specify the way in which the white and dark areas of the entire source image and the white and dark areas of the pattern interact with the destination image to produce the finished effect.

For example

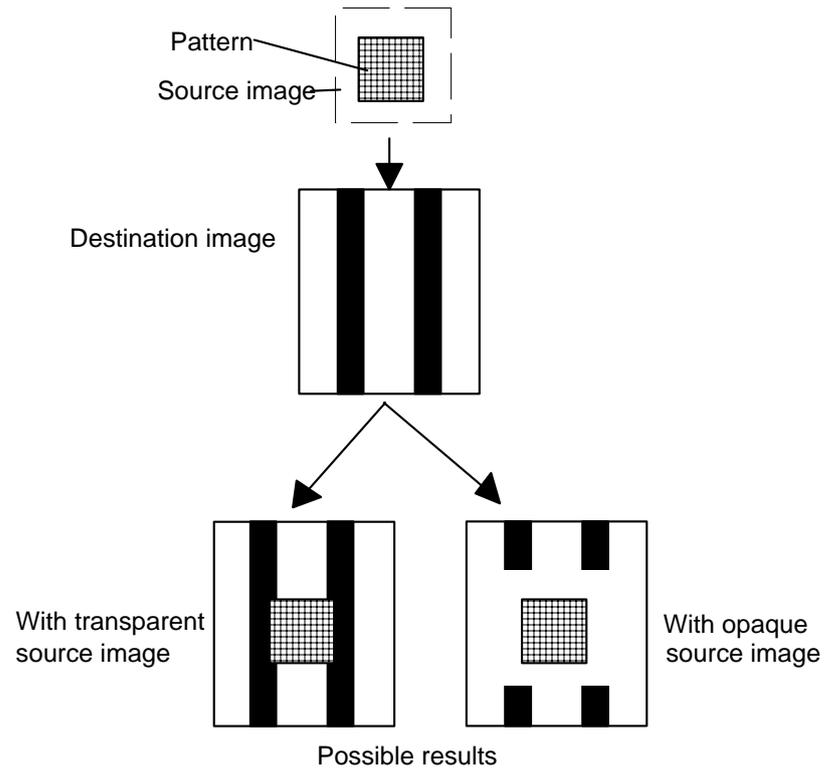


6.1.1. Set source transparency

`Esc*v#N` (27) (42) (118) # (78) `<1Bh><2Ah><76h>#<4Eh>`

- This command sets the source image transparency.
- # is either 0 or 1. Set # to 0 to select transparent mode and to 1 to specify opaque mode.
- Transparent mode means that parts of the destination image will be visible through the white space areas of the source image when the source image has been printed on top of the destination image.
- Opaque mode means that parts of the destination image will not be visible through the white space areas of the source image when the source image has been printed on top of the destination image.

For example

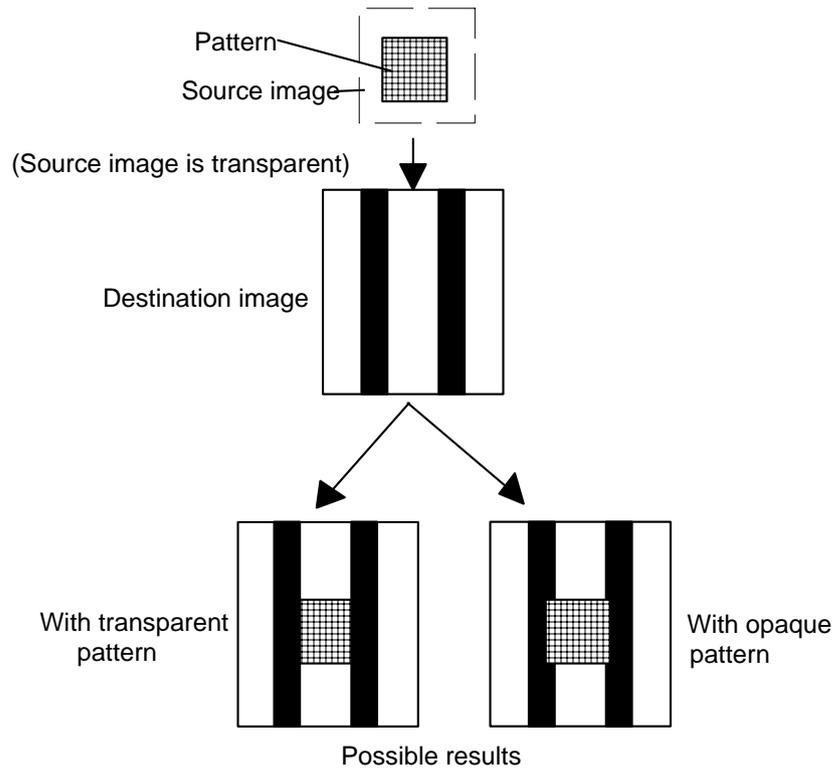


6.1.2. Set pattern transparency

`Esc*v#0 (27) (42) (118) # (79) <1Bh><2Ah><76h>#<4Fh>`

- This command sets the pattern transparency.
- # is either 0 or 1. Set # to 0 to select transparent mode and to 1 to specify opaque mode.
- Transparent mode means that parts of the destination image will be visible through the patterned areas of the source image when the source image has been printed on top of the destination image. If the pattern is a solid black fill obviously you will not be able to see any of the destination image through the patterned areas of the source image.
- Opaque mode means that the destination image will not be visible through the patterned areas of the source image when the source image has been printed on top of the destination image.

For example



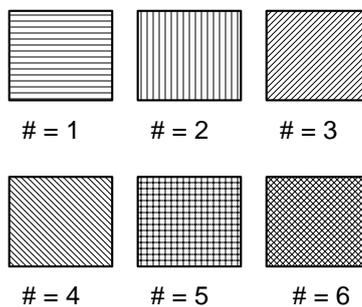
6.1.3. Set area fill identity

`Esc*c#G (27) (42) (99) # (71) <1Bh><2Ah><63h>#<47h>`

- This command sets the pattern ID of a shading tone, a fill pattern or a user-defined pattern for subsequent selection with the Set Pattern Type command.
- # 1 ~ 100 specify the percentage of a gray scale.
- # 1 ~ 6 select a fill pattern.
- # 1 ~ 32767 select a user-defined pattern.
- You can specify a gray scale tone from 1 to 100. To use the specified tone for shading you must then select one of the two gray scale pattern options with the Set Pattern Type command.

For example

Fill patterns



6.1.4. User-defined pattern command

Esc*c#W [data] (27) (42) (99) # (87) <1Bh><2Ah><63h>#<57h>

- # should be in the range 0 ~ 32767.
- # stands for the number of pattern data bytes.
- User defined patterns can be defined by binary data or an 8 byte pattern descriptor.
- The formats for the pattern descriptor are listed below.

<For 300 dpi>

	MSB	LSB
0 - 1	Format (0)	Continuation (0)
2 - 3	Pixel Encoding (1)	Reserved (0)
4 - 5	Height in Pixels	
6 - 7	Width in Pixels	
8 -	Pattern Image	

	MSB	LSB
0 - 1	Format (20)	Continuation (0)
2 - 3	Pixel Encoding (1)	Reserved (0)
4 - 5	Height in Pixels	
6 - 7	Width in Pixels	
8 - 9	X resolution	
10 - 11	Y resolution	X=Y: 300 or 600
12 -	Pattern Image	

- A pattern which is defined at 600 dpi cannot be converted to one at 300 dpi.
- Format - set to 0 or 20.
- Continuation - set to 0.
- Pixel Encoding - set to 1.
- Height in Pixels - specifies the pattern height by the number of rows.
- Width in Pixels - specifies the pattern width by the number of pixels.
- Pattern Image - consists of the raster data for the pattern.
- X resolution - specifies the resolution in the X scan direction.
- Y resolution - specifies the resolution in the Y scan direction.

6.1.5. Set pattern reference point

Esc*p#R (27) (42) (112) # (82) <1Bh><2Ah><70h>#<52h>

- This command sets the pattern reference point to the current cursor position.
- # specifies whether the pattern rotates with the print direction or remains fixed.
- The Pattern reference point should be placed on a physical page and the base pattern is positioned at the pattern reference point for tiling.

6.1.6. User-defined pattern control

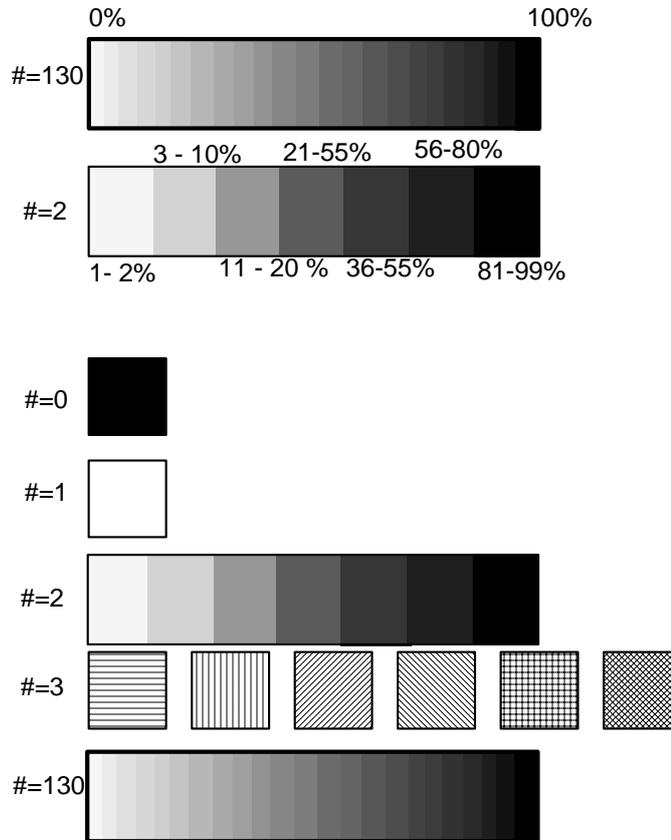
Esc*c#Q (27) (42) (99) # (81) <1Bh><2Ah><63h>#<51h>

- # = 0 deletes all (temporary and permanent) user-defined patterns from the printer memory.
- # = 1 deletes all temporary user-defined patterns from the printer memory.
- # = 2 deletes the pattern whose ID number was specified most recently.
- # = 4 saves the user-defined pattern as a temporary pattern whose ID number was specified most recently.
- # = 5 saves the user-defined pattern as a permanent pattern whose ID number was specified most recently.

6.1.7. Set pattern type

Esc*v#T (27) (42) (118) # (84) <1Bh><2Ah><76h>#<54h>

- This command selects the fill pattern (black, white, gray scale or cross-hatch pattern) for use with subsequent graphics operations.
- # is in the range 0 to 4 or 130.
- # = 0 selects solid black as the fill pattern.
- # = 1 selects white as the fill pattern (all source images will be completely white).
- # = 2 selects one of eight gray scales. Specify the gray scale you require as a percentage (0-100%) with the Set Area Fill Identity command.
- # = 3 selects the cross-hatch pattern you choose with the Set Area Fill Identity.
- # = 4 selects the user-defined pattern
- # = 130 selects one of the 64 gray scales. You can specify the gray scale you require as a percentage (0-100%) with the Set Area Fill Identity command. This feature is unique to these HL-Series printers.



- See the following example for programming examples using patterns.

Pattern example

```

10 WIDTH "LPT1:", 255
20 ESC$ = CHR$(27)
30 REM --- RESET PRINTER ---
40 LPRINT ESC$; "E";
50 REM --- SET SOURCE=TRANSPARENT ---
60 REM --- SET PATTERN=OPAQUE ---
70 LPRINT ESC$; "*v0n10";
80 REM --- BACKGROUND ---
90 LPRINT ESC$; "*c80G"; ESC$; "*v2T";
100 LPRINT ESC$; "*p100x100Y"; ESC$; "*c1000a300b2P";
110 REM --- PATTERN ---
120 LPRINT ESC$; "*p150x300Y";
130 LPRINT ESC$; "(s1p48v0s0b4101T";
140 LPRINT ESC$; "*c1G"; ESC$; "*v3T"; : LPRINT "P";
150 LPRINT ESC$; "*c2G"; ESC$; "*v3T"; : LPRINT "A";
160 LPRINT ESC$; "*c6G"; ESC$; "*v3T"; : LPRINT "T";
170 LPRINT ESC$; "*c4G"; ESC$; "*v3T"; : LPRINT "T";
180 LPRINT ESC$; "*c5G"; ESC$; "*v3T"; : LPRINT "E";
190 LPRINT ESC$; "*c3G"; ESC$; "*v3T"; : LPRINT "R";
200 LPRINT ESC$; "*c1G"; ESC$; "*v3T"; : LPRINT "N";
210 REM --- PAPER EJECT ---
220 LPRINT CHR$(12);
230 END

```

<Sample file 6>

6.2. Plotting Rectangles

Drawing rectangles is a basic case of printing graphics: the source image consists solely of the rectangle itself. Thus only the pattern transparency has any bearing on the final effect - the source transparency is irrelevant.

6.2.1. Cursor position

Position the cursor using the commands described in the chapter entitled "The Page". You can use units, decipoints or rows and columns as coordinate units. Remember that the y-coordinate value goes up as the cursor moves down the logical page.

6.2.2. Set rectangle width

Esc*c#A (27) (42) (99) # (65) <1Bh><2Ah><63h>#<41h>

- This command sets the width of the rectangle to be printed in dots.
- # is the number of dots.

Esc*c#H (27) (42) (99) # (72) <1Bh><2Ah><63h>#<48h>

- This command sets the width of the rectangle to be printed in decipoints.
- # is the number of decipoints.

6.2.3. Set rectangle height

Esc*c#B (27) (42) (99) # (66) <1Bh><2Ah><63h>#<42h>

- This command sets the height of the rectangle to be printed in dots.
- # is the number of dots.

Esc*c#V (27) (42) (99) # (86) <1Bh><2Ah><63h>#<56h>

- This command sets the height of the rectangle to be printed in decipoints.
- # is the number of decipoints.

6.2.4. Draw filled rectangle

Esc*c#P (27) (42) (99) # (80) <1Bh><2Ah><63h>#<50h>

- This command fills a rectangular area with the specified shading option.
- # is 0 to 5 or 130.
- # = 0 uses solid black as the fill pattern.
- # = 1 uses white as the fill pattern.
- # = 2 selects the gray scale you chose with the Set Area Fill Identity command as the fill pattern.
- # = 3 selects the cross-hatch pattern you chose with the Set Area Fill Identity.
- # = 4 selects the user defined pattern, which is the ID number selected by the set Area Fill Identity.
- # = 5 uses the pattern specified by the combination of the most recent Set Area Fill Identity command and the most recent Set Pattern Type command.
- # = 130 selects one of the sixty-four gray scales. You can specify the gray scale you require as a percentage (0-100%) with the Set Area Fill Identity command. This feature is unique to these HL Series printers.

#	Fill
0	Solid black
1	White
2	Gray scale (1 - 8)
3	Cross hatch pattern
4	User-defined pattern
5	Current pattern
130	Gray scale (1 - 64)

- See the following example for programming examples using gray scales.

Gray scale example

```

10 ESC$ = CHR$(27)
20 WIDTH "LPT1:", 255
30 REM --- DRAW A PATTERN USING 64 GRAY SCALES ---
40 X = 50: Y = 100: XL=50 :YL=200
50 FOR GRAY = 0 TO 100 STEP 2
60 GOSUB 220
70 X=GRAY*10+50 :XL=X-XL
80 GOSUB 260
90 XL=X
100 NEXT GRAY
110 REM --- DRAW A PATTERN USING 8 GRAY SCALES ---
120 Y=400
130 FOR GRAY = 0 TO 100 STEP 2
140 GOSUB 220
150 X=GRAY*10+50 :XL=X-XL
160 GOSUB 320
170 XL=X
180 NEXT GRAY
190 REM --- PAPER EJECT ---
200 LPRINT CHR$(12)
210 END
220 REM --- SET THE CURSOR POSITION ---
230 LPRINT ESC$; "*p"; X; "X";
240 LPRINT ESC$; "*p"; Y; "Y";
250 RETURN
260 REM --- PRINT 64-GRAY SCALE PATTERN ---
270 LPRINT ESC$; "*c"; XL; "A";
280 LPRINT ESC$; "*c"; YL; "B";
290 LPRINT ESC$; "*c"; GRAY; "G";
300 LPRINT ESC$; "*c130P";
310 RETURN
320 REM --- PRINT 8-GRAY SCALE PATTERN ---
330 LPRINT ESC$; "*c"; XL; "A";
340 LPRINT ESC$; "*c"; YL; "B";
350 LPRINT ESC$; "*c"; GRAY; "G";
360 LPRINT ESC$; "*c2P";
370 RETURN

```

<Sample file 7>

6.3. Raster Graphics

6.3.1. Positioning the cursor

Position the cursor using the commands described in the chapter entitled “The Page”, using dots, decipoints or rows and columns as coordinate units.

6.3.2. Set raster resolution

Esc*t#R (27) (42) (116) # (82) <1Bh><2Ah><74h>#<52h>

- This command sets the raster image resolution in dots per inch.
- # is 75, 100, 150, 200, 300 or 600.
- The lower the resolution you specify, the less printer memory your raster image will occupy.
- Use this command before you issue a Begin Raster Graphics command, otherwise the resolution that you specify will not take effect until the next time you re-enter raster graphics mode.

6.3.3. Set high resolution control

EscCRRO (27) (13) (82) (79) <1Bh><0Dh><52h><4Fh>

- This command sets high resolution control off.

EscCRRL (27) (13) (82) (76) <1Bh><0Dh><52h><4Ch>

- This command sets high resolution control Light level.

EscCRRM (27) (13) (82) (77) <1Bh><0Dh><52h><4Dh>

- This command sets high resolution control Medium level.

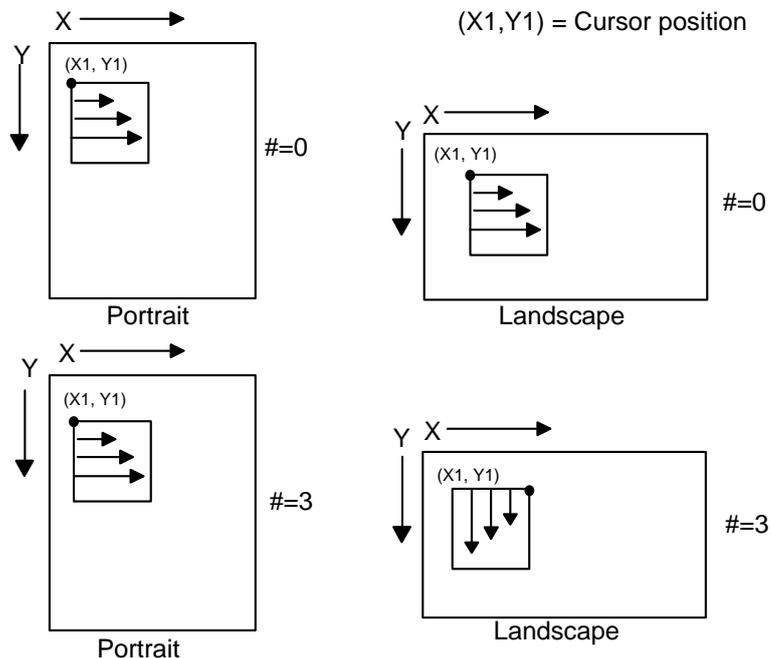
EscCRRD (27) (13) (82) (68) <1Bh><0Dh><52h><44h>

- This command sets high resolution control Dark level.

6.3.4. Set raster image orientation

Esc*r#F (27) (42) (114) # (70) <1Bh><2Ah><72h>#<46h>

- This command specifies the orientation of the raster image.
- # is 0 or 3.
- # = 0 determines that the image will be printed from left to right and from top to bottom within the current logical page.
- # = 3 determines that the image will be printed from left to right and from top to bottom within the current physical page irrespective of logical page orientation.
- The default value of # is 3.



6.3.5. Set raster area height

Esc*r#T (27) (42) (114) # (84) <1Bh><2Ah><72h>#<54h>

- This command sets the height of the raster image to be printed.
- # is the number of raster rows.
- If you use this command after using a Start Raster Graphics or a Transfer Raster Data command, it does not take effect until after the next End Raster Graphics command.

6.3.6. Set raster area width

Esc*r#S (27) (42) (114) # (83) <1Bh><2Ah><72h>#<53h>

- This command sets the width of the raster image to be printed.
- # is the number of dots at the specified dots per inch resolution.
- If you use this command after using a Start Raster Graphics or a Transfer Raster Data command, it does not take effect until after the next End Raster Graphics command.

6.3.7. Set raster y-offset

Esc*b#Y (27) (42) (98) # (89) <1Bh><2Ah><62h>#<59h>

- This command sets the offset (number of blank rows to be skipped) for the raster image to be printed.
- # is the number of rows that are left blank at the top of the image.
- # must be in the range 0-32767.
- This command is only effective in raster graphics mode, that is, after a Start Raster Graphics mode command.

6.3.8. Set compression mode

Esc*b#M (27) (42) (98) # (77) <1Bh><2Ah><62h>#<4Dh>

Identifies the method of compression used to encode the raster image that is to be sent to the printer.

- # is 0, 1, 2, 3, 5, 9, 1152 or 1024.
- # = 0 signifies no compression is to be used.
- # = 1 indicates that run-length encoding is to be used. The raster data bytes are transmitted in pairs. The second byte of each pair specifies the raster output, the first byte specifies the number of times the second byte is successively repeated. A value of 0 for the first byte indicates a single occurrence of the second byte, a value of 1 indicates two consecutive occurrences of the second byte and so on.
- # = 2 indicates that TIFF (tagged image file format) encoding is to be used. In this format the data is transmitted in groups of bytes. The first byte of each group is a control byte and defines how the subsequent data byte or bytes should be interpreted, and how many data bytes there are before the next control byte. If the two's complement value of the control byte is in the range -1 to -127, the following byte is a repeated data byte. The number of successive occurrences of the data byte is given by the absolute value of the control byte plus one - that is, if the control byte is -6, the following data byte is repeated 7 times. If the value of the control byte is in the range 0-127 the bytes which follow are unencoded raster data. The number of data bytes is given by the absolute value of the control byte plus one - that is, if the control byte is 9, the following ten bytes are unencoded data. If a control byte has the two's complement value -128 it is ignored and the next byte is treated as a control byte.

- # = 3 indicates that delta row compression is to be used. In this method byte sequences identify how each raster row differs from the last row that was transmitted. The first byte identifies the number of consecutive bytes (the value of the most significant 3 bits plus 1) to be changed and the position in the line at which to start substituting the replacement bytes (the least significant 5 bits plus 1). Hence, if the command byte has a 3 in the top three bits and 10 in the bottom five bits, the 11th, 12th, 13th and 14th bytes of the last row will be replaced by the four data bytes that follow.

If the least significant 5 bits are all 1, the next byte is treated as a further offset value and its value is added to 32 to calculate the offset. If this byte in turn is all ones the next byte is also treated as a continuation byte and its value is added to the offset and so on until a byte whose value is not 255 is encountered.

This combination of command bytes and replacement bytes is used to specify all the differences between the last raster row sent (the seed row) and the new row to be transmitted. When the new row has been sent it becomes the new seed row.

- # = 5 indicates that adaptive compression is to be used.

This compression compresses multiple rows (a block) into one transfer graphics command.

Most other compression methods compress only one row to one transfer graphics command.

One transfer graphic command (ESC *b##W) can contain only up to 32,767 bytes.

As mode 5 compression compresses multiple rows, the amount of transferred data may become large.

If compressed data exceeds this limit, reduce the number of rows in the block.

We can use mode 0 to mode 3 compression to compress each row. We can even compress empty (white) rows and duplicate rows with these compression methods.

-

Command byte

Mode 5 compressed data consists of multiple elements. Each element contains 3 header bytes at the beginning.

The first byte of the header bytes is a command byte.

First byte		Second, third byte
0	Unencoded	Number of bytes of data
1	Run-length Encoding	
2	TIFF	
3	Delta Row compression	
4	Empty Row	Number of empty row or repetition
5	Duplicate Row	

Command byte

- 0 - This element is an uncompressed row. The next two bytes contain the byte count of the uncompressed data. Uncompressed data follows the header.
- 1 - This element identifies a compressed row. Compression method is mode 1. The next two bytes (upper byte first) contain the byte count of the compressed data. Compressed data follows the header.
- 2 - This element identifies a compressed row. Compression method is mode 2. The next two bytes (upper byte first) contain the byte count of the compressed data. Compressed data follows the header.
- 3 - This element identifies a compressed row. Compression method is mode 3. The next two bytes (upper byte first) contain the byte count of the compressed data. Compressed data follows the header.
- 4 - This element identifies multiple empty rows. The next two bytes (upper byte first) contain the empty row count.
- 5 - This element identifies duplicate rows. The next two bytes (upper byte first) contain the duplicate row count.

- # = 9 Mode 9 compression

Like mode 3 compression, this mode 9 compression data contains only the difference of the current row from the preceding row.

Replacement data often consists of a repetition of a particular byte in mode 3 compression.

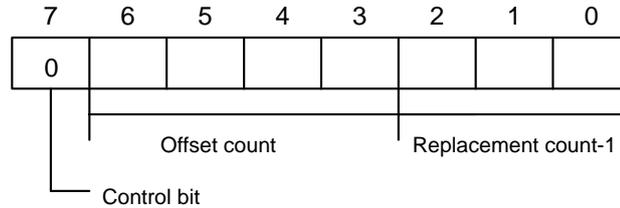
Mode 9 compression is effective in such cases.

Simple mode 9 compression data consists of a command byte and the replacement data.

A Command byte consists of 3 parts. These are the control bit, the offset count and the replacement count.

The Control bit is the most significant bit (bit 7) of a control byte.

Command byte for mode 9 compression (non repeated replacement data)



If the control bit is 0, replacement data is not repeated data. Bits 6 to 3 contain the offset count. This field value is from 0 to 15. If this value is 15, the next byte of the control bytes is an optional offset count. The value of this optional offset count byte is from 0 to 255. If this optional offset count value is 255, then the next byte is another (second) optional offset count byte. Optional offset count bytes will continue until the value is less than 255. The total Offset value is the sum of the offset count in the control byte and all the optional offset bytes.

Bits 2 to 0 of the control byte contains the replacement count - 1. The value is from 0 to 7. If this value is 7, optional replacement byte(s) follow the control byte or optional offset byte(s) (if any).

If the first optional replacement count byte is 255, then a second optional count byte follows the first optional count byte. Optional offset count bytes will continue until the value becomes less than 255. The addition of the replacement count in the control byte and all optional replacement count bytes gives the total replacement count.

Replacement data bytes follow the control byte and any optional offset bytes and any optional replacement count bytes.

<Example>

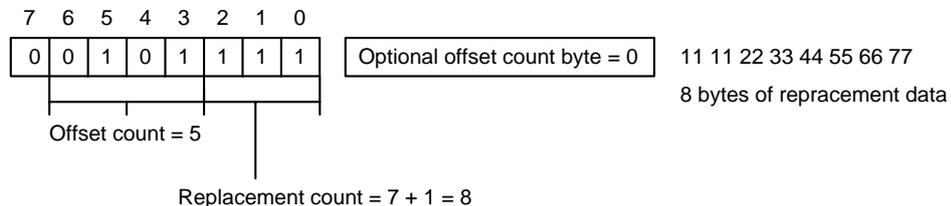
Seed row 55 55 55 55 55 55 55 55 55 55 55 55 55
 Current row 55 55 55 55 55 11 11 22 33 44 55 66 77

<Different section 11 11 22 33 44 55 66 77>

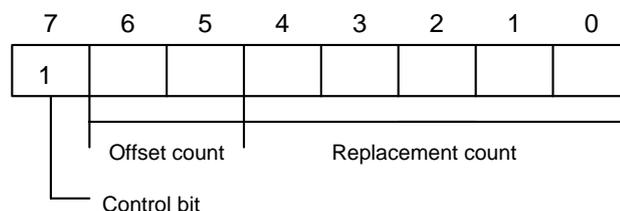
Offset count = 5

Replacement count = 8

Replacement data = 11 11 22 33 44 55 66 77



Command byte for mode 9 compression (repeated replacement data)



If the control bit is 1, replacement data is repeated data. Bits 6 to 5 contain the offset count and bits 4 to 0 contain the 'replacement count (repeat count) - 2'.

If bit 6 and bit 5 are '1', then an optional offset byte follows the control byte. If the value of this optional offset byte is 255, another (second) optional offset byte follows the first optional offset byte. The addition of the offset count in the control byte and any optional offset bytes gives the total offset count.

If bits 4 to 0 are all '1', an optional replacement count byte follows the control byte or any optional offset byte(s). If the first optional replacement count byte has a value of 255, a second optional replacement count byte follows the first optional replacement count byte. Optional replacement count bytes will continue until the value becomes less than 255.

<Example>

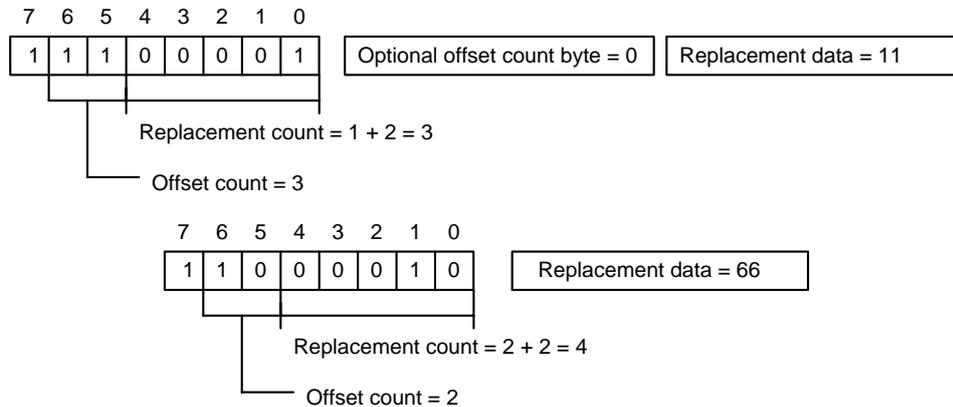
Seed row 55 55 55 55 55 55 55 55 55 55 55 55 55
 Current row 55 55 55 11 11 11 55 55 66 66 66 66 55

<First section 11 11 11>

Offset count = 3
 Replacement count = 3
 Replacement data = 11

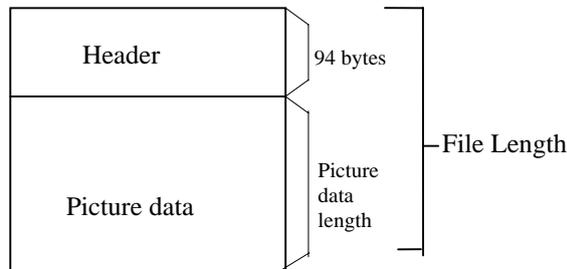
<Second section 66 66 66 66>

Offset count = 2
 Replacement count = 4
 Replacement data = 66



- # = 1152 indicates that CCITT G3/G4 data compression is to be used.

This format is popular in optical document storage areas as this compression is effective to store black and white type pictures. As G3/G4 format does not have picture size/resolution information, the printer requires a header at the beginning of the picture data. The header size is 94 Bytes. Both the header and the picture data are transferred by the ESC*b###W(###=data length) command. The normal PCL transfer graphics data command has a limitation on the data size and ### should not exceed 32767. Unlike other modes, this mode is special and does not have the 32767 size limitation. The data must have the following structure - Header and Picture data. The values in this mode are little endians.



Byte position	Data	Description
0 - 1	6E 6E	'nn' This is header ID.
2 - 3	0A 00	Reserved
4 - 7	5E 00 00 00	Picture data start offset from header top
8 - 11	File length	File length including 94 Byte header. If file length is 65,536 byte, these 4 bytes become "00 00 01 00"
12 - 13	01 00	Reserved
14 - 15	01 00	Reserved
16 - 19	4A 00 00 00	Reserved
20 - 21	Compression mode	02 00: Fax MH format 03 00: Fax MR format 04 00: Fax G4 format
22 - 55	00 ... 00	All zero
56 - 59	Picture data length	If picture data length is 65,442 (65,536 ~-94) byte, these 4 bytes become "A2 FF 00 00."
60 - 61	01 00	bit / pixel
62 - 63	01 00	bit / pixel
64 - 65	Pixels/line	If picture dot width = 2,400, these 2 bytes become "60 09"
66 - 67	Pixels/line	Same as above.
68 - 69	Lines/picture	If picture dot count = 3,100, these 2 bytes become "1C 0C."
71 - 71	Lines/picture	Same as above.
72 - 73	00 00	Reserved
74 - 75	Photometrics 00 00 or 01 00	00 00 : data 0 = white 01 00 : data 0 = black
76 - 77	02 00	Reserved
78 - 79	Fill order 01 00 or 02 00	01 00 : filled from MSB 02 00 : filled from LSB
80 - 81	01 00	Reserved
82 - 83	00 00	Reserved
84 - 85	01 00	Reserved
86 - 87	Resolution 200, 300, 400, 600	C8 00 00 00 : 200 dpi, 2C 01 00 00 : 300 dpi, 90 01 00 00 : 400 dpi, 58 02 00 00 : 600 dpi 400 and 600 dpi are available when the printer operates in 600 dpi mode.
88 - 89	Resolution 200, 300, 400, 600	C8 00 00 00 : 200 dpi, 2C 01 00 00 : 300 dpi, 90 01 00 00 : 400 dpi, 58 02 00 00 : 600 dpi 400 and 600 dpi are available when the printer operates in 600 dpi mode.
90 - 91	02 00	Reserved
92 - 93	00 00	Reserved

For further information about the CCITT G3/G4 data format, please refer to CCITT (The International Telegraph and Telephone Consultative Committee) BLUE BOOK Volume VII.

- # = 1024 indicates TIFF format. This is valid only for 600 dpi data. The raster graphics data is transferred with the ESC*b###W (### = data length) command. The TIFF file follows this mode set command. This printer does not support LZW compression. Pages that contain TIFF data are printed in gray scale mode. The TIFF data contains the header, tag and print data.
This mode supports TIFF Version 5.0 file format. In this mode, the transfer graphics data count does not have a limitation of 32,767 bytes. This printer supports both "MM" (big endian) format and "II" (little endian) format. The Print model is not applied to this type of data transfer. The printer has some limitations on the TIFF format as follows:-
 1. Tag position has to be prior to the picture (strip) data.
 2. Compression tag - Tag ID : 259
The printer supports 1, 2, 3, 4 and 32773.
1 : no compression (Bits/Sample=1,4,8)
2 : CCITT G3 MH (Bits/Sample=1)
3 : CCITT G3 MR (Bits/Sample=1)
4 : CCITT G4 (Bits/Sample=1)
32773 : Pack Bits (Bits/Sample=1)
 3. Sample/pixel - Tag ID : 277
This value should be 1. This means the printer accepts only monochrome TIFF files.
 4. Bits/Sample - Tag ID: 258
The printer supports 1,4 and 8.
If you specify 4 or 8 and the printer resolution is 600 dpi, the printer prints the page using APT.
 5. Horizontal resolution (Tag ID=282) and Vertical resolution (Tag ID=283)

Compression type	Bits/Sample	Available Resolution	APT
No Compression	4,8	From 1 dpi to 300 dpi	ON
No Compression Pack Bit	1	Printer's Resolution (300 or 600 dpi)	OFF
CCITT G3 & G4	1	200,300,400,600 dpi 400 & 600 dpi are only available when the printer operates in 600 dpi mode.	OFF

We recommend 150 dpi or less resolution for APT to reduce data size.

- # = 1025 indicates the Brother original Compression Method.
- # = 1026 indicates the Brother Advanced Data Transfer Mode.

6.3.9. Start raster transfer

Esc*r#A (27) (42) (114) # (65) <1Bh><2Ah><72h>#<41h>

- This command signals the start of the transfer of a raster image to the printer.
- # is 0 or 1.
- # = 0 denotes that the image will be printed starting from the left edge of the logical page.
- # = 1 denotes that the image will be printed starting from the current cursor position.
- The transfer of raster data to the printer continues until either an End Raster Transfer command is sent or a command other than Send Raster Data, Set Compression Mode or Set Raster Y-Offset is sent.

6.3.10. Send raster data

Esc*b#W<data> (27) (42) (98) # (87) <1Bh><2Ah><62h>#<57h>

- This command sends a single row of the raster image to the printer for printing.
- # signifies the number of bytes to be sent.
- If more data is transmitted than can be fitted onto one row of the specified raster area, the excess data will be ignored.

6.3.11. Compress transfer graphics

Esc*b#C<image data> (27) (42) (98) # (67) <1Bh><2Ah><62h>#<43h>

- As a more efficient alternative to the Send Raster Data command, this command sends a single row of the raster image to the printer for printing in a compressed form.
- # signifies the number of data bytes that the uncompressed row consisted of.
- Pairs of bytes describe the data which follows.
- If the MSB of the first byte of a pair is 1, the byte that follows the pair is repeated. The number held in the remaining fifteen bits of the byte pair is the number of times the data byte is repeated.
- If the MSB of the first byte of the pair is 0, the bytes that follow the pair are not repeated. The number held in the remaining fifteen bits of the byte pair is the number of bytes of unrepeated raster data that follow.
- A raster row is made up of a sequence of byte pair-image data combinations.

6.3.12. End raster transfer

Esc*rB (27) (42) (114) (66) <1Bh><2Ah><72h><42h>

- This command signals the end of a transfer of a raster image to the printer.
- After execution of this command the cursor is positioned a distance of one raster row (at the last specified number of dots per inch) down from the bottom of the raster area.

Esc*rC (27) (42) (114) (67) <1Bh><2Ah><72h><43h>

- This command signifies the end of the raster graphic data transfer and this is a modified version of the **ESC*rB** command.
- After receiving this command, the printer resets the compression seed, compression mode and left-graphics margin to 0.
- Also, the cursor is positioned a distance of one raster row (at the last specified number of dots per inch) down from the bottom of the raster data.
- This command resets the compression mode setting to 0.
- This command defaults the left graphics margin to 0.

Raster graphics example

```

10 REM ***** A EXAMPLE OF RASTER GRAPHICS *****
20 ESC$=CHR$(27)
30 WIDTH "LPT1:",255
40 REM --- SET GRAPHICS RESOLUTION TO 300 DPI ---
50 LPRINT ESC$+"*t300R";
60 REM --- START RASTER GRAPHICS ---
70 LPRINT ESC$+"*r1A";
80 REM --- TRANSFER RASTER GRAPHICS ---
90 FOR I=1 TO 28
100 REM --- TRANSFER 1 LINE OF DOTS (4 byte = line) ---
110 LPRINT ESC$+"*b4W";
120 FOR J=1 TO 4
130 READ A$
140 LPRINT CHR$(VAL("&H"+A$));
150 NEXT J
160 NEXT I
170 REM --- END RASTER GRAPHICS ---
180 LPRINT ESC$+"*rB"
190 LPRINT
200 LPRINT
210 REM --- CHANGE GRAPHIC RESOLUTION
220 LPRINT ESC$+"*t75R";
230 REM --- START RASTER GRAPHICS ---
240 LPRINT ESC$+"*r1A";
250 REM --- TRANSFER RASTER GRAPHICS ---
260 RESTORE 410
270 FOR I=1 TO 28
280 REM --- TRANSFER 1 LINE OF DOTS (4 byte = line) ---
290 LPRINT ESC$+"*b4W";
300 FOR J=1 TO 4
310 READ A$
320 LPRINT CHR$(VAL("&H"+A$));
330 NEXT J
340 NEXT I
350 REM --- END RASTER GRAPHICS ---
360 LPRINT ESC$+"*rB"
370 REM --- PAPER EJECT ---
380 LPRINT CHR$(12);
390 END
400 REM --- RASTER DATA ---
410 DATA 00,1F,E0,00
420 DATA 00,7F,F8,00
430 DATA 01,F0,3E,00
440 DATA 03,C0,0F,00
450 DATA 07,00,03,80
460 DATA 0E,00,01,C0
470 DATA 1C,38,70,E0
480 DATA 18,70,70,60
490 DATA 38,38,70,70
500 DATA 30,00,00,30
510 DATA 70,00,00,38
520 DATA 61,00,02,18
530 DATA 61,00,02,18
540 DATA 6F,80,07,98
550 DATA 67,80,07,D8
560 DATA 61,80,06,18
570 DATA 61,C0,0E,18
580 DATA 70,E0,1C,38
590 DATA 30,70,78,30
600 DATA 38,3F,F0,70
610 DATA 18,0F,C0,60
620 DATA 1C,00,00,E0
630 DATA 0E,00,01,C0
640 DATA 07,00,03,80
650 DATA 03,C0,0F,00
660 DATA 01,F0,3E,00
670 DATA 00,7F,F8,00
680 DATA 00,1F,E0,00
690 REM --- DATA END ---

```

<Sample file 8>

6.3.13. Horizontal 1200-dpi image format mode (Raster Graphic Mode 1027)

The printer supports 1200 dpi printing for special image formats in 1200 dpi mode. We recommend that the installed printer memory is 10 Mbytes or more for 1200 dpi printing.

To set 1200 dpi mode,

1. Set 1200 dpi printing mode by using the following PJI command:

@PJI SET RAS1200MODE = ON

2. Choose PCL mode with the following PJI command:

@PJI ENTER LANGUAGE = PCL

(If you select a mode other than PCL mode, 1200 dpi printing mode cannot be selected.)

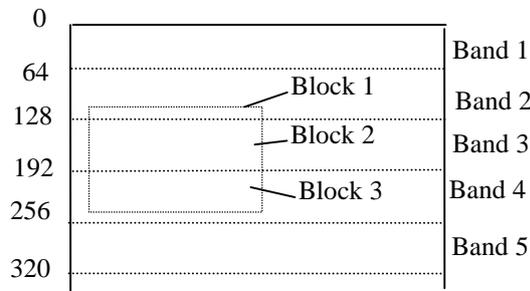
The PCL Mode set command for 1200 dpi Image Format is ESC *b1027M. The transfer raster data command (ESC*b###W) then transfers horizontal 1200 dpi data.

<1200 dpi Graphic Data Compression Format>

This compression format consists of blocks of data 64 dots down the page starting from the leading edge of the paper.

- i.e.: If the graphic data extends over three bands as shown in the following diagram, it transfers the data as three blocks of data:

ESC*b###W <Block 1> <Block 2> <Block 3>



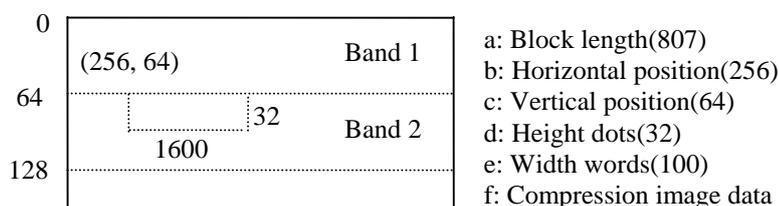
In mode 1027, the transfer graphic data command byte count does not have a limitation of 32,767 bytes.

The block data is composed as follows:

Position	Data	Description
0 - 1	Block length	n - 2
2 - 3	Horizontal position	dots from the left of the page
4 - 5	Vertical position	dots from the leading edge of the page
6	Height dots	number of image vertical dots
7 - 8	Width words	number of image horizontal 16 bit words
9 - (n - 1)	Compression data	compression image data

- i.e.: Data is at horizontal position = 256, vertical position = 64, height = 32 dots, width = 100 x 16 bit words (1600 dots), and compression data is 800 bytes;

ESC*b809W 03h 27h 01h 00h 00h 40h 20h 00h 64h [Data800Byte]



- a: Block length(807)
- b: Horizontal position(256)
- c: Vertical position(64)
- d: Height dots(32)
- e: Width words(100)
- f: Compression image data

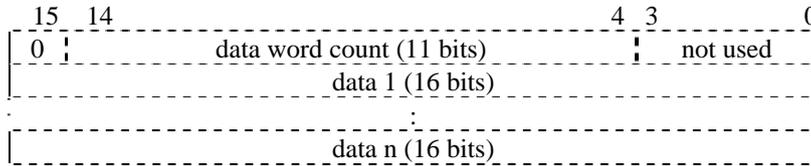
<Compressed Image Data>

Data compression compresses the original image data word by word (16 bits).

The compressed data consists of both horizontal compression which uses 16 bit, 8 bit and 4 bit repeating patterns within 1 word or 2 words of data and vertical compression which indicates how many times to repeat the same data as in the previous line within 1 word of data.

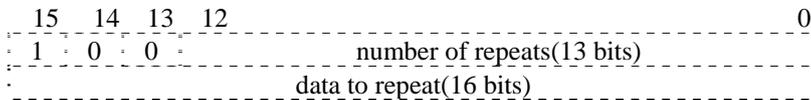
• Non-compressed data

When the most significant bit in the first 2 bytes is 0, the printer goes into non-compression mode. The following 11 bits then indicate the number of words of data, the least significant 4 bits are not used. After that, the image data follows word by word.



• 16 bit repeating compressed data

When the most significant 3 bits in the first 2 bytes are in the order 1, 0, 0, the remaining 13 bits indicate the number of times to repeat 16 bit data. The following 2 bytes should be the 16 bit data to repeat.



• 8 bit repeating compressed data

When the most significant 3 bits in the first 2 bytes are in the order 1, 1, 0, the following 5 bits indicate the number of times to repeat 16 bit (two by 8 bits) data. The remaining 8 bits should be the 8 bit data to repeat.



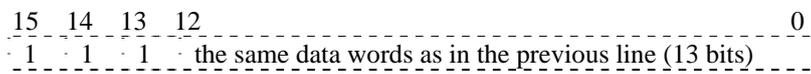
• 4 bit repeating compression data

When the most significant 3 bits in the first 2 bytes are in the order 1, 0, 1, the following 4 bits are the 4 bit data to repeat. The remaining 9 bits indicate the number of times to repeat the 16 bit (4 by 4 bits) data.



• Vertical repeating compressed data

When the most significant 3 bits in the first 2 bytes are in the order 1, 1, 1, the remaining 13 bits indicate the same data words as in the previous line.



The printer cannot support the APT and HRC function in the 1200 dpi printing mode.

6.4. Vector Graphics

For large-scale graphic images it is more efficient to use vector graphics. In LaserJet emulation mode you can set up the page area on which to print vector graphics images. The vector graphics capabilities of these HL Series printers working in HP-GL/2 mode are described in the HP-GL/2 section of this manual.

6.4.1. Enter HP-GL/2 mode

Esc%#B (27) (37) # (66) <1Bh><25h>#<42h>

- This command enters HP-GL/2 graphics mode.
- # = 0 the cursor is positioned at the previous HP-GL/2 cursor position. If this is the first time you have switched to HP-GL/2 mode since switching the printer on, the cursor is placed at the origin of the HP-GL/2 graphics window.
- # = 1 the cursor remains at its current position.

6.5. The Picture Frame

The PCL picture frame is the rectangular area of the page on which you can print graphic images. You can position and size the picture frame to suit your requirements and achieve effects such as scaling or distortion of vector graphics images.

6.5.1. The default picture frame

The default picture frame size and position is determined by the default logical page size and text length for each given paper size.

6.5.2. Set picture frame anchor point

`Esc*c0T` (27) (42) (99) (48) (84) `<1Bh><2Ah><63h><30h><54h>`

- This command sets the anchor point (top left hand corner) of the picture frame to the current cursor position.

6.5.3. Set picture frame vertical size

`Esc*c#Y` (27) (42) (99) # (89) `<1Bh><2Ah><63h>#<59h>`

- This command sets the vertical size of the picture frame.
- # is the height of the picture frame in decipoints.

6.5.4. Set picture frame horizontal size

`Esc*c#X` (27) (42) (99) # (88) `<1Bh><2Ah><63h>#<58h>`

- This command sets the horizontal size of the picture frame.
- # is the width of the picture frame in decipoints.

6.5.5. Specify vertical plot size

`Esc*c#L` (27) (42) (99) # (76) `<1Bh><2Ah><63h>#<4Ch>`

- This command specifies the height in inches of an imported image.
- # is the height of the image in inches.
- # can be in the range 0 to 32767 and can have up to four places of decimals.
- This command is only applicable to existing graphic images which are being imported from an application.
- The imported graphic will be scaled so that its height matches that of the HP-GL/2 graphics window.

6.5.6. Specify horizontal plot size

`Esc*c#K` (27) (42) (99) # (75) `<1Bh><2Ah><63h>#<4Bh>`

- This command specifies the width in inches of the image being imported.
- # is the width of the image in inches.
- # can be in the range 0 to 32767 and can have up to four places of decimals.
- This command is only applicable to existing graphic images which are being imported from an application.
- The imported graphic will be scaled so that its width matches that of the HP-GL/2 graphics window.

7. MACROS

7.1. The Purpose of a Macro

A macro is a sequence of commands that you wish to execute. You can specify the command sequence and download it to the printer after which you can execute it with a single command. For example, you might wish to draw a raster image at the top of each page you print. Rather than sending the same sequence of commands every time you print a new page, it is more efficient to define a macro to draw the image and store the macro in the printer's memory. Having done this, you can draw the picture on each page simply by running the macro, that is, with a single command.

Like downloaded fonts, macros take up printer memory. To alleviate this, some macros are available on cartridges that can be plugged into the printer's cartridge slots. A cartridge-based macro must have a unique ID number or else you will not be able to access it. If a downloaded macro has the same ID number as a cartridge macro, all references to the ID number will be interpreted as references to the downloaded macro. To access the cartridge macro you would first have to delete the downloaded macro.

Another method of storing Macros is uniquely available on the HL-1660e/2060/2400C/2400Ce/3400CN/2600CN/3450CN/2460/7050/3260N/6050/6050D/6050DN/8050N/2700CN printers. Macros can be saved to these cards as required and then executed from the card. For the HL-2400Ce/3400CN/2600CN/3450CN/2460/3260N printers, Macros can be also saved to and executed from the optional internal hard disk drive installed as required. A delete facility is also included to allow the removal of macros when no longer required. The rules for identifying and calling Macros from this card are exactly the same as for cartridge stored Macros detailed above. For the HL-1270N/1470N/1650/1670N/1850/1870N/5070N/5170DN/6050/6050D/6050DN/5270DN/5280DW printer, Macros can be stored in the incorporated Flash memory.

One macro can call another, however, only two levels of nesting are permitted.

A printer reset will delete macros from the printer's memory unless they have been explicitly designated as permanent.

The PCL picture frame commands, the printer reset command and HP-GL/2 graphic language commands cannot be invoked from within a macro.

7.2. Defining a Macro

To define a macro you must first assign an ID number to it, then send to the printer a Start Macro Definition command, the macro definition itself (consisting of a sequence of PCL commands) and finally an End Macro Definition command.

7.2.1. Macro ID

Esc&f#Y (27) (38) (102) # (89) <1Bh><26h><66h>#<59h>

- This command assigns an identity number to a macro that is to be downloaded, or references an existing macro in the printer's memory.
- # is the ID number of a macro. The ID number must be in the range 0-32767.
- If you specify the ID number of an existing macro and then download a new macro definition to the printer, the new macro will overwrite the existing macro.

7.2.2. Start macro definition

Esc&f0X (27) (38) (102) (48) (88) <1Bh><26h><66h><30h><58h>

- This command signifies that the following commands constitute a macro definition.

7.2.3. End macro definition

Esc&f1X (27) (38) (102) (49) (88) <1Bh><26h><66h><31h><58h>

- This command terminates the macro definition.

7.3. Running a Macro

Macros can be invoked in three different ways: they can be 'executed', 'called' or 'enabled for overlay'. When a macro is 'executed' it uses the current modified print environment. Any changes it makes to the environment are permanent. A macro that is 'called' also uses the current modified print environment, however, any changes it makes to the environment are discarded when the macro has performed its function. When a macro is 'enabled' for overlay, the macro's command sequence is performed as the final operation every time a page is printed. Overlaid macros use the overlay environment. The overlay environment is a combination of the user default environment and the modified print environment. This environment is effective only while the macro is running.

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

7.3.1. Execute macro

Esc&f2X (27) (38) (102) (50) (88) <1Bh><26h><66h><32h><58h>

- This command executes the macro whose ID number was specified most recently.
- Any changes made to the modified print environment during the execution of a macro, such as font selection or margin settings, are retained after macro execution has been completed.

7.3.2. Call macro

Esc&f3X (27) (38) (102) (51) (88) <1Bh><26h><66h><33h><58h>

- This command calls the macro whose ID number was specified most recently.
- Any changes made to the modified print environment during a macro call, such as raster graphics settings, are temporary and remain in effect only while the macro is running. They are not retained after the macro has finished.

7.3.3. Enable macro for overlay

Esc&f4X (27) (38) (102) (52) (88) <1Bh><26h><66h><34h><58h>

- This command overlays the macro whose ID number was specified most recently.

7.3.4. Disable macro for overlay

Esc&f5X (27) (38) (102) (53) (88) <1Bh><26h><66h><35h><58h>

- This command stops overlaying the macro whose ID number was specified most recently.

7.4. Handling Macros

7.4.1. Delete all macros

Esc&f6X (27) (38) (102) (54) (88) <1Bh><26h><66h><36h><58h>

- This command deletes all macros from the printer's memory.

7.4.2. Delete all temporary macros

Esc&f7X (27) (38) (102) (55) (88) <1Bh><26h><66h><37h><58h>

- This command deletes all temporary macros from the printer's memory. Temporary macros are those which have not been made permanent with the Esc&f10X command.

7.4.3. Delete macro

Esc&f8X (27) (38) (102) (56) (88) <1Bh><26h><66h><38h><58h>

- This command deletes from printer memory the macro whose ID number was specified most recently.

7.4.4. Make macro temporary

Esc&f9X (27) (38) (102) (57) (88) <1Bh><26h><66h><39h><58h>

- This command makes the macro whose ID number was specified most recently temporary (that is, it will not be retained if the printer is reset).

7.4.5. Make macro permanent

Esc&f10X (27) (38) (102) (49) (48) (88) <1Bh><26h><66h><31h><30h><58h>

- This command makes the macro whose ID number was specified most recently permanent (that is, it will be retained if the printer is reset).

7.4.6. Delete all macros from the storage device

Esc&f1030X (27) (38) (102) (49) (48) (51) (48) (88)
<1Bh><26h><66h><31h><30h><33h><30h><58h>

- This command deletes all macros and all data from the storage device.

7.4.7. Delete macro from the storage device

Esc&f1036X (27) (38) (102) (49) (48) (51) (54) (88)
<1Bh><26h><66h><31h><30h><33h><36h><58h>

- This command deletes the macro whose ID number was specified most recently from the storage device.

7.4.8. Save macro into the storage device

Esc&f1038X (27) (38) (102) (49) (48) (51) (56) (88)
<1Bh><26h><66h><31h><30h><33h><38h><58h>

- This command saves the macro whose ID number was specified most recently into the storage device.

Macro example

```

10 REM ***** A EXAMPLE OF A MACRO *****
20 ESC$=CHR$(27)
30 WIDTH "LPT1:",255
40 REM --- RESET PRINTER ---
50 LPRINT CHR$(27);"E":
60 REM --- SET MACRO ID TO 0 ---
70 LPRINT ESC$+"&f0Y";
80 REM --- START MACRO DEFINITION ---
90 LPRINT ESC$+"&f0X";
100 REM --- SET CURSOR POSITION X=1800 DOT, Y=0 DOT ---
110 LPRINT ESC$+"*p1800x0Y";

```

```

120 REM --- SET FONT TO LETTER GOTHIC (18 DOTS WIDE) ---
130 LPRINT ESC$+"(s0p16.66h8.5v0s0b130T";
140 REM --- PRINT COMMENT ---
150 LPRINT "Printed by this printer";
160 REM --- SET CURSOR POSITION X=1790 DOT, Y=-40 DOT ---
170 LPRINT ESC$+"*p1790x-40Y";
180 REM --- PERFORM SHADING ---
190 REM --- SET SHADING WIDTH TO 23 CHARACTERS + 20 DOTS ---
200 LPRINT ESC$+"*c";23*18+20;"A";
210 REM --- SET SHADING HEIGHT TO 30 DOTS ---
220 LPRINT ESC$+"*c60B";
230 REM --- DRAW SHADING PATTERN (5% GRAY SCALE) ---
240 LPRINT ESC$+"*c5g2P";
250 REM --- END MACRO DEFINITION ---
260 LPRINT ESC$+"&f1X";
270 REM --- MACRO OVERLAY ON (PRINT THE MESSAGE ON EVERY
PRINTOUT) -- 280 LPRINT ESC$+"&f4X";
290 REM --- SET FONT TO BROUGHAM 10 ---
300 LPRINT ESC$+"(s0p10h12v0s0b128T";
310 REM --- MACRO OVERLAY ON, PAPER EJECT ---
320 LPRINT "MACRO OVERLAY ON"
330 LPRINT CHR$(12);
340 REM --- MACRO OVERLAY ON, PAPER EJECT ---
350 LPRINT "MACRO OVERLAY ON"
360 LPRINT CHR$(12);
370 REM --- MACRO OVERLAY OFF (PRINT WITHOUT THE MESSAGE) ---
380 LPRINT ESC$+"&f5X";
390 REM --- MACRO OVERLAY OFF, PAPER EJECT ---
400 LPRINT "MACRO OVERLAY OFF"
410 LPRINT CHR$(12);
420 END

```

7.4.9. Execute data

The data saved in the storage device by using Printer's control panel "SAVE DATA" function can be printed by the following command. It can also be printed by operation of the Printer control panel.

EscCR!#E (27) (13) (33) # (69) <1Bh><0Dh><21h>#<45h>

- # indicates the DATA ID.
- Execute the data which is saved in the flash memory card or Hard Disk card.
- The printer uses the current environment when this command is executed.
- While executing the data, it is possible to change the emulation or reset the printer.
- If this command is included in the last data which was saved by the "SAVE DATA" operation from the printer's control panel, the printer enters a permanent loop so that saved data such as DEMO printing keeps printing. To stop it, press the RESET key on the printer's control panel. This function is available only for the Flash ROM card.

7.4.10. AppleTalk configuration

Esc&b#W[key] <sp>[value] (27) (38) (98) # (87) [Key] (32) [value]
<1Bh><26h><62h>#<57h> [Key] <20h> [value]

- # value can be from 0 to 32767.
- # stands for number of bytes in the data which is following this command.
- [key] should be [RENAME], [JOB] or [TYPE].

- If the key is [RENAME], this command allows the printer to change the name field of the AppleTalk name binding protocol.
`<ESC>&b#WRENAME<sp>printername`
 printername should be specified with 1 to 31 characters.
 The characters \$00 to \$FF (except for \$00, @, :, *, =, \$C5) can be used for the printername.
 \$00 is used as the terminator.
 If invalid characters are used, this command is ignored.
- If the [key] is set to [JOB], this command changes the current job name.
`<ESC>&b#WJOB<sp>jobname`
 All characters from \$00 to \$FF can be used for the jobname.
 jobname can have a maximum of 127 characters.
- If the [key] is set to [TYPE], this command allows the printer to change the type field of the AppleTalk name binding protocol.
`<ESC>&b#WTYPE<sp>devicetype`
 devicetype should be specified with 1 to 31 characters.
 The characters \$00 to \$FF (except for \$00, @, :, *, =, \$C5) can be used for the devicetype.
 \$00 is used as the terminator.
 If invalid characters are used, this command is ignored.

7.4.11. MIO video I/O port control

The HL-1660e and 2060 printers have only the "VSREQ" signal for vertical synchronization that can be sent to the MIO port. This causes a short delay to the actual printing start after sending the VSREQ signal if the video controller is processing an interrupt. This delay causes an incorrect vertical printing position. To avoid the problem, the following command is useful.

EscCR!12340M (27) (13) (33) (49) (50) (51) (52) (48) (77)
`<1Bh><0Dh><21h><31h><32h><33h><34h><30h><4Dh>`

- Laser diode video interface port of the MIO port is closed.

EscCR!12341M (27) (13) (33) (49) (50) (51) (52) (49) (77)
`<1Bh><0Dh><21h><31h><32h><33h><34h><31h><4Dh>`

- Laser diode video interface port of the MIO port is opened.

EscCR!12342M (27) (13) (33) (49) (50) (51) (52) (50) (77)
`<1Bh><0Dh><21h><31h><32h><33h><34h><32h><4Dh>`

- Laser diode video interface port of the MIO port is opened and the print start command is sent to the printer engine immediately after sending the VSREQ signal.

8. STATUS READBACK

8.1. Introduction

Status readback features are explained in this section. The printer sends a status response message after receiving a request for its status by these commands. You can get the information as shown below from the printer.

- available printer (user) memory
- current available fonts and symbol sets
- the ID numbers of downloaded macros and user-defined patterns to verify their presence

The computer system must have a device driver for bi-directional communication to get the printers status response. Bi-directional communication is supported on the HL Series laser printers by the printer driver that comes with these machines.

8.2. Memory Status request

You can identify the capacity of the user memory in the printer by using the memory status request. You can determine whether to execute "downloading" or not, by knowing the available memory and thus avoid printer memory overrun errors.

8.3. Entity Status

You can request the printer to send the status of its entities. A font, symbol set, macro or user-defined pattern in the printer can be an entity. In order to request entity status, a position type and a position unit must be identified first and then the entity request command must be sent.

Location type is the memory positions that contain the entities. Memory positions are internal ROM, RAM, cartridges/cards, the storage device and one additional position specified as "currently selected". Currently selected means the entity is active. However, "currently selected" can be applied only for fonts and user-defined patterns.

Location unit means a more specific position within the location type.

When the location type and unit are identified, you can request the status with the Inquire Status Readback Entity command. The entity (font, symbol set, macro or user-defined pattern) is specified by this command and the printer sends the response.

When an invalid request is sent, the printer sends an error response back.

8.4. Status Response

If a status request (command) is received, the printer produces the response data. The printer accumulates this data in an I/O status buffer and saves the response in this buffer until a user reads it or you turn off the printer.

The printer clears the status responses when Printer resolution, Page protection or Emulation language is changed.

The printer processes status requests and their related response in the order in which the printer receives them.

According to the internal printer operations, the number of responses the printer can accumulate is different. If you use multiple applications or share the printer, you should read the response to a request before making a new request.

You should use the Echo command so that your applications request will synchronize with the printer's responses, because an earlier application might have requested a status and the printer might retain it.

A status response gets routed back to the I/O port that it was requested from.

8.5. Status Response Syntax

All of the status responses begin with "PCL", Carriage Return control code and a Line Feed control code. The response is ended by a Carriage Return and a Line Feed control code. At the end of the transaction, status responses are ended by a Form Feed Control code. The fundamental syntax for the status response is as shown below.

```
PCL<CR> <LF>
INFO TITLE<CR><LF>
KEYWORDn=DATAn<CR><LF>
KEYWORDn=DATAn<CR><LF>
.
.
.
<FF>
```

TITLE, KEYWORDn, and DATAn are strings which differ according to the status readback command being operated. One or more keyword lines related to the status readback response accompany every status readback response. The Echo command response differs from this and is as shown below.

```
PCL<CR><LF>
ECHO ValueField<CR><LF>
<FF>
```

ValueField is the decimal number which comes from the Echo command value field.

For future printers, keywords might be added. Applications in which the status readback is used should be made to disregard lines with keywords they do not understand.

8.5.1. Set status readback location type

ESC*s#T (27) (42) (115) # (84) <1Bh><2Ah><73h>#<54h>

This command determines the status location type according to the value of #.

The location type is used in association with the location unit in order to specify an entity location for a status request.

- #=0 specifies an invalid location. When the printer receives an Inquire Entity Command, an error response is generated. This is the default value. When you execute a printer reset, this value is reset to 0.
- # = 1 specifies the currently selected location.
- # = 2 specifies all locations.
- # = 3 specifies the printer's internal location.
- # = 4 specifies the downloaded entity.
- # = 5 specifies the user-installed card/cartridge

The location type setting is retained by the printer. When the printer does not send the set status readback location type command in order to change the setting for an entity request, then the printer uses the currently available location type setting.

8.5.2. Set status readback location unit

ESC*s#U (27) (42) (115) # (85) <1Bh><2Ah><73h>#<55h>

- The status location unit is selected by the value of #.
- The printer uses the location unit in association with the location type in order to specify an entity location for a status request.

Type	Unit	
0	-	invalid location
1	-	currently selected location
2	-	all locations
3	0	all internal entities

4	0	all downloaded entities
	1	downloaded entity as temporary
	2	downloaded entity as permanent
5	0	All cartridge/cards
	1	the cartridge/card which has the highest priority.
	n	the cartridge/card which has the lowest priority

- When the location value is 0, 1 and 2, it ignores the unit value (which might be set to any value). The default value is 0, and whenever you reset the printer, the value is reset to the default value.
- The location unit setting is retained by the printer. If the printer does not send this command to change the setting for an entity request, then it uses the currently available location units.
- The printer may set the location type and unit in order. It does not identify any invalid combinations until it receives the inquire entity command. Hence, if the unit value is not in the correct range, it sets the unit to the value for a proper error response to be sent when the inquire entity command is received.

8.5.3. Inquire status readback entity

ESC*s#I (27) (42) (115) # (73) <1Bh><2Ah><73h>#<49h>

- Specifies the entity type and makes the printer produce a status response for the entity identified in the status readback location (type and unit).

Value	Entity type
0	Font
1	Macro
2	User-defined Pattern
3	Symbol set
4	Font extended

8.5.4. Entity status response

The status response for an inquire status readback entity command differs according to the type of the requested entity.

8.5.5. Font response

Keywords returned from the printer depend on whether the printer font is a bitmap, unbound scalable or bound scalable. Below is the list of keywords for a font request.

```
SELECT =
SYMBOLSETS=
LOCTYPE=
LOCUNIT=
```

Below is an example of a font status response for inquire status command.

```
Internal, bitmap, LetterGothic 16.66
Internal, unbound scalable, PcTennessee italic
Downloaded, bound scalable, Portugal
```

Font status:

```
PCL
INFO FONTS
SELECT="<Esc>(8U<ESC>(s0p16.66h9.5v0s0b130T"
SELECT="<Esc>(s1p__v1s0b4101T"
SYMBOLSETS="0D, 0I, 0N, 0S, 0U, 1E, 1F, 1G, ..."
SELECT="<Esc>(1U<Esc>(s1p__v0s0b5111T<Esc>(22X"
```

In a font status response, the "SELECT=" keyword line specifies the individual fonts. The font is identified by this line by specifying the font selection characteristics such as symbol set, spacing, pitch, height, style, stroke weight, and typefaces. It returns the "SELECT=" for all font types.

In a status response, the five characters "<", "E", "s", "c", and "&>" represent an escape character.

Keywords following a "SELECT=" keyword mean the font specified by that "SELECT=" keyword.

8.5.6. Bitmap fonts

For bitmap fonts, the printer returns the "SELECT=" line. This specifies the font selection features. For instance, the printer returns the printer's internal, bitmap, Roman-8 LetterGothic font as follows.

```
PCL
INFO FONTS
SELECT="<Esc>(8U<Esc>(s0p16.66h8.5v0s0b130T"
```

8.5.7. Bound scalable fonts

For bound scalable fonts, an underscore("...s1p__v0s...",) in the "SELECT=" line means it is a bound scalable font. Also, the related features are indicated. Either the height or pitch is indicated depending upon whether the font is proportional or fixed spaced. The printer, for instance, returns the printer's internal scalable Symbol font (proportionally spaced) as follows.

```
PCL
INFO FONTS
SELECT="<Esc>(19M<Esc>(s1p__v0s0b16901T"
```

8.5.8. Unbound scalable fonts

For unbound fonts, the printer adds the "SYMBOLSETS=" keyword to specify the symbol sets which can be used, as the symbol sets can also be used with an unbound font, and there is no symbol set sequence in the "SELECT=" line. The printer, for instance, returns the printer's internal unbound scalable Brougham (medium, fixed spaced) font and Pc Tennessee (bold italic, proportional spaced) fonts as follows.

```
PCL
INFO FONTS
SELECT="<Esc>(s0p__h0s0b4099T"
SYMBOLSETS="0D, 0I, 0N, 0U, 1E, 1F, 1G, ..."
SELECT="<Esc>(s1p__v1s1s3b4101T"
SYMBOLSETS="0D, 0I, 0N, 0S, 0U, 1E, 1F, 1G, ..."
```

8.5.9. Download fonts

For download fonts (bitmap, bound scalable or unbound scalable), the font ID number is included at the end of the "SELECT=" line. For instance, the printer returns a downloaded bitmap Brougham with a font ID of 40 and a downloaded, unbound scalable, Dom Casual typeface with a font ID of 79 as follows.

```
PCL
INFO FONTS
SELECT="<Esc>(8U<Esc>(s0p11.00h12.0v0s0b3T<Esc>(40X"
SELECT="<Esc>(s1p__v1s0b5259T<Esc>)79X"
SYMBOLSETS="0D, 0D, 0N, 0S, 0U, 1E, 1F, 1G, ..."
```

8.5.10. Location type 1 (currently selected) font

For a status location type 1 (currently selected) font, the printer returns a single font, the printer font which is currently selected. The following are the keywords and data returned.

The printer returns the "LOCTYPE=" and "LOCUNIT=" after the "SELECT=" line for every font.

The "SELECT=" line changes for bound and unbound scalable fonts.

For all scalable fonts, the actual size (height or pitch) is indicated instead of the underscores. For unbound scalable fonts, the symbol set which is bound to the font at present is indicated. For all fonts, when the font is a secondary font, ")" replace the "(" characters in the "SELECT=" line.

"LOCTYPE=" specifies the location type of the font which is selected at present. The value field of the Set Status Readback Type command is related to the value returned.

"LOCUNIT=" specifies the location unit of the font which is selected at present. The value field of the Set Status Readback Unit command is related to the value returned.

For instance, if the printer font which is selected at present is a bold 12 point Presentation bitmap font which is selected from a cartridge, and a font entity request with the location type set to 1 is produced, the response will be returned as follows.

```
PCL
INFO FONTS
SELECT="<Esc>(2U<Esc>(s0p10.00h12.0v0s3b11T"
LOCTYPE=5
LOCUNIT=1
```

For instance, suppose the printer font which is selected at present is unbound scalable Dom Casual font with the features below:

```
downloaded (font ID of 78)
temporary
Roman-8(specified for printing)
secondary font
18 point
```

When an entity request is produced with the location type set to 1(selected at present), it returns the response below.

```
PCL
INFO FONTS
SELECT="<Esc>8U<Esc>s1p18.00v1s0b4148T<Esc>)78X"
LOCTYPE=4
LOCUNIT=1
```

8.5.11. Font extended response

The font extended response supplies a method to return the name and internal ID number of the font as well as the "SELECT=" line. It is the same as a font status response since "SELECT=", "SYMBOLSETS=", "LOCTYPE=", and "LOCUNIT=" are returned in the same way. With regard to a font extended request, it returns the two additional keywords, "DEFID=" and "NAME=" as follows.

"DEFID" specifies the internal ID number of the font which is shown on the test print (font list). This is the number which is used to select the font as the default font from the control panel of printer or from PJI. The "DEFID=" number is made of two parts, which are a location and an ID number. The locations which are likely are as follows;

```
I      - Internal
C      - Cartridge (printer with single cartridge)
Cn     - Cartridge (printer with multiple cartridge/card when n is specified by printer.)
S      - Permanent download fonts
```

For temporary download fonts, it returns "DEFID=NONE" because temporary download fonts do not have an internal ID number.

The printer assigns the internal ID number of a temporary download font with the Font ID (ESC*c#D) command. This internal ID number differs from the downloaded ID number assigned to a downloaded font.

It returns "NAME=" only for font extended status requests. The name of the font is the same as shown on the font printout.

For instance, it returns the font extended response for the printer's internal bitmap LetterGothic font and a downloaded unbound Portugal temporary font as follows.

```
PCL
INFO FONTS EXTENDED
SELECT="<Esc>(8U<Esc>(s0p10.00h12.0v0s0b0T"
DEFID="I 45"
NAME="Line Printer"
SELECT="<Ec>(s1p_v1s3b4111T<Esc>(7X"
SymbolSETS="0D, 0I, 0N, 0S, 0U, 1E, 1F, 1G,..."
DEFID=NONE
NAME="CG Palacio BdIt"
SELECT="..."
```

For instance, a font extended response with the location type set to 1(selected at present) where the font which is selected at present is the internal Pc Tennessee (18 point identified for printing) bold, returns the response as follows.

```
PCL
INFO FONTS EXTENDED
SELECT="<Esc>(8U<Esc>(s0p18.00h0s3b4101T"
DEFID="<Esc>(8U<Esc>s0p18.000s3b4101T"
DEFID="I 2"
NAME="PcTennessee Bd"
LOCTYPE=1
LOCUNIT=1
```

8.5.12. Macro response

The status response for macros indicates all of the macro IDs ("IDLIST=") for the macros in a particular location.

Status location type 1(selected at present) is an unused location for macros and an error is returned.

A macro status response may be shown as follows.

```
PCL
INFO MACROS
IDLIST="1, 3, 8, 29, 32"
```

8.5.13. Use-defined pattern response

The status response of user-defined patterns indicates all of the user-defined patterns and all of the user-defined pattern IDs ("IDLIST") for the patterns in a particular location.

A user-defined pattern response may be shown as follows.

```
PCL
INFO PATTERN
IDLIST="1, 2, 9, 13, 27, 456"
```

When the location type is specified to 1 (selected at present), "LOCTYPE=" and "LOCUNIT=" lines are added.

It returns the "LOCTYPE=" only for a status location type 1 requirement. It specifies the location type of the pattern which is selected at present.

It returns the "LOCUNIT=" only for a status location type 1 requirement. It specifies the location unit of the pattern which is selected at present.

A user-defined pattern response for the pattern selected at present may be shown as follows.

```
PCL
INFO PATTERN
IDLIST="88"
LOCTYPE=4
LOCUNIT=2
```

When the pattern selected at present is set to one of the internal HP-specified patterns, there is no number available and it returns the response "ERROR=NONE".

```
PCL
INFO PATTERNS
ERROR=NONE
```

8.5.14. Symbol set response

The symbol set response indicates all of the symbol set IDs ("IDLIST") for all of the symbol sets in the identified location. There can be bound and unbound scalable fonts in the identified location (type and unit).

A symbol set response may be shown as follows.

```
PCL
INFO SYMBOLSETS
IDLIST="0U, 2K, 8M, 11U"
```

Status location type 1 (selected at present) is an incorrect location for unbound font symbol sets and returns an error.

Example responses in this section for "SYMBOLSETS=" do not indicate the complete list of symbol sets which are available internally, but only a partial list . The internal symbol sets depend on the printer and might differ according to the printer.

8.5.15. Entity error codes

When an out-of-range value exists in the command value fields, or when the entity is not supported or does not exist, or the request is inadequate, the printer replies with one of four likely errors as follows:

```
Invalid Entity
Invalid Location
None
Internal Error
ERROR=INVALID ENTITY
```

When the identified entity type is not in the range or not supported, it returns an invalid entity error.

```
PCL
INFO ENTITY
ERROR=INVALID ENTITY
ERROR=INVALID LOCATION
```

When the entity type is correct, but the location (the type, the unit, or the combination) is not, or when the identified device is not installed, it returns an invalid location error.

```
PCL
INFO FONTS
ERROR=INVALID LOCATION
ERROR=NONE
```

When the entity type and location are correct, but there are not any entities of the identified type in the location, or when the type is not correct for the identified entity, it generates the NONE error response.

```
PCL
INFO SYMBOLSETS
ERROR=NONE
ERROR=INTERNAL ERROR
```

The status response for some requirements could be quite big. When status replies are requested, it returns an internal error if the printer runs out of memory as follows:

```
PCL
INFO SYMBOL SETS
ERROR=INTERNAL ERROR
```

8.5.16. Free space command

ESC*s1M (27) (42) (115) (48) (77) <1Bh><2Ah><73h><31h><4Dh>

The amount of memory which is free for use is returned by this command. Two values are returned: the total amount of free memory and the largest block of free memory.

When you send a value other than 1, an error ("ERROR = INVALID UNIT")is returned.

The Free Space command is sent to check the free memory space and you can acknowledge whether the printer has enough memory for a job or not before you execute your job. Also you can check the amount of memory which an entity or any other data has already used.

Free memory space will always be changing during different printing conditions.

For example, when the printer receives print data, it is stored in the printer memory and so the free space in the printer memory becomes smaller. After the data is printed, the printer memory becomes empty, so the free space becomes larger again.

Certain action is needed when you decide there is not enough memory to hold the data to be downloaded.

8.5.17. Font cache

In order to print characters from a scalable font, the printer changes the scalable character outlines into sized bitmaps. These bitmapped characters are produced on a character-by-character basis and the produced bitmapped characters are stored in memory. As it prints more pages using more fonts, more memory is consumed by the bitmaps. The bitmap characters used on the first page of a job can stay in memory till the end of a job. These stored bitmap characters are known as the font cache.

If a Brother HL-Series printer encounters a memory low condition, all of the font cache is automatically deleted. Also, font cache and temporary entities can be cleared by a Printer Reset command.

8.5.18. Memory status response

The total available memory is specified by "TOTAL=" and the largest continuous block size of available memory is specified by "LARGEST=".

```
PCL
INFO MEMORY
TOTAL = 10000
LARGEST = 3500
```

8.5.19. Memory error response

When the value field of the free memory command is out of range, the response for this command would be as follows;

```
PCL
INFO MEMORY
ERROR = INVALID UNIT
```

8.5.20. Flush all pages command

```
ESC&r#F (27) (38) (114) # (70) <1Bh><26h><72h>#<46h>
```

This command suspends accepting data from a PC and clears the user memory.

- #=0 suspends receiving data and clears all completed data. Incompleted data remains in the printers memory.
- #=1 suspends receiving data and clears all data remaining in the printer memory.

8.5.21. Echo command

```
ESC*s#X (27) (42) (115) # (88) <1Bh><2Ah><73h>#<58h>
```

This command is used to distinguish each request and response. In networking/sharing environments, some requests may be sent from a number of PCs to one printer. This command sends the user selected value to the printer and the printer can return the same value. Adding this command before the status request command allows this echo value to distinguish the corresponding status response.

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