UNISYS

AP 9215-1 Printer LaserJet+™ Emulation

Programming Reference Manual

August 1987
Distribution Code EQ
Printed in Japan
1205713

Priced Item

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AP 9215-1 Printer LaserJet+™ Emulation
Programming Reference Manual
Form Number 1205713
August 1987

Please change the following information in your copy of the manual described above.

********** Page 3-4 **********

Change Table 3-1 to read as follows:

Paper Size	Lines Per Page	
	6 lpi	8 lpi
Letter	1-66	1-83
A4	1-70	1-93
Legal	1-84	1-112

********** Page 3-5 **********

Change the Set Top Margin command Function to read as follows:

> This command sets the location of the top margin in terms of lines down from the top of the paper edge.

Change the first paragraph of the Example to read as follows:

> This example tells the printer to skip 6 lines at the top of each page. If the line pitch is set to 6 lines per inch (lpi), the resulting top margin will be 1 inch.

Delete Note 1 of the Set Top Margin command.

********** Page 3-6 **********

Change the second sentence of the Set Left Margin command Function to read as follows:

> The column position is calculated from the left edge of the printable area.

********** Page 3-7 **********

Change the first paragraph of the Set Left Margin command Example to read as follows:

> This example sets the left margin so the first character in each line will print in column 12. If you are using a 12 character-per-inch (cpi) font, the actual width of the margin will be 1 1/6 inches.

Delete Note 1 of the Set Left Margin command.

Change the second sentence of the Set Right Margin command Example to read as follows:

> The actual distance of the right margin from the left paper edge will depend on the width of the left margin.

********** Page 3-8 **********

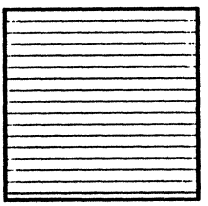
Delete Note 1 of the Clear Left and Right Margins command.

********** Page 7-8 **********

At the bottom of Figure 7-3, change "16+" to "16".

********** Page 9-6 **********

In Figure 9-2, change pattern #1 to the following:



#1

********** Page B-2 **********

Change the caption of Table B-1 to "Roman-8 Symbol Set."

********** Page B-3 **********

Change Table B-2 to "Table B-1. Roman-8 Symbol Set (continued)."

Change the Note to read as follows:

> Locations in Table B-1 that are blank do not have characters assigned to them.

********** Page C-2 **********

For the Page Origin mode, delete the second value, "Paper Edge."

In Note 2, delete the words "Page Origin."

Add the following note to the bottom of the page:

3 In the LaserJet+ emulation mode, the Page Origin mode is always set to "Printable Area." You do not have the option of setting the Page Origin to "Paper Edge" as you do in the Diablo 630 mode.

****

About This Manual

This manual is the Programming Reference Manual for the AP 9215-1 printer LaserJet+ emulation. The emulation program is contained in a card which can be inserted in the back of your printer. The style number for the LaserJet+ emulation card is B 9968-52.

Purpose

This manual explains how to install and use the emulation card that makes your AP 9215-1 printer emulate the Hewlett-Packard LaserJet+ printer.

Scope

This document includes instructions for the installation and removal of the emulation card, and information necessary to use the available features. Also included is information about the resident command set, fonts, interface, and other reference information.

This manual does not describe the special features of your laser printer or the way in which to control its functions from the operation panel. These are described in the *AP 9215-1 Printer Installation and Operations Guide.* Refer to that guide for details on setting the printer modes, interpreting error messages, replacing parts, and so forth.

Audience

This manual is intended for use by system administrators, programmers, and others who will use the AP 9215-1 printer with software written for the LaserJet+.

Prerequisites

Before using this manual, you should be familiar with the operation of the AP 9215-1 printer and should have read the *AP 9215-1 Printer Installation and Operations Guide.*

How to Use This Document

The reader should use this manual for installation of the AP 9215-1 printer LaserJet+ emulation card. After installation, consult various sections of this manual for reference information.

This manual is intended to be used as a supplement to your printer's installation and operations guide. This manual does not describe the special features of your laser printer, or the way in which to control its functions from the operation panel.

Organization

Section 1: Introduction to the LaserJet+ Emulation

Briefly describes printer emulations in general and the LaserJet+ emulation in particular; reviews the procedure for installing and removing the emulation card; and describes how to activate the LaserJet+ emulation mode.

Section 2: Using Control Codes and Escape Sequences

Explains how control codes and escape sequences are used, describes the available control codes, and explains the formatting and other conventions used with the escape sequences.

Section 3: Page Formatting Commands

Describes the commands which perform page formatting functions, such as setting margins and adjusting character and line spacing.

Section 4: Active Position Movement Commands

Describes commands which control the movement of the "active position," a numerical pointer that at any given time indicates the location of one dot within the maximum print area.

Section 5: Word Processing Commands

Explains how to use the commands which activate or control certain word processing functions such as underlining and printing multiple copies.

Section 6: Font Control and Management Commands

Describes commands for selecting and managing character fonts.

Section 7: Font Definition Commands

Describes the commands used to create and download fonts.

Section 8: Raster Graphics Commands

Describes the four commands that are used to produce graphics by controlling the printing of individual dots.

Section 9: Advanced Graphics Commands

Describes commands which allow the user to print ruled lines, predefined patterns, or shading.

Section 10: Macro Commands

Provides a detailed explanation of the commands used to create macros.

Section 11: Diagnostic Commands

Describes the commands used to reset the printer, perform an interface self-test, and print control codes.

Appendixes provide a summary of the commands; tables of the Roman-8 symbol set characters and locations; a description of the mode settings supported in the LaserJet+ emulation mode; and samples of the LaserJet+ emulation mode resident fonts.

Results

This manual should provide readers with the information they need to use the AP 9215-1 printer with most software written for the LaserJet+ printer.

Related Product Information

AP 9215-1 Printer Installation and Operations Guide (form 1205796).

Conventions Used in This Manual

In this manual, hexadecimal (or hex) numbers are indicated by angle brackets:

<1D>

When examples of commands are given, the hex code is shown on the first line and the equivalent ASCII character or control code is shown on the second line:

<1B>	<26>	<6C>	<33>	<44>
ESC	&	l	3	D

The angle brackets surrounding the hex values are used as a visual aid to separate each component of a command. Do not enter the angle brackets.

The symbol "#" refers to a variable field whose value is represented by a string of ASCII numbers.

Contents

Illustrations

Tables

Introduction to the LaserJet+ Emulation

This section briefly describes printer emulations in general and the LaserJet+ emulation in particular; reviews the procedure for installing and removing the emulation card; and describes how to activate the LaserJet+ emulation mode.

What Is a Printer Emulation?

A printer emulation is a program which allows one printer to imitate another. The first printer is then able to work with most software written for the second printer. An emulation program will **not** make one printer **identical** to another. Small differences in printer design usually prevent the emulating printer from functioning in the exact same way as the original printer. These small differences should not prevent you from using the printer emulation for most purposes.

The emulation program that comes with the printer is called the resident emulation. In the AP 9215-1 printer, the resident emulation imitates a Diablo® 630 printer.

The AP 9215-1 is able to emulate other printers through the use of emulation cards. The emulation card is contained in a small, flat plastic package about the size of a credit card. At one end of the package is a connector that has two rows of holes. When the emulation card is inserted in the back of the printer and the Emulation Mode is set to "Option," the AP 9215-1 will emulate the emulation card's printer rather than the Diablo 630. (Instructions for inserting the emulation card and setting the emulation mode appear later in this section.)

Diablo is a registered trademark of XEROX Corporation.

Things To Be Aware of when Using the LaserJet+ Emulation

In general, procedures for controlling printer functions from the indicator panel are the same in the LaserJet+ emulation mode as in the resident Diablo 630 mode. However, you should be aware of the following differences:

- The LaserJet+ mode supports only two print orientation modes, word processing portrait and landscape. There is no provision for a separate data processing mode such as the one supported by the Diablo 630 emulation.
- With the LaserJet+ mode, line pitch depends on the selected font; it cannot be selected by changing the mode setting.
- The LaserJet+ mode does not support the AP 9215-1 printer's optional font cartridges.

Consult Appendix C of this manual for the indicator panel mode settings that are supported in the LaserJet+ emulation mode.

Generally speaking, if a mode setting and a command apply to the same function (for example, the Auto Wrap Around mode setting and the ENABLE/DISABLE AUTOMATIC END-OF-LINE WRAP command), the command will take precedence over (override) the mode setting.

Installing the Emulation Card

Caution: Make sure the power to your printer is completely off before installing the emulation card. Installing the card while the power is on may damage the card.

1. Set the power switch on the left side of the printer to the OFF (O) position and wait until the indicator panel lights are completely off.
2. As you face the back of the printer, you will see a slot for the emulation card in the lower left corner. Slide the emulation card into the slot, making sure that the label side of the card is facing right. The end of the card will protrude slightly from the slot.

Activating the LaserJet+ Emulation Mode

To activate the LaserJet+ emulation, set the Emulation Mode to "Option." Instructions for doing this follow. For details about setting other printer modes, consult the *AP 9215-1 Printer Installation and Operations Guide.*

1. Set the printer power switch to the ON (I) position.
2. Press the On/Off Line button to place the printer in the off-line mode. The On-line indicator will go out and the message "Off Line" will appear in the display panel.
3. Press the Shift and Form Feed buttons simultaneously. The message "Mode Set" will appear in the display panel.
4. Press the Shift and Reset buttons simultaneously. The name of one of the printer modes will appear in the display panel.
5. Press the Form Feed button until "Emulation Mode" appears in the display panel.
6. Press the Test button until "Option" appears in the display panel.
7. Press the Form Feed button to return to the list of default modes.
8. Press the Shift and Form Feed buttons simultaneously. The message "Mode Set: Saved" will appear in the display panel.
9. Press the On/Off Line button to return the printer to on-line mode. The On-line indicator will light. The printer will now use the emulation specified by the emulation card instead of the resident (Diablo 630) emulation. The printer will also default to the emulation card emulation after turning on the printer or performing a hard reset.

Removing the Emulation Card

Caution: Make sure the power to your printer is completely off before removing the emulation card. Removing the card while the power is on may damage the card.

1 Set the printer power switch to the OFF (O) position and wait until the indicator panel lights are completely off.

2 Pull the card out of the slot in the back of the printer.

To return the printer to its resident Diablo 630 emulation mode, follow the procedure for "Activating the LaserJet+ Emulation Mode," except at Step 6 press the Test button until "Internal (D630)" appears in the display panel.

Using Control Codes and Escape Sequences

The AP 9215–1 printer uses special command sequences to select the various features available. This section explains how control codes and escape sequences are used, describes the available control codes, and explains the formatting and other conventions used with the escape sequences.

Entering Control Codes and Escape Sequences

The method for entering control codes and escape sequences varies depending on the keyboard, programming language, and software package you are using. Consult your computer or terminal documentation for instructions on entering control codes and escape sequences.

Control codes are embedded in your files by using the Control key, or its equivalent, with an ASCII character. Some keyboards are equipped with keys that already perform these functions. See "Control Codes" later in this section for a description of the available control codes.

The escape control code (ESC) is used with an ASCII character to form an escape sequence. Most escape sequences also include a parameter field whose value determines how the sequence operates. See "Escape Sequences" later in this section for the organization of the commands in this document.

General Information

Any feature that is activated will remain enabled until it is either disabled with an escape sequence or the printer is reset or turned off. For example, if the automatic underline feature is enabled, it will remain active until it is disabled with the appropriate escape sequence.

The printer ignores control codes and escape sequences that are not supported or not recognized.

Single-Byte ASCII Control Codes

BS (Backspace). This code moves the active position one column width to the left. The column width is determined by the current horizontal motion index (HMI) setting. The corresponding hexadecimal code is <08>.

CR (Carriage Return). This character moves the active position to the left margin of the same line. If the Line Termination mode has been set for CR=NL or the SET LINE TERMINATION MODE command has been set to 1 or 3, the active position also moves to the next line. The corresponding hexadecimal code for the carriage return is <0D>. For more information about the printer modes used with the LaserJet+ emulation, refer to Appendix C of this manual. The SET LINE TERMINATION MODE command is described in Section 5.

ESC (Escape). This code initiates an escape sequence. The corresponding hexadecimal code is <1B>.

FF (Form Feed). When the printer receives this code it prints out any data in the print buffer, ejects the sheet of paper, and advances the active position to the top margin on the next page. If the Line Termination mode has been set for LF=NL or the SET LINE TERMINATION MODE command has been set to 2 or 3, the active position also moves to the left margin. The corresponding hexadecimal code for the form feed is <0C>. The SET LINE TERMINATION MODE command is described in Section 5.

LF (Line Feed). This command moves the active position down to the next print line without changing the horizontal position. If the Line Termination mode has been set for LF=NL or the SET LINE TERMINATION MODE command has been set to 2 or 3, the active position also moves to the left margin. The corresponding hexadecimal code is <0A>. For more information about the printer modes used with the LaserJet+ emulation, refer to Appendix C of this manual. The SET LINE TERMINATION MODE command is described in Section 5.

SI (Shift In). This code switches printing to the primary character font. The corresponding hexadecimal code is <0F>.

SO (Shift Out). This code switches printing to the secondary character font. The corresponding hexadecimal code is <0E>.

Escape Sequences

The LaserJet+ emulation uses two kinds of escape sequences: those with parameters and those without parameters. Sequences with parameters include a variable field whose value determines how the sequence operates. Sequences without parameters consist entirely of character constants and always operate in the same way. Both types of sequences begin with the Escape character (hexadecimal <1B>, or 27 decimal).

Sequences with parameters have the following general format:

ESC X y # Z binary data

The individual fields in this format have the following meanings:

ESC:	The Escape character (hex <1B> or 27 decimal) which begins all escape sequences.
X:	Sequence with parameter character. This field consists of a single ASCII character ranging from ! (hex <21>) to / (hex <2F>). The presence of a character in this field indicates that the escape sequence includes a parameter.
y:	Group character. This field consists of a single ASCII character ranging from " (hex <22>) to ~ (hex <7E>). This character indicates the type of control function performed by the escape sequence.
#:	Value field. This field consists of an ASCII representation of a numeric decimal value. The field length is variable, depending on the number being specified, and may include the characters **0** (hex <30>) to **9** (hex <39>), + (hex <2B>), - (hex <2D>), and the decimal point (hex <2E>). The + and - signs are added in front of the numeric characters to indicate positive or negative values, and the decimal point is inserted in the string of numeric characters to show that the value includes a decimal fraction.
Z:	Terminating character. This field consists of a single ASCII character which determines the meaning of the value specified in the value field.
binary data:	Some escape sequences with parameters are followed by binary data. With such sequences, the number of bytes of binary data is specified in the value field.

All of the escape sequences for the LaserJet+ emulation are described in the following sections. Each description includes the command name, function, and format. Examples are provided where applicable.

The command format is represented in its ASCII form. Commands must be sent to the printer in hexadecimal form.

Examples are given in hexadecimal format. Each value is surrounded by angle brackets (<>). The angle brackets are used as a visual aid to separate the components of a command. Do not enter the angle brackets.

Combining Escape Sequences

To reduce the number of bytes sent to the printer from the host computer, you can combine related escape sequences into one string. The following rules apply:

- The first two characters following the ESC must be the same. The ESC and the first two characters are entered only once in the string.
- The last value for each individual escape sequence must be entered in lower case. The last value for the entire string must be entered in upper case.
- The string is executed in sequence from left to right.

The following is an example of combining two related escape sequences into a single string.

Example

Combining **ESC & l 1 0 E** and **ESC & l 7 0 F** results in the following single string:

ESC & l 1 0 e 7 0 F

Page Formatting Commands

Laser printers, as you know, print text one page at a time. These pages are printed in a given format, which includes such parameters as top and side margins, text length, vertical and horizontal spacing, and print orientation. This section of the manual describes the commands which perform these page formatting functions.

Paper Size and Default Margins

When the LaserJet+ emulation card is installed in the AP 9215-1 printer, the printer responds to all of the LaserJet+ formatting commands. Therefore, you can set paper size and page parameters for the AP 9215-1 in the same way as you would on the LaserJet+.

Keep in mind, however, that the printable areas of the LaserJet+ and AP 9215-1 printers differ slightly in width and height. Ordinarily, this will be of little practical importance. However, if the software you are using is designed specifically for the LaserJet+, the difference may result in improperly formatted pages.

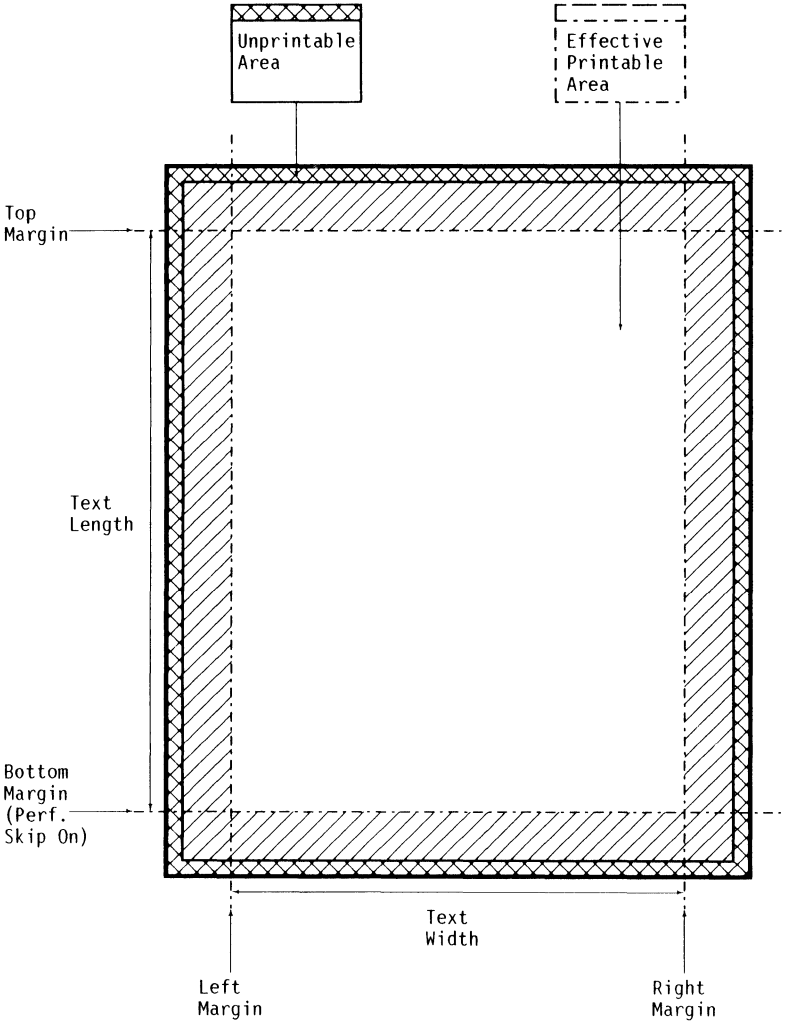
First of all, the default left margin is slightly narrower with the LaserJet+ than it is with the AP 9215-1. The LaserJet+'s left margin is .157 inch; the AP 9215-1's left margin is .167 inch (approximately 1/6 inch).

Secondly, the printable area of the LaserJet+ is slightly wider than that of the AP 9215-1. If you are using the default margin settings, this difference will have no effect, because the AP 9215-1's right margin has been set to provide the same line length given with the LaserJet+'s default margins. However, the maximum possible line length for the LaserJet+ is greater than that for the AP 9215–1. If you try to use the LaserJet+'s maximum line length, you will move into the unprintable margin area of the AP 9215-1 and you may lose data.

Finally, the width of the unprintable areas at the top and bottom of the page is slightly greater with the LaserJet+ than with the AP 9215-1. This means that it is possible to print more lines per page with AP 9215-1 than with the LaserJet+. To do so, however, you must change the default top margin and text length settings. (Text length is the number of lines that can be printed between the top margin and the point at which printing moves to the next page. The LaserJet+ and the AP 9215-1 resident emulation modes provide the same default top margin and text length settings.)

Figure 3-1 illustrates the relationship between the margins, text length, and printable area.

Figure 3-1 **Printable Area**



Set Page Length (Paper Size)

Function This command sets the page length (paper size). When this command is used, the text length and top, left, and right margins are set to their default values.

Format ESC & l # P

Parameter

- The number of lines per page. Table 3-1 lists the allowable lines-per-page values for each paper size usable for the AP 9215-1 printer.
If this parameter is specified as 0, or as a value that exceeds the maximum, the default value for the current paper size is used.

Example This example sets the paper size to 11 inches when 6 lines per inch (lpi) is in effect. (11 inches x 6 lpi = 66 lines.) Note that with the default top margin and text length, this results in 60 printed lines per page.

<1B>	<26>	<6C>	<36>	<36>	<50>
ESC	&	l	6	6	P

Table 3-1 **Allowable Lines Per Page**

Paper Size	Lines Per Page	
	6 lpi	8 lpi
Letter	61-66	81-83
A4	67-70	89-93
Legal	71-84	94-112

Notes:

1 If the value of # does not fall in the allowable range of lines per page for the currently installed paper size, an error message will appear on the indicator panel when the first page is printed.

2 The value of # is determined relative to the current line spacing. Therefore, set the line spacing before setting the paper size. If you set the line spacing after setting the paper size, the paper size will not be affected.

3 When the printer receives this command, it prints out any data in the buffer before resetting the paper size. Therefore, send this command before sending any printable text on the page.

4 You can change the line spacing setting using the vertical spacing commands discussed later in this section.

Set Top Margin

Function

This command sets the location of the top margin in terms of lines down from either the top edge of the actual page or the top of the printable area, depending on the setting of the Page Origin mode.

Format

ESC & l # E

Parameter

- The number of lines to skip at the top of the page in the range from 0 to the page length. The actual size of the margin is dependent on the current line spacing.

Example

This example tells the printer to skip 6 lines at the top of each page. If the line pitch is set to 6 lines-per-inch (lpi) and the Page Origin is set at "Paper Edge," the resulting top margin will be 1 inch. If the Page Origin is set at "Printable Area," the resulting top margin will be 1 1/6 inches (1/6 inch for the unprintable area + 6 lines at 6 lpi).

<1B>	<26>	<6C>	<36>	<45>
ESC	&	l	6	E

Notes:

1 If the Page Origin is set for "Paper Edge," do not specify a top margin of 0 or 1. If you do, the first line of data on each page will fall in the unprintable area and data will be lost.

2 When the top margin is set, the text length is automatically adjusted. (For example, if the top margin is moved down by five lines, the text length is automatically reduced by five lines.)

3 This command can be initiated from any position on the page. Printing of the current page, however, will start from the active position at the time this command was sent, unless you also send a command to move the active position back to the new top margin. Therefore, send the top margin command only when the active position is on the same line as the new top margin.

Set Text Length

Function This command sets the length of the page area in terms of number of lines from the top margin. The actual size of the text length in inches is relative to the top margin and current line spacing.

Format ESC & l # F

Parameter

- The number of lines per page.

Example This example sets the page length to 9 inches at 6 lpi.
1. 9 inches x 6 lpi = 54 lines per page
2. Convert 54 into hex = <35> <34>

<1B>	<26>	<6C>	<35>	<34>	<46>
ESC	&	l	5	4	F

Notes:

1 The text length is automatically adjusted whenever the top margin is changed. Therefore, set the top margin before setting the text length.

2 If a text length greater than the page length is set, the command is ignored.

Set Left Margin

Function This command sets the left margin at the column position specified by parameter #. The column position is calculated from either the left paper edge or the left edge of the printable area, depending on the setting of the "Page Origin" mode.
Column width depends on the pitch of the selected font. With proportional fonts, column width is defined as the width of the space character.

Format ESC & a # L

Parameter

- The column number where the first character in each line of text prints. The value for # can be any column number within the maximum number of columns for the current paper size. (To determine the maximum number of columns, take the width of the paper, subtract 1/6 inch for each of the two side unprintable areas, and multiply the result by the character pitch.)
The default value for # is 1.

Example

This example sets the left margin so the first character in each line will print in column 12. If you are using a 12 character per inch (cpi) font and the Page Origin is set to "Paper Edge," the actual width of the left margin will be 1 inch. If the Page Origin is set to "Printable Area," the actual width will be 1 1/6 inches.

<1B>	<26>	<61>	<31>	<32>	<4C>
ESC	&	a	1	2	L

Notes:

1 If the Page Origin is set for "Paper Edge," do not specify a left margin of 1, 2, or 3, depending on the character spacing. If you do, the first few characters of each line, which cannot print in the paper's unprintable area, will overprint at the left edge of the printable area and data will be lost.

2 If the value for # exceeds the maximum number of columns or specifies a position to the right of the currently specified right margin, the command is ignored.

Set Right Margin

Function

This command sets the right margin as number of columns from the left edge of the printable area.
Column width depends on the pitch of the selected font. With proportional fonts, column width is defined as the width of the space character.

Format

ESC & a # M

Parameter

- The column number where the last character in each line of text prints. The value for # can be any column number within the maximum number of columns for the current paper size. (To determine the maximum number of columns, take the width of the paper, subtract 1/6 inch for each of the two side unprintable areas, and multiply the result by the character pitch.)

Example

This example sets the right margin so the last character in each line will print in column 78. The actual distance of the right margin from the left paper edge will depend on the Page Origin setting and the width of the left margin.

<1B>	<26>	<61>	<37>	<38>	<4D>
ESC	&	a	7	8	M

Notes:

1 If the value for # exceeds the maximum number of columns or specifies a position to the left of the currently specified left margin, the command is ignored.

2 In portrait orientation, the default right margin is 8 inches to the right of the default left margin. This distance does not depend on the currently selected character pitch; when a new pitch is selected, the physical location of the margin remains unchanged, although this distance in terms of columns is internally redefined.

Clear Left and Right Margins

Function This command clears the left and right margins and resets them to their default values (that is, column 1 for the left margin and 8 inches to the right of the left margin for the right margin).

Format ESC 9

Notes:

1 If the Page Origin is set to "Paper Edge," the default left margin will be in the unprintable area of the page. Therefore, after sending the ESC 9 command, either reset the Page Origin to "Printable Area" or reset the left margin.

2 To move the active position to the new left margin, send a CR control code (hex<0D>) **after** sending ESC 9.

Perforation Skip Mode ON/OFF (Disable Text Length Setting)

Function This command controls the perforation skip mode. If set to ON, the page is ejected when a line feed or half-line feed moves the active position past the text length. If set to OFF, the text length is ignored and the page is ejected when the active position moves into the unprintable area of the page.

Format ESC & l # L

Parameter

# - Perforation skip mode.
# = 1: ON
# = 0: OFF
Default = 1

Note: If you turn the perforation skip mode OFF, the text length setting will not become effective again until you turn the mode back ON. This applies even if you change the text length after turning perforation skip OFF.

Set HMI

Function

This command sets the horizontal motion index (HMI). The HMI determines the distance the active position moves across the page after each character.
This command overrides the default HMI. For example, if the currently selected font is 12 cpi (HMI = 1/12 inch) and you use this command to reset the HMI to 1/10 inch, the 12 cpi font will be printed at 10 cpi. However, when this command is used with a proportional font, only the HMI for the space character is changed.

Format

ESC & k # H

Parameter

- The amount of horizontal movement in increments of 1/120 inch. The value of # can range from 0 to 126 and can include up to 4 decimal places.
The default HMI is the width of the space character of the selected font.

Example

This example sets the HMI to 1/15 inch. The active position will move 1/15 inch for every character. You must first convert 1/15 inch into a multiple of 1/120 inch (1/15 = 8/120).

<1B>	<26>	<6B>	<38>	<48>
ESC	&	k	8	H

Note: The new HMI is canceled when you set a different orientation or symbol set; change the character pitch, height, or spacing (proportional/non-proportional); or switch between primary and secondary fonts using Shift In or Shift Out.

Vertical Spacing: Set Lines Per Inch

Function

This command sets the vertical spacing in lines per inch (lpi). When this setting is in effect, it is used to compute the page length, text length, and size of the top margin.
The lpi setting remains in effect until a new value is set using the SET VMI command or the printer is reset or turned off.

Format

ESC & l # D

Parameter

- The line spacing increment in terms of lines per inch. Valid values are 1, 2, 3, 4, 6, 8, 12, 16, 24, 48. The default is 6 lpi. If any other value is specified, the command is ignored.

Example

This example sets the vertical spacing to 3 lpi. This is comparable to double-spacing with a typewriter.

<1B>	<26>	<6C>	<33>	<44>
ESC	&	l	3	D

Notes:

1 This setting is not affected by font selection.

2 The vertical motion index (VMI) can also be set directly using the SET VMI command.

Vertical Spacing: Set VMI

Function

This command sets the vertical spacing directly in increments of 1/48 inch. This command allows for more flexible vertical spacing than is possible with the SET LPI command. This setting, when in effect, is used to compute the page length, text length, and size of the top margin.
When the printer receives a line feed (LF) command, the active position moves down the page vertically the distance of the current VMI setting.

Format

ESC & l # C

Parameter

- The amount of vertical movement in increments of 1/48 inch. The value of # can range from 0 to 126 and can include up to 4 decimal places.

Example

This example sets the VMI at 1/10 inch (that is, 10 lines per inch).

1. Convert 1/10 inch into a multiple of 1/48 inch (1/10 = 4.8/48).
2. Convert 4.8 into hex = <34> <2E> <38>

<1B>	<26>	<6C>	<34>	<2E>	<38>	<43>
ESC	&	l	4	.	8	C

Notes:

1 The vertical motion index (VMI) setting remains in effect until a new value is set using the SET LPI command or the printer is reset or turned off.

2 This setting is not affected by font selection.

3 The VMI can also be set using the SET LPI command.

Set Page Orientation

Function

This command sets the page orientation to either portrait or landscape. Characters are automatically rotated to match the selected page orientation.

Format

ESC & l # O

Parameter

# - Page orientation.
# = 0: Portrait
# = 1: Landscape
Default = 0

Notes:

1 It is not possible to print in both orientations on the same page. Therefore, send this command only at the beginning of a page. Otherwise, this command will cause an immediate Form Feed and Carriage Return and move the active position to the beginning of a new page.

2 Changing the page orientation returns the margin and text length settings, as well as the HMI and VMI, to their default values. The active position moves to the point where the top and left margins intersect.

3 You can change the power-on default setting for the page orientation by changing the Printer Mode setting. For the procedure, refer to the *AP 9215-1 Printer Installation and Operations Guide*.

Movement Commands

The active position (sometimes abbreviated "AP") is a numerical pointer that at any given time indicates the location of one dot within the maximum printable area. The active position can be moved to any point on a page. This is done within the memory of the printer, which stores all data for a given page until the page is printed. The active position can be moved vertically or horizontally. The distance by which the active position is to be moved can be expressed in terms of inches, columns, lines, or dots. The destination can be expressed in either absolute terms, or in relation to the current position.

Since these movements "take place" in the printer's memory, previous positions can be stored and recalled. This is done using the "push/pop position" command.

This section describes the use of active position movement commands. Commands for horizontal movement are presented first, followed by commands for vertical movement. The push/pop position command is discussed last.

Bear in mind that certain vertical and horizontal movement commands can be combined, since the sequences start with the same escape codes. For example, both vertical line and horizontal column positions can be defined in a single string. This is shown in the "push/pop position" program example at the end of this section.

Move AP Horizontally (By Columns)

Function

This command moves the active position horizontally in terms of column units; the vertical position is unchanged. The new position can be expressed in relation to either the current position or the left edge of the printable area.

Format

ESC & a # C

Parameter

- The direction and distance of active position movement, expressed as a string of ASCII numeric characters. This string is preceded by a "+" sign to move to the right, or a "-" sign to move left. If the sign is omitted, the value of # represents the number of columns from the left edge of the printable area, where the left edge is column 0.

Examples

1. This example moves the active position to column 20 of the current line. You must first convert 20 into hexadecimal form (<32> <30>).

<1B>	<26>	<61>	<32>	<30>	<43>
ESC	&	a	2	0	C

2. This example moves the active position 15 columns to the right of its current position.

<1B>	<26>	<61>	<2B>	<31>	<35>	<43>
ESC	&	a	+	1	5	C

Notes:

1 The physical width of the columns is determined by the character pitch of the currently selected font.

2 If you specify a point outside the printable area, the active position moves to the left or right printable area edge that is closest to the point specified. Left and right margins are ignored.

Move AP Horizontally (By Decipoints)

Function

This command moves the active position horizontally in 1/720 inch increments called decipoints; the vertical position is unchanged. The new position can be expressed in relation to either the current position or the left edge of the printable area.

Format

ESC & a # H

Parameter

- The direction and distance of active position movement, expressed as a string of ASCII numeric characters. This string is preceded by a "+" sign to move to the right, or a "-" sign to move left. If the sign is omitted, the value of # represents the number of decipoint columns from the left edge of the printable area, where the left edge is column 0. The decipoint values can be expressed to two decimal places (that is, 1/72,000-inch units). Fractional decipoints are approximated to within the 300 dots per inch resolution of the printer.

Examples

1. This example moves the active position to the point 2 inches from the left edge of the printable area.
   1. Convert 2 inches into decipoints (2 inches = 1440/720 inches = 1440 decipoints).
   2. Convert 1440 into hex = <31> <34> <34> <30>

<1B>	<26>	<61>	<31>	<34>	<34>
ESC	&	a	1	4	4
<30>	<48>				
0	H				

2. This example moves the active position 1/480 inch to the left of the current position.
   1. Convert 1/480 inch into decipoints (1/480 inch = 1.5/720 inch = 1.5 decipoints).
   2. Convert -1.5 to hex = <2D> <31> <2E> <35>

<1B>	<26>	<61>	<2D>	<31>	<2E>
ESC	&	a	-	1	.
<35>	<48>				
5	H				

Notes:

1 The new active position can be outside the left or right margins, so long as it is within the printable area.

2 If you specify a point outside the printable area, the active position moves to the left or right printable area edge that is closest to the point specified. Left and right margins are ignored.

Move AP Horizontally (By Dots)

Function

This command moves the active position horizontally in 1/300 inch dots; the vertical position is unchanged. These dots represent the 300 dots per inch (dpi) resolution of the printer. The new position can be expressed in relation to either the current position or the left edge of the printable area.

Format

ESC * p # X

Parameter

- The direction and distance of active position movement, expressed as a string of ASCII numeric characters. This string is preceded by a "+" sign to move to the right, or a "-" sign to move left. If the sign is omitted, the value of # represents the number of dots from the left edge of the printable area, where the left edge is column 0.

Example

This example moves the active position 1/20 inch to the right of the current position.

1. Convert 1/20 inch into number of dots (1/20 = 15/300 = 15 dots).
2. Convert +15 to hex = <2B> <31> <35>

<1B>	<2A>	<70>	<2B>	<31>	<35>	<58>
ESC	*	p	+	1	5	X

Notes:

1 The new active position can be outside the left or right margins, so long as it is within the printable area.

2 If you specify a point outside the printable area, the active position moves to the left or right printable area edge that is closest to the point specified. Left and right margins are ignored.

Move AP Vertically (By Lines)

Function

This command moves the active position vertically in terms of number of lines; the horizontal position is unchanged. The new position can be expressed in relation to either the current position or the top edge of the printable area.

Format

ESC & a # R

Parameter

- The direction and distance of active position movement, expressed as a string of ASCII numeric characters. This string is preceded by a "+" sign to move down or a "-" sign to move up. If the sign is omitted, the value # represents the number of lines from the top edge of the printable area, where the top edge is line 0.

Examples

1. This example moves the active position to line 20. You must first convert 20 to hex form (<32> <30>).

<1B>	<26>	<61>	<32>	<30>	<52>
ESC	&	a	2	0	R

2. This example moves the active position 15 lines down from the current position. You must first convert +15 to hex form (<2B> <31> <35>).

<1B>	<26>	<61>	<2B>	<31>	<35>	<52>
ESC	&	a	+	1	5	R

Notes:

1 The physical width of the lines is determined by the most recent lpi or VMI setting.

2 If you specify a point above the printable area, the active position moves to the top edge of the printable area.

3 If you specify a point below the bottom edge of the printable area using the "+" sign, the current page is printed and ejected, and the active position moves onto a new page.

4 If you specify a point below the bottom edge of the printable area without the "+" sign, the text length setting is ignored, and the active position moves as far as the bottom edge.

Move AP Vertically (By Decipoints)

Function

This command moves the active position vertically in 1/720 inch increments called decipoints; the horizontal position is unchanged. The new position can be expressed in relation to either the current position or the top edge of the printable area.

Format

ESC & a # V

Parameter

- The direction and distance of active position movement, expressed as a string of ASCII numeric characters. This string is preceded by a "+" sign to move down, or a "-" sign to move up. If the sign is omitted, the value of # represents the number of decipoint lines from the top edge of the printable area, where the top edge is 0.
The decipoint values can be expressed to two decimal places (that is, 1/72,000 inch). Fractional decipoints are approximated to within the 300 dpi resolution of the printer.

Examples

1. This example moves the active position 2 inches from the top edge of the printable area.
   1. Convert 2 inches into decipoints (2 inches = 1440 decipoints).
   2. Convert 1440 to hex = <31> <34> <34> <30>

<1B>	<26>	<61>	<31>	<34>	<34>
ESC	&	a	1	4	4
<30>	<56>				
0	V				

2. This example moves the active position 1/20 inch below the current position.
   1. Convert 1/20 inch into decipoints (1/20 inch = 36 decipoints).
   2. Convert +36 to hex = <2B><33><36>

<1B>	<26>	<61>	<2B>	<33>	<36>	<56>
ESC	&	a	+	3	6	V

Notes:

1 If you specify a point above the printable area, the active position moves to the top edge of the printable area.

2 If you specify a point below the bottom edge of the printable area using the "+" sign, the current page is printed and ejected and the active position moves onto a new page.

3 If you specify a point below the bottom edge of the printable area without the "+" sign, the active position moves as far as the bottom edge, and the text length setting is ignored.

Move AP Vertically (By Dots)

Function

This command moves the active position vertically in 1/300 inch dots; the horizontal position is unchanged. These dots represent the 300 dpi resolution of the printer. The new position can be expressed in relation to the current position or the left edge of the printable area.

Format

ESC * p # Y

Parameter

- The direction and distance of active position movement, expressed as a string of ASCII numeric characters. This string is preceded by a "+" sign to move down, or a "-" sign to move up. If the sign is omitted, the value of # represents the number of dots from the top edge of the printable area, where the top edge is line 0.

Examples

1. This example moves the active position 2 inches from the top edge of the printable area.
   1. Convert 2 inches into dots (2 inches = 600 dots).
   2. Convert 600 to hex = <36> <30> <30>

<1B>	<2A>	<70>	<36>	<30>	<30>	<59>
ESC	*	p	6	0	0	Y

2. This example moves the active position 1/20 inch below the current position.
   1. Convert 1/20 inch into dots (1/20 inch = 15 dots).
   2. Convert +15 into hex = <2B> <31> <35>

<1B>	<2A>	<70>	<2B>	<31>	<35>	<56>
ESC	*	a	+	1	5	V

Notes:

1 The new active position can be above the top margin or beyond the area set as the text length as long as it is within the printable area.

2 If you specify a point outside the printable area, the active position moves to the top or bottom edge of the printable area, whichever is closer to the point specified.

3 Moving the active position down with this command will not cause the printer to eject the current page.

Half-Line Feed

Function This command moves the active position down by one half of a line. The physical distance of this movement is one half of the line-feed distance most recently set by the lpi or VMI commands.

Format ESC =

Push/Pop Position

Function This command stores and recalls up to 20 active positions in the printer's memory. The last position stored (pushed) is the first position recalled (popped).
The printer saves this information when the current page is printed. Therefore, this command can store positions from more than one page or can return to positions from previous pages.

Format ESC & f # S

Parameter

- # = 0: Store the current active position.
= 1: Move the active position to the last position stored.

Examples

1. This example stores ("pushes") the current active position.

<1B>	<26>	<66>	<30>	<53>
ESC	&	f	0	S

2. This example moves ("pops") the active position to the last position stored in the stack.

<1B>	<26>	<66>	<31>	<53>
ESC	&	f	1	S

3. The following short program stores three active positions and recalls them in reverse order. Note that the first position stored is the last recalled and vice-versa. Also note, in lines 10, 40, 70, and 100, the way in which horizontal and vertical positioning commands can be combined.

```
10 LPRINT CHR$(27);"&a100h100V";      :'Move to position (100,100)
20 LPRINT CHR$(27);"&f0S";            :'Store position 1
30 LPRINT "100,100";
40 LPRINT CHR$(27);"&a200h200V";      :'Move to position (200,200)
50 LPRINT CHR$(27);"&f0S";            :'Store position 2
60 LPRINT "200,200";
70 LPRINT CHR$(27);"&a300h300V";      :'Move to position (300,300)
80 LPRINT CHR$(27);"&f0S";            :'Store position 3
90 LPRINT "100,100";
100 LPRINT CHR$(27);"&a400h400V";     :'Move to position (400,400)
110 LPRINT CHR$(27);"&f1S";           :'Recall position 3
120 LPRINT "----------";
130 LPRINT CHR$(27);"&f1S";           :'Recall position 2
140 LPRINT "----------";
150 LPRINT CHR$(27);"&f1S";           :'Recall position 1
160 LPRINT "----------";
170 LPRINT CHR$(12)
```

Word Processing Commands

This section explains how to use the commands which activate or control certain word-processing functions. The functions performed by these commands include:

- Setting the line termination mode
- Setting the automatic end-of-line wrap
- Underlining
- Setting the number of copies

Set Line Termination Mode

Function This command sets the way the printer will respond to Line Feed (LF), Carriage Return (CR), and Form Feed (FF) codes. Refer to Table 5-1.

Format ESC & k # G

Parameter

- Specifies the line termination mode. The valid values are 0, 1, 2, or 3. These values correspond with Table 5-1. The default setting is 0.

Example This example executes both a carriage return and a line feed when a carriage return is received.

<1B>	<26>	<6B>	<31>	<47>
ESC	&	k	1	G

Table 5-1 **Line Termination Modes**

#	LF	CR	FF
0	LF	CR	FF
1	LF	CR + LF	FF
2	LF + CR	CR	FF + CR
3	LF + CR	CR + LF	FF + CR

Enable/Disable Automatic End-of-Line Wrap

Function This command executes a carriage return and line feed when the active position moves outside the right margin.

Format ESC & s # C

Parameter

# - # = 0: Enable end-of-line wrap
# = 1: Disable end-of-line wrap
Default = 1

Start Automatic Underlining

Function	When enabled, this command automatically underlines all succeeding characters and spaces until the command is disabled with ESC & d @.
Format	ESC & d D

Note: If the active position is moved to the right by a horizontal positioning command while the automatic underlining function is enabled, any intervening spaces will be underlined.

End Automatic Underlining

Function	This command disables the automatic underlining feature. The default setting is to have the feature disabled.
Format	ESC & d @

Set Number of Copies

Function	This command prints multiple copies of each page until the command is disabled. The command can be sent at any point in the data stream and affects the current page as well as subsequent pages.
Format	ESC & l # X
Parameter	
# -	The number of copies ranging from 1 to 99.

Note: This command does not produce collated sets. For example, if you specify 3 copies of each page, the printer will print 3 copies of page 1, followed by 3 copies of page 2, and so on.

Paper Input Control

Function

The LaserJet+ uses this command to control the feeding and ejecting of paper to and from the printer. Because of the differences in hardware between the LaserJet+ and the AP 9215-1 printer, these commands are not needed and are consequently not supported. You can control paper feed and eject using the paper input trays and the Form Feed button on the operation panel.

Format

ESC & l # H

Parameter

- If the AP 9215-1 printer receives this command with the parameter # = 0, the printer executes a Carriage Return - Form Feed.
If the AP 9215-1 printer receives this command with any value other than 0 specified for the parameter, the printer ignores the command.

Font Control and Management Commands

The LaserJet+ emulation mode provides a number of commands for selecting and managing character fonts. This section describes these commands. For information about creating fonts and downloading them from the host computer, consult Section 7, "Font Definition Commands."

Fonts are collections of characters with uniform characteristics. With the LaserJet+ emulation, your AP 9215–1 printer has the ability to print several different fonts. The fonts are Courier 10 LJ, Prestige Elite 12 LJ, Letter Gothic 16.7 LJ, and Century PS LJ, all of which can be used in either portrait or landscape orientation. (For samples of these fonts, see Appendix D.) You can download other fonts to the printer from the host computer. You can use a maximum of 16 different fonts per page.

Notes:

1 The resident fonts that are part of the AP 9215–1 printer's resident Diablo 630 emulation cannot be used in the LaserJet+ emulation mode.

2 Fonts contained in font cartridges cannot be used in the LaserJet+ emulation mode.

You can select a font by using escape sequences to specify the font's characteristics. These characteristics, listed in order of priority, are:

- print orientation (portrait or landscape)
- symbol set (Roman-8, Line Draw, USASCII, and so on)
- proportional or fixed (non-proportional) spacing
- print pitch (for fixed pitch fonts only)
- character height (point size)
- character style (upright or italic)
- stroke weight (light, medium, or bold)
- typeface (Courier, Pica, Elite, and so on)

When two or more characteristics are specified by a string of escape sequences, the printer checks all fonts present for the specified characteristic that has the highest priority and drops from consideration those fonts not having this characteristic. This process of elimination continues to progressively lower levels of priority until only one font remains; this font is then selected.

A font does not have to completely match the characteristics specified by the command to be selected. If any font present has the characteristic(s) with the highest priority, it will be selected. If no font has the specified characteristic with the highest priority, the active font remains unchanged.

Commands are also available to specify characteristics for both a primary font and a secondary font. Primary and secondary fonts are explained later in this section. Once a primary and secondary font have been designated, you can switch printing back and forth between them with the Shift In and Shift Out codes.

Set Page Orientation

Orientation describes the way the lines of type appear in relation to the sides of the page. There are two orientations, portrait, which is the default, and landscape. Portrait orientation prints lines of text parallel to the short side of the page; landscape orientation prints lines of text parallel to the long side of the page.

Note: The use of this command is explained in Section 3, "Page Formatting Commands". It is mentioned here because it affects the font selection process.

Select Symbol Set (Character Set)

Symbol sets (known as character sets in the Diablo 630 and some other printer emulations) are sets of characters that are mapped to locations in the printer's memory. The LaserJet+ has two categories of symbol sets, 7-bit and 8-bit sets. The 7-bit set is able to print characters assigned to codes in the range <00> to <7F>. The 8-bit set is also able to print characters assigned to the codes in the range <00> to <7F>, as well as those assigned to <80> to <FF>.

Roman-8 is the symbol set for all fonts in the LaserJet+ emulation card. A table of the characters in the Roman-8 symbol set is in Appendix B.

For applications requiring typefaces or symbol sets not supported by the resident fonts, a variety of fonts are available which you can download to the printer. Table 6-1 lists these symbol sets and the commands for accessing them. For these commands to be effective, one or more fonts having the requested symbol set must be present in the printer.

Table 6-1 **Select Symbol Set Commands**

Symbol Set	Primary Font	Secondary Font
8-bit Symbol Sets		
Roman-8	ESC (8 U	ESC) 8 U
Kana-8	ESC (8 K	ESC) 8 K
Math-8	ESC (8 M	ESC) 8 M
ANSI-8	ESC (9 U	ESC) 9 U
7-bit Symbol Sets		
USASCII	ESC (0 U	ESC) 0 U
Line Draw	ESC (0 B	ESC) 0 B
Math Symbols	ESC (0 A	ESC) 0 A
US Legal	ESC (1 U	ESC) 1 U
Roman Extension	ESC (0 E	ESC) 0 E
ISO Denmark/Norway	ESC (0 D	ESC) 0 D
ISO United Kingdom	ESC (1 E	ESC) 1 E
ISO France	ESC (0 F	ESC) 0 F
ISO Germany	ESC (0 G	ESC) 0 G
ISO Italy	ESC (0 I	ESC) 0 I
ISO Sweden/Finland	ESC (0 S	ESC) 0 S
ISO Spain	ESC (1 S	ESC) 1 S

Select Proportional/Fixed Spacing

Function

This command selects proportional or fixed spacing for the primary and secondary fonts.

Format

1. ESC (s # P
   Use this format to select spacing for the primary font.
2. ESC) s # P
   Use this format to select spacing for the secondary font.

Parameter

# - Font spacing.
# = 0: Fixed spacing
# = 1: Proportional spacing
Default = 0

Set Character Pitch

Function This command sets the pitch in characters per inch (cpi) for the primary and secondary fonts.

Format

1. ESC (s # H
   Use this format to select pitch for the primary font.
2. ESC) s # H
   Use this format to select pitch for the secondary font.

Parameter

- Pitch value. The value specified can have up to 2 decimal places. Values to specify for the resident fixed-pitch fonts are:
Courier 10 LJ: **10**
Prestige Elite 12 LJ: **12**
Letter Gothic 16.7 LJ: **16.66**
Default pitch = 10 cpi

Example This example specifies 10 cpi for the primary font.

<1B>	<28>	<73>	<31>	<30>	<48>
ESC	(	s	1	0	H

Notes:

1 If no font with the specified pitch is present, the font with the next largest pitch is selected.

2 If a proportional font has been selected with the SELECT PROPORTIONAL/ FIXED SPACING command, these commands are ignored.

Set/Cancel Compressed Pitch

Function This command sets the compressed pitch mode. Compressed pitch is the equivalent to 16.66 cpi. This command provides an alternate method of selecting the print pitch.

Format ESC & k # S

Parameter

- Compressed pitch mode.
= 2: Set compressed pitch (16.66 cpi)
= 0: Set standard pitch (10 cpi)

Note: The mode selected affects both the primary and secondary fonts.

Set Character Height (Point Size)

Function

This command selects the character height for both the primary and secondary fonts.

Format

1. ESC (s # V
   Use this format to select the character height for the primary font.
2. ESC) s # V
   Use this format to select the character height for the secondary font.

Parameter

- The character height value in points (one point = 1/72 inch). The value specified for # can be up to two decimal places. Values to specify for the resident fonts are:
Courier 10 LJ: **12**
Prestige Elite 12 LJ: **10**
Letter Gothic 16.7 LJ: **8.5**
Century PS LJ: **10**
Default = 12 points

Example

This example selects a font with a height of 10 points for the primary font.

<1B>	<28>	<73>	<31>	<30>	<56>
ESC	(	s	1	0	V

Note: If no font with the specified character height is present, the font with the closest size is selected.

Select Character Style (Upright/Italic)

Function

This command selects the character style, either upright or italic, of the primary and secondary fonts.

Format

1. ESC (s # S
   This format selects the character style for the primary font.
2. ESC) s # S
   This format selects the character style for the secondary font.

Parameter

# - Character style.
# = 0: Upright
# = 1: Italic
Default = 0

Note: If no font with the selected style is present, this command is ignored.

Select Stroke Weight

Function

This command selects the stroke weight (character boldness) for printing.

Format

1. ESC (s # B
   This format selects the stroke weight for the primary font.
2. ESC) s # B
   This format selects the stroke weight for the secondary font.

Parameter

# - Stroke weight value.
# = -7 to -1: Light
# = 0: Medium
# = 1 to 7: Bold
Default = 0
Stroke weights for the resident fonts are:
Courier 10 LJ: **0**
Prestige Elite 12 LJ: **0**
Letter Gothic 16.7 LJ: **-3**
Century PS LJ: **0**

Notes:

1 The normal stroke weight for bold fonts is 3; that for light fonts is -3.

2 If no font with the selected stroke weight is present, the font with the closest weight is selected.

Select Typeface

Function

These commands select the typeface for the primary and secondary fonts.

Format

1. ESC (s # T
   This format selects the typeface for the primary font.
2. ESC) s # T
   This format selects the typeface for the secondary font.

Parameter

- Typeface code. (See Table 6-2 for a list of typeface codes and their meanings.)

Table 6-2 **Typeface Codes**

#	Typeface
0	Line printer (Letter Gothic 16.7 LJ)
1	Pica
2	Elite (Prestige Elite 12 LJ)
3	Courier (Courier 10 LJ)
4	Helvetica
5	Times Roman
6	Gothic
7	Script
8	Prestige
9	Caslon (Century PS LJ)
10	Orator

Notes:

1 In Table 6-2, typefaces of resident fonts are indicated in parentheses. Other typefaces can only be selected if a matching font has been downloaded to the printer.

2 If no font of the specified typeface is present, this command is ignored.

Examples of Font Selection

Table 6-3 summarizes escape sequences that can be used for selecting the resident fonts as the **primary** font in **portrait** orientation.

Table 6-3 **Font Selection Commands for Use with Resident Fonts**

Characteristic	Courier 10 LJ	Prestige Elite 12 LJ	Letter Gothic 16.7 LJ	Century PS LJ
Orientation	ESC &l0O	ESC &l0O	ESC &l0O	ESC &l0O
Symbol Set	ESC (8U	ESC (8U	ESC (8U	ESC (8U
Prop/Fixed	ESC (s0P	ESC (s0P	ESC (s0P	ESC (s1P
Pitch	ESC (s10H	ESC (s12H	ESC (s16.66H	(None)
Height	ESC (s12V	ESC (s10V	ESC (s8.5V	ESC (s10V
Style	ESC (s0S	ESC (s0S	ESC (s0S	ESC (s0S
Weight	ESC (s0B	ESC (s0B	ESC (s-3B	ESC (s0B
Typeface	ESC (s3T	ESC (s2T	ESC (s0T	ESC (s9T

You can combine these commands for output to the printer as follows:

- To select Courier 10 LJ:
  ESC &l0O ESC (8U ESC (s0p10h12v0s0b3T
- To select Prestige Elite 12 LJ:
  ESC &l0O ESC (8U ESC (s0p12h10v0s0b2T
- To select Letter Gothic 16.7 LJ:
  ESC &l0O ESC (8U ESC (s0p16.66h8.5v0s-3b0T
- To select Century PS LJ:
  ESC &l0O ESC (8U ESC (s1p10v0s0b9T

Specify Font ID

Function This command assigns an arbitrary identification (ID) number to the currently selected font. Once this number has been assigned, you can select the font for printing by its number, rather than by specifying font characteristics using the commands described earlier in this section.

Format ESC * c # D

Parameter

- The ID number to be assigned to the font in the range from 0 to 32767.

Procedure The general procedure for assigning a font ID number is:

1. Designate the desired font as the primary font by specifying font characteristics with the commands described earlier in this section. After designating the primary font, send the Shift In code to the printer to ensure that it is selected.
2. To assign the font ID number, send the command ESC * c # D to the printer, specifying the number to be assigned in the # field.
3. Assign the temporary or permanent attribute to the font with the FONT AND CHARACTER CONTROL command described next.

Example This example designates Century PS LJ as the primary font, selects the primary font, then assigns the ID number 15 to the font.

```
110 LPRINT CHR$(27);"&l0O";                 :' Select Century PS LJ
120 LPRINT CHR$(27);"(8U";
130 LPRINT CHR$(27);"(s1p10v0s0b9T";
140 LPRINT CHR$(15);                        :'Switch to primary font
150 LPRINT CHR$(27);"*c15D";                'Assign font ID number 15
```

Notes:

1 You can assign font numbers to up to 32 fonts at a time.

2 After assigning an ID number to a font, you can select it as primary or secondary at any time with the commands ESC (# X (DESIGNATE DOWNLOAD FONT AS PRIMARY) or ESC) # X (DESIGNATE DOWNLOAD FONT AS SECONDARY).

Font and Character Control

Function This command performs a variety of font and character control functions, depending on the value given to parameter #.

Format ESC * c # F

Parameter

- See Table 6-4 for valid parameter values and their meanings.

Example The following example assigns the temporary attribute to the font whose ID number was specified in the immediately preceding SPECIFY FONT ID command.

```
160 LPRINT CHR$(27);"*c4F";          :' Assign temporary attribute
```

Table 6-4 **Font and Character Control Parameter Values**

#	Function
0	Deletes all fonts (both temporary and permanent).
1	Deletes all temporary fonts.
2	Deletes the font specified by the last preceding SPECIFY FONT ID command.
3	Deletes the character specified by the last preceding SPECIFY CHARACTER CODE command from the font specified by the last preceding SPECIFY FONT ID command. (See Section 7 for a description of the SPECIFY CHARACTER CODE command.)
4	Assigns the temporary attribute to the font specified by the last preceding SPECIFY FONT ID command.
5	Assigns the permanent attribute to the font specified by the last preceding SPECIFY FONT ID command.
6	Copies/assigns the current font and gives it the current ID number.

Designate Download Font as Primary

Function This command designates the font whose ID number is specified in the # field as the primary font. If the specified font is present, it becomes the primary font and its characteristics become valid for printing characters.

Format ESC (# X

Parameter

- The ID number of the font to be downloaded as the primary font.

Example This example designates font ID number 15 as the primary font.

<1B>	<28>	<31>	<35>	<58>
ESC	(	1	5	X

Notes:

1 If the specified font is not present or its orientation does not match the currently selected print orientation, this command is ignored.

2 If the font selected is a proportional font, the pitch parameter remains in effect as a primary font attribute.

Designate Download Font as Secondary

Function This command designates the font whose ID number is specified in the # field as the secondary font. If the specified font is present, it becomes the secondary font and its characteristics become valid for printing characters.

Format ESC) # X

Parameter

- The ID number of the font to be downloaded as the secondary font.

Example This example designates font ID number 1 as the secondary font.

<1B>	<29>	<31>	<58>
ESC	)	1	X

Notes:

1 If the specified font is not present or its orientation does not match the currently selected print orientation, this command is ignored.

2 If the font selected is a proportional font, the pitch parameter remains in effect as a secondary font attribute.

Set Primary Font Defaults

Function This command changes primary font characteristics according to the value specified in the # field.

Format ESC (# @

Parameter

- See Table 6-5 for valid parameter values and their meanings.

Table 6-5 **Primary Font Defaults**

#	Function
0 or 1	Selects the default symbol set for the current orientation as the primary font symbol set.
2	Selects the current primary symbol set as the symbol set for the primary font in the current orientation. As a result, all current font characteristics are re-evaluated and the closest font is selected.
3	Selects the default font as the primary font for the current orientation and applies all default values to font selection.

Note: With function 3 in Table 6-5, if the default font is proportional, the current pitch parameter remains in effect as a font attribute.

Set Secondary Font Defaults

Function This command changes secondary font characteristics according to the value specified in the # field.

Format ESC) # @

Parameter

- See Table 6-6 for valid parameter values and their meanings.

Table 6-6 **Secondary Font Defaults**

#	Function
0	Selects the default symbol set for the current orientation as the secondary font symbol set.
1	Sets the symbol set of the secondary font to that of the current orientation's default primary font.
2	Sets the symbol set of the secondary font to that of the current orientation's current primary font.
3	Selects the default font for the current orientation as the secondary font and applies all default values to font selection.

Note: With function 3 in Table 6-6, if the default font is proportional, the current pitch parameter remains in effect as a font attribute.

Font Definition Commands

The general procedure for creating a font is as follows:

1 Set a font ID with the SPECIFY FONT ID command.

2 Create a font descriptor with the CREATE FONT DESCRIPTOR command.

3 Specify the character to be downloaded with the SPECIFY CHARACTER CODE command.

4 Download character data for one character with the DOWNLOAD CHARACTER command.

5 Repeat Steps 3 and 4 for other characters in the font.

The SPECIFY FONT ID command is discussed in Section 6 of this manual. This section describes the other font definition commands.

Create Font Descriptor

Function This command creates a font descriptor (font header) for the font specified by the SPECIFY FONT ID command. The font descriptor describes character attributes that pertain to all characters in the currently selected primary font.
If a descriptor is created for an ID number that belongs to a currently existing font, the existing font is deleted from memory, even if command execution fails due to insufficient memory.

Format ESC) s # W *font-descriptor*

Parameter

- The number of bytes in font-descriptor. Specify the number 26.

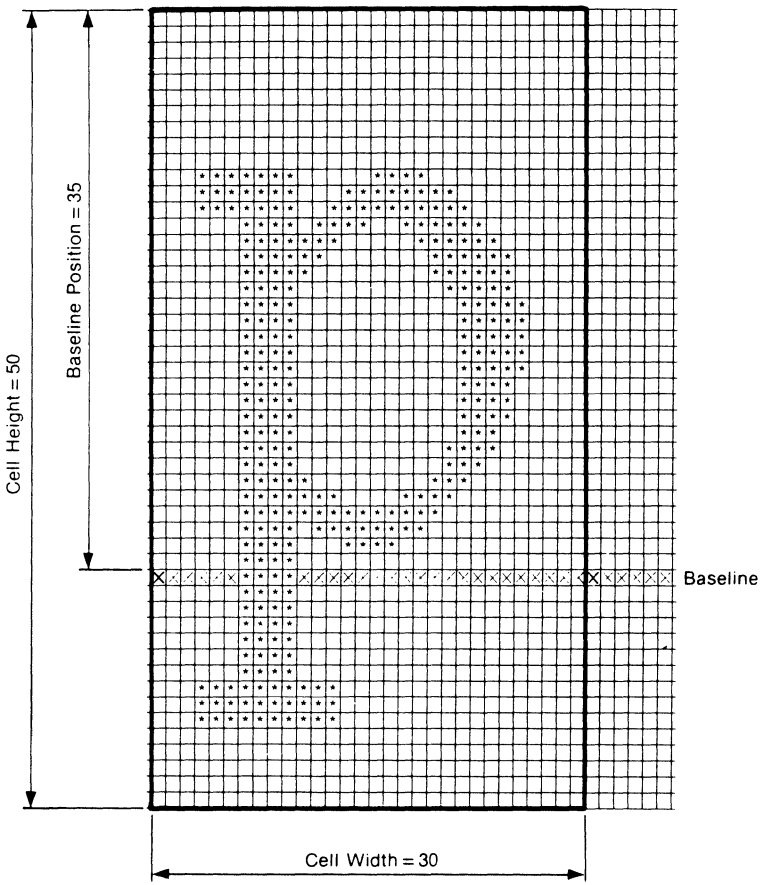
font-descriptor Data specified in this parameter consists of 26 bytes. Figure 7-1 shows the format of this data.

Figure 7-1 **Font Descriptor Format**

0	(0)	(26)
2	(0)	Font Type
4	(0)	(0)
6	Baseline Position	
8	Cell Width	
10	Cell Height	
12	Orientation	Fixed/Proportional
14	Symbol Set	
16	Pitch (Default HMI)	
18	Height	
20	(0)	(0)
22	(0)	Style
24	Stroke Weight	Typeface

font-descriptor (continued) All values in the font descriptor are specified as 1- or 2-byte binary numbers. With 2-byte numbers, the more significant (high) byte is specified first and the less significant (low) byte is specified second. Values that affect character dimensions are shown in Figure 7-2.

Figure 7-2 **Font Descriptor Information**



font-descriptor (continued) Meaning of individual fields in font-descriptor are as follows.

font type Font type.
0 = 7-bit font (codes in the range 33 to 127 are printable)
1 = 8-bit font (codes in the ranges 33 to 127 and 160 to 255 are printable)

baseline position The distance in dots from the top of the character cell to the baseline.

cell width The character cell width in dots in the range from 1 to 255.

cell height The character cell height in dots in the range from 1 to 255.

orientation Font orientation.

0 = Portrait
1 = Landscape

fixed/proportional Font spacing

0 = Monospaced (fixed spacing)
1 = Proportional spacing

symbol set The symbol set by which the font is to be identified. This field consists of two bytes. The number specified in this field is calculated according to the following expression:

(value field number x 32) + (decimal value of ASCII terminator - 64) = symbol set value

If the symbol set value is less than 256, then the first byte of the field equals 0. If the value is greater than or equal to 256, then the first byte equals 1.

If the first byte of the field equals 0, then the second byte is equal to the symbol set value. If the first byte equals 1, then the second byte equals the symbol set value minus 256.

Value field numbers and ASCII terminators for individual symbol sets are as follows.

Symbol Set	**VFN**	**ASCII**
8-bit Symbol Sets		
Roman-8	8	U
Kana-8	8	K
Math-8	8	M
7-bit Symbol Sets		
USASCII	0	U
Linedraw	0	B
Math Symbols	0	A
US Legal	1	U
Roman Extension	0	E
ISO Denmark/Norway	0	D
ISO United Kingdom	1	E
ISO France	0	F
ISO Germany	0	G
ISO Italy	0	I
ISO Sweden/Finland	0	S
ISO Spain	1	S

Example of symbol set calculation

For Roman-8, the value field number is 8 and the ASCII terminator is U. Since the decimal value of the ASCII code corresponding to U is 85, the number to specify in the font descriptor's symbol set field is:

(8 x 32) + (85 - 64) = 277

In this example, the symbol set value is greater than 256; therefore, the value for the first byte is 1. The value for the second byte is 277 - 256; that is, 21.

pitch — Font pitch. Specify the value that is four times the desired pitch in dots.

You can specify the pitch to a precision of 1/4 dot. After multiplication by 4, the range of values specifiable in this field is 2 (1/2 dot) to 1260 (315 dots).

For example, a desired 1/10-inch character pitch corresponds to 30 dots (300 dpi/10 = 30 dots). Since 4 x 30 = 120, specify 120 in the pitch field (0 in the first byte and 120 in the second byte).

height — Character cell height. Specify the value that is four times the desired height in dots.

You can specify height to a precision of 1/4 dot. After multiplication by 4, the range of values specifiable in this field is 0 (0 dots) to 10922 (2730.5 dots).

style — Font style (upright or italic).

0 = Upright
1 = Italic

stroke weight — Boldness of character in the font. The value specified must be in the range from -7 to 7, with 0 corresponding to the standard weight.

typeface — Typeface of the font.

0 = Line printer
1 = Pica
2 = Elite
3 = Courier
4 = Helvetica
5 = Times Roman
6 = Gothic
7 = Script
8 = Prestige
9 = Caslon
10 = Orator

Example This example illustrates creation of a typical font descriptor.

```
100  LPRINT CHR$(27);")s26W";          :'Create font descriptor
110  'Font descriptor
120  LPRINT CHR$(0);CHR$(26);          :'Bytes 0 and 1
130  LPRINT CHR$(0);                   :'Byte 2
140  LPRINT CHR$(0);                   :'Font type: 7-bit
150  LPRINT CHR$(0);CHR$(0);           :'Bytes 4 and 5
160  LPRINT CHR$(0);CHR$(35);          :'Baseline pos: 35
170  LPRINT CHR$(0);CHR$(30);          :'Cell width: 30
180  LPRINT CHR$(0);CHR$(50);          :'Cell height: 50
190  LPRINT CHR$(0);                   :'Orientation: Portrait
200  LPRINT CHR$(0);                   :'Spacing: Fixed
210  LPRINT CHR$(0);CHR$(21);          :'Symbol set: USASCII
220  LPRINT CHR$(0);CHR$(120);         :'Pitch: 4 x 30 dots = 120
230  LPRINT CHR$(0);CHR$(200);         :'Height: 4 x 50 dots = 200
240  LPRINT CHR$(0);CHR$(0);           :'Bytes 20 and 21
250  LPRINT CHR$(0);                   :'Byte 22
260  LPRINT CHR$(0);                   :'Style: 0 = Upright
270  LPRINT CHR$(0);                   :'Stroke weight: 0 = Normal
280  LPRINT CHR$(1);                   :'Typeface: 1 = Pica
```

Specify Character Code

Function This command specifies the character to be downloaded by the DOWNLOAD CHARACTER command.

Format ESC * c # E

Parameter

- The decimal equivalent of the ASCII code to which the character is to be assigned. The code specified by the # parameter must be in the range from 0 to 255.
If no character code is specified, the default is 0.

Example This example specifies downloading a character to code 33 (<21>).

<1B>	<2A>	<63>	<33>	<33>	<45>
ESC	*	c	3	3	E

Download Character

Function This command defines a character descriptor and downloads a character to the last character code specified with the SPECIFY CHARACTER CODE command. The character is added to the last font whose ID number was specified with the SPECIFY FONT ID command.

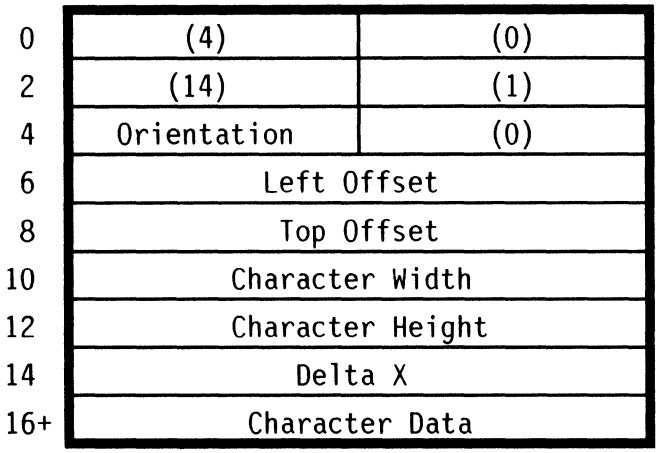
Format ESC (s # W *descriptor-and-data*

Parameter

- The number of bytes of data that follow in the descriptor-and-data parameter.

descriptor-and-data This parameter consists of 16 bytes (0 to 15) plus an indefinite number of bytes of character data. Figure 7-3 shows the format of the character descriptor.

Figure 7-3 **Character Descriptor Format**



descriptor-and-data (continued)

All values in the character descriptor are specified as 1- or 2-byte binary numbers. With 2-byte numbers, the more significant (high) byte is specified first and the less significant (low) byte is specified second. Values that affect character dimensions are shown in Figures 7-4 and 7-5.

Figure 7-4 **Character Descriptor Information - Portrait**

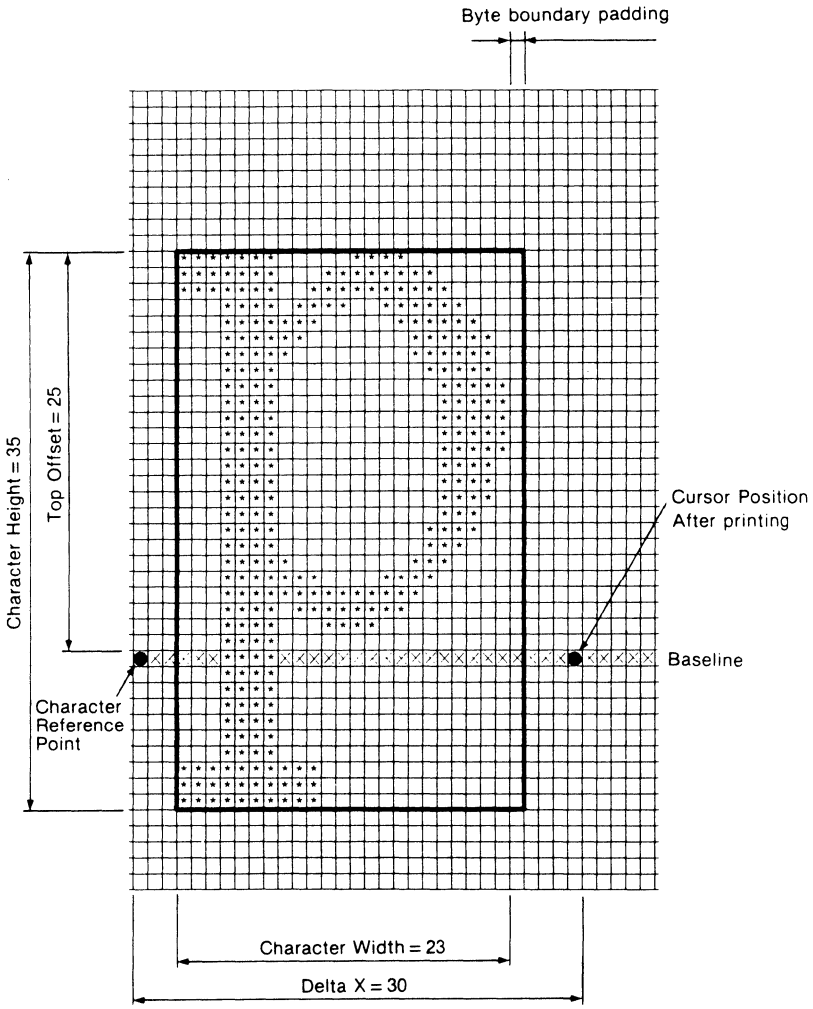
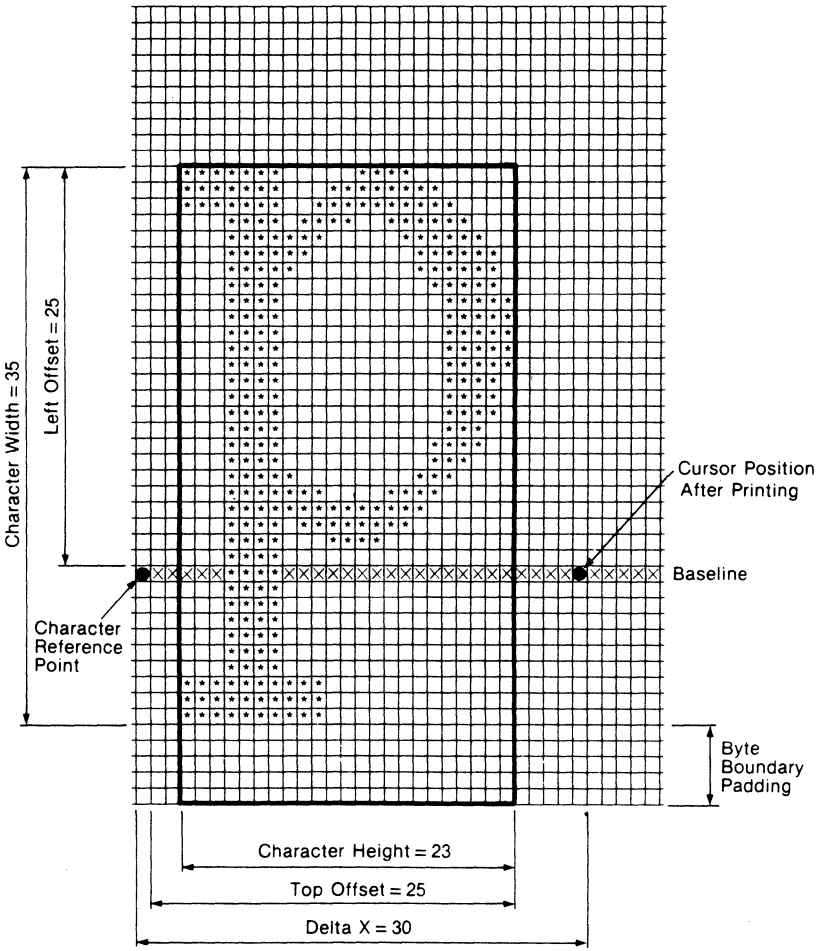


Figure 7-5 **Character Descriptor Information - Landscape**



descriptor-and-data (continued)

Meaning of individual fields in descriptor-and-data are as follows.

orientation

Indicates whether the character being downloaded is for use with portrait or landscape page orientation.

0 = Portrait
1 = Landscape

left offset

The number of dots between the character cell reference point (the first dot in the baseline) and the physical left edge of the character pattern (the leftmost black point in the character cell).

The term "physical left" indicates the side of the character that is closest to the left edge of the physical page. With portrait orientation, this is the same as the left edge of the character when it is viewed upright, but with landscape orientation it corresponds to the top edge of the upright character.

top offset

The number of dots between the character cell reference point (the first dot in the baseline) and the physical top edge of the character pattern (the topmost black point in the character cell).

The term "physical top" indicates the side of the character that is closest to the top edge of the physical page. With portrait orientation, this is the same as the top edge of the character when it is viewed upright, but with landscape orientation it corresponds to the right edge of the upright character.

character width

The overall width of the character pattern in dots in the range 0 to 128.

character height

The overall height of the character pattern in dots.

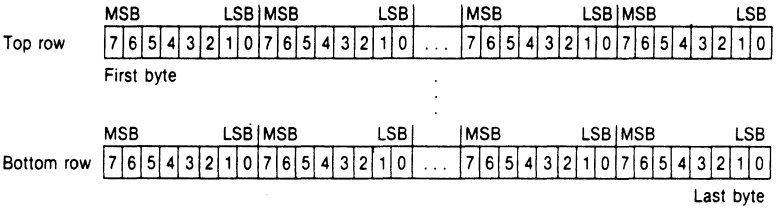
delta X

With a proportional character, the amount by which the active position moves when the character is printed. Specify the value that is 4 x the number of dots movement for the character being downloaded.

character data

Raster scan data for the character being downloaded. The first byte sent corresponds to the upper lefthand corner of the character pattern, and the last byte corresponds to the lower righthand corner (see Figure 7-6).

Figure 7-6 **Arrangement of Bytes for Character Data**



Example

The following program downloads the portrait "p" shown in Figure 7-4.

```
1000 'Reset printer
1010 LPRINT CHR$(27);"E";
1020 WIDTH LPRINT 255
1030 'Download portrait p
1040 'Specify 5 as font ID
1050 LPRINT CHR$(27);"*c5D";
1060 'Create font descriptor
1070 LPRINT CHR$(27);")s26W";
1080 LPRINT CHR$(0);CHR$(26);CHR$(0);          :'Bytes 0-2
1090 LPRINT CHR$(1);                          :'Font type = 1 (8-bit)
1100 LPRINT CHR$(0);CHR$(0);                  :'Bytes 4-5
1110 LPRINT CHR$(0);CHR$(35);                 :'Baseline position = 35 dots
1120 LPRINT CHR$(0);CHR$(30);                 :'Cell width = 30
1130 LPRINT CHR$(0);CHR$(50);                 :'Cell height = 50
1140 LPRINT CHR$(0);                          :'Orientation =0 (portrait)
1150 LPRINT CHR$(0);                          :'Spacing = 0 (fixed)
1160 LPRINT CHR$(0);CHR$(12);                 :'Symbol set = Kana-8
1170 '                                        :(8K->267 = 1 * 256 + 12)
1180 LPRINT CHR$(0);CHR$(120);                :'Pitch = 4 x 30 dots = 120
1190 LPRINT CHR$(0);CHR$(200);                :'Height = 4 x 50 dots = 200
1200 LPRINT CHR$(0);CHR$(0);CHR$(0);          :'Bytes 20-22
1210 LPRINT CHR$(0);                          :'Style = 0 (upright)
1220 LPRINT CHR$(0);                          :'Stroke weight = 0 (normal)
1230 LPRINT CHR$(1);                          :'Typeface = 1 (Pica)
1240 'Specify character code
1250 LPRINT CHR$(27);"*c112E";                :'"p" -> 112 (<70>)
1260 'Download character data
1270 'Character descriptor
1280 LPRINT CHR$(27);"s121W";                 :'No. descriptor bytes = 121
1290 LPRINT CHR$(4);CHR$(0);CHR$(14);CHR$(1); :'Bytes 0-3
1300 LPRINT CHR$(0);                          :'Orientation = 0 (portrait)
1310 LPRINT CHR$(0);                          :'Byte 5
1320 LPRINT CHR$(0);CHR$(3);                  :'Left offset = 3 dots
1330 LPRINT CHR$(0);CHR$(10);                 :'Top offset = 10 dots
1340 LPRINT CHR$(0);CHR$(23);                 :'Character width = 23 dots
1350 LPRINT CHR$(0);CHR$(35);                 :'Character height = 35 dots
1360 LPRINT CHR$(0);CHR$(120);                :'Delta X = 120 (4 x 30 dots)
1370 'Raster scan data
1380 LPRINT CHR$(&HFE);CHR$(&HF);CHR$(&H0);
1390 LPRINT CHR$(&HFE);CHR$(&H3F);CHR$(&HC0);
1400 LPRINT CHR$(&HFE);CHR$(&H7F);CHR$(&HE0);
1410 LPRINT CHR$(&H1E);CHR$(&HF3);CHR$(&HF0);
1420 LPRINT CHR$(&H1F);CHR$(&HC0);CHR$(&HF8);
1430 LPRINT CHR$(&H1F);CHR$(&H80);CHR$(&HFC);
```

```
1440 LPRINT CHR$(&H1F);CHR$(&H0);CHR$(&HFC);
1450 LPRINT CHR$(&H1E);CHR$(&H0);CHR$(&H7C);
1460 LPRINT CHR$(&H1E);CHR$(&H0);CHR$(&H3E);
1470 LPRINT CHR$(&H1E);CHR$(&H0);CHR$(&H3E);
1480 LPRINT CHR$(&H1E);CHR$(&H0);CHR$(&H3E);
1490 LPRINT CHR$(&H1E);CHR$(&H0);CHR$(&H3E);
1500 LPRINT CHR$(&H1E);CHR$(&H0);CHR$(&H3E);
1510 LPRINT CHR$(&H1E);CHR$(&H0);CHR$(&H3C);
1520 LPRINT CHR$(&H1E);CHR$(&H0);CHR$(&H3C);
1530 LPRINT CHR$(&H1E);CHR$(&H0);CHR$(&H3C);
1540 LPRINT CHR$(&H1E);CHR$(&H0);CHR$(&H38);
1550 LPRINT CHR$(&H1E);CHR$(&H0);CHR$(&H78);
1560 LPRINT CHR$(&H1E);CHR$(&H0);CHR$(&H70);
1570 LPRINT CHR$(&H1F);CHR$(&H0);CHR$(&HE0);
1580 LPRINT CHR$(&H1F);CHR$(&HC3);CHR$(&HC0);
1590 LPRINT CHR$(&H1F);CHR$(&HFF);CHR$(&H80);
1600 LPRINT CHR$(&H1E);CHR$(&HFF);CHR$(&H0);
1610 LPRINT CHR$(&H1E);CHR$(&HEC);CHR$(&H0);
1620 LPRINT CHR$(&H1E);CHR$(&H0);CHR$(&H0);
1630 LPRINT CHR$(&H1E);CHR$(&H0);CHR$(&H0);
1640 LPRINT CHR$(&H1E);CHR$(&H0);CHR$(&H0);
1650 LPRINT CHR$(&H1E);CHR$(&H0);CHR$(&H0);
1660 LPRINT CHR$(&H1E);CHR$(&H0);CHR$(&H0);
1670 LPRINT CHR$(&H1E);CHR$(&H0);CHR$(&H0);
1680 LPRINT CHR$(&H1E);CHR$(&H0);CHR$(&H0);
1690 LPRINT CHR$(&H1E);CHR$(&H0);CHR$(&H0);
1700 LPRINT CHR$(&HFF);CHR$(&HC0);CHR$(&H0);
1710 LPRINT CHR$(&HFF);CHR$(&HC0);CHR$(&H0);
1720 LPRINT CHR$(&HFF);CHR$(&HC0);CHR$(&H0);
1730 'Binary representation of raster scan data
1740 '1111-1110-0000-1111-0000-0000
1750 '1111-1110-0011-1111-1100-0000
1760 '1111-1110-0111-1111-1110-0000
1770 '0001-1110-1111-0011-1111-0000
1780 '0001-1111-1100-0000-1111-1000
1790 '0001-1111-1000-0000-1111-1100
1800 '0001-1111-0000-0000-1111-1100
1810 '0001-1110-0000-0000-0111-1100
1820 '0001-1110-0000-0000-0011-1110
1830 '0001-1110-0000-0000-0011-1110
1840 '0001-1110-0000-0000-0011-1110
1850 '0001-1110-0000-0000-0011-1110
1860 '0001-1110-0000-0000-0011-1110
1870 '0001-1110-0000-0000-0011-1100
1880 '0001-1110-0000-0000-0011-1100
1890 '0001-1110-0000-0000-0011-1100
1900 '0001-1110-0000-0000-0011-1000
1910 '0001-1110-0000-0000-0111-1000
1920 '0001-1110-0000-0000-0111-0000
1930 '0001-1111-0000-0000-1110-0000
1940 '0001-1111-1100-0011-1100-0000
1950 '0001-1111-1111-1111-1000-0000
```

```
1960 '0001-1110-1111-1111-0000-0000
1970 '0001-1110-0011-1100-0000-0000
1980 '0001-1110-0000-0000-0000-0000
1990 '0001-1110-0000-0000-0000-0000
2000 '0001-1110-0000-0000-0000-0000
2010 '0001-1110-0000-0000-0000-0000
2020 '0001-1110-0000-0000-0000-0000
2030 '0001-1110-0000-0000-0000-0000
2040 '0001-1110-0000-0000-0000-0000
2050 '0001-1110-0000-0000-0000-0000
2060 '1111-1111-1100-0000-0000-0000
2070 '1111-1111-1100-0000-0000-0000
2080 '1111-1111-1100-0000-0000-0000
2090 LPRINT CHR$(27);"(5X";
2100 LPRINT CHR$(27);"(2@";
2110 LPRINT CHR$(27);"(8K";"abcdefghijklmnopqrstuvwxyz"
2120 LPRINT CHR$(12);
2130 END
```

Raster Graphics Commands

This section describes the four commands that are used to produce graphics by controlling the printing of individual dots. Graphics produced in this manner in the LaserJet+ emulation mode are called raster graphics. At the end of this section is a sample program using these commands.

The LaserJet+ emulation mode's raster graphics function lets you control printing of individual dots in a series of raster scanning lines. This is done by sending binary raster graphics data to the printer; each byte (8 bits) of raster graphics data controls the settings of eight print dots in one raster scanning line.

For example, the following sequence of binary data could be sent to the printer to print a sine wave.

Line	Byte 1	2	3	4	5	6	7	8
1	00000000	00000000	00000011	11100000	00000000	00000000	00000011	11100000
2	00000000	00000000	00001100	00011000	00000000	00000000	00001100	00011000
3	00000000	00000000	00110000	00000110	00000000	00000000	00110000	00000110
4	00000000	00000000	01000000	00000001	00000000	00000000	01000000	00000001
5	10000000	00000000	10000000	00000000	10000000	00000000	10000000	00000000
6	01000000	00000001	00000000	00000000	01000000	00000001	00000000	00000000
7	00110000	00000110	00000000	00000000	00110000	00000110	00000000	00000000
8	00001100	00011000	00000000	00000000	00001100	00011000	00000000	00000000
9	00000011	11100000	00000000	00000000	00000011	11100000	00000000	00000000

When programming, the data would ordinarily be coded in decimal or hexadecimal format rather than binary. In these formats, values of individual bytes for the first scanning line would be:

Byte	Binary	Decimal	Hexadecimal
1	00000000	0	<00>
2	00000000	0	<00>
3	00000011	3	<03>
4	11100000	224	<E0>
5	00000000	0	<00>
6	00000000	0	<00>
7	00000011	3	<03>
8	11100000	224	<E0>

You can select any of four different print resolutions for raster graphics printing: 75 dpi, 100 dpi, 150 dpi, or 300 dpi. At lower resolutions, each bit of binary data controls the setting of a rectangular cluster of dots.

Four commands are used for processing raster graphics data. These commands must be sent to the printer in the order listed.

- Select Raster Graphics Resolution
- Start Raster Graphics
- Transfer Raster Graphics
- End Raster Graphics

The SELECT RASTER GRAPHICS RESOLUTION command is required only when changing the raster graphics resolution; the other commands must be sent to the printer with each block of raster graphics data. One block of raster graphics data may consist of any number of lines, each of which must begin with a TRANSFER RASTER GRAPHICS command. You cannot include any text data in a block of raster scanning data; however, you can include text data between blocks. The END RASTER GRAPHICS command is required at the end of each block.

In summary, the sequence of commands to transfer a block of raster graphics data five lines long would be:

```
Select Raster Graphics Resolution
Start Raster Graphics
  Transfer Raster Graphics (first line)
  Transfer Raster Graphics (second line)
  Transfer Raster Graphics (third line)
  Transfer Raster Graphics (fourth line)
  Transfer Raster Graphics (fifth line)
End Raster Graphics
```

The rest of this section explains the syntax and rules for using the four raster graphics commands.

Select Raster Graphics Resolution

Function

This command sets the print resolution for raster graphics data. Physical dot patterns correspond to each bit of raster graphics data.

At 75 dots per inch (dpi), sixteen dots, four across and four down, are printed for each "1" bit.

At 100 dpi, nine dots, three across and three down, are printed for each "1" bit.

At 150 dpi, four dots, two across and two down, are printed for each "1" bit.

At 300 dpi, one dot is printed for each "1" bit.

Format

ESC * t # R

Parameter

# - The print resolution for raster graphics data.
# = 75: 75 dpi
# = 100: 100 dpi
# = 150: 150 dpi
# = 300: 300 dpi
Default = 75 dpi

Example

This example sets the raster graphics resolution to 100 dots per inch.

<1B>	<2A>	<74>	<31>	<30>	<30>	<52>
ESC	*	t	1	0	0	R

Note: This command is ignored unless it is received prior to the START RASTER GRAPHICS command

Start Raster Graphics

Function

This command switches printing to the raster graphics mode and designates the starting position for raster graphics printing. After receiving this command, the next data sent to the printer must be raster graphics data.

The vertical position at which raster graphics printing starts is always the same as the current vertical location of the active position. The horizontal starting position is determined by the value of parameter #.

Format

ESC * r # A

Parameter

- Horizontal starting position of raster graphics printing.
= 0: Printing starts from the left edge of the printing area.
= 1: Printing starts from the current horizontal location of the active position.

Notes:

1 When parameter # = 1, no raster graphics data is printed to the left of the current active position.

2 Once the printer receives the START RASTER GRAPHICS command, no changes in resolution or left graphics margin are possible until raster graphics printing is ended with the END RASTER GRAPHICS command.

Transfer Raster Graphics

Function This command specifies the number of bytes of raster graphics data to be printed in the current raster graphics line. This command must be sent to the printer with each line of raster graphics data.

Format ESC * b # W *raster-data*

Parameter

- The number of bytes of binary raster data.

raster-data - Binary data for one raster graphics scanning line. Dots corresponding to "1" bits print, and those corresponding to "0" bits do not print.

Notes:

1 After execution of this command, the active position moves down one dot (the actual distance varies according to the selected raster graphics resolution) and to the left graphics margin on the next graphics line

2 This command ignores all text margins (top, bottom, left, and right).

End Raster Graphics

Function This command ends transfer of raster graphics data.

Format ESC * r B

Example

The following program prints the sine wave shown at the beginning of this section.

```
10   WIDTH LPRINT 255
20   'Select Raster Graphics Resolution
30   LPRINT CHR$(27);"*T75R";                    :;75 dpi
40   'Start Raster Grahics
50   LPRINT CHR$(27);"*r0A";                     :'From left edge
60   FOR I = 1 TO 9                              :'9 lines
70   'Transfer Raster Graphics
80   LPRINT CHR$(27);"*b8W";
90   FOR J = 1 TO 8
100  READ A
110  LPRINT CHR$(A);
120  NEXT J
130  NEXT I
140  'End Raster Graphics
150  LPRINT CHR$(27);"*rB";
160  LPRINT CHR$(12);
170  END
180  'Raster graphics data
190  DATA 0,0,3,224,0,0,3,224                    :'Data for line 1
200  DATA 0,0,12,24,0,0,12,24                    :'Data for line 2
210  DATA 0,0,48,6,0,0,48,6                      :'Data for line 3
220  DATA 0,0,64,1,0,0,64,1                      :'Data for line 4
230  DATA 128,0,128,0,128,0,128,0                :'Data for line 5
240  DATA 64,1,0,0,64,1,0,0                      :'Data for line 6
250  DATA 48,6,0,0,48,6,0,0                      :'Data for line 7
260  DATA 12,24,0,0,12,24,0,0                    :'Data for line 8
270  DATA 3,224,0,0,3,224,0,0                    :'Data for line 9
```

Advanced Graphics Commands

Whereas raster graphics commands produce graphics by controlling the printing of individual dots, advanced graphics commands allow you to print ruled lines, predefined patterns, or shading. This section describes the advanced graphics commands.

To use the advanced graphics functions, four steps are generally required:

- Move the active position to the top left edge of the graphic pattern printing area. This is done with any of the movement commands described in Section 4.
- Specify the pattern size (both horizontal and vertical). Commands used to do this are:
  - Set Horizontal Rule/Pattern Size (in Dots)
  - Set Horizontal Rule/Pattern Size (in Decipoints)
  - Set Vertical Rule/Pattern Size (in Dots)
  - Set Vertical Rule/Pattern Size (in Decipoints)
- Specify the gray scale density or pattern ID. This is done with the DESIGNATE PATTERN ID command.

  Note: This step is not necessary when printing ruled lines.
- Print the ruled line or pattern with the PRINT RULE/PATTERN command.

Set Horizontal Rule/Pattern Size (in Dots)

Function This command specifies the horizontal size of a rule or pattern in dots. With portrait orientation, this dimension is at right angles to the direction of paper feed; with landscape orientation, it parallels the direction of paper feed.

Format ESC * c # A

Parameter

- Number of dots (1 dot = 1/300 inch).

The default, effective when the power is turned on or when the printer is reset with the Hard Reset button or ESC E, is 0.

Example This example sets the horizontal pattern size to 30 dots (1/10 inch).

<1B>	<2A>	<63>	<33>	<30>	<41>
ESC	*	c	3	0	A

Note: Horizontal sizes exceeding the page width are valid; however, that portion of the rule or pattern extending outside the page is not printed.

Set Horizontal Rule/Pattern Size (in Decipoints)

Function This command specifies the horizontal size of a rule or pattern in decipoints. With portrait orientation, this dimension is at right angles to the direction of paper feed; with landscape orientation, it parallels the direction of paper feed.

Format ESC * c # H

Parameter

- Number of decipoints (1 decipoint = 1/720 inch). If the number of decipoints specified is not an integral multiple of 1/300 inch (the size of one dot), the fraction is rounded up. The default, effective when the power is turned on or when the printer is reset with the Hard Reset button or ESC E, is 0.

Example This example sets the horizontal pattern size to 72 decipoints (1/10 inch).

<1B>	<2A>	<63>	<37>	<32>	<48>
ESC	*	c	7	2	H

Note: Horizontal sizes exceeding the page width are effective; however, that portion of the rule or pattern extending outside the page is not printed.

Set Vertical Rule/Pattern Size (in Dots)

Function This command specifies the vertical size of a rule or pattern in dots. With portrait orientation, this dimension parallels the direction of paper feed; with landscape orientation, it is at right angles to the direction of paper feed.

Format ESC * c # B

Parameter

- Number of dots (1 dot = 1/300 inch).
The default, effective when the power is turned on or when the printer is reset with the Hard Reset button or ESC E, is 0.

Example This example sets the vertical pattern size to 30 dots (1/10 inch).

<1B>	<2A>	<63>	<33>	<30>	<42>
ESC	*	c	3	0	B

Note: Vertical sizes exceeding the page length are valid; however, that portion of the rule or pattern extending outside the page is not printed.

Set Vertical Rule/Pattern Size (in Decipoints)

Function This command specifies the vertical size of a rule or pattern in decipoints. With portrait orientation, this dimension parallels the direction of paper feed; with landscape orientation, it is at right angles to the direction of paper feed.

Format ESC * c # V

Parameter

- Number of decipoints (1 decipoint = 1/720 inch). If the number of decipoints specified is not an integral multiple of 1/300 inch (the size of one dot), the fraction is rounded up.
The default, effective when the power is turned on or when the printer is reset with the Hard Reset button or ESC E, is 0.

Example This example sets the vertical pattern size to 120 decipoints (1/6 inch).

<1B>	<2A>	<63>	<31>	<32>	<30>	<56>
ESC	*	c	1	2	0	V

Note: Vertical sizes exceeding the page length are valid; however, that portion of the rule or pattern extending outside the page is not printed.

Designate Pattern ID

Function This command designates the type of pattern to be printed.

Format ESC * c # G

Parameter

- The meaning of the value specified by this parameter varies according to the type of pattern specified in the PRINT/RULE PATTERN command.

If the PRINT RULE/PATTERN command defines a gray scale pattern, parameter # specifies the shading density ranging from 1 to 100 percent. (See Figure 9-1 for examples of the gray scale shading densities.)

If the PRINT RULE/PATTERN command defines a predefined pattern, parameter # specifies one of six predefined patterns, numbered 1 to 6. (See Figure 9-2 for examples of the predefined patterns.)

Figure 9-1 **Gray Scale Shading Densities**

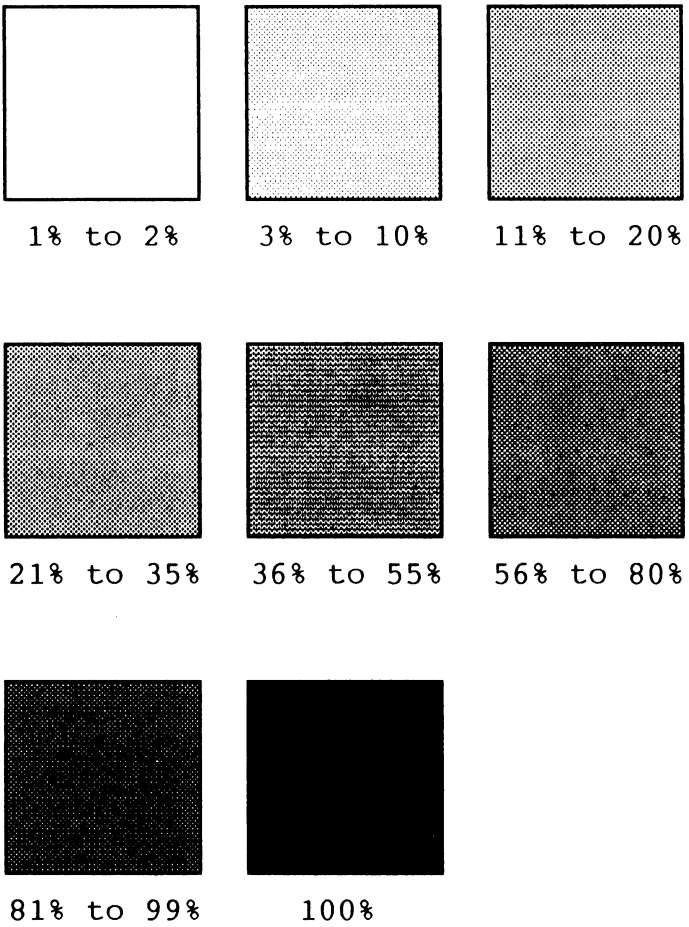
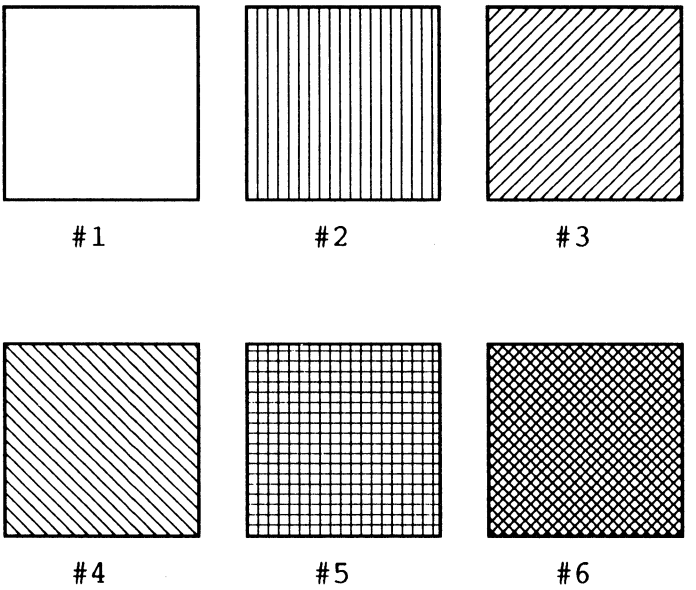


Figure 9-2 **Predefined Patterns**



Notes:

1 This command is not required when printing ruled lines.

2 The designated pattern or gray scale shading is printed with the PRINT RULE/PATTERN command.

Print Rule/Pattern

Function

This command prints the rule or pattern designated by the DESIGNATE PATTERN ID command. Printing starts at the current active position, filling the rectangular area whose dimensions are specified with the SET HORIZONTAL/ VERTICAL RULE/PATTERN SIZE commands with the designated pattern.

Format

ESC * c # P

Parameter

- Type of pattern.
= 0: Rule
= 2: Gray scale pattern
= 3: Predefined pattern

Examples

1. This example prints a ruled line measuring 15 dots (1/20 inch) horizontally and 1800 dots (6 inches) vertically. The rule is printed starting at the position which is 600 dots (2 inches) from the top of the printable area and 300 dots (1 inch) from its left edge.

```
100     'Changing the active position
110     LPRINT CHR$(27);"*p300X";:'300 dots from left edge
120     LPRINT CHR$(27);"*p600Y";:'600 dots from top edge
130     'Pattern size specification
140     LPRINT CHR$(27);"*c15A";;'15 dots horizontally
150     LPRINT CHR$(27);"*c1800B";:'1800 dots vertically
160     'Print pattern
170     LPRINT CHR$(27);"*c0P";:'Print rule
180     END
```

2. This example moves the active position to 300 dots (1 inch) from the top and left edges of the printable area, sets the rule/pattern size to 100 dots horizontally and 200 dots vertically, selects predefined pattern number 6, then prints the pattern in the predefined area.

```
100     'Changing the active position
110     LPRINT CHR$(27);"*p300X";:'300 dots from left edge
120     LPRINT CHR$(27);"*p300Y";:'300 dots from top edge
130     'Pattern size specification
140     LPRINT CHR$(27);"*c100A";;'100 dots horizontally
150     LPRINT CHR$(27);"*c200B";:'200 dots vertically
160     'Pattern ID designation
170     LPRINT CHR$(27);"*c6G";:'Pattern 6
180     'Print pattern
190     LPRINT CHR$(27);"*c3P";:'Print predefined pattern
200     END
```

Macro Commands

This section provides a detailed explanation of the commands used to create macros. An example of their use follows the explanation of the MACRO CONTROL command.

Macros are combinations of escape sequences and/or print data that are stored in printer memory, then invoked for printing with just a few commands. They perform functions similar to the forms overlay commands in the Diablo 630 emulation.

Once defined, macros make it possible to do complicated tasks without sending lengthy command sequences to the printer. Any data — including raster graphics, advanced graphics, and other escape sequences — can be included in a macro definition. You can define up to 32 macros at any given time.

The LaserJet+ emulation mode supports two types of macros: temporary and permanent. Temporary macros are deleted by the RESET command (ESC E), but permanent macros are not affected by RESET.

Note: Both types of macros are lost when the printer's power is turned off or the printer is reset using the Hard Reset button on the indicator panel.

Macros can be nested; that is, one macro can include commands that invoke another macro. Such nesting is possible to two levels.

In general, two commands are involved in defining and invoking macros:

- The DESIGNATE MACRO ID command must be sent to the printer to identify the pertinent macro whenever a macro is defined, invoked, or deleted.
- The MACRO CONTROL command starts and ends macro definition, invokes and deletes macros, and assigns the temporary or permanent attribute to defined macros.

Designate Macro ID

Function This command specifies a macro ID number. This command must be sent to the printer before initiating any other macro operation with the MACRO CONTROL command.

Format ESC & f # Y

Parameter

- The ID number of the pertinent macro in the range from 0 to 31.

Example This example designates macro number 15 as the macro that applies to an ensuing MACRO CONTROL command.

<1B>	<26>	<66>	<31>	<35>	<59>
ESC	&	f	1	5	Y

Macro Control

Function This command executes one of the macro control functions.

Format ESC & f # X

Parameter

- The number of the desired macro control function. These functions are listed in Table 10-1 and explained following the table.

Table 10-1 **Macro Control Functions**

#		Macro Control Function
0	*	Start macro definition
1		End macro definition
2	*	Execute macro
3	*	Call macro
4	*	Enable automatic macro overlay
5		Disable automatic macro overlay
6		Delete all macros
7		Delete all temporary macros
8	*	Delete specified macro
9	*	Designate specified macro as "temporary"
10	*	Designate specified macro as "permanent"

Note: For functions marked by an asterisk (*), the MACRO CONTROL command must be preceded by the DESIGNATE MACRO ID command to specify the desired macro.

Descriptions of the Macro Control Functions

Start/End Macro Definition (# = 0 or 1)

These functions establish a temporary macro under the ID number specified by the preceding DESIGNATE MACRO ID command. Steps to establishing a macro with these functions are:

- Execute the DESIGNATE MACRO ID (ESC & f # Y) command to specify the macro number.
- Execute the MACRO CONTROL command with 0 specified in the # field start macro definition.
- Send data to be included in the macro to the printer.
- Execute the MACRO CONTROL command with 1 specified in the # field to end macro definition.

All data sent to the printer between the Start and End functions is included in the macro definition.

Execute Macro (# = 2)

This function initiates all print operations registered under the macro ID number specified by the preceding DESIGNATE MACRO ID command. With this function, changes in any of the following printer conditions during macro execution will be maintained after macro execution is completed.

Page length
Page orientation
Number of copies
Margins
Perforation skip mode
Line termination
End-of-line wrap
Font attributes
HMI (character pitch)
Primary font selection
Font ID
Character code
Macro ID
VMI (line spacing)
Horizontal rule spacing
Vertical rule size
Underline mode
Graphics resolution
Graphics mode
Graphics left margin
Pattern ID

Call Macro (# = 3)

This function acts in the same manner as the Execute Macro function, but after macro operation is completed, all of the printer conditions listed for that function, except the active position, are restored to the states they were in before the function was invoked.

Enable Automatic Macro Overlay (# = 4)

This function automatically calls the macro specified by the preceding DESIGNATE MACRO ID command in each page printed. If automatic macro overlay is currently enabled for some other macro, overlay by that macro is superseded by the macro specified.

When automatic macro overlay is enabled, current settings of the following printer variables become effective each time that macro is automatically invoked.

- Overlay
- Page length
- Orientation
- Number of copies
- Position stack

In addition, the default settings given in Table 10-2 become effective during macro operation.

Table 10-2 **Default Settings During Macro Operation**

Printer Variable	Default Setting
Top margin	1/2 inch from top of page
Text length setting	1/2 inch from bottom of page
Left margin	Leftmost printable position
Right margin	Rightmost printable position
Perforation skip mode	ON
End-of-line wrap	OFF
Font attributes	Printer default values
HMI	Printer default value
Primary font	Printer default value
Secondary font	Printer default value
Font ID	0
Character code	0
Macro ID	0
Current active position	Intersection of top and left margins
VMI (line spacing)	6 lines per inch
Horizontal rule size	0
Vertical rule size	0
Underline mode	OFF
Graphics resolution	75 dots per inch
Graphics mode	OFF
Pattern ID	0
Line termination	0

After macro operation is completed, all of the above variables are restored to the values they held before the function was invoked.

Automatic macro overlay remains effective until disabled with the Disable Automatic Macro Overlay function (# = 5).

Note: Automatic macro overlay is also disabled by changing the page length or orientation, unless such changes are made by the macro being executed. If page length or orientation is changed from within the macro, after macro operation has been completed they are automatically restored to the values they held before the function was invoked.

Disable Automatic Macro Overlay (# = 5)

This function turns off the automatic macro overlay function for the current page and all following pages.

Note: Any change in page length or orientation will — except when made from within a macro — also turn off automatic macro overlay; however, in this case the function is disabled after the page is printed.

Delete All Macros (# = 6)

This function deletes all macros, both temporary and permanent. If received while automatic macro overlay is enabled, automatic overlay ceases.

Delete All Temporary Macros (# = 7)

This function deletes all temporary macros. If any temporary macros are involved in automatic macro overlay, automatic overlay ceases.

Delete Specified Macro (# = 8)

This function deletes the macro specified by the preceding DESIGNATE MACRO ID command.

Designate Specified Macro as "Temporary" (# = 9)

This function assigns the "temporary" attribute to the macro specified by the preceding DESIGNATE MACRO ID command.

Designate Specified Macro as "Permanent" (# = 10)

This function assigns the "permanent" attribute to the macro specified by the preceding DESIGNATE MACRO ID command.

Example

The following program example defines a macro that selects Prestige Elite as the primary character set, then calls the macro to change the character set.

```
10 'Sample macro definition/execution
20 'Reset printer
30 LPRINT CHR$(27);"E";
40 WIDTH LPRINT 255
50 'Specify macro ID
60 LPRINT CHR$(27);"&f1Y";                    :'Macro ID = 1
70 'Start macro definition
80 LPRINT CHR$(27);"&f0X";
90 'Send macro data for primary font selection to printer
100 LPRINT CHR$(27);"&l0O";                   :'Page orientation = 0 (portrait)
110 LPRINT CHR$(27);"(8U";                    :'Symbol set = 8U (Roman-8)
120 LPRINT CHR$(27);"(s12H";                  :'Pitch = 12 (12 cpi)
130 LPRINT CHR$(27);"(s10V";                  :'Height = 10 (10 point)
140 LPRINT CHR$(27);"(s0";                    :'Style = 0 (upright)
150 LPRINT CHR$(27);"(s0B";                   :'Stroke weight = 0 (medium)
160 LPRINT CHR$(27);"(s2T";                   :'Typeface = 2 (Prestige Elite 12)
170 'End of macro data
180 'End macro definition
190 LPRINT CHR$(27);"&f1X";
200 '
210 'Specify macro ID
220 LPRINT CHR$(27);"&f1Y";                   :'Macro ID = 1
230 'Execute macro
240 LPRINT CHR$(27);"&f2X";
250 LPRINT "Primary font: Prestige Elite 12";CHR$(12);
260 END
```

Diagnostic Commands

The diagnostic commands are used to reset the printer, perform an interface self-test, and print control codes.

The RESET command is useful for restoring the printer to a known state before sending print data. The INTERFACE SELF-TEST checks the interface for possible errors. The commands which print embedded control codes are useful for detecting errors in input data.

Reset

Function This command prints any data in the buffer and resets all programmable features to their default values. No data is lost, and communication between the host and the printer is not interrupted. Fonts and macros are retained in memory.

Format ESC E

Note: Normally, this command would be sent when the use of one computer function or software package has been completed and another is to be executed.

Interface Self-Test

Function When the printer receives this command, it stops processing data, prints any data in the buffer, and then performs an interface self-test. If no errors are detected, the printer resumes operation on a new page.

Format ESC z

Start Display Functions Mode

Function This command disables execution of other escape sequences and control codes and, instead, prints them as blanks. This command is useful when debugging and looking for errors.

Format ESC Y

Note: The only codes not affected by this command are the CR code, which is executed as a carriage return and line feed, and the function-termination ESC Z code. ESC Z is printed as a blank space followed by a "Z", after which all other functions are re-enabled.

End Display Functions Mode

Function This command disables the START DISPLAY FUNCTIONS MODE command. This is the default setting for this feature.

Format ESC Z

Ignore Control Codes and Escape Sequences (Transparent Print Data)

Function

This command ignores all escape sequences and control codes, including CR and ESC Z, that appear in the designated number of bytes. Control codes in those bytes are replaced with spaces.

Format

ESC & p # X

Parameter

- The number of bytes for which control codes and escape sequences will be ignored.

Example

This example ignores control codes and escape sequences in the subsequent 1066 bytes.

<1B>	<26>	<70>	<31>	<30>	<36>	<36>	<58>
ESC	&	p	1	0	6	6	X

Command Summary

Page Formatting Commands	Sequence
Set Page Length (Paper Size)	ESC & l # P
Set Top Margin	ESC & l # E
Set Text Length	ESC & l # F
Set Left Margin	ESC & a # L
Set Right Margin	ESC & a # M
Clear Left and Right Margins	ESC 9
Perforation Skip Mode ON/OFF	ESC & l # L
Set HMI	ESC & k # H
Set Lines Per Inch	ESC & l # D
Set VMI	ESC & l # C
Set Page Orientation	ESC & l # O

Movement Commands	Sequence
Move AP Horizontally (By Columns)	ESC & a # C
Move AP Horizontally (By Decipoints	ESC & a # H
Move AP Horizontally (By Dots)	ESC * p # X
Move AP Vertically (By Lines)	ESC & a # R
Move AP Vertically (By Decipoints)	ESC & a # V
Move AP Vertically (By Dots)	ESC * p # Y
Half Line Feed	ESC =
Push/Pop Position	ESC & f # S

Word Processing Commands	Sequence
Set Line Termination Mode	ESC & k # G
Enable/Disable Automatic End-of-Line Wrap	ESC & s # C
Start Automatic Underlining	ESC & d D
End Automatic Underlining	ESC & d @
Set Number of Copies	ESC & l # X
Paper Input Control	ESC & l # H

Font Control and Management Commands	Sequence
Set Page Orientation	ESC & l # O
Select Symbol Set, Primary Font	ESC (# letter
Select Symbol Set, Secondary Font	ESC) # letter
Select Proportional/Fixed Space, Primary	ESC (s # P
Select Proportional/Fixed Space, Secondary	ESC) s # P
Set Character Pitch, Primary Font	ESC (s # H
Set Character Pitch, Secondary Font	ESC) s # H
Set/Cancel Compressed Pitch	ESC & k # S
Set Character Height, Primary Font	ESC (s # V
Set Character Height, Secondary Font	ESC) s # V
Select Character Style, Primary Font	ESC (s # S
Select Character Style, Secondary Font	ESC) s # S
Select Stroke Weight, Primary Font	ESC (s # B
Select Stroke Weight, Secondary Font	ESC) s # B
Select Typeface, Primary Font	ESC (s # T
Select Typeface, Secondary Font	ESC) s # T
Specify Font ID	ESC * c # D
Font and Character Control	ESC * c # F
Designate Download Font as Primary	ESC (# X
Designate Download Font as Secondary	ESC) # X
Set Primary Font Defaults	ESC (# @
Set Secondary Font Defaults	ESC) # @

Font Definition Commands	Sequence
Create Font Descriptor	ESC) s # W
Specify Character Code	ESC * c # E
Download Character	ESC (s # W

Raster Graphics Commands	Sequence
Select Raster Graphics Resolution	ESC * t # R
Start Raster Graphics	ESC * r # A
Transfer Raster Graphics	ESC * b # W
End Raster Graphics	ESC * r B

Advanced Graphics Commands	Sequence
Set Horizontal Rule/Pattern Size (in Dots)	ESC * c # A
Set Horizontal Rule/Pattern Size (in Decipoints)	ESC * c # H
Set Vertical Rule/Pattern Size (in Dots)	ESC * c # B
Set Vertical Rule/Pattern Size (in Decipoints)	ESC * c # V
Designate Pattern ID	ESC * c # G
Print Rule/Pattern	ESC * c # P

Macro Commands	Sequence
Designate Macro ID	ESC & f # Y
Macro Control	ESC & f # X

Diagnostic Commands	Sequence
Reset	ESC E
Interface Self-Test	ESC z
Start Display Functions Mode	ESC Y
End Display Functions Mode	ESC Z
Ignore Control Codes	ESC & p # X

Roman-8 Symbol Set Characters and Locations

Roman-8 is the symbol set for all fonts that come with the LaserJet+ emulation. To use other fonts and symbol sets with your LaserJet+ emulation, you must download them into the printer.

Tables B-1 and B-2 display the Roman-8 characters and their hexadecimal and decimal locations.

Table B-1 **Roman-8 Symbol Set (Primary)**

Hex	Dec	Char	Hex	Dec	Char	Hex	Dec	Char	Hex	Dec	Char
00	000	NUL	20	032	SP	40	064	@	60	096	'
01	001	SOH	21	033	!	41	065	A	61	097	a
02	002	STX	22	034	"	42	066	B	62	098	b
03	003	ETX	23	035	#	43	067	C	63	099	c
04	004	EOT	24	036	$	44	068	D	64	100	d
05	005	ENQ	25	037	%	45	069	E	65	101	e
06	006	ACK	26	038	&	46	070	F	66	102	f
07	007	BEL	27	039	'	47	071	G	67	103	g
08	008	BS	28	040	(	48	072	H	68	104	h
09	009	HT	29	041	)	49	073	I	69	105	i
0A	010	LF	2A	042	*	4A	074	J	6A	106	j
0B	011	VT	2B	043	+	4B	075	K	6B	107	k
0C	012	FF	2C	044	,	4C	076	L	6C	108	l
0D	013	CR	2D	045	-	4D	077	M	6D	109	m
0E	014	SO	2E	046	.	4E	078	N	6E	110	n
0F	015	SI	2F	047	/	4F	079	O	6F	111	o
10	016	DLE	30	048	0	50	080	P	70	112	p
11	017	DC1	31	049	1	51	081	Q	71	113	q
12	018	DC2	32	050	2	52	082	R	72	114	r
13	019	DC3	33	051	3	53	083	S	73	115	s
14	020	DC4	34	052	4	54	084	T	74	116	t
15	021	NAK	35	053	5	55	085	U	75	117	u
16	022	SYN	36	054	6	56	086	V	76	118	v
17	023	ETB	37	055	7	57	087	W	77	119	w
18	024	CAN	38	056	8	58	088	X	78	120	x
19	025	EM	39	057	9	59	089	Y	79	121	y
1A	026	SUB	3A	058	:	5A	090	Z	7A	122	z
1B	027	ESC	3B	059	;	5B	091	[	7B	123	{
1C	028	FS	3C	060	<	5C	092	\	7C	124	|
1D	029	GS	3D	061	=	5D	093	]	7D	125	}
1E	030	RS	3E	062	>	5E	094	^	7E	126	~
1F	031	US	3F	063	?	5F	095	_	7F	127	▒

Notes:

1 Character positions for the primary font are the same as the standard ASCII character set.

2 Column one contains the ASCII control codes.

Table B-2 **Roman-8 Symbol Set (Secondary)**

Hex	Dec	Char	Hex	Dec	Char	Hex	Dec	Char	Hex	Dec	Char
80	128		A0	160		C0	192	â	E0	224	Á
81	129		A1	161	À	C1	193	ê	E1	225	Ã
82	130		A2	162	Â	C2	194	ô	E2	226	ã
83	131		A3	163	È	C3	195	û	E3	227	Đ
84	132		A4	164	Ê	C4	196	á	E4	228	đ
85	133		A5	165	Ë	C5	197	é	E5	229	Í
86	134		A6	166	Î	C6	198	ó	E6	230	Ì
87	135		A7	167	Ï	C7	199	ú	E7	231	Ó
88	136		A8	168	´	C8	200	à	E8	232	Ò
89	137		A9	169	`	C9	201	è	E9	233	Õ
8A	138		AA	170	^	CA	202	ò	EA	234	õ
8B	139		AB	171	¨	CB	203	ù	EB	235	Š
8C	140		AC	172	~	CC	204	ä	EC	236	š
8D	141		AD	173	Ù	CD	205	ë	ED	237	Ú
8E	142		AE	174	Û	CE	206	ö	EE	238	Ÿ
8F	143		AF	175	£	CF	207	ü	EF	239	ÿ
90	144		B0	176	¯	D0	208	Å	F0	240	Þ
91	145		B1	177		D1	209	î	F1	241	þ
92	146		B2	178		D2	210	Ø	F2	242	
93	147		B3	179	°	D3	211	Æ	F3	243	
94	148		B4	180	Ç	D4	212	å	F4	244	
95	149		B5	181	ç	D5	213	í	F5	245	
96	150		B6	182	Ñ	D6	214	ø	F6	246	—
97	151		B7	183	ñ	D7	215	æ	F7	247	¼
98	152		B8	184	¡	D8	216	Ä	F8	248	½
99	153		B9	185	¿	D9	217	ì	F9	249	ª
9A	154		BA	186	¤	DA	218	Ö	FA	250	º
9B	155		BB	187	£	DB	219	Ü	FB	251	«
9C	156		BC	188	¥	DC	220	É	FC	252	■
9D	157		BD	189	§	DD	221	ï	FD	253	»
9E	158		BE	190	ƒ	DE	222	ß	FE	254	±
9F	159		BF	191	¢	DF	223	Ô	FF	255	

Note: Locations in Table B-2 that are blank do not have characters assigned to them.

Mode Setting Table

Table C-1 shows the mode settings that are supported in the LaserJet+ emulation mode. Note the following differences between these mode settings and those that are supported in the Diablo 630 emulation mode:

- The LaserJet+ mode supports only two print orientation modes, word processing portrait and landscape. There is no provision for a separate data processing mode such as the one supported by the Diablo 630 emulation.
- With the LaserJet+ emulation mode, line pitch depends on the selected font; it cannot be selected by changing the mode setting.
- Only an emulation card font can be selected as the default font. Default to a cartridge font is not possible.

The procedure for changing mode settings is exactly the same as when using the printer in the resident Diablo 630 mode. For information about setting the printer modes, consult the *AP 9215-1 Printer Installation and Operations Guide*.

Table C-1 **LaserJet+ Emulation Mode Settings**

Mode	Values
Host Interface	Parallel, ACK In Busy Parallel, ACK Out Busy Serial, DTR Serial, DTR + XON/XOFF Serial, XON/XOFF
Emulation Mode	Internal (D630) Option
Printer Mode	WP-Portrait WP-Landscape
Line Termination	CR=CR, LF=LF CR=NL, LF=LF CR=CR, LF=NL CR=NL, LF=NL
Auto Wrap Around	Enable Disable
Current CPI	10 CPI 12 CPI 16.7 CPI Depends on Font

Current Font	Courier 10 LJ Prestige Elite 12 LJ Letter Gothic 16.7 LJ Century PS LJ
Nationality	U.S.A.
Serial Baud Rate	150 baud 300 baud 600 baud 1200 baud 2400 baud 4800 baud 9600 baud 19200 baud
Serial Data Form	8 bits 1 stop none 8 bits 1 stop odd 8 bits 1 stop even 8 bits 2 stop none 8 bits 2 stop odd 8 bits 2 stop even 7 bits 1 stop none 7 bits 1 stop odd 7 bits 1 stop even 7 bits 1 stop mark 7 bits 1 stop space 7 bits 2 stop none 7 bits 2 stop odd 7 bits 2 stop even 7 bits 2 stop mark 7 bits 2 stop space
Serial I/F Mode	Half duplex mode Full duplex mode
Page Origin	Printable area Paper edge
Endless Feed	Enable Disable

Notes:

1 If fonts are switched from the indicator panel, they may not operate as expected, depending on your application software.

2 Upon entering the LaserJet+ emulation mode, the permanent settings for the following Diablo 630 modes will remain effective unless they are changed along with the emulation mode: Host Interface, Nationality, Page Origin, Endless Feed.

LaserJet+ Emulation Card Fonts

Figure D-1 LaserJet+ Emulation Card Fonts (Part 1 of 2)

Courier 10 LJ:

```
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOP
QRSTUVWXYZ[\]^_'abcdefghijklmnopqrstuvwxyz{|}~▒À
ÂÈÊËÎÏ´`^¨˜ÙÛ£¯°ÇçÑñ¡¿¤£¥§ƒ¢âêôûáéóúàèòùäëöüÅîØÆ
åíøæÄìÖÜÉïßÔÁÃãÐđÍÌÓÒÕõŠšÚŸÿÞþ—¼½ª º«■»±
```

P.Elite 12 LJ:

```
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOP
QRSTUVWXYZ[\]^_'abcdefghijklmnopqrstuvwxyz{|}~▒À
ÂÈÊËÎÏ´`^¨˜ÙÛ£¯°ÇçÑñ¡¿¤£¥§ƒ¢âêôûáéóúàèòùäëöüÅîØÆ
åíøæÄìÖÜÉïßÔÁÃãÐđÍÌÓÒÕõŠšÚŸÿÞþ—¼½ª º«■»±
```

L.GOTHIC 16.7 LJ:

```
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOP
QRSTUVWXYZ[\]^_'abcdefghijklmnopqrstuvwxyz{|}~▪À
ÂÈÊËÎÏ´`^¨˜ÙÛ£¯°ÇçÑñ¡¿¤£¥§ƒ¢âêôûáéóúàèòùäëöüÅîØÆ
åíøæÄìÖÜÉïßÔÁÃãÐđÍÌÓÒõŠšÚŸÿÞþ–½½ªº«■»±
```

Century PS LJ:

```
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOP
QRSTUVWXYZ|\|^_'abcdefghijklmnopqrstuvwxyz{|}~▒À
ÁÈÊËÍÏ´`^¨˜ÙÛ£_°ÇçÑñ¡¿¤£¥§ƒ¢âêôûáéóúàèòùäëöüÅîØÆ
åíøæÄìÖÜÉïßÔÁÃãÐđÎÌÓÒÕõŠšÚŸÿÞþ–½½ªº«■»±
```

Figure D-1 LaserJet+ Emulation Card Fonts (Part 2 of 2)

Glossary

An acronym or name in parentheses at the beginning of a definition in this glossary indicates the following:

- ANDIPS: The definition is taken from the *American National Dictionary for Information Processing Systems* (American National Standards Committee X3, Information Processing Systems, 1982).
- ISO: The definition is approved by the International Organization for Standardization Technical Committee 97, Subcommittee 1.
- Kroenke: The definition is taken from *Business Computer Systems: An Introduction* by David M. Kroenke (Mitchell: Santa Cruz, California, 1981).

active position (AP). A numerical pointer that at any given time indicates the location of one dot within the maximum printable area.

American Standard Code for Information Interchange (ASCII). An 8-bit code in which seven bits indicate the character and the eighth bit verifies the character's accuracy.

AP. Active position.

ASCII. American Standard Code for Information Interchange (pronounced askey).

Backspace (BS). A single-byte ASCII control code that moves the active position one column width to the left. The corresponding hexadecimal code is <08>.

baseline. The imaginary line on which the characters in a font "rest."

baud rate. The speed of data transmission from a computer to a peripheral device, such as a printer, or from one device to another, measured in bits per second.

binary. A system of numbers that has two as its base and uses only combinations of the digits zero (0) and one (1).

binary digit. *Synonymous with* bit.

bit. 1. The smallest unit of information transfer recognized by a computer, having a value of either zero (0) or one (1). Characters are composed of seven or eight bits. 2. (ISO) *Synonym for* binary digit.

bit image graphics. *Synonymous with* raster graphics.

BS. Backspace.

buffer. (Kroenke) An area of printer memory used as a temporary holding place for data.

byte. A computer storage unit equivalent to eight bits (one character) of information.

Carriage Return (CR). A single-byte ASCII control code that moves the active position to the left margin of the same line. In the LaserJet+ emulation, if the Line Termination mode has been set for CR=NL or the SET LINE TERMINATION MODE command has been set to 1 or 3, the active position also moves to the next line. The corresponding hexadecimal code is <0D>.

character cell. The rectangular space allotted for each character in a font.

character cell reference point. The first dot in the baseline.

character pitch. In printing, a measure of the number of characters that can fit in an inch. Sometimes referred to as simply "pitch."

character set. *Synonymous with* symbol set.

command. An instruction to the printer to perform a specific action.

control code. A single-byte ASCII character that can be embedded in a file to instruct the printer to perform a certain action.

cpi. Characters per inch.

cps. Characters per second.

CR. Carriage Return.

decipoint. In printing, a unit of measure equal to 1/10 point or 1/720 inch.

default. A predetermined value the system uses, or action the system takes, unless it receives an instruction to use an alternate value or perform an alternate action.

download. To transmit data from a host computer to the memory of another system or device. For example, to download font data from a host computer to a printer.

dpi. Dots per inch.

effective printable area. 1. The area on a sheet of paper to which printing is restricted as determined by page length, perforation skip, and top, left, and right margin settings. 2. *Contrast with* maximum printable area, unprintable area.

emulate. 1. (ANDIPS, ISO) To imitate one system with another, primarily by hardware, so that the imitating system accepts the same data, executes the same programs, and achieves the same results as the imitated system. 2. Specifically in this manual, to imitate the command set of another printer.

emulation. *See* printer emulation, resident emulation.

emulation card. 1. A small card packaged in plastic which contains the command set of another printer. When the card is installed in the AP 9215-1 printer, it allows the AP 9215–1 to imitate the other printer and use its commands. 2. *See also* printer emulation.

ESC. Escape.

Escape (ESC). A single-byte ASCII control code that initiates an escape sequence. The corresponding hexadecimal code is <1B>.

escape sequence. A series of characters beginning with the control code ESC (decimal 27 or hexadecimal <1B>) that activates a printer function.

FF. Form feed.

fixed spacing. 1. *Synonym for* monospacing. 2. A method of printing text so that the amount of horizontal space for each character is equal regardless of its width. 3. *Contrast with* proportional spacing.

font. 1. A group of characters (letters, number, symbols, and so on) that share certain characteristics, such as size and style. An example of a font is Courier 10. 2. *See also* typeface, resident font.

Form Feed (FF). A single-byte ASCII control code that prints out any data in the printer buffer, ejects the sheet of paper, and advances the active position to the top margin on the next page. In the LaserJet+ emulation, if the Line Termination mode has been set for LF=NL or the SET LINE TERMINATION MODE command has been set to 2 or 3, the active position also moves to the left margin. The corresponding hexadecimal code is <0C>.

full duplex. 1. Pertaining to a mode of data communication which allows independent, simultaneous transmission and reception of data. 2. *Contrast with* half duplex.

h. Hexadecimal.

half duplex. 1. Pertaining to a mode of data communication in which transmission is alternating and unidirectional (one way at a time). 2. *Contrast with* full duplex.

hard reset. *Synonym for* reset.

hex. Hexadecimal.

hexadecimal (h or hex). A number based on 16 digits. Hexadecimal means 16: (HEX=6) + (DEC=10). Programmers use hexadecimal numbers as a shorthand method for representing binary numbers. Each four bits of binary is converted to a single hexadecimal digit.

HMI. Horizontal motion index.

horizontal motion index (HMI). 1. The distance the active position moves across the page after each character. 2. *Synonymous with* horizontal motion increment in the Diablo 630 emulation.

landscape. 1. In printing, a page orientation in which the lines of type run parallel to the long side of the page. 2. *Contrast with* portrait.

LF. Line feed.

Line Feed (LF). A single-byte ASCII control code that moves the active position down to the next print line without changing the horizontal position. In the LaserJet+ emulation, if the Line Termination mode has been set for LF=NL or the SET LINE TERMINATION MODE command has been set to 2 or 3, the active position also moves to the left margin. The corresponding hexadecimal code is <0A>.

line feed pitch. In printing, a measure of the number of lines that can fit in a vertical inch.

lpi. Lines per inch.

macro. A combination of escape sequences and/or print data that is stored in printer memory, then invoked for printing with just a few commands. Macros perform functions similar to the forms overlay commands in the Diablo 630 emulation.

maximum printable area. 1. The area on a sheet of paper within which it is physically possible to print. 2. *Contrast with* effective printable area, unprintable area.

monospacing. *Synonymous with* fixed spacing.

nest. 1. To stack one command, loop, or other program structure inside another. 2. Specifically in this manual, to include commands in one macro that invoke another macro.

orientation. 1. In printing, the way the lines of type appear in relation to the sides of the page. 2. *See also* portrait, landscape.

override. To take precedence over, as when one printer command *overrides* another.

page orientation. *See* orientation.

parameter. A variable or constant value that a system needs to execute and operation.

perforation skip. In printers which use fanfold (continuous) paper, the distance between the last print line on one page and the first print line on the next. The printer uses this measurement to skip over the perforations between the sheets of paper. In the LaserJet+ emulation for the AP 9215-1 laser printer, this distance marks the bottom margin.

physical left. The side of a character closest to the left edge of the physical page. With portrait orientation, the left edge of the character when viewed upright; with landscape orientation, the top edge of the upright character.

physical left edge. When describing a character, the leftmost black point in the character cell.

physical top. The side of the character closest to the top edge of the physical page. With portrait orientation, the top edge of the character when viewed upright; with landscape orientation, the right edge of the upright character.

physical top edge. When describing a character, the topmost black point in the character cell.

pitch. *See* character pitch, line feed pitch.

point. In printing, a unit of measure equal to 1/72 inch.

portrait. 1. In printing, the page orientation in which the lines of type run parallel to the short side of the page. 2. *Contrast with* landscape.

primary character set. 1. Generally, characters located at hexadecimal code positions <20> through <7F>. The primary character set usually consists of the standard alphabet in both upper and lower case letters, the numbers 0 through 9, and standard symbols, such as the asterisk (*) and ampersand (&). 2. *Contrast with* secondary character set.

printable area. 1. The rectangular portion of a sheet of paper that is able to receive print. In the AP 9215-1 printer, the printable area is less than the full paper size to allow for differences in mechanical tolerances in the print engine (registration and skew) and for sheet to sheet variations in the paper itself. 2. *See also* effective printable area, maximum printable area, unprintable area.

printer emulation. 1. A program which allows one printer to imitate another. 2. *See also* resident emulation.

proportional spacing. 1. A method of printing text so that the amount of horizontal space for each character is proportional to its width. For example, more space is allotted to the letter W than the letter I. 2. *Contrast with* fixed spacing.

raster graphics. 1. Graphics produced by controlling the printing of individual dots. 2. *Synonym for* bit image graphics.

reference point. *See* character cell reference point.

reset. 1. In this manual, to restore all printer modes and settings to the values they hold when the printer's power is turned on. 2. *Synonymous with* hard reset.

resident emulation. 1. The command set that comes with the printer. For the AP 9215-1, the resident emulation imitates a Diablo 630 printer. 2. *See also* printer emulation.

resident font. 1. A font that is provided in the memory of the printer or printer emulation. 2. *See also* font.

secondary character set. 1. Generally, characters located at hexadecimal code positions <A0> through <FF>. The more unusual symbols, accents, and diacritical marks are usually in the secondary character set. 2. *Contrast with* primary character set.

Shift In (SI). 1. A single-byte ASCII control code that switches printing to the primary character font. The corresponding hexadecimal code is <0F>. 2. *Contrast with* Shift Out.

Shift Out (SO). 1. A single-byte ASCII control code that switches printing to the secondary character font. The corresponding hexadecimal code is <0E>. 2. *Contrast with* Shift In.

SI. Shift In.

SO. Shift Out

symbol set. 1. *Synonym for* character set. 2. A group of characters that are mapped to locations in the printer's memory.

text length. The number of lines that can be printed between the top margin and the point at which printing moves to the next page.

typeface. 1. A group of characters (letters, numbers, symbols, and so on) that share certain design characteristics. Courier is an example of a typeface. 2. *See also* font.

unprintable area. 1. The area on a sheet of paper within which it is impossible to print. This area allows for differences in mechanical tolerances in the print engine (registration and skew) and for sheet to sheet variations in the paper itself. 2. *Contrast with* effective printable area, maximum printable area.

vertical motion index (VMI). 1. The distance the active position moves down the page after each line. 2. *Synonymous with* vertical motion increment in the Diablo 630 emulation.

VMI. Vertical motion index.

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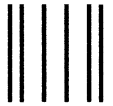

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