Model 8900 Series Printer
Technical Reference Manual

**LAKE ERIE
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COMPUTING AND PRINTER SOLUTIONS

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Preface

This manual contains technical information about the Model 8900 Series Printers. This information supplements the information contained in the *Model 8900 Series Printer User's Manual* Part No. 2557785-0002 and is essential to programmers, system managers, and other technically oriented people.

The information in this manual is presented in individual sections so you can skip pages with information you already know or that does not apply to your particular application.

Symbols Used in This Manual

Two international symbols are used throughout this manual to advise you of important information.

This symbol indicates a **Note** concerning operating procedures or information you should know to help you operate your printer.

This symbol alerts you to a **Warning** or **Caution** which can prevent you from causing a hazard to yourself or to your printer.

Contents

Chapter 1 — General Information provides a general description of the Model 8900 Series Printer and brief information about some of the principals of dot-matrix printing.

Chapter 2 — Printer Setup provides information about printer configuration. Specifically, this chapter describes the control panel switch functions and the setup/test menu. This information supplements the information contained in Chapter 4 of the *Model 8900 Series Printer User's Manual,* Part No. 2557785-0002.

Chapter 3 — Character Sets and Global Commands provides general information about character sets and their use in the Model 8900 Series Printer and describes the commands that are valid for all emulation modes, both standard and optional. These commands provide control of the basic features of the Model 8900 Series Printer.

Chapter 4 — Texas Instruments Model 880 Printer Emulation describes the commands of the Model 880 Printer command set and provides information about operating the Model 8900 Series Printer in the Model 880 Printer emulation mode.

Chapter 5 — Texas Instruments Model 855 Printer WP Emulation describes the commands of the Model 855 Printer WP emulation command set and provides information about operating the Model 8900 Series Printer in the Model 855 Printer WP emulation mode.

Chapter 6 — Texas Instruments Model 855 Printer DP Emulation describes the commands of the Model 855 Printer DP emulation command set and provides information about operating the Model 8900 Series Printer in the Model 855 Printer DP emulation mode.

Chapter 7 — IBM Proprinter XL Emulation describes the commands of the IBM Proprinter XL command set and provides information about operating the Model 8900 Series Printer in the IBM Proprinter XL emulation mode.

Chapter 8 — Epson FX Printer Emulation describes the commands of an Epson FX printer command set and provides information about operating the Model 8900 Series Printer in the Epson FX printer emulation mode.

Chapter 9 — Optional Emulation Commands describes optional emulation commands available for the Model 8900 Series Printer.

Chapter 10 — Communication Interfaces describes the standard parallel and serial communication interfaces used with the Model 8900 Series Printer.

Appendix — Application Instructions explains how to use the Z-axis printhead adjustment escape sequence and how to clean the automatic page finder sensor.

Other Manuals About the Printer

The following manuals are available to help you learn more about your printer and to help you operate and maintain the printer.

Title	Part Number
Model 8900 Series Printer Quick Reference Guide	*2557786-0002*
Model 8900 Series Printer User's Manual	*2557785-0002*
Model 8900 Series Printer Maintenance Manual	*2557788-0001*
Model 8900 Series Printer Safety Instructions	*2557807-0002*

Supplies

2551152-0011 Ribbon Cartridge, Black
2551152-0014 Ribbon Cartridge, Color

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1
General Information

Introduction

The Model 8900 Series Printer is one of a family of rugged, high-performance, dot-matrix impact printers, which forms letters, numbers, and other symbols by printing dot patterns. The printer offers a variety of common and unique features, such as multiple paper paths and paper-feed methods, selectable print-quality settings, zero paper tear-off to prevent waste of paper and forms, and color printing.

This chapter provides general information about the printer.

Paper-Handling System

Both models (8930 and 8920) of the Model 8900 Series Printer can print heavy-duty multipart continuous forms. In addition, the 8930 can accept hand-inserted cut-sheet paper. Upon completion of a printing operation, the printer automatically positions the tear-off perforation even with the tear-off bar to allow removal of the printed document.

A useful feature of the printer is its ability to *park* continuous paper out of the print station area for unloading the paper supply or for switching to another paper-handling mode. This feature lets you switch instantly from continuous paper operation to cut-sheet paper insertion (Model 8930).

Each time you load continuous paper or insert cut-sheet paper, the printer automatically positions the paper and adjusts the printhead. The Page Finder™ sensor (located on the printhead carriage) detects the top, left, and right edges of the paper and sends this information to the printer electronics. The printer uses this information to adjust the paper to the top-of-form position and to adjust the printhead to operate within the left and right boundaries of the paper, regardless of the paper width. The Z-Axis Control™ motor adjusts the printhead-to-paper (z-axis) clearance to its optimum value, regardless of the thickness of the paper or form set.

All paper-handling operations are accessible through the control panel and via the host computer using global commands.

Printer Features

The Model 8900 Series Printer includes the following features.

❑ Print quality choices — letter-quality (LQ), text, normal draft, and Rapid Print™ draft

❑ Standard character sets — US ASCII (with 13 international substitution tables), IBM® PC1, IBM PC2, IBM Multinational, ISO 8859/1 Multinational and Nordic PC

❑ Character spacing (pitch) — 5.0, 6.0, 7.5, 8.6, 10.0, 12.0, 15.0, 16.7 and 17.1 characters per inch (cpi), depending on the emulation mode in effect

❑ Line length — 13.6 inches (345.44 mm) maximum

❑ Maximum character columns — 136 at 10.0 cpi, 163 at 12.0 cpi, 204 at 15 cpi, and 227 at 16.7 cpi

❑ Line spacing — 3, 4, 6 and 8 lines per inch (lpi)

❑ Line feed modes — forward and reverse full or one-half line (for superscript and subscript characters)

❑ Print enhancements — bold, emphasized, underlined, and expanded with true descenders (for lowercase characters such as *g, j,* and *y*)

❑ Standard fonts — Courier and Gothic

❑ Optional fonts — Prestige Elite, Presenter, Barcode 3 of 9, Interleave 2 of 5, OCRA, OCRB and PostNet

❑ Graphics capabilities — vertical raster graphics (all points addressable)

❑ Color printing — up to seven colors, including black, for both text and graphics (standard on Model 8930 and optional on Model 8920)

❑ Resident emulation modes — TI 880, TI 855, Epson® FX and IBM Proprinter XL

❑ Standard communication interfaces — serial (RS-232 or RS-423 specified by customer when purchasing the printer) and parallel

❑ Optional communication interfaces — RS-422 serial and current loop (TTY)

Print Quality

The dot-matrix impact printhead forms a character by printing dots in a rectangular arrangement of dot cells called a dot matrix.

The following figure shows some examples of dot-matrix characters. Each character is printed in a 7-dot by 9-dot matrix. Three columns of blank dots at the right side of each character, the intercharacter space, provide the proper horizontal spacing between characters.

typical dot-matrix characters
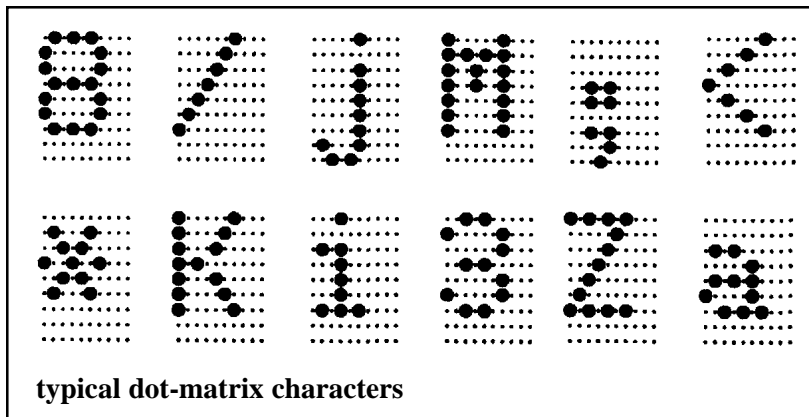
Quality can be improved by increasing the dot density (resolution), as shown in the following figure. Dot density is expressed in dots per inch (dpi).

| **low-resolution character** | **medium-resolution character** | **high-resolution character** |

effect of increasing dot density
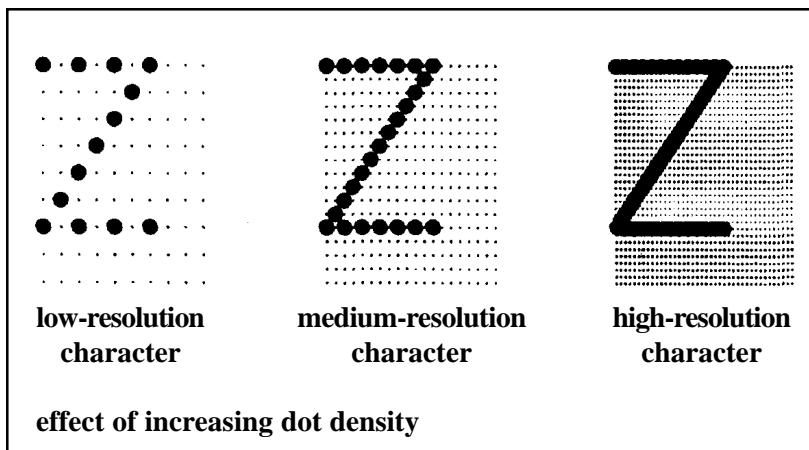
The Model 8900 Series Printer offers four levels of print quality, based on the dot density and the placement of dots on the matrix. The increased dot density at higher print-quality levels decreases the print speed.

The printer offers the following print-quality levels and speeds.

❑ Letter quality (LQ) — high-resolution, 32-dot by 18-dot characters at 100 characters per second (cps).

❑ Text quality — medium-resolution, 15-dot by 9-dot characters at 240 cps.

❑ Normal draft quality — low-resolution, 9-dot by 9-dot characters at 400 cps.

❑ Rapid Print draft quality — low-resolution, 7-dot by 9-dot characters. This mode is only valid for character spacings (pitches) of 12 characters per inch (cpi) and 15 cpi. These character pitches allow the printer to print at speeds of 480 cps and 600 cps, respectively.

Raster Graphics

The all-points-addressable raster graphics mode lets you use your printer to produce pictorial material, such as charts, graphs, special characters, or almost any design you can devise. Special commands allow you to design images of any shape by causing the printhead to print dots in the appropriate places. (See Chapters 4 through 8 for information about raster graphics commands.)

The best way to print graphics is to use one of the many commercially available application programs. These programs let you design images by drawing them on your computer monitor and then issuing a command to send them to your printer.

2
Printer Setup

Introduction

The Model 8900 Series Printers are compatible with a wide range of computers and application software. The printer menu structure enables you to select and alter the fundamental printer operating parameters to fit the requirements of your computer, its communication interface, and its application software. You can set these parameters via the operator control panel (see the following figure).

To set up the printer, you set the various printer parameters to meet the requirements of your computer system. (Refer to your computer operator's manual for more information.) After you set the parameters to the required values, the printer stores these settings in its nonvolatile random-access memory (NVRAM). Because the NVRAM retains information even when the printer is without power, the printer retains these settings until you change them.

function switch associated with messages and symbols shown at the left end of the display (loads form on 8930)

select items shown on the display (loads form on 8920)

display

function switch associated with messages and symbols shown at the right end of the display

selects one of ten preset form formats or forms settings report

allows you to change form format values

allows you to select the primary paper path or an alternate paper path

selects online or offline operation

selects one of four character spacing choices

clears error messages from the display

selects one of three print quality choices

selects one of the standard fonts or an optional font

allows you to get a report of current printer settings, test basic printer functions, and change printer features

advances paper to the top of the next form

causes the display to show a brief summary of printer status and current printer settings

invokes the form align screen which lets you move the paper up or down in the print station

operator control panel

Note: The *Model 8900 Series Printers User's Manual* (Part No. 2557785-0002) explains the basic use of the operator control panel and its associated menu structure.

The Setup/Test switch on the control panel lets you enter the setup/test menu. This menu consists of the following submenus containing most of the printer setup parameters and test features.

❑ Emulation mode — The emulation mode submenu lets you select an emulation mode and set its parameters. This submenu also lets you select the hexadecimal dump mode.

❑ Interface parameters — The interface parameters submenu lets you set the serial communication parameters to the values required by the host computer and by the communication interface.

❑ Miscellaneous parameters — The miscellaneous parameters submenu lets you select various printer features, both standard and optional.

❑ Test mode — The test mode submenu lets you select the printer test features.

The following figure shows the setup/test menu and the following paragraphs describe the setup/test submenus.

setup/test menu
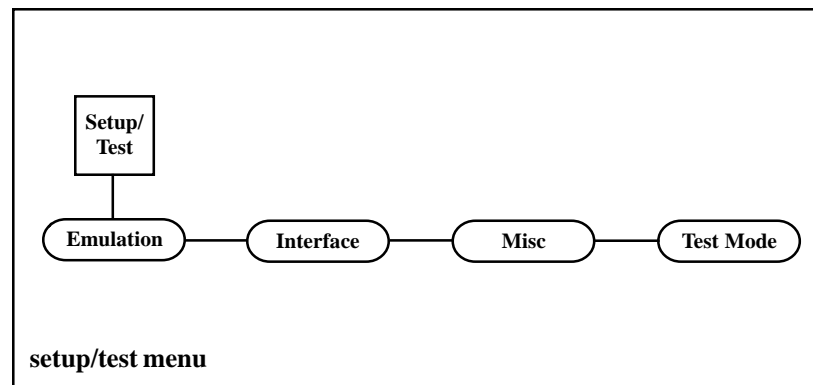
Model 8900 Series Emulation Modes

The emulation mode determines how the printer responds to commands
from the host computer and determines the specific set of commands
to which the printer responds. For example, if you select the TI 880
emulation mode, the printer emulates the functions of the TI Model
880 Printer and responds to the set of commands designed for that
printer.

The emulation mode submenu lets you choose one of the following
emulation modes or select the hexadecimal dump mode.

❑ TI Model 880 printer (default)

❑ TI Model 855 printer

❑ IBM Proprinter XL

❑ Epson FX printer

❑ Optional

❑ Hexadecimal dump

Chapters 4 through 8 of this manual describe these emulation modes
and their functions. The emulation mode you choose must be
compatible with the host computer and its currently installed software.

The following figure shows the emulation mode submenu and the
following paragraphs describe the emulation mode setup parameters.

Emulation

| TI880 | TI855 | ProPrinter | Epson | *optional* | Hexdump |

TI880
- Execute Commands
  - ON
  - OFF
- LF/CR ON LF
  - OFF
  - OFF
- LF/CR ON CR
  - ON
  - OFF
- CR W/LF VT DC2
  - ON
  - OFF
- Graphics
  - ON
  - OFF
- SO= Expand
  - ON
  - OFF

TI855
- Proc Mode
  - DP
  - WP
- Auto LF
  - NO
  - YES

ProPrinter
- Auto LF
  - NO
  - YES
- Auto CR
  - NO
  - YES
- Slashed 0's
  - NO
  - YES

Epson
- Auto LF
  - NO
  - YES
- Auto CR
  - NO
  - YES
- Slashed 0's
  - NO
  - YES

emulation mode submenu
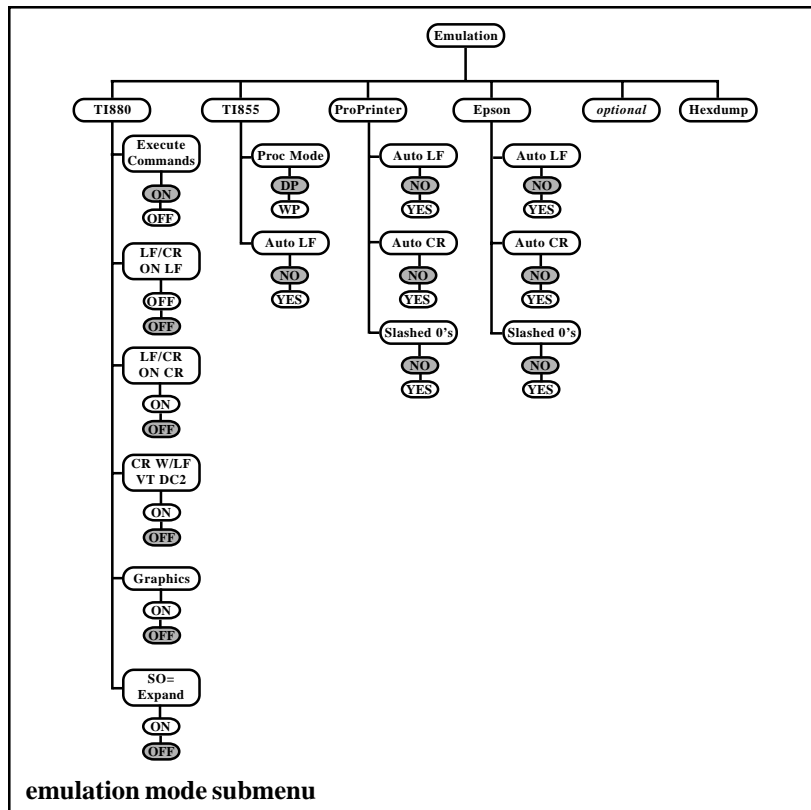
TI 880 Emulation

The TI 880 emulation submenu contains a group of setup parameters that can be set to either on or off. These parameters determine how your printer responds to certain commands from the host computer.

Execute Commands

When on, this parameter enables the printer to respond to escape sequence commands from the host computer. The default setting is ON.

Line Feed and Carriage Return Upon Receipt of LF

When on, this parameter causes the printer to perform both a line feed (LF) operation and a carriage return (CR) operation upon receiving an LF command from the host computer. The default setting is OFF.

Line Feed and Carriage Return Upon Receipt of CR

When on, this parameter causes the printer to perform both an LF operation and a CR operation upon receiving a CR command from the host computer. The default setting is OFF.

Carriage Return Upon Receipt of LF, VT, or DC2

When on, this parameter causes the printer to perform a CR operation upon receiving any of the following commands.

❑ Line feed (LF) — The printer moves the printhead down to the next print line and returns the carriage to the left margin.

❑ Vertical tabulation (VT) — The printer prints the remainder of the current print line, moves the printhead down to the next vertical tab stop, and returns the carriage to the left margin.

❑ Device control 2 (DC2) — The printer moves the printhead down to the print line specified by the DC2 *n* (Move to Line *n)* command and returns the printhead to the left margin.

The default setting for the parameter CR W/LF VT DC2 is OFF.

Graphics

When on, this parameter enables the raster graphics escape sequences described in Chapter 4. The default setting is OFF.

Shift Out Equals Expanded Print

When on, this parameter causes the printer to print one line of expanded print after receiving a shift out (SO) command. When this parameter is off, the printer invokes the G1 character set into the GL area of the character table upon receiving SO. The default setting is OFF.

TI 855 Emulation

The TI 855 emulation submenu contains the processing mode (WP/DP) parameter and the automatic line feed parameter, both of which can be set to match the requirements of your computer. The following paragraphs describe these parameters.

Processing Mode

The Tl 855 emulation mode lets you choose either of the following processing modes.

❑ DP mode — uses commands (described in Chapter 6) similar to those used by a dot-matrix-type printer.

❑ WP mode — uses commands (described in Chapter 5) similar to those used by a daisy-wheel printer.

The default setting for the processing mode parameter is DP.

Automatic Line Feed

Some software programs send both a CR command and an LF command at the end of each print line, while others send only a CR command. For software that sends only a CR command at the end of each print line, the printer needs to perform an LF operation automatically. The default setting for the automatic LF parameter is NO.

IBM Proprinter XL and Epson FX Emulations

The IBM Proprinter XL and Epson FX emulation submenus contain the same following parameters.

Automatic Line Feed

This parameter is identical to the automatic LF parameter described for the TI 855 emulation mode. The default setting is NO.

Automatic Carriage Return

This parameter is similar to the automatic LF parameter but is turned on for software that does not send a CR command at the end of each print line. If the printer advances from print line to print line but fails to perform a carriage return operation, you need to turn on the automatic CR parameter. The default setting is NO.

Slashed Zeros

When on, this parameter causes the printer to print slashes over all zeros to distinguish them from the letter *O.* The default setting is NO.

Hexadecimal Dump Mode

The hexadecimal dump (HEXDUMP) mode causes the printer to print the ASCII (hexadecimal) codes for all text characters, control characters, and escape-sequence commands it receives. The resulting printout can be useful as a troubleshooting device or in analyzing a block of data and commands sent from the host computer.

The printer does not respond to any control characters or commands *except* when the printer is using the serial or option port and FLOW CONTROL is set to ETX/ACK; in such a case, the printer interprets and responds to an ETX control character as an end-of-text command. The ETX character is also included as part of the hex dump.

Note: Chapter 3 describes ASCII codes and control characters; Chapters 5 and 6 describe the escape-sequence commands for the TI 855 emulation mode.

Interface Parameters

The interface parameters are values associated with serial communication interfaces. When using a serial interface, these parameters must be set to correspond to the capabilities of the host computer and the interface.

The following figure shows the interface submenu and the following paragraphs describe the interface setup parameters.

interface parameters submenu
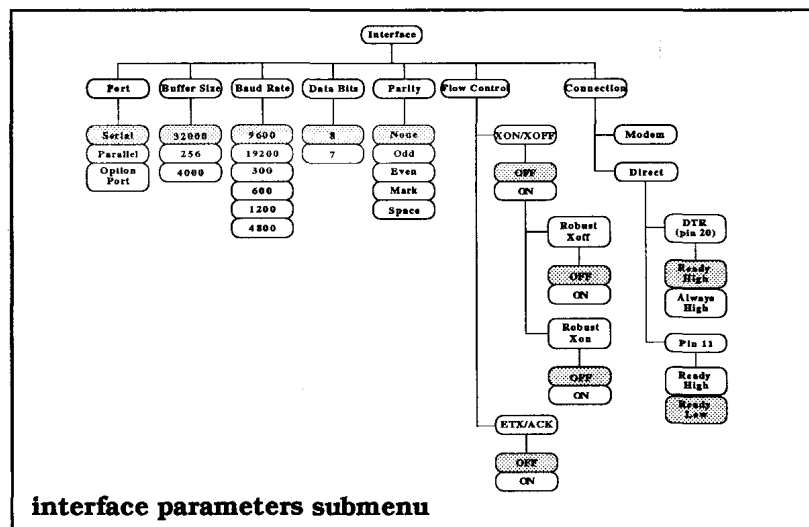
Port

The port submenu lets you choose the correct communication interface port, depending on whether you are using a serial, parallel, or optional interface. The default setting is SERIAL.

Buffer Size

The buffer size specifies the number of data bytes that the printer's receive buffer can store. The buffer size parameter can be set to 256, 4000, or 32,000 bytes. The default setting is 32,000.

Baud Rate

The baud rate is the rate (in bits per second) at which the interface transfers data. This parameters are 300, 600, 1200, 2400, 4800, 9600, or 19,200 bits per second. The default setting is 9600.

Note: Data transferred over a serial interface consists of either 7- or 8-bit data bytes, each of which is accompanied by a start bit, a stop bit, and a parity bit. The values chosen for the data bits and parity parameters depend upon the requirements of the host. (See Chapters 3 and 10.)

Data Bits

The data bits parameter specifies whether the printer is to print 7- or 8-bit character codes. The default setting is 8. (Refer to Chapters 3 and 10 for information about 7- and 8-bit data.)

Parity

Parity checking (often called simply *parity)* is a method of verifying that data is not changed in the transfer process. This parameters are None, Odd, Even, Mark, or Space, depending upon the requirements and capabilities of your computer. The default setting is NONE. If the parity bit is selected, it is in addition to the 7 or 8 data bits.

Flow Control

To ensure the orderly flow of data between the host and printer, the host computer establishes a set of rules commonly known as the ready/busy protocol. This protocol allows the printer to notify the host that it is either ready to receive data or that it is busy and cannot receive data. The following paragraphs describe the flow-control parameters.

XON/XOFF (transmit-on/transmit-off)

For this busy-handling protocol, the printer sends a single XON (a DC1 control character) to indicate that it is ready to receive data and a single XOFF (a DC3 control character) to indicate that it is busy. The default setting is OFF.

Robust XON/XOFF

For the robust XON/XOFF protocol, the printer sends an XON (DC1 control character) approximately every 5 seconds to indicate that it is ready to receive data until either data is received or another busy condition occurs. The printer sends an XOFF *(*DC3 control character) when the initial busy condition occurs (buffer overflow) to indicate that it is busy. If the host continues to send data, the printer sends an XOFF approximately every 20 ms until the hosts stops sending data. The default setting is OFF.

The following table lists the ready and busy points using the XON/XOFF protocol.

LCD Display of Buffer Size	Busy Point From Empty	Ready Point After Busy
32,000	@ 32,000 Bytes	@ 31,250 Bytes
4,000	@ 4,000 Bytes	@ 3,250 Bytes
256	@ 256 Bytes	@ 128 Bytes

Note: Actual buffer size is 32,768 bytes; overflow error status only occurs after 32,768 bytes.

ETX/ACK (end-of-text/acknowledge)

For this busy-handling protocol, the host sends an ETX control character at the end of each data transmission, and the printer responds with an ACK control character to indicate that it is ready to receive additional data. If the printer is busy when it receives the ETX control character, it delays sending the ACK control character until the busy condition is cleared. The default setting is OFF.

Connection

This feature provides selections for use when connecting the printer directly to the host computer or indirectly via a modem. When you connect the printer to a modem, set the connection parameter to MODEM. When you connect the printer directly to the host computer or a terminal, select DIRECT and set the busy-handling parameters to conform to the requirements of the computer. The default setting is DIRECT. The following paragraphs describe the direct connection, ready/busy protocol.

DTR (Pin 20)

For this parameter you can choose either READY HIGH or ALWAYS HIGH. For the READY HIGH setting, the printer sets interface pin 20 high to indicate that it is ready to receive data and low to indicate that it is busy. For the ALWAYS HIGH setting, pin 20 is not used for busy notification; one of the other busy-handling options must be chosen. The default setting is READY HIGH.

PIN 11

For this parameter, you can choose either READY HIGH or READY LOW. For the READY HIGH setting, the printer sets interface pin 11 high to indicate that it is ready to receive data and low to indicate that it is busy. For the READY LOW setting the printer sets interface pin 11 low to indicate that it is ready to receive data and high to indicate that it is busy. The default setting is READY LOW.

Miscellaneous Setup Parameters

The miscellaneous setup parameters are mechanical and operational features that do not fit logically into the other setup categories.

The following figure shows the miscellaneous setup parameters submenu and the following paragraphs describe these parameters.

miscellaneous setup parameters submenu
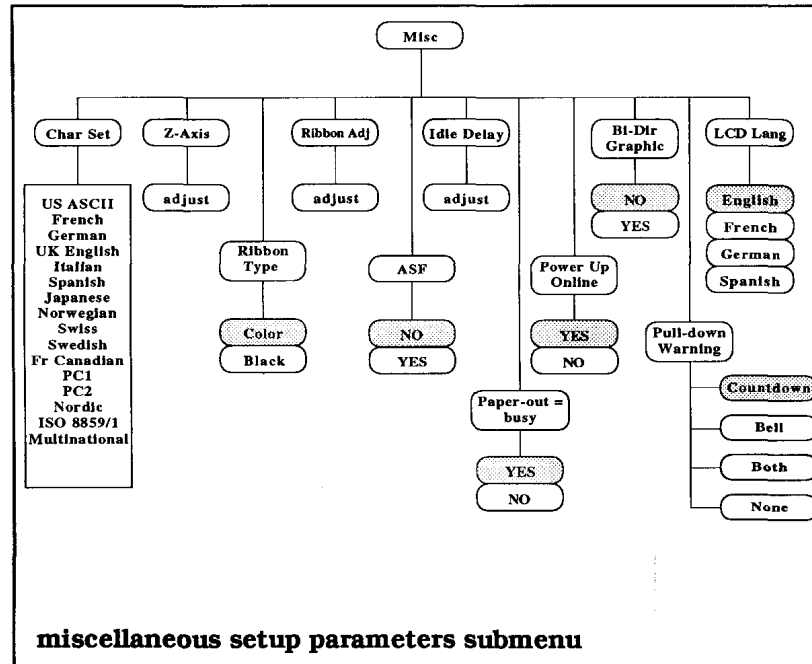
Character Set

The Model 8900 Series Printers character set repertoire includes 6 standard character sets and 11 international language versions. The default character set is IBM PC1 and the default international language version is U.S. English.

Z-Axis Control

The printer adjusts the printhead-to-paper clearance (*z*-axis) auto-matically when you load paper into the printer. In addition, the Z-AXIS parameter provides a manual *z*-axis adjustment. This selection invokes a display that lets you adjust the printhead in or out.

You also can adjust the *z*-axis using an escape sequence described in the Appendix to this manual.

Ribbon Type

The RIBBON TYPE parameter lets you choose between color printing and black printing. The default setting is COLOR.

Ribbon Adjust

If the printer appears to be printing mixed colors or missing the upper or lower parts of the characters, the ribbon may need adjustment. The RIBBON ADJ parameter invokes a display that lets you adjust the ribbon up or down.

Idle Delay

At the end of a printing operation, if the paper is at top of form, the printer waits for more data and then, after a short delay (idle delay), moves the paper to the tear-off position. The IDLE DELAY parameter invokes a display that lets you adjust the idle delay to a value in the range of 300 milliseconds to 90 seconds.

You can disable the idle delay feature by selecting a value above 90 seconds, in which case the LCD displays DISABLE. When you disable this feature, the printhead "relaxes" (moves away from the paper) after 91 seconds of idle time and the paper is not moved to the tear-off position.

Power-Up Online

The PWRUP ONLINE parameter lets you set the printer to power-up in either its online or offline condition. The default setting is YES (power-up online).

Paper Pull-Down Warning

This parameter lets you select the type of warning that occurs when the printer is about to pull down tractor-fed paper from its tear-off position to the normal printing position.

The COUNTDOWN option (factory default) causes the printer LCD to display the numerals 9, 8, 7... down to 1, visually warning that paper pull-down is imminent. The pull-down time delay is increased about 3 to 4 seconds.

The BELL option causes a series of nine beeps of increasing duration to indicate paper pull-down. The pull-down time delay is increased about 3 to 4 seconds.

The BOTH option causes the COUNTDOWN and BELL options to occur simultaneously.

The NONE option turns off the pull-down warning.

Graphics Printing Mode

The BI-DIR GRAPHIC parameter lets you choose whether the printer prints graphics bidirectionally or from left to right only. The default setting is NO (print graphics from left to right only).

LCD Language

The LCD LANG parameter lets you set the control panel LCD to display its messages in English, French, German, or Spanish. The default setting is ENGLISH.

Paper Out Equals Busy

The PAPER OUT = BUSY parameter, when set to YES, lets the printer send a busy condition signal to the communication interface when the printer runs out of paper. The default setting is YES.

Limiting Control Panel Operation

This parameter enables you to select three levels of control panel functioning, intended to limit operator access to certain printer function. This effectively prevents operator error resulting from incorrect control panel operation. The menu offers four choices from Level 0 (factory default) to Level 3.

Level 0 is conventional, full control panel operation.

Level 1 permits full offline control panel operation, but when the printer is online only the **Online** and **Clear Error** keys function.

Level 2 limits online operation to the **Online** and **Clear Error** keys and, when offline, disables the **Form Config**, **Pitch**, **Quality**, **Font**, and **Setup/Test** keys.

Level 3 limits online operation to the **Online** and **Clear Error** keys and, when offline, disables the **Form Select**, **Form Config**, **Pitch**, **Quality**, **Font**, and **Setup/Test**, and **Form Feed** keys.

Access the menu to select the four available options as follows.

1. Press and hold the **Clear Error** switch, then press and hold the **Status** switch.

2. Release the **Clear Error** switch, continue to hold the **Status** switch, then press and hold the **Setup/Test** switch.

3. Release the **Status** switch, continue to hold the **Setup/Test** switch. The LCD displays Key Access.

4. Press the **F2** switch until the level you want is displayed, then press the **On Line** switch to return the printer to its previous mode.

Test Features

The test mode submenu lets you use the built-in printer test features. The *Model 8900 Series Printers User's Manual,* Part No. 2557785-0001, describes the status report and the barberpole test.

limiting control panel operation menu
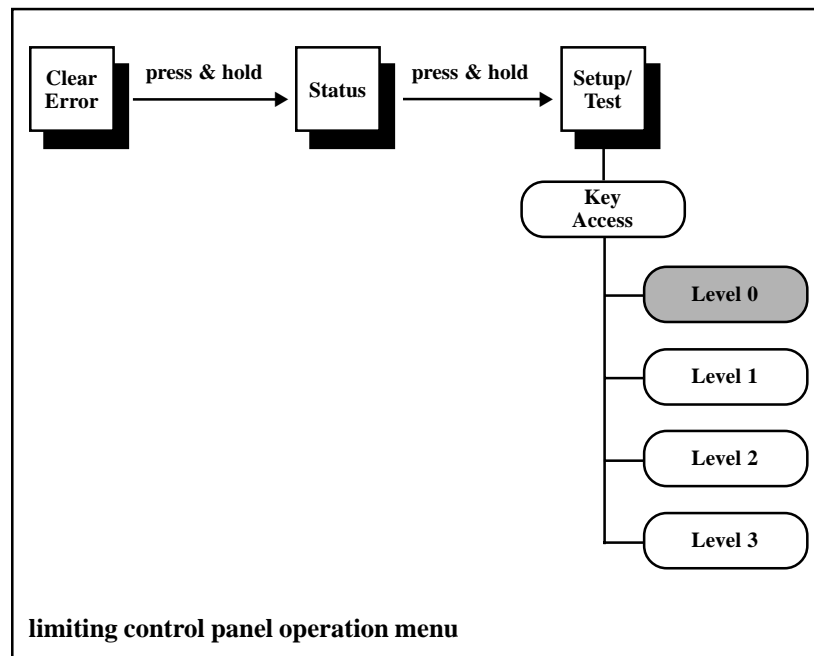
3
Character Sets and Global Commands

Introduction

This chapter describes the standard character sets and provides information about their use in the Model 8900 Series Printers.

The printer can use any of several standard or optional character sets that can be selected via the operator control panel switches or via the host computer. These character sets provide all control characters and graphic characters necessary to implement the various printer emulation modes.

The standard character sets reside in the printer read-only memory (ROM), and the optional character sets can be plugged into one of the option ROM sockets on the printer logic board.

Character Code Table

The following figure shows the printer character code table. The character code table is an area in the printer memory in which one 8-bit character set or two 7-bit character sets reside.

character code table
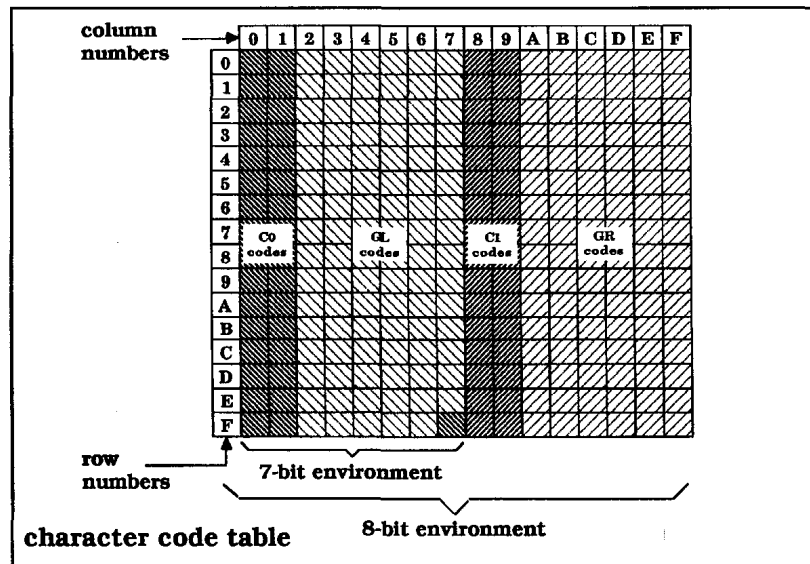
Character Sets

Your printer can use any of the following character sets.

❑ US ASCII (default character set)

❑ IBM PC1

❑ IBM PC2

❑ Nordic PC

❑ ISO 8859/1 Multinational

❑ IBM Multinational

Note: The option ROM sockets on the printer logic board let you install additional character sets.

The US ASCII Character Set

The following table shows the U.S.A. Standard Code for Information Interchange (US ASCII) character set. This 7-bit character set is defined by the American National Standards Institute document ANSI X3.4 and is a variant of the ISO 646 character set.

US ASCII Character Set

	0	1	2	3	4	5	6	7
0	NUL	DLE	SPACE	0	@	P	`	p
1	SOH	DC1	!	1	A	Q	a	q
2	STX	DC2	"	2	B	R	b	r
3	ETX	DC3	#	3	C	S	c	s
4	EOT	DC4	$	4	D	T	d	t
5	ENQ	NAK	%	5	E	U	e	u
6	ACK	SYN	&	6	F	V	f	v
7	BEL	ETB	'	7	G	W	g	w
8	BS	CAN	(	8	H	X	h	x
9	HT	EM	)	9	I	Y	i	y
A	LF	SUB	*	:	J	Z	j	z
B	VT	ESC	+	;	K	[	k	{
C	FF	FS	,	<	L	\	l	¦
D	CR	GS	-	=	M	]	m	}
E	SO	RS	.	>	N	^	n	~
F	SI	US	/	?	O	_	o	

International ASCII Character Sets

With a few exceptions, the international versions of the ASCII character set are identical to the US ASCII character set. These international versions can be selected via the operator control panel or via the host computer. The following table lists the variations between the US ASCII character set and the international versions.

Variations Between US ASCII and International ASCII

Hexadecimal Address	23	24	40	5B	5C	5D	5E	60	7B	7C	7D	7E
U.S. ASCII	#	$	@	[	\	]	^	`	{	¦	}	~
French	£		à	°	ç	§			é	ù	è	¨
German			§	Ä	Ö	Ü			ä	ö	ü	ß
U.K. English	£											
Italian				°		é		ù	à	ò	è	ì
Spanish	₧			¡	Ñ	¿			°	ñ	ç	
Japanese					¥							
Norwegian		¤	É	Æ	Ø	Å	Ü	é	æ	ø	å	ü
Swiss	£		à	é	ç	é			ä	ö	ü	¨
Swedish		¤	É	Ä	Ö	Å	Ü	é	ä	ö	å	ü
French Canadian			à	â	ç	ê	î	ô	é	ù	è	û

The IBM PC1 Character Set

The following two tables show, respectively, the left half and right half of the the IBM PC 1 character set.

IBM PC1 Character Set, Left Half

	0	1	2	3	4	5	6	7
0	NUL	DLE	SPACE	0	@	P	`	p
1	SOH	DC1	!	1	A	Q	a	q
2	STX	DC2	"	2	B	R	b	r
3	ETX	DC3	#	3	C	S	c	s
4	EOT	DC4	$	4	D	T	d	t
5	ENQ	NAK	%	5	E	U	e	u
6	ACK	SYN	&	6	F	V	f	v
7	BEL	ETB	'	7	G	W	g	w
8	BS	CAN	(	8	H	X	h	x
9	HT	EM	)	9	I	Y	i	y
A	LF	SUB	*	:	J	Z	j	z
B	VT	ESC	+	;	K	[	k	{
C	FF	FS	,	<	L	\	l	¦
D	CR	GS	-	=	M	]	m	}
E	SO	RS	.	>	N	^	n	~
F	SI	US	/	?	O	_	o	

IBM PC1 Character Set, Right Half

	8	9	A	B	C	D	E	F
0	NUL	DLE	á	▒	└	⊥⊥	α	≡
1	SOH	DC1	í	▓	⊥	╤	β	±
2	STX	DC2	ó	█	┬	╥	Γ	≥
3	ETX	DC3	ú	│	├	╙	π	≤
4	EOT	DC4	ñ	┤	─	╘	Σ	⌠
5	ENQ	NAK	Ñ	╡	┼	╒	σ	⌡
6	ACK	SYN	ª	╢	╞	╓	μ	ÿ
7	BEL	ETB	º	╖	╟	╫	τ	≈
8	BS	CAN	¿	╕	╚	╪	Φ	°
9	HT	EM	⌐	╣	╔	┘	Θ	•
A	LF	SUB	¬	║	╩	┌	Ω	·
B	VT	ESC	½	╗	╦	█	δ	√
C	FF	FS	¼	╝	╠	▄	∞	η
D	CR	GS	¡	╜	=	█	φ	^{2}
E	SO	RS	«	╛	╬	█	ε	■
F	SI	US	»	┐	⊥	▄	∩	(SP)

The IBM PC2 Character Set

The following two tables show, respectively, the left half and the right half of the IBM PC2 character set.

IBM PC2 Character Set, Left Half

	0	1	2	3	4	5	6	7
0	NUL	DLE	SPACE	0	@	P	`	p
1	SOH	DC1	!	1	A	Q	a	q
2	STX	DC2	"	2	B	R	b	r
3	♥	DC3	#	3	C	S	c	s
4	♦	DC4	$	4	D	T	d	t
5	♣	§	%	5	E	U	e	u
6	♠	SYN	&	6	F	V	f	v
7	BEL	STB	'	7	G	W	g	w
8	BS	CAN	(	8	H	X	h	x
9	HT	EM	)	9	I	Y	i	y
A	LF	SUB	*	:	J	Z	j	z
B	VT	ESC	+	;	K	[	k	{
C	FF	FS	,	<	L	\	l	¦
D	CR	GS	-	=	M	]	m	}
E	SO	RS	.	>	N	^	n	~
F	SI	US	/	?	O	_	o	

	8	9	A	B	C	D	E	F
0	Ç	É	á	▓	└	⊥	α	≡
1	ü	æ	í	▒	⊥	⊤	β	±
2	é	Æ	ó	█	⊤	⊤⊤	Γ	≥
3	â	ô	ú	│	├	⊔	π	≤
4	ä	ö	ñ	┤	─	⊢	Σ	⌠
5	à	ò	Ñ	╡	┼	╒	σ	⌡
6	å	û	ª	╢	╞	╓	μ	ÿ
7	ç	ù	º	╖	╟	╫	τ	≈
8	ê	ÿ	¿	╕	╚	╪	Φ	°
9	ë	Ö	⌐	╣	╔	┘	Θ	●
A	è	Ü	¬	║	╩	┌	Ω	·
B	ï	¢	½	╗	╦	█	δ	√
C	î	£	¼	╝	╠	▄	∞	η
D	ì	¥	¡	╜	═	█	φ	2
E	Ä	₧	«	╛	╬	█	ε	■
F	Å	ƒ	»	┐	⊥	▄	∩	(SP)

The Nordic PC Character Set

The following two tables show, respectively, the left half and right half of the Nordic PC character set.

Nordic PC Character Set, Left Half

	0	1	2	3	4	5	6	7
0	NUL	►	SPACE	0	@	P	`	p
1	☺	◄	!	1	A	Q	a	q
2	☻	↕	"	2	B	R	b	r
3	♥	‼	#	3	C	S	c	s
4	♦	¶	$	4	D	T	d	t
5	♣	§	%	5	E	U	e	u
6	♠	▬	&	6	F	V	f	v
7	•	↨	'	7	G	W	g	w
8	◘	↑	(	8	H	X	h	x
9	○	↓	)	9	I	Y	i	y
A	◙	→	*	:	J	Z	j	z
B	♂	←	+	;	K	[	k	{
C	♀	∟	,	<	L	\	l	¦
D	♪	↔	-	=	M	]	m	}
E	♫	▲	.	>	N	^	n	~
F	☼	▼	/	?	O	_	o	∆

	8	9	A	B	C	D	E	F
0	Ç	É	á	▓	└	⊥	α	≡
1	ü	æ	í	▒	┴	╤	β	±
2	é	Æ	ó	█	┬	╥	Γ	≥
3	â	ô	ú	│	├	╙	π	≤
4	ä	ö	ñ	┤	─	╘	Σ	⌠
5	à	ò	Ñ	╡	┼	╒	σ	⌡
6	å	û	õ	╢	╞	╓	μ	ÿ
7	ç	ù	Õ	╖	╟	╫	τ	≈
8	ê	ÿ	¿	╕	╚	╪	Φ	°
9	ë	Ö	ã	╣	╔	┘	Θ	•
A	è	Ü	Ã	║	╩	┌	Ω	·
B	ï	ø	ℓ	╗	╦	█	δ	√
C	î	£	n'	╝	╠	▄	∞	η
D	ì	Ø	¡	╜	═	█	φ	2
E	Ä	Ŀ	3	╛	╬	█	ε	■
F	Å	ŀ	¤	┐	⊥	▄	∩	(SP)

ISO 8859/1 Multinational Character Set

The following two tables show, respectively, the left half and right half of the ISO 8859/1 Multinational character set. The shaded character positions (128-159) represent the Cl control characters which are not implemented in the Model 8900 Series Printers.

ISO 8859/1 Multinational Character Set, Left Half

	0	1	2	3	4	5	6	7
0	NUL	DLE	SPACE	0	@	P	`	p
1	SOH	DC1	!	1	A	Q	a	q
2	STX	DC2	"	2	B	R	b	r
3	ETX	DC3	#	3	C	S	c	s
4	EOT	DC4	$	4	D	T	d	t
5	ENQ	NAK	%	5	E	U	e	u
6	ACK	SYN	&	6	F	V	f	v
7	BEL	ETB	'	7	G	W	g	w
8	BS	CAN	(	8	H	X	h	x
9	HT	EM	)	9	I	Y	i	y
A	LF	SUB	*	:	J	Z	j	z
B	VT	ESC	+	;	K	[	k	{
C	FF	FS	,	<	L	\	l	¦
D	CR	GS	-	=	M	]	m	}
E	SO	RS	.	>	N	^	n	~
F	SI	US	/	?	O	_	o	

ISO 8859/1 Multinational Character Set, Right Half

	8	9	A	B	C	D	E	F
0		DCS	NBSP	°	À	Ð	à	ð
1		PU1	¡	±	Á	Ñ	á	ñ
2	BPH	PU2	¢	²	Â	Ò	â	ò
3	NBH	STS	£	³	Ã	Ó	ã	ó
4	IND	CCH	¤	′	Ä	Ô	ä	ô
5	NEL	MW	¥	μ	Å	Õ	å	õ
6	SSA	SPA	¦	¶	Æ	Ö	æ	ö
7	ESA	EPA	§	•	Ç	ˆ	ç	ÿ
8	HTS	SOS	¨	,	È	Ø	è	ø
9	HTJ		©	¹	É	Ù	é	ù
A	VTS	SCI	ª	º	Ê	Ú	ê	ú
B	PLD	CSI	«	»	Ë	Û	ë	û
C	PLU	SI	¬	¼	Ì	Ü	ì	ü
D	RI	OSC	-	½	Í	Ý	í	ý
E	SS2	PM	®	¾	Î	Þ	î	þ
F	SS3	APC	_	¿	Ï	ß	ï	ÿ

IBM Multinational Character Set

The following two tables show, respectively, the left half and right half of the IBM Multinational character set.

IBM Multinational Character Set, Left Half

	0	1	2	3	4	5	6	7
0	NUL	►	SPACE	0	@	P	`	p
1	☺	◄	!	1	A	Q	a	q
2	●	↕	"	2	B	R	b	r
3	♥	‼	#	3	C	S	c	s
4	♦	¶	$	4	D	T	d	t
5	♣	§	%	5	E	U	e	u
6	♠	▬	&	6	F	V	f	v
7	•	↨	'	7	G	W	g	w
8	◘	↑	(	8	H	X	h	x
9	○	↓	)	9	I	Y	i	y
A	◎	→	*	:	J	Z	j	z
B	♂	←	+	;	K	[	k	{
C	♀	∟	,	<	L	\	l	¦
D	♪	↔	-	=	M	]	m	}
E	♫	▲	.	>	N	^	n	~
F	☼	▼	/	?	O	_	o	Δ

	8	9	A	B	C	D	E	F
0	Ç	É	á	▒	└	ð	Ó	-
1	ü	æ	í	▓	⊥	Đ	ß	±
2	é	Æ	ó	█	┬	Ê	Ô	=
3	â	ô	ú	│	├	Ë	Ò	¾
4	ä	ö	ñ	┤	─	È	õ	¶
5	à	ò	Ñ	Á	┼	¹	Õ	§
6	å	û	ª	Â	ã	Í	µ	~
7	ç	ù	º	À	Ã	Î	þ	,
8	ê	ÿ	¿	©	└	Ï	Þ	°
9	ë	Ö	®	╡	╔	┘	Ú	¨
A	è	Ü	←	║	╩	┌	Û	·
B	ï	ø	½	╗	╦	█	Ù	¹
C	î	£	¼	╝	╠	▬	ý	³
D	ì	Ø	¡	¢	═	¦	Ý	²
E	Ä	^	«	¥	╬	Ì	—	■
F	Å		»	┐	¤	▬	´	

Control Characters

Any character that causes the printer to perform a function is classified as a control character. Note that, although the Cl control characters are available in one of the standard character sets (ISO 8859/Multinational), your printer does not implement them.

American National Standard ANSI X3.4 and International Standard ISO 646 define the C0 control characters based on the specific function performed by the character. The C0 control characters are divided into the following categories.

❑ Communication controls - Control characters intended to control or enable data transmissions over communication networks.

❑ Format effectors - Control characters that control the layout or position of information on the printed page.

❑ Information separators - Control characters that separate and qualify information in a logical sense.

❑ Miscellaneous control characters - Control characters whose definitions preclude their inclusion in the preceding categories.

The following table lists and defines the original use of the C0 control characters.

Note: The functions of the control characters can vary from one emulation mode to another. Therefore, these descriptions are included in Chapters 4 through 9.

C0 Control Characters

Char	Hexadecimal Code	Definition
Communication controls:		
SOH	01	Start of header
STX	02	Start of text
ETX	03	End of text
EOT	04	End of transmission
ENQ	05	Enquiry
ACK	06	Acknowledge
DLE	10	Data link escape
NAK	15	Negative acknowledge
SYN	16	Synchronous idle
ETB	17	End of transmission block
Format effectors:		
BS	08	Backspace
HT	09	Horizontal tabulation
LF	0A	Line feed
VT	0B	Vertical tabulation
FF	0C	Form feed
CR	0D	Carriage return
FS	1C	File Separator
Information separators:		
GS	1D	Group separator
RS	1E	Record separator
US	1F	Unit separator
Miscellaneous controls:		
NUL	00	Null
BEL	07	Bell
SO	0E	Shift out
SI	0F	Shift in
DC1	11	Device control 1
DC2	12	Device control 2
DC3	13	Device control 3
DC4	14	Device control 4
CAN	18	Cancel
EM	19	End of medium
SUB	1A	Substitute
ESC	1B	Escape
DEL	7F	Delete

Printer Commands

The Model 8900 Series Printers receive commands from the host computer in the form of ASCII control character codes and escape-sequence codes. In response to these commands, the printer performs one or more operations defined by the command set of the currently selected emulation mode. Chapters 4 through 8 describe the standard emulation modes.

An example of a control character command common to all character sets and all emulation modes is the line feed (LF) character. This control character (designated by hexadecimal code 0A or decimal code 10) causes the printer to advance the paper or form to the next print line. To invoke the line feed operation, the host computer sends the 8-bit code (00001010) identified as the LF character.

An escape-sequence command is a sequence of two or more characters that always begins with the ASCII escape (ESC) control character designated by hexadecimal code 1B. The ESC control character signals the printer that one or more succeeding characters are an escape-sequence command.

An example of an escape-sequence command common to all standard emulation modes is the Set Form Length command ESC C *n*. This command contains the following elements.

❑ ESC — the ASCII control character that signals the start of an escape sequence

❑ C — an ASCII character that identifies the escape sequence as a form length command

❑ n — a decimal variable that can be set to a range of values to specify the form length in number lines

Note: Decimal values of variables are designated by lowercase italic letters. ASCII characters and number values of variables are designated by uppercase italic letters.

Some escape sequence commands, valid for all emulation modes, are called global commands. These are special commands that select or control some basic or specially defined printer operation.

Global Command Set

The following table lists the global commands for the Model 8900 Series Printers. These commands are characterized by an intermediate control character DLE following the ESC character.

Model 8900 Series Printers Global Commands

Command	Command Name
ESC DLE B P *t r s* ETX	Set Barcode Parameters
ESC DLE B C *text* ETX	Print Barcode Text
ESC DLE C C *text* ETX	Print Oversize Characters
ESC DLE C P *p1 p2* ETX	Set Oversize Characters Scale Factor
ESC DLE c *n*	Select Color Printing
ESC DLE E *text* ETX	Select Emulator
ESC DLE EM *n*	Select Automatic Sheet Feeder Bin
ESC DLE F *x*	Select Form Format
ESC DLE *G d1 d2 n1 n2 data*	Define Raster Graphics
ESC DLE f *n*	Select font
ESC DLE H	Select Font HMI
ESC DLE P *n*	Select Characters Per Inch (cpi)
ESC DLE p 0	Load from Current Paper Path
ESC DLE p 1	Park Continuous Paper
ESC DLE p 2	Load Cut-Sheet Paper from Front
ESC DLE p 3	Load Continuous Paper
ESC DLE p 4	Load Cut-Sheet Paper from Top
ESC DLE Q *n*	Select Print Quality
ESC DLE R *n*	Select International Character Set
ESC DLE STX *text* ETX	Write to Printer Display
ESC DLE *z S NN*	Adjust Printhead Z-axis Position

Global Command Descriptions

The following paragraphs describe the Model 8900 Series Printers global commands.

Barcode Operations

The barcode commands let you select a barcode font, set its parameters, and print any specified character in the equivalent barcode font.

Note: If the barcode option is not installed, using this ESC sequence causes an ESC SEQ error.

Set Barcode Parameters

Escape sequence:	ESC	DLE	B	P	*t*	*r*	*s*	ETX
Hexadecimal:	1B	10	42	50	*t*	*r*	*s*	03

This command, where t = type, r = readability, and s = size, lets you select a barcode font and set its associated parameters. The following values are valid for the command variables.

❑ Type:

> 0 — Barcode 3 of 9 (default)
>
> 1 — Interleaved 2 of 5
>
> 3 — Codabar

❑ Readability:

> 0 — Not human readable (default)
>
> 1 — Human readable characters on top
>
> 2 — Human readable characters on bottom
>
> 3 — Human readable characters on top and bottom

❑ Size:

> Vertical height in 8/72 inch increments (default 8/72")

Note: PostNet barcode is available as a font; see "Selecting a Font."

Print Barcode Text

Escape sequence:	ESC	DLE	B	C	*text*	ETX
Hexadecimal:	1B	10	42	43	*text*	03

This command lets you print a character or string of characters specified by the variable *text*. For example, to print the barcode equivalents of the numerals 0, 1, and 2 from the barcode font set selected by the Set Barcode Parameters command, enter the sequence ESC DLE B C 0 1 2 ETX.

Oversize Characters Feature

Using this feature, you can increase the size of your selected font from 1 times to 127 times the original size. One global command determines the character size; a second global command prints the oversize characters.

Set Oversize Character Scale Factor

Escape sequence:	ESC	DLE	C	P	*p1*	*p2*	ETX
Hexadecimal:	1B	10	43	50	*p1*	*p2*	03

This command defines the horizontal and vertical scale factors which determine the size of the characters printed by the Print Oversize Character command.

The *p1* variable is the vertical scale factor (1 byte), from 1 to 127; the default is 2. The *p2* variable is the horizontal scale factor (1 byte), from 1 to 127; the default is 2. If either variable is set to less than 1 or more than 127, the value defaults to 2.

Print Oversize Character

Escape sequence:	ESC	DLE	C	C	*text*	ETX
Hexadecimal:	1B	10	43	43	*text*	03

This command prints the text contained within the command using the horizontal and vertical scale factors selected by the Set Oversize Characters command. The *text* variable is the character string to be printed in oversize characters.

You can use a maximum of 200 characters in a text string; excess characters are treated as normal characters, and the command is limited to printing from the logical start position to the logical end position of a single line of text. Text extending beyond the end of the line is truncated at the logical end position.

Because the ETX control character is used as the command sequence delimiter, if your text string requires an ETX character you must use two consecutive ETX characters within the *text* string to be recognized.

The printer uses the bit patterns dictated by the print quality selected; draft quality bit patterns in draft mode, text quality bit patterns in text and quality modes.

Color Printing

Escape sequence:	ESC	DLE	c	*n*
Hexadecimal:	1B	10	63	*n*

The Model 8900 Series Printers can print up to seven different colors (including black). This feature is standard on the Model 8930 and optional on the Model 8920.

This command selects the color specified by the variable *n*, where *n* can be any of the following values.

0 — black	4 — green
1 — cyan	5 — purple
2 — magenta	6 — orange
3 — yellow	

Selecting an Automatic Sheet Feeder Bin

Escape sequence: ESC   DLE   EM   *n*
Hexadecimal: 1B   10   19   *n*

This command selects the ASF bin designated by the variable *n,* where *n* can range from 30 through 33 hex as follows:

0 (30H) = Load from current bin

1 (31H) = Select & load from bin 1

2 (32H) = Select & load from bin 2

3 (33H) = Load from current bin

If the command is received with paper loaded from a friction feed path, the currently loaded form is ejected, and a form is loaded as defined by this command. If the command is received with paper loaded from the tractor feed path, this command is accepted but ignored.

The ASF option on the Miscellaneous Menu of the printer control panel must be set to "YES" for this function to operate.

Selecting a Form Format

Escape sequence: ESC   DLE   F   *x*
Hexadecimal: 1B   10   46   *x*

The Model 8900 Series Printers offer a set of ten predefined form formats. Each of these form formats, designated as A through J, has an associated set of values that defines the parameters of the form. Although these form format parameters are preset at the factory to their default values, the user can select any of the form formats and alter its parameters to fit any specific application. The *Model 8900 Series Printers User's Manual,* Part No. 2557785-0002, describes the preset form format parameters and explains how to select and change them. The Select Form Format command selects the form format designated by the variable *x,* where the value of *x* can be any of the ten predefined form formats A through J.

Defining Raster Graphics

Escape sequence: ESC   DLE   G   *d1 d2*   *n1 n2*   *data*
Hexadecimal: 1B   10   47   *d1 d2*   *n1 n2*   *data*

This command defines the dots-per-inch (DPI) density, the byte count of bit-image data, and bit-image data of those emulations that currently support raster graphics.

The variable *d1 d2 is* DPI density, where *d1* is LSB and *d2* is MSB. The variable *nl n2* is the byte count, where *n1* is the LSB and *n2* is the MSB. And *data* is bit-image data. All variables can range from 0 through 255.

DPI density defines the horizontal dots per inch at which the bit image data is printed. Valid DPI values are 60, 72, 80, 90, 100, 120, 135, 144, 150, 180, 200, 240, and 300 dots per inch. Any other value causes an escape sequence error. The DPI density format is **d1 + (d2 * 256)** = DPI.

The byte count variable indicates the number of bit-image data bytes to follow. The byte count format is **n1 + (n2 * 256)** = byte count.

A bit-image data byte defines a column of 8-pin raster graphics. The bits of each byte have valid values of 1, 2, 4, 8, 16, 32, 64, and 128. In a vertical column of dots, the dots are arranged so that the MSB (bit value = 128) is at the top, and the LSB (bit value = 1) is at the bottom.

Selecting a Font

Escape Sequence: ESC   DLE   f   *n*
Hexadecimal: 1B   10   66   *n*

This command allows you to access type styles not specifically supported by an emulation.

This command selects the font designated by the variable *n*, where *n* can range from 0 through 254 decimal as follows:

Font	ID No.
Courier	0
Prestige Elite	1
OCR A	3
OCR B	4
Gothic	5
Presentor	6
PostNet	7

Note: Using any value other than the valid font ID number for *n,* causes the printer to accept and ignore the command, and cause a FONT NOT AVAILABLE ERROR.

Selecting a Font's HMI

Escape sequence: ESC   DLE   H
Hexadecimal: 1B   10   48

This command enables you to access natural pitches of a font that may not be specifically supported by an emulation. The command sets horizontal motion index (HMI) to the currently selected font's HMI.

The command cancels the double-width print mode, but does not cancel the oversize-character (scalable characters) command. This command resets the Epson variable spacing to zero.

Selecting Characters Per Inch (cpi)

Escape sequence: ESC   DLE   P   *n*
Hexadecimal: 1B   10   50   *n*

This command enables you to access natural pitches of a font that may not be specifically supported by an emulation. The command sets pitch according to the variable *n*, which can range from 30 through 33 hex.

Unless specified otherwise, the emulation's default HMI is used.

Character pitch commands are effective immediately upon receipt, thus causing a pitch change within a line.

This command cancels double-wide print mode and compressed print mode. The values of *n* for cpi selection are listed in the following table.

Value of *n*	Hex Value	Pitch*
1	30	10
2	31	12
3	32	15
4	33	16.7

*for standard fonts and emulations

Selecting Print Quality

Escape sequence: ESC   DLE   Q   *n*
Hexadecimal: 1B   10   51   *n*

This command enables you to access print quality modes not specifically supported by an emulation. The command selects the print quality mode according the the variable *n*, which can range from 30 through 33 hex.

This command does not affect the forms configuration draft/rapid-draft setting. However, the fast draft mode setting is valid only in 12 and 15 cpi. If 10 cpi is set, draft mode is selected.

The values of *n* for print mode selection are listed in the following table.

Mode	Hex Value
Draft	30
Text	31
Letter	32
Fast Draft	33

Selecting an International Character Set

Escape sequence: ESC   DLE   R   *n*
Hexadecimal: 1B   10   52   *n*

The ASCII character set contains the C0 control codes, the uppercase and lowercase elements of the Latin alphabet, punctuation symbols, and other commonly used symbols. The international versions of the ASCII character set are identical to the standard US ASCII version with a few exceptions. (See the paragraph entitled "International ASCII Character Sets" in Chapter 3.)

This command selects the international ASCII character set designated by the variable *n*, where the value of *n* can be any of the hexadecimal values shown in the following table.

Character Set	Hex	Character Set	Hex
United States English	00	not used	0C
French	01	PC No. l, LH	0D
German	02	PC No. 1, RH	0E
United Kingdom English	03	PC No. 2, LH	0F
Italian	04	PC No. 2, RH	10
Spanish	05	Multinational LH	11
Japanese	06	Multinational RH	12
Norwegian	07	Nordic No. 2, LH	13
Swiss	08	Nordic No. 2, RH	14
Swedish	09	ISO 8859/1 LH	15
French Canadian	0A	ISO 8859/1 RH	16
All Characters	0B		

A character set is defined as 128 character positions. If more than 128 character positions are required, the set is divided in two and is designated left half (LH) for positions 1 through 127 and right half (RH) for positions 128 through 255. The MSB determines if the character set is placed in the left half (0 through 7F) or the right half (80 through FF) of the 8-bit character set table. An MSB of zero places the character set in the left half, MSB of one, in the right half.

Note: The hex value 1B (left half) is reserved for use as the ASCII escape control character (ESC). Any graphic defined at this location is not printed.

The error message FONT NOT AVAILABLE occurs if the value of *n* is not specified or is out of range.

Selecting an Emulator

Escape sequence: ESC DLE E *text* ETX
Hexadecimal: 1B 10 45 *text* 03

The Select Emulator command selects the emulation mode specified by the variable *text*. To use this command, substitute the name of the emulator for *text* that appears on the control panel display. If the name does not exactly match one of the following resident emulation modes (or an installed optional emulation mode), the printer ignores this command.

❑ TI880

❑ TI855

❑ PROPRINTER

❑ EPSON

❑ HEXDUMP

Note: When the printer is in the hexadecimal dump mode, the Select Emulator command is not functional.

Adjusting the Print head *Z*-Axis Position

Escape sequence:	ESC	DLE	*z*	*S*	*NN*
Hexadecimal:	1B	10	7A	*S*	*NN*

The Adjust Printhead Z-Axis Position command adjusts the printhead in or out by the number of steps specified by the variable *NN,* which is a two-digit ASCII value ranging from 00 through 99.

See Appendix A for Application Instructions.

Writing to the Printer Display

Escape sequence:	ESC	DLE	STX	*text*	ETX
Hexadecimal:	1B	10	02	*text*	03

The Write to Printer Display command lets you write a message of up to 16 characters to the second line of the printer display. For example, to write THIS IS TEXT to the display, enter the sequence ESC DLE STX THIS IS TEXT ETX. The display then shows the message THIS IS TEXT on the second line. A message is terminated by either ETX or upon reaching the sixteenth character.

Paper-Handling Operations

Escape sequence:	ESC	DLE	p	*n*
Hexadecimal:	1B	10	70	*n*

The paper-handling commands enable you to clear the current paper path or select various paper-loading options, where *n* is a value ranging from 30 through 33 hex. The value of *n* selects the following paper-handling options:

0 (30H) = Load from current paper path
1 (31H) = Clear current paper path
2 (32H) = Load from front friction-feed path
3 (33H) = Load from tractor-feed path
4 (34H) = Load from top friction-feed path

If the paper is not at the top-of-form position when the printer receives the clear current path command, the printer executes a form feed operation before attempting to park tractor-fed paper and displays a prompt to PLEASE TEAR paper.

If the PAPEROUT=BUSY option in the Setup/Test menu is set to YES, clearing (parking) the paper causes the printer to send a BUSY signal to the host, which may suspend communication.

The clear-current-paper-path command ($n = 1$) is executed as follows:

❑ With tractor-fed paper loaded, the printer parks the paper.

❑ With friction-fed paper loaded, the printer ejects any cut sheets.

❑ With no paper loaded, the printer accepts but ignores the command.

If tractor-fed paper is currently loaded, only the clear/park command ($n = 1$) is executed; any other paper path command is ignored.

If friction-fed paper (cut sheet) is currently selected and loaded, the command functions as follows:

❑ Any command option to select another paper path causes ejection of the current paper before execution of the command.

❑ A friction-feed command for the currently selected paper path is accepted but ignored.

❑ A clear/park command ($n = 1$) causes ejection of the cut sheet.

4
Texas Instruments Model 880
Printer Emulation

Introduction

The Texas Instruments Model 880 Printer emulation mode is the default emulation mode of your printer. If your printer includes color printing and the automatic sheet feeder, this mode lets you use the global commands described in Chapter 3 for operating these options. This mode also lets you use the global commands to select the international versions of the ASCII character set. While operating in this mode, the printer can perform all the functions of the Model 880 Printer with the following considerations:

❑ The escape sequence for font selection is ESC f *N*.

❑ The Model 880 emulation supports all Model 8900 global commands.

❑ Factory selected power-up defaults for the Model 880 emulation are:

   — LF/CR on CR — OFF

   — CR with LF, VT, or DC2 — OFF

   — Graphics — OFF

   — SO = expanded print (1 line) — OFF

   — The last selected form setting change made either via the control panel or the host (escape sequence) is retained and restored at power-up.

❑ Horizontal graphics is not supported.

❑ The escape sequence ESC P *n* ESC / to invoke a character set is not supported.

TI 880 Answer Message Function

The TI 880 emulation provides, as a TI 880 feature, an answerback message (ABM) that can be programmed with a message of up to 20 characters. If a message is programmed, it is transmitted when the ASCII character ENQ is received. The ABM is stored in the printer's nonvolatile memory and is programmable with an escape sequence when the ABM load setup parameter (ABM MSG LOAD) of the TI 880 emulation is turned on.

Escape sequence: ESC	[	Q	*text*	NUL
Hexadecimal: 1B	5B	51	*text*	00

where text can contain up to 20 ASCII characters, and the NUL character is used as the string terminator.

TI 880 Response Format Selection

The TI 880 emulation provides a response format selection feature (RESP FMT) allowing the user to select whether the response formats for configuration and status inquiries are preceded by an ASCII ESC character and if the string terminator is to be preceded by a semicolon. The default selection is *W/O ESC*.

❑ When the RESP FMT selection is *W/O ESC* the format of the responses to the configuration and status requests are not preceded by the ASCII ESC character.

Response Examples:

Config: [880;14;27;36;41c
Status: [880;24;2Cn

❑ When the RESP FMT selection is *W/ ESC* the format of the responses to the configuration and status requests are preceded by the ASCII ESC character.

Response Examples:

Config: ESC[880;14;27;36;41c
Status: ESC[880;24;2Cn

❑ When the RESP FMT selection is *W/ ESC;* the format of the responses to the configuration and status requests are preceded by the ASCII *ESC* character and the string terminator is preceded by a semicolon.

Response Examples:

Config: ESC[880;14;27;36;41;c
Status: ESC[880;24;2C;n

Model 880 Printer Emulation Commands

When operating in the Model 880 emulation mode, your printer can respond to both escape-sequence commands and the standard US ASCII C0 control character commands. The following table lists all of these commands.

Note: The functions performed by many of the control characters in the Model 880 emulation mode depend upon the printer configuration parameters selected via the operator control panel.

Model 880 Emulation Commands

Command	Command Name
Printer Operation	
BEL	Sound Bell
ESC [c	Transmit Configuration Report
ESC [n	Transmit Status Report
ESC u	Select Unidirectional Printing
ESC b	Cancel Unidirectional Printing
Form Format Selection	
ESC [*N* t	Set Form Length to *N* Lines
ESC C *n*	Set Form Length to *n* Lines
ESC 2 *n*	Set Form Length to *n* Lines
ESC P L 0 ESC \	Load Default Form Parameters
ESC @	Load Default Form Parameters

Model 880 Emulation Commands (continued)

Command	Command Name
Margin Control	
ESC [*N* r	Set Top Margin at Line *N*
ESC [; *N* r	Set Bottom Margin at Line *N*
ESC [*N1* ; *N2* r	Set Top and Bottom Margins at Lines *N1* and *N2*
ESC [*N* s	Set Left Margin at Column *N*
ESC [; *N* s	Set Right Margin at Column *N*
ESC [*N1* ; *N2* s	Set Left and Right Margins at Columns *N1* and *N2*
ESC : *n*	Set Line Width to *n* Columns
ESC ;	Restore Default Line Width
Horizontal Motion	
BS	Backspace
HT	Tab Horizontally
DC 4 *n*	Move to Column *n*
CR	Carriage Return
ESC [*N* '	Tab Right to Column *N*
ESC [*N* a	Tab Right *N* Columns
ESC [*N1*...*N16* u	Set Horizontal Tab Stops
ESC 3 *n1*...*n16* NUL	Set Horizontal Tab Stops
ESC 3 NUL	Clear All Horizontal Tab Stops
ESC [2 g	Clear All Horizontal Tab Stops
ESC H	Set Horizontal Tab Stop at Current Position
ESC [0 g	Clear Horizontal Tab Stop at Current Position

Model 880 Emulation Commands (continued)

Command	Command Name
Vertical Motion	
LF	Line Feed
FF	Form Feed
VT	Tab Vertically
DC2 *n*	Move to Line *n*
ESC [*N* d	Tab Vertically to Line *N*
ESC [*N* e	Tab Vertically *N* Lines
ESC [*N1...N16* v	Set Vertical Tab Stops
ESC 1 *n1...n16* NUL	Set Vertical Tab Stops
ESC J	Set Vertical Tab Stop at Current Position
ESC [4 g	Clear All Vertical Tab Stops
ESC [1 g	Clear Vertical Tab Stop at Current Position
Character Pitch	
ESC P I ESC \	Set Character Pitch to 5 cpi
ESC P J ESC \	Set Character Pitch to 8.3 cpi
ESC P C ESC \	Set Character Pitch to 10 cpi
ESC 6	Set Character Pitch to 10 cpi
ESC P K ESC \	Set Character Pitch to 12 cpi
ESC P D ESC \	Set Character Pitch to 16.7 cpi
ESC 7	Set Character Pitch to 16.7 cpi
Line Spacing	
ESC P B ESC \	Set Line Spacing to 3 lpi
ESC P G ESC \	Set Line Spacing to 4 lpi
ESC P A ESC \	Set Line Spacing to 6 lpi
ESC 4	Set Line Spacing to 6 lpi
ESC 2	Set Line Spacing to 6 lpi
ESC P H ESC \	Set Line Spacing to 8 lpi
ESC 5	Set Line Spacing to 8 lpi
ESC 0	Set Line Spacing to 8 lpi
ESC A *n*	Set Line Spacing to *n*/72 Inch
ESC [*N* # q	Set Line Spacing to *N/* 144 Inch
ESC 3 *n*	Set Line Spacing to *n*/216 Inch
ESC P S ESC \	Select Double Line Spacing
ESC P T ESC \	Cancel Double Line Spacing

Model 880 Emulation Commands (concluded)

Command	Command Name
Print Enhancement	
SO	Select Expanded Print (1)
ESC P M ESC \	Select Expanded Print
ESC P N ESC \	Cancel Expanded Print
ESC P O ESC \	Select Letter-Quality Print
ESC P P ESC \	Cancel Letter-Quality Print
Raster Graphics	
ESC [H ; B ; V q	Set Up Graphics Parameters
ESC K $n1$ $n2$	Select 60 dpi Raster Graphics
ESC L $n1$ $n2$	Select 120 dpi Raster Graphics
Font Selection	
ESC f N	Select Font N
ESC (N	Designate G0 Font
ESC) N	Designate Gl Font
ESC * N	Designate G2 Font
ESC + N	Designate G3 Font
EM y	Select Designated G2 Character
GS y	Select Designated G3 Character
SI	Invoke G0 Font as GL
SO	Invoke Gl Font as GL (2)
ESC n	Invoke G2 Font as GL
ESC o	Invoke G3 Font as GL
ESC k	Invoke Gl Font as GR
ESC l	Invoke G2 Font as GR
ESC m	Invoke G3 Font as GR

(1) SO = Expand set to ON.

(2) SO = Expand set to OFF.

Model 880 Command Descriptions

The following paragraphs describe the Model 880 emulation mode commands. Many of the escape-sequence commands contain one or more variables to specify various command parameters. These variables are italicized in the command formats to indicate that they can be set to more than one value.

Note: For clarity, the individual terms of each escape-sequence are separated by spaces throughout this chapter. When you enter these commands, you must omit these spaces.

The Variables *N* and n

Many of the Model 880 commands contain variables, represented by the uppercase letter *N* or the lowercase letter *n*. The uppercase letter *N* represents an ordinary decimal value, consisting of one or more numerals. The lowercase letter *n* represents a single ASCII character whose value is equivalent to the decimal value from the US ASCII character table.

The following examples illustrate the use of the variables *N* and *n*.

Example 1. Use the escape sequence ESC [*N* t to set the form length to 50 lines.

Escape sequence:	ESC	[	5	0	t
Hexadecimal:	1B	5B	35	30	74

In this example, the variable *N* (50) is represented by the two ASCII characters 5 and 0. From the US ASCII character table, the hexadecimal values of these characters are, respectively, 35 and 30. Thus, to set the value of *N* to 50, the computer sends the hexadecimal values 35 and 30.

Example 2. Use the escape sequence ESC C *n* to set the form length to 50 lines.

Escape sequence:	ESC	C	2
Hexadecimal:	1B	43	32

From the US ASCII character table, the ASCII character whose decimal value is 50 is the ASCII character 2. Thus, in this example, you set the value of *n* to 2.

Printer Operation Commands

These commands allow the host computer to control some basic printer functions.

Sound Bell

Control character: BEL
Hexadecimal: 07

This command causes the printer to sound a short tone.

Transmit Configuration Report

Escape sequence: ESC   [c
Hexadecimal: 1B   5B   63

The host computer sends this command to request a report of the current printer configuration. A configuration report contains hexadecimal codes that inform the host of the current printer configuration.

Example. The following is a typical configuration report.

      [880;14;27;36;41c

Each of the two-digit numbers is a hexadecimal configuration code that indicates the following.

Code	Configuration
14	The current printer communication mode is *direct-connection* with pin 11 of the serial interface active for ready.
27	The current baud rate setting is 4800 bits per second.
36	The printer is set for 7-bit operation with even parity checking.
41	The current ASCII language version is U.S.

The following table provides a complete list of Model 880 configuration codes.

Model 880 Configuration Codes

Code	Description
Communication Mode	
13	Full-duplex modem connect
14	Direct connection, pin 11 high for ready
15	Direct connection, pin 11 low for ready
16	Optional communication interface
17	Parallel communication interface
Baud Rate	
23	300 bps
24	600 bps
25	1200 bps
26	2400 bps
27	4800 bps
28	9600 bps
2A	19,200 bps
Parity Checking Mode (7-bit Data Format)	
31	Odd, received bits not checked
32	Even, received bits not checked
35	Odd, received bits checked
36	Even, received bits checked
37	Mark, received bits not checked
38	Space, received bits not checked
Parity Checking Mode (8-bit Data Format)	
39	No parity checking
3A	Odd, received bits checked
3B	Even, received bits checked
International Language Version	
41	US ASCII
42	France
43	United Kingdom
44	Germany /Austria
45	Sweden/Finland
46	Denmark/Norway
47	Spain/Latin America
48	Switzerland
49	Canadian French

Model 880 Configuration Codes

Code	Description
Miscellaneous Configuration Codes	
81	Escape sequence execution enabled
83	X-on/X-off control (DC1 = ready, DC3 = busy)
84	LF and CR on receipt of LF
85	LF and CR on receipt of CR
8A	Pin 20 ready/busy protocol enabled
8B	CR on receipt of LF, VT, or DC2
9A	SO selects expanded print
9B	Power-up online selected
9C	256-byte receive buffer selected

Transmit Status Report

Escape sequence:	ESC	[	n
Hexadecimal:	1B	5B	6E

The host computer sends this command to request a report of the current printer status. A status report contains either hexadecimal error codes to indicate a current printer error or no error codes to indicate that the printer is online and ready to receive data.

Example. The following is a typical status report

    [880;24;2Cn

Each of the two-digit numbers is a hexadecimal error code that indicates the following.

Code	Error
24	Parity error
2C	Character set not installed

The following table provides a complete list of Model 880 error codes.

Model 880 Error Codes

Code	Description
02	ROM error
03	NVRAM error
04	UART error
06	Communication controller error
07	Standard RAM error
12	Paper-out condition
23	Receive buffer overflow condition
24	Parity error
29	Invalid escape sequence
2A	Escape sequence not executed
2B	Form length error
2C	Character set not installed

Select Unidirectional Printing

Escape sequence: ESC   u
Hexadecimal: 1B   75

This command causes the printer to print subsequent characters from left to right only.

Cancel Unidirectional Printing

Escape sequence: ESC   b
Hexadecimal: 1B   62

This command cancels the unidirectional print mode and causes the printer to resume bidirectional (normal) printing.

Form Format Selection Commands

The form format commands let you select and set some form-related parameters.

Set Form Length to *N* Lines

Escape sequence: ESC   [*N*   t
Hexadecimal: 1B   5B   *N*   74

The variable *N* can be any value in the range of 0 through 113 (hexadecimal 00 through 31 31 33).

Set Form Length to *n* Lines

Escape sequence: ESC   C   *n*
Hexadecimal: 1B   43   *n*

Escape sequence: ESC   2   *n*
Hexadecimal: 1B   32   *n*

The variable *n* can be any value in the range of 0 through 113 (hexadecimal 30 through 71).

Note: The command ESC 2 *n* is not valid when raster graphics is enabled.

Load Default Form Parameters

Escape sequence: ESC   P   L   0   ESC   \
Hexadecimal: 1B   50   4C   30   1B   5C

Escape sequence: ESC   @
Hexadecimal: 1B   40

These commands reset the print quality, character pitch, line spacing, form length, margins, and perforation skip parameters to their default values (see the following figure for a listing of the defaults).

```
                        CURRENT FORM SETTINGS
                     A          B          C          D          E
CPI                  10.0       10.0       10.0       10.0       10.0
PRINT QUAL           DRAFT      DRAFT      DRAFT      DRAFT      LQ
FONT                 GOTHIC     GOTHIC     GOTHIC     GOTHIC     GOTHIC
PRINT IMPACT         NORMAL     NORMAL     NORMAL     NORMAL     NORMAL
LPI                  6          6          6          6          6
DRAFT MAP            DRAFT      DRAFT      DRAFT      DRAFT      DRAFT
QUAL MAP             LQ         LQ         LQ         LQ         LQ
FORMLENGTH (Inches)  3.00       3.50       7.00       8.50       11.00
FORMLENGTH (mm.)     76.2       88.9       177.8      215.9      279.4
FORMLENGTH (lines)   18         21         42         51         66
FIRST LINE           0.000      0.000      0.000      0.000      0.000
LEFT EDGE (tractor)  0.50       0.50       0.50       0.50       0.50
LEFT EDGE (friction) 0.25       0.25       0.25       0.25       0.25
RIGHT EDGE (tractor) 0.39       0.39       0.39       0.39       0.39
RIGHT EDGE (friction)0.14       0.14       0.14       0.14       0.14
LINE WIDTH           13.60      13.60      13.60      13.60      13.60
PAGE FINDER          STANDARD   STANDARD   STANDARD   STANDARD   STANDAR
P/O DETECTION        CONTINUOUS CONTINUOUS CONTINUOUS CONTINUOUS CONTINU
SCAN LINE            default    default    default    default    default
OVRDRIVE COMP        A          A          A          A          A

                     F          G          H          I          J
CPI                  10.0       10.0       10.0       10.0       10.0
PRINT QUAL           DRAFT      DRAFT      DRAFT      DRAFT      DRAFT
FONT                 GOTHIC     GOTHIC     GOTHIC     GOTHIC     GOTHIC
PRINT IMPACT         NORMAL     NORMAL     NORMAL     NORMAL     NORMAL
LPI                  6          6          6          6          6
DRAFT MAP            DRAFT      DRAFT      DRAFT      DRAFT      DRAFT
QUAL MAP             LQ         LQ         LQ         LQ         LQ
FORMLENGTH (Inches)  12.00      14.00      8.26       11.68      16.53
FORMLENGTH (mm.)     304.8      355.6      209.9      296.8      419.9
FORMLENGTH (lines)   72         84         49         70         99
FIRST LINE           0.000      0.000      0.000      0.000      0.000
LEFT EDGE (tractor)  0.50       0.50       0.50       0.50       0.50
LEFT EDGE (friction) 0.25       0.25       0.25       0.25       0.25
RIGHT EDGE (tractor) 0.39       0.39       0.39       0.39       0.39
RIGHT EDGE (friction)0.14       0.14       0.14       0.14       0.14
LINE WIDTH           13.60      13.60      13.60      13.60      13.60
PAGE FINDER          STANDARD   STANDARD   STANDARD   STANDARD   STANDAR
P/O DETECTION        CONTINUOUS CONTINUOUS CONTINUOUS CONTINUOUS CONTINU
SCAN LINE            default    default    default    default    default
OVRDRIVE COMP        A          A          A          A          A
```

form format default parameters

Margin Control Commands

After the margins have been set, changing the line spacing does not affect the top and bottom margins. However, changing the character pitch shifts the left margin to the nearest column of the new pitch value. The right margin shifts in proportion to the change in pitch.

Set Top Margin at Line *N*

Escape sequence: ESC   [*N*   r
Hexadecimal: 1B   5B   *N*   72

This command sets the top margin to the line specified by *N,* where *N* can be any value in the range of 1 through the currently selected form length value. For example, if the currently selected form length value is 66 lines, *N* can be any value in the range of 1 through 66 (hexadecimal 31 through 36 36). If *N* equals 0, the top margin equals the default value (line 1).

Set Bottom Margin at Line *N*

Escape sequence: ESC   [;   *N*   r
Hexadecimal: 1B   5B   3B   *N*   72

This command sets the bottom margin to the line specified by *N,* where *N* can be any value in the range of 1 through the currently selected form length value. For example, if the currently selected form length value is 66 lines, *N* can be any value in the range of 1 through 66 (hexadecimal 31 through 36 36). If *N* equals 0, the bottom margin equals the current form length value.

Set Top and Bottom Margins at Lines *N1* and *N2*

Escape sequence: ESC   [*N1*   ;   *N2*   r
Hexadecimal: 1B   5B   *N1*   3B   *N2*   72

This command sets the top and bottom margins to the lines specified by *N1* and *N2,* respectively, where *N1* can be any value in the range of 1 through the current bottom margin value and *N2* can be any value in the range of 1 through the current form length value. If *N1* equals 0, the top margin equals the default value; if *N2* equals 0, the bottom margin equals the default value.

Set Left Margin at Column *N*

Escape sequence: ESC [*N* s
Hexadecimal: 1B 5B *N* 73

The variable *N* can be any value in the range of 1 through, the column immediately to the left of the current right margin value, as determined by the line width setting. For example, if the current right margin is at column 80, the valid range of *N* is 1 through 79. If *N* equals 0, the left margin equals the default value.

Set Right Margin at Column *N*

Escape sequence: ESC [; *N* s
Hexadecimal: 1B 5B 3B *N* 73

The variable *N* can be any value in the range of the current left margin value through the value of the right-most column, as determined by the current line width setting. If *N* equals 0, the right margin equals the default value.

Set Left and Right Margins at Columns *N1* and *N2*

Escape sequence: ESC [*N1* ; *N2* s
Hexadecimal: 1B 5B *N1* 3B *N2* 73

This command sets the left and right margins to the columns specified by *N1* and *N2,* respectively. The *N1* and *N2* limits are, respectively, the same as for the Set Left Margin at Column *N* and the Set Right Margin at Column *N* commands.

Set Line Width to *n* Columns

Escape sequence: ESC : *n*
Hexadecimal: 1B 3A *n*

The variable *n* can be any value in the range of 0 through 127 for 7-bits or 0 through 227 for 8-bits.

Restore Default Line Width

Escape sequence: ESC ;
Hexadecimal: 1B 3B

This command sets the line width to the value currently selected by the **Form Select** switch.

Horizontal Motion Commands

After the horizontal tab stops have been set, changing from standard print to expanded print does not affect the tab stop positions. However, changing the character pitch alters the tab stop positions in proportion to the change in pitch.

Backspace

Control character: BS
Hexadecimal: 08

This command causes the printer to move the printhead one space to the left within the limits of the current left margin.

Tab Horizontally

Control character: HT
Hexadecimal: 09

This command moves the printhead right, to the next tab stop. If no horizontal tab stops are set between the current logical print position and the right margin, the printer prints the next character at the first column of the next line.

Move to Column *n*

Control character: DC4   *n*
Hexadecimal: 14   *n*

The variable *n* can be any value within the range of 0 through 255 and within the current line width.

Carriage Return

Control character: CR
Hexadecimal: 0D

If the printer is configured to perform both a line feed and a carriage return upon receiving CR, the printer prints the current line, and then performs a line feed and a carriage return. If the printer is not configured to perform both a line feed and a carriage return upon receiving CR, the printer prints the current line and moves the logical print position to the left margin of the current line.

Tab Right to Column *N*

Escape sequence:	ESC	[	*N*	'
Hexadecimal:	1B	5B	*N*	60

The variable *N* can represent any column between the current print position and the currently set right margin position.

Tab Right *N* Columns

Escape sequence:	ESC	[	*N*	a
Hexadecimal:	1B	5B	*N*	61

For any value of *N* that exceeds the right margin limit, the printer performs a line feed and carriage return and prints the next character in column one of the next line.

Set Horizontal Tab Stops

Escape sequence:	ESC	[	*N1...N16*	u
Hexadecimal:	1B	5B	*N1...N16*	75

Escape sequence:	ESC	3	*n1...n16*	NUL
Hexadecimal:	1B	33	*n1...n16*	00

These commands set up to 16 horizontal tab stops at the columns specified by *N1...N16* or *n1...n16*. The command ESC 3 *n1...n16* NUL also clears all previously set horizontal tab stops.

The variable *N* can be any value in the range of column 1 through column 220. The variable *n* can be any value in the range of column 1 through 127 for a 7-bits and column 1 through 220 for an 8-bits.

Note: The command ESC 3 *n1...n16* is not valid when raster graphics is enabled.

Clear All Horizontal Tab Stops

Escape sequence:	ESC	3	NUL
Hexadecimal:	1B	33	00

Escape sequence:	ESC	[	2	g
Hexadecimal:	1B	5B	32	67

Set Horizontal Tab Stop at Current Position

Escape sequence: ESC   H
Hexadecimal: 1B   48

Clear Horizontal Tab Stop at Current Position

Escape sequence: ESC   [0   g
Hexadecimal: 1B   5B   30   67

Vertical Motion Commands

Vertical tab stops define the line numbers at which the paper stops when performing vertical tab operations. After vertical tab stops have been set, any change of the vertical pitch causes a proportional change in the vertical tab stop positions.

Line Feed

Control character: LF
Hexadecimal: 0A

For either of the following conditions, this command causes the printer to print the current line, advance the paper one print line, and perform a carriage return.

❑ The printer is configured to perform a carriage return upon receiving an LF control character.

❑ If the printer is not configured to comply with this condition, LF causes the printer to print the current line and advance the paper one print line without performing a carriage return.

Form Feed

Control character: FF
Hexadecimal: 0C

This command causes the printer to print the current line, advance the paper to the first print line of the next form, and position the printhead at the left margin.

Tab Vertically

Control character: VT
Hexadecimal: 0B

If the printer is configured to perform a carriage return upon receiving a VT control character, this command causes the printer to print the current line, advance the paper to the next vertical tab stop, and perform a carriage return. If the printer is not configured to perform a carriage return upon receiving VT, the printer prints the current line and advances the paper to the next vertical tab stop without performing a carriage return.

Move to Line *n*

Control character: DC2   *n*
Hexadecimal: 12   *n*

If the printer is configured to perform a carriage return upon receiving a DC2 control character, this command causes the printer to position the printhead at the left margin of the print line specified by *n*. If the printer is not configured to perform a carriage return upon receiving DC2, the printer advances the printhead vertically to the specified print line without performing a carriage return. The variable *n* can be any value in the range of 0 through the current form length setting or through line 113, whichever is less.

Tab Vertically to Line *N*

Escape sequence: ESC   [*N*   d
Hexadecimal: 1B   5B   *N*   64

The variable *N* can be any value in the range of 0 through 113 (hexadecimal 30 through 31 31 33) but must be between the current print position and the bottom margin.

Tab Vertically *N* Lines

Escape sequence: ESC   [*N*   e
Hexadecimal: 1B   5B   *N*   65

The variable *N* can be any value in the range of 0 through 113 (hexadecimal 30 through 31 31 33).

Set Vertical Tab Stops

Escape sequence:	ESC	[	*N1...N16*	v
Hexadecimal:	1B	5B	*N1...N16*	76

Escape sequence:	ESC	1	*n1...n16*	NUL
Hexadecimal:	1B	31	*n1...n16*	00

These commands set vertical tab stops at the lines specified by the variables *N1* through *N16* or *n1* through *n16,* where each of the variables *N1* through *N16* or *n1* through *n16* can be any value in the range of 0 through 113. The command ESC 1 *n1...n16* NUL also clears all previously set tab stops.

Set Vertical Tab Stop at Current Position

Escape sequence:	ESC	J
Hexadecimal:	1B	4A

Clear All Vertical Tab Stops

Escape sequence:	ESC	[	4	g
Hexadecimal:	1B	5B	34	67

Clear Vertical Tab Stop at Current Position

Escape sequence:	ESC	[	1	g
Hexadecimal:	1B	5B	31	67

Character Pitch Commands

Character pitches of 5, 8.3, 10, 12, and 16.7 characters per inch (cpi) are available in the Model 880 emulation mode.

Set Character Pitch to 5 cpi

Escape sequence:	ESC	P	I	ESC	\
Hexadecimal:	1B	50	49	1B	5C

Set Character Pitch to 8.3 cpi

Escape sequence:	ESC	P	J	ESC	\
Hexadecimal:	1B	50	4A	1B	5C

Set Character Pitch to 10 cpi

Escape sequence:	ESC	P	C	ESC	\
Hexadecimal:	1B	50	43	1B	5C

Escape sequence:	ESC	6
Hexadecimal:	1B	36

Set Character Pitch to 12 cpi

Escape sequence:	ESC	P	K	ESC	\
Hexadecimal:	1B	50	4B	1B	5C

Set Character Pitch to 16.7 cpi

Escape sequence:	ESC	P	D	ESC	\
Hexadecimal:	1B	50	44	1B	5C

Escape sequence:	ESC	7
Hexadecimal:	1B	37

Line Spacing Commands

The Model 880 emulation mode provides line spacing values of 3, 4, 6, and 8 lpi.

Set Line Spacing to 3 lpi

Escape sequence:	ESC	P	B	ESC	\
Hexadecimal:	1B	50	42	1B	5C

Set Line Spacing to 4 lpi

Escape sequence:	ESC	P	G	ESC	\
Hexadecimal:	1B	50	47	1B	5C

Set Line Spacing to 6 lpi

Escape sequence:	ESC	P	A	ESC	\
Hexadecimal:	1B	50	41	1B	5C

Escape sequence:	ESC	4
Hexadecimal:	1B	34

Escape sequence:	ESC	2
Hexadecimal:	1B	32

Note: The command ESC 2 is valid only when raster graphics is enabled.

Set Line Spacing to 8 lpi

Escape sequence:	ESC	P	H	ESC	\
Hexadecimal:	1B	50	48	1B	5C

Escape sequence:	ESC	5
Hexadecimal:	1B	35

Escape sequence:	ESC	0
Hexadecimal:	1B	30

Set Line Spacing to *n*/72 Inch

Escape sequence:	ESC	A	*n*
Hexadecimal:	1B	41	*n*

This sequence is valid only if raster graphics is enabled. The valid range of *n* is 0 through 85.

Set Line Spacing to *N*/144 Inch

Escape sequence:	ESC	[	*N*	#	q
Hexadecimal:	1B	5B	*N*	23	71

The valid range of *N* is 0 through 255 (hexadecimal 30 through 32 35 35).

Set Line Spacing to *n*/216 Inch

Escape sequence:	ESC	3	*n*
Hexadecimal:	1B	33	*n*

This sequence is valid only if raster graphics is enabled. The valid range of *n* is 0 through 127 for 7-bits and 0 through 255 for 8-bits.

Select Double Line Spacing

Escape sequence:	ESC	P	S	ESC	\
Hexadecimal:	1B	50	53	1B	5C

Cancel Double Line Spacing

Escape sequence:	ESC	P	T	ESC	\
Hexadecimal:	1B	50	54	1B	5C

Print Enhancement Commands

The print enhancement commands enable your printer to improve or enhance print quality. Print enhancements include expanded and letter quality print.

Select Expanded (Double-Wide) Print

Escape sequence:	ESC	P	M	ESC	\
Hexadecimal:	1B	50	4D	1B	5C

Control character:	SO
Hexadecimal:	0E

The SO control character functions in this manner only if SO = EXPAND is entered from the control panel (set to ON).

Cancel Expanded (Double-Wide) Print

Escape sequence:	ESC	P	N	ESC	\
Hexadecimal:	1B	50	4E	1B	5C

Select Letter-Quality Print

Escape sequence:	ESC	P	O	ESC	\
Hexadecimal:	1B	50	4F	1B	5C

Cancel Letter-Quality Print

Escape sequence:	ESC	P	P	ESC	\
Hexadecimal:	1B	50	50	1B	5C

Raster Graphics Commands

In the Model 880 raster graphics mode, the printer alternates between the left and right printhead pins and uses only the top eight pins of each column. The graphics feature enables you to create drawings by sending dot patterns (in the form of hexadecimal codes) to the printer.

When the printer receives a hexadecimal code from the host computer, it maps the individual code bits to the individual printhead pins.

Set Up Graphics Parameters

Escape sequence:	ESC	[	*H*	;	*B*	;	*V*	q
Hexadecimal:	1B	5B	*H*	3B	*B*	5B	*V*	71

This command sets the horizontal dot density (*H*) and the vertical line spacing (*V*) and specifies the number of hexadecimal code bytes (*B*) to print. The variables *H, V,* and *B* are as follows.

❑ Horizontal dot density (*H*) — 60, 72, 120, or 144 dpi. The default value is 60 dpi. If the horizontal dot density is omitted, the printer defaults to the last value selected since the last power-up operation.

❑ Number of hexadecimal code bytes (*B*) to print — can be set to any value in the range of 0 to 1958 (for a line width of 13.6 inches and a horizontal dot density of 144 dpi). If this parameter is omitted or set to 0, the printer prints no raster graphics.

❑ Vertical line spacing (*V*) — *N/*144 inch, where the range of *N* is 0 through 255. A value of 0 indicates that no line feed operation is to occur.

Select 60 dpi Graphics

Escape sequence:	ESC	K	*n1*	*n2*
Hexadecimal:	1B	4B	*n1*	*n2*

The variables *n1* and *n2* specify the number of bytes to print.

Use the following steps to find the values of *n1* and *n2* for a horizontal line of graphics of a given length in inches.

1. Multiply by 60 the length of the line (in inches) to be printed. This operation yields the number of bytes (*n*) required at 60 dots per inch.

2. Divide the number of bytes by 256 (*n*/256); the quotient and the remainder of *n*/256 are, respectively, the decimal values of *n2* and *n1*.

3. Convert the decimal values of *n2* and *n1* obtained in step 1 to their hexadecimal equivalents.

Note: This procedure can be applied to any of the graphics selection commands in this chapter as well as those in Chapters 5 through 8.

Select 120 dpi Graphics

Escape sequence:	ESC	L	*n1*	*n2*
Hexadecimal:	1B	4C	*n1*	*n2*

The variables *n1* and *n2* specify the number of bytes to print. Modify the procedure described for the Select 60 dpi Graphics command to determine the values of *n1* and *n2*. In step 1 of this procedure, multiply the line length by 120 instead of 60 to determine the number of bytes required.

Note: ESC K nl n2 and ESC L nl n2 are valid only when raster graphics is enabled.

Font Selection Commands

Select Font *N*

Escape sequence: ESC   f   *N*
Hexadecimal: 1B   66   *N*

The printer can have a maximum of 10 fonts, including the two standard fonts (Gothic and Courier) and up to eight optional fonts.

The variable *N* can be any value in the range of 0 through 9, where 0 designates Gothic, 1 designates Courier, 2 designates the first font in option ROM 1, 3 designates the second font in option ROM 1, and so on. The range of *N* for either option ROM depends upon the number of fonts contained in each ROM.

Examples. If option ROM 1 has two fonts and option ROM 2 has three fonts, then the range of *N* is 2 through 3 for option ROM 1 and 4 through 7 for option ROM 2. If option ROM 1 has four fonts and option ROM 2 has three fonts, then the range of *N* is 2 through 5 for option ROM 1 and 6 through 8 for option ROM 2.

Font Invocation

The Model 880 Printer emulation enables you to define the contents of the "in-use" font table. The in-use table defines the font currently being printed. The contents of the in-use table can be replaced entirely by an alternate font, or individual characters in the in-use table can be replaced by individual characters invoked from an alternate font. There are four possible alternate sets, called *G0, G1, G2, and G3.*

Designate G0 Font by ROM Identifier *N*

Escape sequence: ESC   (*N*
Hexadecimal: 1B   28   *N*

Designate G1 Font by ROM Identifier *N*

Escape sequence: ESC   )   *N*
Hexadecimal: 1B   29   *N*

Designate G2 Font by ROM Identifier *N*

Escape sequence: ESC   *   *N*
Hexadecimal: 1B   2A   *N*

Designate G3 Font by ROM Identifier *N*

Escape sequence: ESC   +   *N*
Hexadecimal: 1B   2B   *N*

Valid values for *N* are *G* for Gothic and *C* for Courier.

Select Designated Character From G2 Font

Control Character: EM   *N*
Hexadecimal: 19   *N*

Select Designated Character From G3 Font

Control Character: GS   *N*
Hexadecimal: 1D   *N*

Valid values for *N* are any font character.

Invoke G0 Font as GL

Control Character: SI
Hexadecimal: 1F

Invoke G1 Font as GL

Control Character: SO
Hexadecimal: 1E

Note: You must set SO to Expand OFF using the control panel before using this command.

Invoke G2 Font as GL

Escape sequence: ESC   n
Hexadecimal: 1B   6E

Invoke G3 Font as GL

Escape sequence: ESC   o
Hexadecimal: 1B   6F

Invoke G1 Font as GR

Escape sequence: ESC k
Hexadecimal: 1B 6B

Invoke G2 Font as GR

Escape sequence: ESC l
Hexadecimal: 1B 6C

Invoke G3 Font as GR

Escape sequence: ESC m
Hexadecimal: 1B 6D

5
Texas Instruments
Model 855 Printer WP Emulation

Introduction

This chapter describes the Texas Instruments Model 855 word processing (WP) emulation mode. The Model 855 WP emulation mode allows the Model 8900 Series Printer to accept and respond to commands similar to those for a daisy-wheel printer. This mode allows the printer to emulate most functions of the Model 855 Printer operating in its WP mode with the following considerations.

❑ The Model 855 WP emulation supports all Model 8900 global commands.

❑ You can select ribbon color with the command sequence ESC c *n* or ESC r *n.*

❑ Factory selected power-up defaults for the Model 855 WP emulation are:

— Processing mode — DP (The WP mode must be selected after power-up.)

— Auto LF — NO

— The last form setting change made via the control panel is retained and restored at power-up.

❑ The Model 855 WP emulation uses standard pitch and point for superscript and subscript characters.

❑ The standard character set is the IBM PC2 Character Set.

❑ The escape sequence to select mosaic graphics by setting the MSDB to 1 is ESC v.

❑ The escape sequence to cancel mosaic graphics by setting the MSDB to 1 is ESC =.

❑ The escape sequence for font selection is ESC f *N*.

❑ Selecting or canceling proportional spacing is not supported.

❑ Disabling the paper-out detection is not supported.

Motion Indexes

The Model 855 WP emulation mode uses motion indexes to specify certain horizontal and vertical parameters. These motion indexes are established by character pitch and line spacing commands described later in this chapter.

The horizontal motion index and vertical motion index are abbreviated, respectively, as HMI and VMI. Their definitions are as follows.

❑ HMI — The horizontal distance between two adjacent characters. The HMI range is 0 through 254/120 (0 through 2.12) inches in increments of 1/120 inch.

❑ VMI — The vertical distance between two adjacent print lines. The VMI range can be either of the following, depending upon the escape sequence used to establish the VMI.

— 0 through 84/48 (0 through 1.75) inches in increments of 1/48 inch

— 0 through 254/144 (0 through 1.62) inches in increments of 1/144 inch

Model 855 WP Commands

The following table lists the Model 855 WP commands. The paragraphs that follow the table describe these commands.

Model 855 WP Commands

Command	Command Name
Printer Operation	
ESC @	Select DP Mode
ESC CR P	Select WP Mode
ESC SUB I	Select WP Mode
ESC w	Suspend Printing
ESC >	Select Unidirectional Printing
ESC <	Cancel Unidirectional Printing
ESC 6	Select Reverse Printing
ESC 5	Cancel Reverse Printing
ESC v	Set Most Significant Bit
ESC =	Reset Most Significant Bit
Form Format and Font Selection	
ESC F *n1 n2*	Set Form Length to *n1 n2* Lines
ESC f *n*	Select Font *n*
Margin Control	
ESC]	Select Right Margin Justification
ESC [	Cancel Right Margin Justification
ESC +	Set Top Margin at Current Position
ESC -	Set Bottom Margin at Current Position
ESC 9	Set Left Margin at Current Position
ESC 0	Set Right Margin at Current Position

Model 855 WP Commands (continued)

Command Name	Command Name
Horizontal Motion	
BS	Backspace
HT	Tab Horizontally
CR	Carriage Return
ESC BS	Move Back 1/120 Inch
ESC HT *n*	Tab Horizontally Absolute
ESC 1	Set Horizontal Tab Stop at Current Position
ESC 2	Clear All Horizontal Tab Stops
ESC 8	Clear Horizontal Tab Stops at Current Position
Vertical Motion	
LF	Line Feed
FF	Form Feed
VT	Tab Vertically
ESC VT *n*	Tab Vertically Absolute
ESC LF	Move Up One Line
ESC D	Move Up One-Half Line
ESC U	Move Down One-Half Line
Character Pitch	
ESC US *n*	Set Horizontal Motion Index to $(n-1)/120$ Inch
ESC y	Set Character Pitch to 10 cpi
ESC z	Set Character Pitch to 12 cpi
Line Spacing	
ESC RS *n*	Set Vertical Motion Index to $(n-1)/48$ Inch
ESC FS *n*	Set Vertical Motion Index to $(n-1)/144$ Inch

Model 855 WP Commands (concluded)

Command Name	Command Name
Horizontal Motion	
ESC SP	Print Special Character
ESC /	Print Special Character
Print Enhancement	
SO	Select Expanded Print
DC4	Cancel Expanded Print
SI	Select Compressed Print
DC2	Cancel Compressed Print
ESC q	Select Letter-Quality Print
ESC e	Select Letter-Quality Print
ESC d	Cancel Letter-Quality Print
ESC I	Select Text-Underline Print
ESC J	Cancel Text-Underline Print
ESC K *n*	Select Boldface Print
ESC M	Cancel Boldface Print
ESC Q	Select Shadow Print
ESC R	Cancel Shadow Print
Raster Graphics	
ESC k *n1 n2*	Select 60 dpi Graphics
ESC n *n1 r2*	Select 72 dpi Graphics
ESC j *n1 n2*	Select 120 dpi Graphics
ESC o *n1 n2*	Select 144 dpi Graphics

Model 855 WP Command Descriptions

The following paragraphs describe the Model 855 WP emulation commands. The command formats are listed following each command description. Many of the escape-sequence commands contain one or more variables to specify various command parameters. These variables are italicized in the command formats to indicate that they can be set to more than one value.

Printer Operation Commands

These commands allow the host computer to control some basic printer functions.

Select DP Mode

Escape sequence: ESC @
Hexadecimal: 1B 40

This command disables the 855 WP emulation mode and enables the 855 data processing (DP) emulation mode.

Select WP Mode

Escape sequence: ESC CR P
Hexadecimal: 1B 0D 50

Escape sequence: ESC SUB I
Hexadecimal: 1B 1A 49

These commands enable the 855 WP emulation mode.

Suspend Printing

Escape sequence: ESC w
Hexadecimal: 1B 77

This command causes the printer to print the current print line from the print buffer, to suspend printing, and to go to its offline condition.

Select Unidirectional Printing

Escape sequence: ESC   >
Hexadecimal: 1B   3E

This command causes the printer to print all subsequent characters in the forward (left-to-right) direction only.

Cancel Unidirectional Printing

Escape sequence: ESC   <
Hexadecimal: 1B   3C

This command causes the printer to resume normal bidirectional printing.

Select Reverse Printing

Escape sequence: ESC   6
Hexadecimal: 1B   36

This command causes characters received from the host to be printed in reverse order. For example, if the host sends the characters *abcde,* the printer prints them as *edcba.*

Cancel Reverse Printing

Escape sequence: ESC   5
Hexadecimal: 1B   35

Set Most Significant Bit

Escape sequence: ESC   v
Hexadecimal: 1B   76

This command sets the most significant bit of all received characters to one.

Reset Most Significant Bit

Escape sequence: ESC   =
Hexadecimal: 1B   3D

This command cancels the mode set by ESC v.

Form Format and Font Selection Commands

The form format commands let you select and set some form-related parameters. The font selection command lets you choose between the two standard fonts and any installed optional fonts.

The standard fonts for the Model 8900 Series Printer are Courier and Gothic. Residing in printer ROM, these fonts can be selected via the control panel or by the host computer. Optional fonts include Prestige Elite and Presentor. These optional fonts are available as ROMs that plug into sockets on the printer logic board. When installed, these fonts can also be selected via the control panel or by the host computer.

Set Form Length to *n1 n2* Lines

Escape sequence:	ESC	F	*n1*	*n2*
Hexadecimal:	1B	46	*n1*	*n2*

The terms *n1* and *n2* represent a two-digit form-length value expressed as the number of lines that can be printed at 6 lpi.

If the current bottom margin value is less than the new form length value set by this command, the bottom margin position does not change. If the current bottom margin value is greater than the new form length value, the bottom margin position moves to the new form length value.

When using the set form length command, any form-length value of 1 through 99 lines is expressed as two decimal values (*n1* and *n2*). For example, for a form length value of 8 lines, $n1 = 0$ and $n2 = 8$; for a form-length value of 29 lines, $n1 = 2$ and $n2 = 9$. For any form-length value greater than 99 lines, the value of *n1* is expressed as a hexadecimal number and the value of *n2* is limited to the decimal values 1 through 9.

Select Font *n*

Escape sequence: ESC   f   *n*
Hexadecimal: 1B   66   n

The printer can have a maximum of 10 fonts, including the two standard fonts (Gothic and Courier) and up to eight optional fonts.

The variable *n* can be any value in the range of 0 through 9, where 0 designates Gothic, 1 designates Courier, 2 designates the first font in option ROM 1, 3 designates the second font in option ROM 1, and so on. The range of *n* for either option ROM depends upon the number of fonts contained in each ROM.

Examples. If option ROM 1 has two fonts and option ROM 2 has three fonts, then the range of *n* is 2 through 3 for option ROM 1 and 4 through 7 for option ROM 2. If option ROM 1 has four fonts and option ROM 2 has three fonts, then the range of *n* is 2 through 5 for option ROM 1 and 6 through 8 for option ROM 2.

Margin Control Commands

After the left and right margins are set, subsequent character pitch changes do not affect them. The bottom margin must always be set below the top margin, and both margins must be within the form boundaries. Once the top and bottom margins are set, subsequent line spacing changes do not affect them.

For any line feed operation that advances the print position beyond the bottom page margin, the printer automatically positions the printhead at the top margin of the following page.

Select Right Margin Justification

Escape sequence: ESC   ]
Hexadecimal: 1B   5D

This command causes the printer to insert enough space between characters to cause each line to occupy the entire space between the left and right margins.

Cancel Right Margin Justification

Escape sequence: ESC   [
Hexadecimal: 1B   5B

Set Top Margin at Current Position

Escape sequence: ESC   +
Hexadecimal: 1B   2B

Changing the form length setting overrides this command and resets the top margin to the top-of-form position.

Set Bottom Margin at Current Position

Escape sequence: ESC   -
Hexadecimal: 1B   2D

If the form length does not exceed the bottom margin, the bottom of the form is the same as the bottom margin setting. If the form length exceeds the bottom margin, the bottom margin is unchanged.

Set Left Margin at Current Position

Escape sequence: ESC   9
Hexadecimal: 1B   39

For any left margin setting greater than 1, the BS control character or the absolute tabulation escape sequence (ESC HT *n*) permits printing to the left of the margin.

Set Right Margin at Current Position

Escape sequence: ESC   0
Hexadecimal: 1B   30

Horizontal Motion Commands

The following paragraphs describe the commands for horizontal motion and horizontal tab functions in the Model 855 WP emulation mode.

Backspace

Control character: BS
Hexadecimal: 08

This command causes the printer to move the printhead one HMI position to the left. The next character printed following a BS command overstrikes the most recently printed character. In the backward print mode, each BS control character moves the printhead to the right one HMI position.

Tab Horizontally

Control character: HT
Hexadecimal: 09

This command moves the printhead to the next horizontal tab stop. If the printer receives an HT command following the last horizontal tab stop on a line, the printer performs a carriage return and a line feed and starts the next print operation at the left margin.

Carriage Return

Control character: CR
Hexadecimal: 0D

This command causes the printer to perform the following functions.

❑ The printer prints the current line of data from the print buffer and begins the next line at the left margin.

❑ If right margin justification is active, the CR command causes each line of print to occupy the entire space between the left and right margins.

❑ If the expanded print mode is active, the CR command resets the printer to the normal print mode.

❑ If the automatic line feed function is active, the CR command causes the paper to advance one print line.

Move Back 1/120 inch

Escape sequence: ESC   BS
Hexadecimal: 1B   08

This command moves the print position 1/120 inch to the left.

Tab Horizontally Absolute

Escape sequence: ESC   HT   *n*
Hexadecimal: 1B   09   *n*

This command moves the printhead horizontally (left or right) to the column specified by the variable *n* where *n* can be any value in the range of 1 through 127. When *n* equals zero or the number of a column beyond the right margin, the printer ignores the command. If the value of *n* is greater than the right-most column, the printer positions the printhead to the right-most column.

Set Horizontal Tab Stop at Current Position

Escape sequence: ESC   1
Hexadecimal: 1B   31

Clear All Horizontal Tab Stops

Escape sequence: ESC   2
Hexadecimal: 1B   32

Clear Horizontal Tab Stop at Current Position

Escape sequence: ESC   8
Hexadecimal: 1B   38

Vertical Motion Commands

Vertical tab stops define the line numbers at which the paper stops when performing vertical tab operations. After vertical tab stops have been set, any change of the vertical pitch causes a proportional change in the vertical tab stop positions.

Line Feed

Control character: LF
Hexadecimal: 0A

This command moves the paper forward one line position without performing a carriage return. The VMI determines the distance from one line to the next.

Form Feed

Control character: FF
Hexadecimal: 0C

This command advances the paper to the top margin of the next page and causes the printer to perform a carriage return to the left margin.

Tab Vertically

Control character: VT
Hexadecimal: 0B

This command advances the paper to the next print line without performing a carriage return.

Tab Vertically Absolute

Escape sequence: ESC   VT   *n*
Hexadecimal: 1B   0B   *n*

This command moves the paper vertically (up or down) to the line specified by the variable *n.* The line space is the distance defined by the VMI or the distance set by the operator via the **Form Config** switch. The valid range of *n* is 1 through 126.

Move Up One Line

Escape sequence: ESC LF
Hexadecimal: 1B 0A

The line space is the distance defined by the VMI or the distance set via the **Form Config** switch on the control panel.

Move Up One-Half Line

Escape sequence: ESC D
Hexadecimal: 1B 40

When one-half line space is a fractional number of 1/144 inch steps, the printer truncates the number of steps to a whole number.

Move Down One-Half Line

Escape sequence: ESC U
Hexadecimal: 1B 55

When one-half line space is a fractional number of 1/144 inch steps, the printer truncates the number of steps to a whole number.

Character Pitch Commands

The following paragraphs describe the commands for character pitch operations in the Model 855 WP emulation mode.

Set Horizontal Motion Index to (*n*-1)/120 Inch

Escape sequence: ESC US *n*
Hexadecimal: 1B 1F *n*

This command sets the HMI to (n-1)/120 inch, where the variable n is valid for any value in the range of 1 through 255.

Set Character Pitch to 10 cpi

Escape sequence: ESC y
Hexadecimal: 1B 79

Set Character Pitch to 12 cpi

Escape sequence: ESC   z
Hexadecimal: 1B   7A

This command sets the character pitch to 12 cpi.

Line Spacing Commands

The following paragraphs describe the commands for line spacing operations in the Model 855 WP emulation mode.

Set Vertical Motion Index to (n-1)/48 Inch

Escape sequence: ESC   RS n
Hexadecimal: 1B   1E n

The variable n can be any value in the range of 1 through 85, resulting in a VMI range of 0 through 84/48 (0 through 1.75) inches.

Set Vertical Motion Index to (n-1)/144 Inch

Escape sequence: ESC   FS n
Hexadecimal: 1B   1C n

The variable n can be any value in the range of 1 through 255, resulting in a VMI range of 0 through 254/144 (0 through 1.76) inches.

Character Set Commands

The character set commands for the 855 WP mode are limited to the following commands that cause the printer to print special characters similar to those printed by daisy-wheel printers.

Print Special Character

Escape sequence: ESC   SP
Hexadecimal: 1B   20

Escape sequence: ESC   /
Hexadecimal: 1B   2F

Print Enhancement Commands

The print enhancement commands enable your printer to improve or enhance the print quality. Print enhancements include such things as expanded, compressed, LQ, and underlined text as well as boldface and shadow printing.

Select Expanded Print

Control character: SO
Hexadecimal: 0E

This command causes the printer to double the horizontal dot spacing and then make a second pass to fill in the dots for one line only. This mode is terminated by a carriage return.

Cancel Expanded Print

Control character: DC4
Hexadecimal: 14

Select Compressed Print

Control character: SI
Hexadecimal: 0F

This command reduces the width of all subsequently printed characters to about 60 percent of their normal widths.

Cancel Compressed Print

Control character: DC2
Hexadecimal: 12

Select Letter-Quality Print

Escape sequence: ESC q
Hexadecimal: 1B 71

Escape sequence: ESC e
Hexadecimal: 1B 65

Cancel Letter-Quality Print

Escape sequence: ESC   d
Hexadecimal: 1B   64

This command cancels LQ print and returns the printer to the draft print mode.

Select Text-Underline Print

Escape sequence: ESC   I
Hexadecimal: 1B   49

Cancel Text-Underline Print

Escape sequence: ESC   J
Hexadecimal: 1B   4A

Select Boldface Print

Escape sequence: ESC   K   *n*
Hexadecimal: 1B   4B   *n*

The variable *n* is valid for any of the following values.

❑   0 and 1 — turn boldface printing off

❑   2 through 4 — turn boldface printing on

Cancel Boldface Print

Escape sequence: ESC   M
Hexadecimal: 1B   4D

Select Shadow Print

Escape sequence: ESC   Q
Hexadecimal: 1B   51

In the shadow print mode, the printer prints each line twice with second-pass dots offset by 1/120 inch.

Cancel Shadow Print

Escape sequence: ESC   R
Hexadecimal: 1B   52

Raster Graphics Commands

The following paragraphs describe the commands that control the raster graphics feature In the TI 855 WP emulation mode. To find the values of *n1* and *n2* for any of the following commands, modify the procedure described for the Select 60 dpi Graphics command in Chapter 4. In step 1 of the procedure, substitute the appropriate dot density value for 60.

Select 60 dpi Graphics

Escape sequence:	ESC	k	*n1*	*n2*
Hexadecimal:	1B	6B	*n1*	*n2*

Select 72 dpi Graphics

Escape sequence:	ESC	n	*n1*	*n2*
Hexadecimal:	1B	6E	*n1*	*n2*

Select 120 dpi Graphics

Escape sequence:	ESC	j	*n1*	*n2*
Hexadecimal:	1B	6A	*n1*	*n2*

Select 144 dpi Graphics

Escape sequence:	ESC	o	*n1*	*n2*
Hexadecimal:	1B	6F	*n1*	*n2*

6
Texas Instruments Model 855 Printer DP Emulation

Introduction

This chapter describes the Texas Instruments Model 855 Printer data processing (DP) emulation mode. The Model 855 DP emulation mode allows the Model 8900 Series Printer to accept and respond to commands similar to those for common dot-matrix printers. This mode allows the printer to emulate most of the functions of the Model 855 Printer operating in its DP mode with the following considerations:

❑ The Model 855 DP emulation supports all Model 8900 global commands.

❑ You can select ribbon color with the command sequence ESC c *n* or ESC r *n*.

❑ Factory selected power-up defaults for the Model 855 DP emulation are:

— Processing mode — DP

— Auto LF — NO

— The last form setting change made via the control panel is retained and restored at power-up.

❑ The Model 855 DP emulation uses standard pitch and point for superscript and subscript characters.

❑ The standard character set is the IBM PC2 Character Set.

❑ The escape sequence to select mosaic graphics by setting the MSDB to 1 is ESC v.

❑ The escape sequence to cancel mosaic graphics by setting the MSDB to 1 is ESC =.

❑ Disabling the paper-out detection is not supported.

❑ The escape sequence for font selection is ESC f *N*.

The following table lists the Model 855 DP commands.

Model 855 DP Commands

Command Name	Command Name
Printer Operation	
ESC@	Select DP Mode
ESC CR P	Select WP Mode
ESC SUB I	Select WP Mode
ESC w	Suspend Printing
ESC u	Select Unidirectional Printing
ESC b	Cancel Unidirectional Printing
ESC >	Set Most Significant Bit
ESC =	Reset Most Significant Bit
Form Format and Font Selection	
ESC C *n*	Set Form Length to *n* Lines
ESC f *n*	Select Font *n*
Horizontal Motion	
BS	Backspace
HT	Tab Horizontally
CR	Carriage Return
ESC <	Move Print Position to Left Margin
ESC D *n1...n16* NUL	Set Horizontal Tab Stops
ESC D NUL	Clear All Horizontal Tab Stops

Model 855 DP Commands (continued)

Command Name	Command Name
Vertical Motion	
LF	Line Feed
FF	Form Feed
VT	Tab Vertically
ESC ^	Move Up One-Half Line
ESC v	Move Down One-Half Line
ESC B *n1...n16* NUL	Set Vertical Tab Stops
ESC B NUL	Clear All Vertical Tab Stops
Character Pitch	
ESC y	Set Character Pitch to 10 cpi
ESC z	Set Character Pitch to 12 cpi
Line Spacing	
ESC 2	Set Line Spacing to 6 lpi
ESC 0	Set Line Spacing to 8 lpi
ESC 1	Set Line Spacing to 7/72 Inch
ESC A *n*	Set Line Spacing to *n*/72 Inch
ESC 3 *n*	Set Line Spacing to *n*/216 Inch
Print Enhancement	
SO	Select Expanded Print
ESC S	Select Expanded Print
DC4	Cancel Expanded Print
ESC T	Cancel Expanded Print
SI	Select Compressed Print
ESC P	Select Compressed Print
DC2	Cancel Compressed Print
ESC Q	Cancel Compressed Print
ESC q	Select Letter-Quality Print
ESC e	Select Letter-Quality Print
ESC d	Cancel Letter-Quality Print

Model 855DP Commands (concluded)

Command	Command Name
Print Enhancement (continued)	
ESC G	Select Boldface Print
ESC H	Select Boldface Print
ESC E	Select Shadow Print
ESC F	Cancel Shadow Print
Color Emulation	
ESC r n	Select color (Epson-JX compatible)
ESC c n	Select color (TI 857 compatible)
Raster Graphics	
ESC K *n1 n2*	Select 60 dpi Graphics
ESC N *n1 n2*	Select 72 dpi Graphics
ESC L *n1 n2*	Select 120 dpi Graphics
ESC J *n1 n2*	Select 120 dpi Graphics
ESC O *n1 n2*	Select 144 dpi Graphics

Model 855 DP Command Descriptions

The following paragraphs describe the TI 855 DP emulation commands. The command formats are listed following each command description. Many of the escape-sequence commands contain one or more variables to specify various command parameters. These variables are italicized in the command formats to indicate that they can be set to more than one value.

Printer Operation Commands

These commands allow the host computer to control some basic printer functions.

Select DP Mode

Escape sequence: ESC   @
Hexadecimal: 1B   40

Select WP Mode

Escape sequence: ESC   CR   P
Hexadecimal: 1B   0D   50

Escape sequence: ESC   SUB   I
Hexadecimal: 1B   1A   49

These commands cause the printer to function in the Model 855 WP mode.

Suspend Printing

Escape sequence: ESC   w
Hexadecimal: 1B   77

This command prints the current print line from the print buffer and suspends printing operations until the suspension is released by the **On Line** switch.

Select Unidirectional Printing

Escape sequence: ESC   u
Hexadecimal: 1B   75

This command causes the printer to print subsequent characters in the forward (left-to-right) direction only.

Cancel Unidirectional Printing

Escape sequence: ESC   b
Hexadecimal: 1B   62

Set Most Significant Bit

Escape sequence: ESC   >
Hexadecimal: 1B   3E

This command sets the most significant bit of all received characters to one. This allows a host that can send only 7-bit data to access the GR side of an 8-bit character set.

Reset Most Significant Bit

Escape sequence: ESC   =
Hexadecimal: 1B   3D

Form Format and Font Selection Commands

The form format commands let you select and set some form-related parameters. The font selection command lets you choose between the two standard fonts and any installed optional fonts.

The standard fonts for the Model 8900 Series Printer are Courier and Gothic. Residing in printer ROM, these fonts can be selected via the control panel or by the host computer. Optional fonts include Prestige Elite and Presentor. These optional fonts are available as ROMs that plug into sockets on the printer logic board. When installed, these fonts can also be selected via the control panel or by the host computer.

Set Form Length to *n* Lines

Escape sequence: ESC C *n*
Hexadecimal: 1B 43 *n*

The variable *n* is valid for any value in range of 1 through 127 for 7-bit character sets and 1 through 255 for 8-bit character sets.

Example. To set the form length to 60 lines, send the sequence ESC C < (1B 43 3C).

Select Font *n*

Escape sequence: ESC f *n*
Hexadecimal: 1B 66 *n*

The printer can have a maximum of 10 fonts, including two standard fonts (Gothic and Courier) and up to eight optional fonts.

The variable *n* can be any value in the range of 0 through 9, where 0 designates Gothic, 1 designates Courier, 2 designates the first font in option ROM 1, 3 designates the second font in option ROM 1, and so on. The range of *n* for either option ROM depends on the number of fonts contained in each ROM.

Examples. If option ROM 1 has two fonts and option ROM 2 has three fonts, then the range of *n* is 2 through 3 for option ROM 1 and 4 through 7 for option ROM 2. If option ROM 1 has four fonts and option ROM 2 has three fonts, then the range of *n* is 2 through 5 for option ROM 1 and 6 through 8 for option ROM 2.

Horizontal Motion Commands

The following paragraphs describe the commands for horizontal motion and tabulation functions in the Model 855 DP emulation mode.

Backspace

Control character. BS
Hexadecimal: 08

This command causes the printer to move the printhead one space to the left.

The next character printed following a BS command over-strikes the most recently printed character. In the backward print mode, each BS control character moves the printhead to the right one space.

The BS command can cause characters to be printed to the left of the left margin in the forward print mode or to the right of the right margin in the backward print mode.

Tab Horizontally

Control character: HT
Hexadecimal: 09

This command advances the printhead to the next horizontal tab stop and the printer starts the next print operation at that position. If the printer receives an HT command following the last horizontal tab stop on a line, the printer performs a carriage return and a line feed and starts the next print operation at the left margin.

Carriage Return

Control character: CR
Hexadecimal: 0D

This command causes the printer to perform the following functions.

❑ The printer prints the current line of data from the print buffer and begins the next line at the left edge (column 1), set via the form configuration menu.

❑ If right margin justification is active, the CR command causes each line of print to occupy the entire space between the left and right margins

❑ If the expanded print mode is active, the CR command resets the printer to the normal print mode.

❑ If the automatic line feed function is active, the CR command causes the paper to advance one print line.

Move Print Position to Left Margin

Escape sequence: ESC   <
Hexadecimal: 1B   3C

This command moves the printhead to the left margin and causes the next print operation to be in the forward direction.

Set Horizontal Tab Stops

Escape sequence: ESC   D   *n1...n16*   NUL
Hexadecimal: 1B   44   *n1...n16*   00

This command clears all previously set horizontal tab stops and sets a new stop at each of the columns specified by the variables *n1...n16*. Each of the variables *n1* through *n16* can range from 1 through 255. However, the printer ignores any setting to the right of the right margin.

Clear All Horizontal Tab Stops

Escape sequence: ESC   D   NUL
Hexadecimal: 1B   44   00

Vertical Motion Commands

Vertical tab stops define the line numbers at which the paper stops when performing vertical tab operations. After vertical tab stops have been set, any change of the vertical pitch causes a proportional change in the vertical tab stop positions.

Line Feed

Control character: LF
Hexadecimal: 0A

This command moves the paper forward one line position and performs a carriage return to the left edge (column 1), as set via the form configuration menu.

Form Feed

Control character: FF
Hexadecimal: 0C

This command advances the paper to the top margin of the next page and causes the printer to perform a carriage return to the left edge (column 1), as set via the form configuration menu.

Tab Vertically

Control character: VT
Hexadecimal: 0B

This command advances the paper to the next vertical tab stop. If no vertical tab stops have been set, the VT command causes the printer to perform a line feed operation. If the printer receives a VT command following the last vertical tab stop on a page, the printer performs a form feed operation.

Move Up One-Half Line

Escape sequence: ESC ^
Hexadecimal: 1B 5E

This command moves the paper in reverse one-half of one line space. The line space is the space defined by the **LPI** menu item of the control panel **Form Config** switch. This sequence can be used for superscripts or to return to the normal print line after invoking the ESC v (move down ½ line) sequence.

Move Down One-Half Line

Escape sequence: ESC v
Hexadecimal: 1B 76

This command moves the paper forward one-half of one line space. The line space is that defined by the **LPI** menu item of the control panel **Form Config** switch. This sequence can be used for subscripts or to return to the normal print line after invoking the ESC ^ (move up ½ line) sequence.

Set Vertical Tab Stops

Escape sequence: ESC   B   *n1...n16*   NUL
Hexadecimal: 1B   42   *n1...n16*   00

This command clears all previously set vertical tabulation stops and sets a new stop at each of the lines specified by the variables *n1...n16.* Each of the variables *n1* through *n16* can range from 1 through 127 for 7-bit character sets and 1 through 255 for 8-bit character sets. However, the printer ignores any setting below the bottom print line.

Clear All Vertical Tab Stops

Escape sequence: ESC   B   NUL
Hexadecimal: 1B   42   00

Character Pitch Commands

The following paragraphs describe the commands for character pitch operations in the Model 855 DP emulation mode.

Set Character Pitch to 10 cpi

Escape sequence: ESC   y
Hexadecimal: 1B   79

Set Character Pitch to 12 cpi

Escape sequence: ESC   z
Hexadecimal: 1B   7A

This command sets the character pitch to 12 cpi.

Line Spacing Commands

The following paragraphs describe the commands for line spacing operations in the Model 855 DP emulation mode.

Set Line Spacing to 6 lpi

Escape sequence: ESC   2
Hexadecimal: 1B   32

Set Line Spacing to 8 lpi

Escape sequence: ESC   0
Hexadecimal: 1B   30

Set Line Spacing to 7/72 Inch

Escape sequence: ESC   1
Hexadecimal: 1B   31

Set Line Spacing to n/72 Inch

Escape sequence: ESC   A   *n*
Hexadecimal: 1B   41   *n*

The variable *n* can be any value in the range of 1 through 127.

Set Line Spacing to *n*/216 Inch

Escape sequence: ESC   3   *n*
Hexadecimal: 1B   33   *n*

The valid range of *n* is 1 through 127 for 7-bit character sets and 1 through 255 for 8-bit character sets.

Print Enhancement Commands

The print enhancement commands enable your printer to improve or enhance the print quality.

Select Expanded Print

Control character: SO
Hexadecimal: 0E

Escape sequence: ESC   S
Hexadecimal: 1B   53

These commands cause the printer to double the horizontal dot spacing of each character and then make a second pass to fill in the dots.

Cancel Expanded Print

Control character: DC4
Hexadecimal: 14

Escape sequence:	ESC	T
Hexadecimal:	1B	54

Select Compressed Print

Control character:	SI
Hexadecimal:	0F

Escape sequence:	ESC	P
Hexadecimal:	1B	50

These commands reduce the width of subsequently printed characters to about 60 percent of their normal size.

Cancel Compressed Print

Control character:	DC2
Hexadecimal:	12

Escape sequence:	ESC	Q
Hexadecimal:	1B	51

Select Letter-Quality Print

Escape sequence:	ESC	q
Hexadecimal:	1B	71

Escape sequence:	ESC	e
Hexadecimal:	1B	65

Cancel Letter-Quality Print

Escape sequence:	ESC	d
Hexadecimal:	1B	64

This command cancels LQ print and returns the printer to the draft print mode.

Select Boldface Print

Escape sequence:	ESC	G
Hexadecimal:	1B	47

In the boldface print mode, the printer double strikes all characters with no physical offset.

Cancel Boldface Print

Escape sequence: ESC   H
Hexadecimal: 1B   48

Select Shadow Print

Escape sequence: ESC   E
Hexadecimal: 1B   45

In the shadow print mode, the printer double strikes all characters with a 1/120-inch horizontal offset.

Cancel Shadow Print

Escape sequence: ESC   F
Hexadecimal: 1B   46

Color Emulation

Select Epson-JX Compatible Color Mode

Escape sequence: ESC   r n
Hexadecimal: 1B   72 n

To provide compatibility with Epson-JX where n is an ASCII value NUL through ACK (hexadecimal value 00 through 06 or decimal value 0 through 6).

$n = 0$ for black
$n = 1$ for red
$n = 2$ for blue
$n = 3$ for purple
$n = 4$ for yellow
$n = 5$ for orange
$n = 6$ for green

Select TI 857 Compatible Color Mode

Escape sequence: ESC   c n
Hexadecimal: 1B   63 n

To provide compatibility with TI 857 where *n* is an ASCII value NUL through ACK (hexadecimal value 00 through 06 or decimal value 0 through 6).

n = 0 for black
n = 1 for blue
n = 2 for red
n = 3 for yellow
n = 4 for green
n = 5 for purple
n = 6 for orange

Raster Graphics Commands

The following paragraphs describe the commands that control the raster graphics feature in the Model 855 DP emulation mode. To find the values of *n1* and *n2* for any of the following commands, modify the procedure described for the Select 60 dpi Graphics command in Chapter 4. In step 1 of the procedure, substitute the appropriate dot density value for 60.

Select 60 dpi Graphics

Escape sequence:	ESC	K	*n1*	*n2*
Hexadecimal:	1B	4B	*n1*	*n2*

Select 72 dpi Graphics

Escape sequence:	ESC	N	*n1*	*n2*
Hexadecimal:	1B	4E	*n1*	*n2*

Select 120 dpi Graphics

Escape sequence:	ESC	L	*n1*	*n2*
Hexadecimal:	1B	4C	*n1*	*n2*

Escape sequence:	ESC	J	*n1*	*n2*
Hexadecimal:	1B	4A	*n1*	*n2*

Select 144 dpi Graphics

Escape sequence:	ESC	O	*n1*	*n2*
Hexadecimal:	1B	4F	*n1*	*n2*

7
IBM Proprinter XL Emulation

Introduction

This chapter describes the IBM Proprinter XL emulation mode. This emulation mode is selectable from the printer setup menu described in Chapter 2. This mode enables your printer to emulate most of the functions of the IBM Proprinter XL with the following considerations:

❑ The Proprinter XL emulation supports all Model 8900 global commands.

❑ Factory selected power-up defaults for the IBM Proprinter XL emulation are:

— Auto LF — NO

— Auto CR — NO

— Slashed zeros — NO

— The last form setting change made via the control panel is retained and restored at power-up.

❑ Selecting or canceling proportional spacing is not supported.

❑ Downloading characters (ESC = n1 n2 data) is not supported.

The IBM Proprinter XL is a nine-pin dot-matrix impact printer that can print draft-quality or near-letter-quality (NLQ) text characters and dot graphics.

IBM Proprinter XL Emulation Commands

Your printer, when operating in the IBM Proprinter XL emulation mode, can respond to both escape-sequence commands and the standard US ASCII control characters. The following table lists the IBM Proprinter XL printer commands.

IBM Proprinter XL Commands

Command	Command Name
Printer Operation	
DC1	Select Printer
ESC Q SYN	Deselect Printer
BEL	Sound Bell
CAN	Cancel Line
ESC U SOH	Select Unidirectional Printing
ESC U NUL	Cancel Unidirectional Printing
Form Format and Margin Control	
ESC C *n*	Set Form Length to *n* Lines
ESC C NUL *n*	Set Form Length to *n* Inches
ESC 4	Set Top of Form Position
ESC N *n*	Set Automatic Perforation Skip to *n* Lines
ESC O	Cancel Automatic Perforation Skip
ESC X *n1 n2*	Set Left and Right Margins at Columns *n1* and *n2*
Horizontal Motion	
BS	Backspace
HT	Tab Horizontally
CR	Carriage Return
ESC D *n1...n28* NUL	Set Horizontal Tab Stops
ESC R	Restore Default Tab Stops

IBM Proprinter XL Commands (continued)

Command	Command Name
Vertical Motion	
LF	Line Feed
FF	Form Feed
VT	Tab Vertically
ESC J *n*	Perform *n*/216 Inch Line Feed
ESC 5 SOH	Enable Automatic Line Feed
ESC 5 NUL	Disable Automatic Line Feed
ESC]	Reverse Line Feed
ESC B *n1...n64* NUL	Set Vertical Tab Stops
ESC B NUL	Clear All Vertical Tab Stops
Character Pitch and Line Spacing	
DC2	Set Character Pitch to 10 cpi
ESC :	Set Character Pitch to 12 cpi
ESC 2	Select Programmable Line Spacing
ESC 0	Set Line Spacing to 8 lpi
ESC 1	Set Line Spacing to 7/72 Inch
ESC A *n*	Set Line Spacing to *n*/72 Inch
ESC 3 *n*	Set Line Spacing to *n*/216 Inch
Character Set	
ESC 7	Select PC1 Character Set
ESC 6	Select PC2 Character Set
ESC ^ *c*	Print Single Specified Character
ESC \ *n1 n2 data*	Print Multiple Specified Characters
Print Enhancement	
SO	Select Expanded Print
ESC SO	Select Expanded Print
ESC W SOH	Select Expanded Print
DC4	Cancel Expanded Print
ESC W NUL	Cancel Expanded Print
SI	Select Compressed Print
ESC SI	Select Compressed Print
DC2	Cancel Compressed Print
ESC I STX	Select Letter-Quality Print
ESC I ACK	Select Letter-Quality Print
ESC I NUL	Cancel Letter-Quality Print
ESC I EOT	Cancel Letter-Quality Print
ESC - SOH	Select Text-Underline Print

IBM Proprinter XL Commands (concluded)

Command	Command
Name Print Enhancement (continued)	
ESC - NUL	Cancel Text-Underline Print
ESC _ SOH	Select Text-Overscore Print
ESC _ NUL	Cancel Text-Overscore Print
ESC G	Select Boldface Print
ESC H	Cancel Boldface Print
ESC E	Select Shadow Print
ESC F	Cancel Shadow Print
ESC S NUL	Select Superscript Print
ESC T	Cancel Superscript Print
ESC S SOH	Select Subscript Print
ESC T	Cancel Subscript Print
ESC [@ *n1 n2*	Enable/Disable Double-High
n3 n4 m1 m2	Double-Wide Print
Raster Graphics	
ESC K *n1 n2*	Select 60 dpi Graphics
ESC L *n1 n2*	Select 120 dpi Graphics
ESC Y *n1 n2*	Select High-Speed 120 dpi Graphics
ESC Z *n1 n2*	Select 240 dpi Graphics

IBM Proprinter XL Command Descriptions

The following paragraphs describe the IBM Proprinter XL emulation commands. Many of the escape-sequence commands contain one or more variables to specify various command parameters. These variables are italicized in the command formats to indicate that they can be set to more than one value.

Printer Operation Commands

The printer operation commands provide printer control functions including printer selection and initialization. These commands allow the host computer to control the basic printer functions.

Select Printer

Control character: DC1
Hexadecimal: 11

This command reselects the printer after it has received a Deselect Printer command, unless the printer has been placed offline via the control panel **On Line** switch.

Note: Some IBM computers and IBM-compatible computers set parallel interface pin 36 low; this condition disables the DC1 command.

Deselect Printer

Escape sequence: ESC   Q   22
Hexadecimal: 1B   51   16

This command sets the printer to its deselected state until it receives a Select Printer (DC1) command from the host. After the printer has received the Deselect Printer command, it cannot be placed online via the control panel **On Line** switch.

Sound Bell

Control character: BEL
Hexadecimal: 07

This command causes the printer to sound a short tone.

Cancel Line

Control character: CAN
Hexadecimal: 18

This command removes all characters except control characters from the current contents of the print buffer.

Select Unidirectional Printing

Escape sequence: ESC   U   SOH
Hexadecimal: 1B   55   01

This command causes the printer to print subsequent text in the forward (left-to-right) direction only.

Cancel Unidirectional Printing

Escape sequence:	ESC	U	NUL
Hexadecimal:	1B	55	00

Form Format and Margin Control Commands

The form format commands let you select and set some form-related parameters. A single margin control command lets you set the left and right margin positions.

Set Form Length to *n* Lines

Escape sequence:	ESC	C	*n*
Hexadecimal:	1B	43	*n*

The variable *n* can be any value in the range of 1 through 127.

Set Form Length to *n* Inches

Escape sequence:	ESC	C	NUL	*n*
Hexadecimal:	1B	43	00	*n*

The variable *n* can be any value in the range of 1 through 21.

Set Top of Form Position

Escape sequence:	ESC	4
Hexadecimal:	1B	34

This command sets the top of form position to the current print line.

Select Automatic Perforation Skip

Escape Sequence: ESC N *n*
Hexadecimal: 1B 4E *n*

This command causes the printer to perform the following actions.

1. Skip the number of lines specified by the variable *n* and the current form parameter settings.

2. Print the next line at the first print line position of the following form.

The variable *n* can be any value in the range of 1 through 255.

Cancel Automatic Perforation Skip

Escape sequence: ESC O
Hexadecimal: 1B 4F

Set Left and Right Margins at Columns *n1* and *n2*

Escape sequence: ESC X *n1* *n2*
Hexadecimal: 1B 58 *n1* *n2*

This command sets the left and right margins at the positions specified by the variables *n1* and *n2,* respectively. The left margin position (*n1*) can be at any column in the range of 1 through the column immediately to the left of the current right margin. The right margin *(n2)* can be at any column in the range of the column immediately to the right of the left margin through 255. If *n1* or *n2* equals 0, the left margin or right margin, respectively, equals the default value. The minimum allowable distance between the left and right margin is one-half inch.

Horizontal Motion Commands

The horizontal motion commands control the horizontal motion of the printhead, including the direction and distance of each movement.

Backspace

Control character: BS
Hexadecimal: 08

This command causes the printer to print the current contents of the print buffer and then move the printhead one character to the left. This command is valid at any point to the right of the left margin but not at or to the left of the left margin. The printer ignores the Backspace command if either full or right margin justification has been selected.

Tab Horizontally

Control character: HT
Hexadecimal: 09

This command moves the printhead horizontally to the next horizontal tab stop. These tab stops can be the ones set by the Set Horizontal Tab Stops command (ESC D *n1...n32*) or the default horizontal tab stops. The default tab stops are at 8-character intervals (in the default character size) between the left and right margins.

Carriage Return

Control character. CR
Hexadecimal: 0D

This command causes the printer to print the current contents of the print buffer and then return the printhead to the left margin. This command may be accompanied by a Line Feed command to move the printhead to the next print line position.

Set Horizontal Tab Stops

Escape sequence:	ESC	D	*n1...n28*	NUL
Hexadecimal:	1B	44	*n1...n28*	00

This command clears all previously set horizontal tab stops and sets a new tab stop at each of the columns specified by the variables *n1...n28.* These variables must be listed in ascending order; that is, the value of each variable must be greater than the one preceding it. Any *n* value of 0 or less than that of the one preceding it terminates the command.

At power-up or upon receiving the Initialize Printer command, the printer automatically sets a horizontal tab stop at every eighth column. These are the default positions.

If you change the character pitch after the horizontal tab stops have been set, the tab stop positions change accordingly. However, the expanded print mode does not affect the horizontal tab settings.

Restore Default Tab Stops

Escape sequence: ESC R
Hexadecimal: 1B 52

This command resets all tab stops (both vertical and horizontal) to their default values.

Vertical Motion Commands

The vertical motion commands are those that control forward or reverse movement of the paper within the printer.

Line Feed

Control character: LF
Hexadecimal: 0A

This command causes the printer to print the current contents of the print buffer and then position the printhead at the next print line.

Form Feed

Control character: FF
Hexadecimal: 0C

The Form Feed command causes the printer to print the current contents of the print buffer and then move the print-head to the first print line of the next form.

Tab Vertically

Control character: VT
Hexadecimal: 0B

This command advances the print position vertically to the next vertical tab stop.

Perform *n*/216 Inch Line Feed

Escape sequence: ESC   J   *n*
Hexadecimal: 1B   4A   *n*

This command advances the print position vertically by a value in the range of 0/216 through 255/216 (0 through 1.18) inches. This command causes an immediate line feed operation but does not produce a carriage return unless the printer is set to perform an automatic carriage return upon receiving an LF control character.

Perform Reverse Line Feed

Escape Sequence: ESC   ]
Hexadecimal: 1B   5D

This command executes an immediate reverse line feed. Printable data in the line print buffer is printed, then a reverse line feed is executed.

Enable Automatic Line Feed

Escape sequence: ESC   5   SOH
Hexadecimal: 1B   35   01

This command enables the automatic line feed mode. With this mode enabled, the printer automatically performs a line feed with every carriage return.

Disable Automatic Line Feed

Escape sequence: ESC 5 NUL
Hexadecimal: 1B 35 00

Reverse Line Feed

Escape sequence: ESC]
Hexadecimal: 1B 5D

Set Vertical Tab Stops

Escape sequence: ESC B *nl...n64* NUL
Hexadecimal: 1B 42 *n1...n64* 00

This command sets up to 64 vertical tab stops (in the current line spacing). Subsequent line spacing changes do not affect these settings. The tab settings must be entered in ascending order (*n1, n2,* and so on); that is, the value of each succeeding *n* variable must be greater than the one preceding it. Any *n* variable with a value of 0 (00) terminates the command.

Clear Vertical Tab Stops

Escape sequence: ESC B NUL
Hexadecimal: 1B 42 00

Character Pitch and Line Spacing Commands

The character pitch is the horizontal distance from the center of one character to the center of an adjacent character. The line spacing is the vertical distance between print lines.

Set Character Pitch to 10 cpi

Control character: DC2
Hexadecimal: 12

Set Character Pitch to 12 cpi

Escape sequence: ESC   :
Hexadecimal: 1B   3A

This command selects 12 cpi character pitch for either draft or LQ printing.

Select Programmable Line Spacing

Escape sequence: ESC   2
Hexadecimal: 1B   32

This command invokes the line spacing value stored in memory by the Set Line Spacing to *n*/72 Inch command (ESC A *n*). If no ESC A *n* command has been received, this command sets the line spacing to 6 lpi.

Set Line Spacing to 8 lpi

Escape sequence: ESC   0
Hexadecimal: 1B   30

Set Line Spacing to 7/72 Inch

Escape sequence: ESC   1
Hexadecimal: 1B   31

Set Line Spacing to *n*/72 Inch

Escape sequence: ESC   A   *n*
Hexadecimal: 1B   32 *n*

The line spacing value can be any value in the range of 1/72 through 85/72 (0.014 through 1.181) inches, depending upon the value of the variable *n*.

Set Line Spacing to *n*/216 Inch

Escape sequence: ESC   3   *n*
Hexadecimal: 1B   32 *n*

This command sets the line spacing to a value in the range of 0/216 through 255/216 (0 through 1.18) inches for subsequent line feed operations.

Character Set Commands

The character set commands let you choose between the IBM PC1 and IBM PC2 character sets and print specified characters from either of these character sets.

Select PC1 Character Set

Escape sequence: ESC 7
Hexadecimal: 1B 37

Select PC2 Character Set

Escape *sequence:* ESC 6
Hexadecimal: 1B 36

Print Single Specified Character

Escape sequence: ESC ^ *c*
Hexadecimal: 1B 5E *c*

This command causes the printer to print from the All Characters character set the single character specified by the variable *c*. The variable *c* can be any hexadecimal code from the character set, including those from columns 0, 1, 8, and 9.

Print Multiple Specified Characters

Escape sequence: ESC \ *n1* *n2* *data*
Hexadecimal: 1B 5C *n1* *n2* *data*

This command causes the printer to print from the All Characters character set the number of characters indicated by the variables *n1* and *n2* and specified by the *data* term. The total number of characters to be printed following this command is equal to $n1 + (n2 \times 256)$, where the valid ranges of both *n*1 and *n2* are 0 through 255. Thus the maximum number of characters that can be specified by this command is $255 + (255 \times 256)$ equals 65,535. The *data* term is a list of the hexadecimal codes of the characters to be printed, including the characters from columns 0, 1, 8, and 9 of the All Characters character set.

Print Enhancement Commands

The print enhancement commands enable your printer to improve or enhance the print quality. Print enhancements include such things as superscript and subscript text, text underlining and overscoring, and emphasized print to make the print appear bolder. The following paragraphs describe the print enhancement commands.

Select Expanded Print

Control character: SO
Hexadecimal: 0E

Escape sequence: ESC SO
Hexadecimal: 1B 0E

Escape sequence: ESC W SOH
Hexadecimal: 1B 57 01

These commands select the expanded (double-wide) print mode for either draft or LQ printing. A Carriage Return command (CR) cancels the expanded print mode; therefore, for two or more consecutive lines of expanded print you must invoke the Select Expanded Print command for each line.

Cancel Expanded Print

Control character. DC4
Hexadecimal: 14

Escape sequence: ESC W NUL
Hexadecimal: 1B 57 00

Select Compressed Print

Control character: SI
Hexadecimal: 0F

Escape sequence: ESC SI
Hexadecimal: 1B 0F

These commands cause the printer to print characters at about 60 percent of their normal widths. For example, for a character pitch of 10 cpi, one inch of text contains about 17 characters instead of the normal 10.

Cancel Compressed Print

Control character: DC2
Hexadecimal: 12

Select Letter-Quality Print

Escape sequence: ESC   I   STX
Hexadecimal: 1B   49   02

Escape sequence: ESC   I   ACK
Hexadecimal: 1B   49   06

Cancel Letter-Quality Print

Escape sequence: ESC   I   NUL
Hexadecimal: 1B   49   00

Escape sequence: ESC   I   EOT
Hexadecimal: 1B   49   04

Select Text-Underline Print

Escape sequence: ESC   -   SOH
Hexadecimal: 1B   2D   01

Cancel Text-Underline Print

Escape sequence: ESC   -   NUL
Hexadecimal: 1B   2D   00

Select Text-Overscore Print

Escape sequence: ESC   _   SOH
Hexadecimal: 1B   5F   01

Cancel Text-Overscore Print

Escape sequence: ESC   _   NUL
Hexadecimal: 1B   5F   00

Select Boldface Print

Escape sequence: ESC   G
Hexadecimal: 1B   47

Cancel Boldface Print

Escape sequence: ESC   H
Hexadecimal: 1B   48

Select Shadow Print

Escape sequence: ESC   E
Hexadecimal: 1B   45

Cancel Shadow Print

Escape sequence: ESC   F
Hexadecimal: 1B   46

Select Superscript Print

Escape sequence: ESC   S   NUL
Hexadecimal: 1B   53   00

After receiving this command the printer prints each subsequent character in the upper part of the character space at about two-thirds its normal height.

Cancel Superscript Print

Escape sequence: ESC   T
Hexadecimal: 1B   54

Select Subscript Print

Escape sequence: ESC   S   SOH
Hexadecimal: 1B   53   01

After receiving this command the printer prints each subsequent character in the lower part of the character space at about two-thirds its normal height.

Cancel Subscript Print

Escape sequence: ESC   T
Hexadecimal: 1B   54

Enable/Disable Double-High Double-Wide Print

Escape sequence: ESC   [@   *n1*   *n2*   *n3*   *n*4   *m1 m2*
Hexadecimal: 1B   5B   40   *n1*   *n2*   *n3*   *n*4   *m1 m2*

where:

n1 n2	= byte count; format is ($n1 + (n2 * 256)$)
n3 n4	= no function, ignored
m1	= line spacing and character height
m2	= character width

This command selects double-high printing in either the standard or expanded width. The variable *m2* specifies the character width, and *m1* specifies the character height and line feed distance as follows.

Considerations for Using Enable/Diasble Double-High Double-Wide Print

Considerations for using the Enable/Disable Double-High Double-Wide command sequence are:

❑ The byte count is usually four (4), when the count is greater than 4, the command is executed as per *m1* and *m2* and the additional bytes are accepted and ignored.

❑ When the byte count is three (3), the command is executed as per *m*1 only.

   No *m*2 byte is provided, the character width remains unchanged. *m*1 is the last byte of the count.

❑ When the byte count is less than three (3) the command is accepted and ignored as follows:

byte count	=		
		2	*n*4 is the last byte of the sequence
		1	*n*3 is the last byte of the sequence
		0	*n*2 is the last byte of the sequence

m1 data byte, bit 0 is least significant

bits 0 and 1 = 00 current character height
    01 standard character height
    10 double character height
    11 current character height

bits 2 and 3 = XX don't care

bits 4 and 5 = 00 current line spacing
      01 single line spacing
      10 double line spacing
      11 current line spacing

bits 6 and 7 = XX don't care

m2 data byte, bit 0 is least significant

bits 0 and 1 = 00 current character width
    01 standard character width
    10 double character width
    11 current character width

bits 2 through 7 = XX don't care

Raster Graphics Commands

The graphics feature provides commands that enable you to design your own images in any shape you desire. These commands allow you to create and adjust the density of various lines and patterns in various combinations.

Note: The allowed ranges of *n1* and *n2* in the following commands are determined by the line length and limited by the width of the installed paper.

To find the values of *n1* and *n2* for any of the following commands, modify the procedure described for the Select 60 dpi Graphics command in Chapter 4. In step 1 of the procedure, substitute the appropriate dot density value for 60.

Select 60 dpi Graphics

Escape sequence: ESC K *n1* *n2*
Hexadecimal: 1B 4B *n1* *n2*

This command selects the 8-pin, 60 dpi graphics mode for the horizontal line length specified by the two-byte variable *n1 n2*.

Select 120 dpi Graphics

Escape sequence: ESC L *n1* *n2*
Hexadecimal: 1B 4C *n1* *n2*

This command selects the 8-pin, 120 dpi graphics mode for the horizontal distance specified by the two-byte variable *n1 n2*.

Select High-Speed 120 dpi Graphics

Escape sequence: ESC Y *n1* *n2*
Hexadectmal: 1B 59 *n1* *n2*

This command selects the 8-pin, high-speed 120 dpi graphics mode for the horizontal distance specified by the two-byte variable *n1 n2*. This is identical to the double-density graphics mode except that the printing speed is doubled.

Select 240 dpi Graphics Mode

Escape sequence: ESC Z *n1* *n2*
Hexadecimal: 1B 5A *n1* *n2*

This command selects the 8-pin, 240 dpi graphics mode for the horizontal distance specified by the two-byte variable *n1 n2*.

8
Epson FX Printer Emulation Mode

Introduction

This chapter describes the Epson FX printer emulation mode. This emulation mode is selectable from the printer setup menu as described in Chapter 2. This mode enables your printer to emulate most of the functions of an Epson FX printer with the following considerations:

❑ The escape sequence for font selection is ESC k *n*.

❑ The escape sequence for selecting ribbon color is ESC r *n*.

❑ The escape sequence for enabling a printable character at 0 - 31 hex is ESC 6.

❑ The escape sequence for enabling a printable character at 128 - 256 hex is ESC I SOH.

❑ The escape sequence for selecting an international character set is ESC R *n*.

❑ The Epson FX emulation uses standard pitch and point for superscript and subscript characters.

❑ The Epson FX emulation's compressed print size is 17.1 cpi only.

❑ The Epson FX emulation supports all Model 8900 global commands.

❑ User selectable automatic carriage return on line feed mode is supported.

❑ Factory selected power-up defaults for the Model 880 emulation are:

    — Auto LF — OFF

    — Auto CR — OFF

— Slashed zeros — OFF

— The last form setting change made via the control panel is retained and restored at power -up.

— The right-half character set defaults to PC1 at power-up.

❑ The following escape sequences are not supported:

— The download characters command sequence ESC & NUL data

— The copy ROM character set to RAM Roman command sequence ESC : 0 0 0

— The copy ROM character set to RAM San Serif command sequence ESC : 0 1 0

— The select normal character set comand sequence ESC % 0

— The select user-defined character set command sequence ESC % 1

— The select cut-sheet feeder mode command sequence ESC EM 0

— The disable cut-sheet feeder mode command sequence ESC EM 4

— The set one-half print speed mode to on or off command sequence ESC s n

Epson FX Printer Emulation Commands

Your printer, when operating in the Epson FX emulation mode, can respond to both escape-sequence commands and the standard US ASCII control characters. The following table lists the FX printer commands.

Epson FX Emulation Commands

Command	Command Name
Printer Operation	
DC1	Select Printer
DC3	Deselect Printer
BEL	Sound Bell
CAN	Cancel Line
DEL	Delete Character
ESC @	Initialize Printer
ESC =	Set MSB to 0
ESC >	Set MSB to 1
ESC #	Cancel MSB Control
ESC <	Select Unidirectional Printing for One Line Only
ESC U SOH	Select Unidirectional Printing
ESC U NUL	Cancel Unidirectional Printing
Form Format	
ESC C n	Set Form Length to n Lines
ESC C NUL n	Set Form Length to n Inches
ESC N n	Select Automatic Perforation Skip
ESC O	Cancel Automatic Perforation Skip
Font Selection	
ESC k SOH	Select LQ Gothic Font
ESC k NUL	Select LQ Courier Font
Margin Control	
ESC a NUL	Select Left Margin Justification
ESC a STX	Select Right Margin Justification
ESC a ETX	Select Full Justification
ESC a SOH	Select Text Centering
ESC 1 n	Set Left Margin at Column n
ESC Q n	Set Right Margin at Column n

Command	Command Name
Horizontal Motion	
BS	Backspace
HT	Tab Horizontally
CR	Carriage Return
ESC $ *n1 n2*	Set Absolute Print Position
ESC \ *n1 n2*	Set Relative Print Position
ESC D *nl...n32* NUL	Set Horizontal Tab Stops
ESC D NUL	Clear All Horizontal Tab Stops
Vertical Motion	
LF	Line Feed
FF	Form Feed
VT	Tab Vertically
ESC J *n*	Perform *n*/216-Inch Line Feed
ESC B *n1...n16* NUL	Set Vertical Tab Stops
ESC / *c*	Select Vertical Tab Channel
ESC b *c n1...n16* NUL	Set VTC Tab Stops
ESC b *c* NUL	Clear All VTC Tab Stops
ESC B NUL	Clear All Vertical Tab Stops
Character Pitch	
ESC P	Set Character Pitch to 10 cpi
ESC M	Set Character Pitch to 12 cpi
ESC SP *n*	Set Intercharacter Space
Line Spacing	
ESC 2	Set Line Spacing to 6 lpi
ESC 0	Set Line Spacing to 8 lpi
ESC 1	Set Line Spacing to 7/72 Inch
ESC A *n*	Set Line Spacing to *n*/72 Inch
ESC 3 *n*	Set Line Spacing to *n*/216 Inch
Character Set	
ESC t NUL	Select Italic Character Set
ESC t SOH	Select Extended Graphics Character Set
ESC R *n*	Select International Character Set
ESC 6	Enable Character Positions 128-159 as Printable Characters
ESC 7	Disable Character Positions 128-159 as Printable Characters

Epson FX Emulation Commands (continued)

Command	Command Name
Character Set (continued)	
ESC I SOH	Enable Character Positions 0-31 and 128-159 as Printable Characters
ESC I NUL	Disable Character Positions 0-31 and 128-159 as Printable Characters
Print Enhancement	
SO	Select Expanded Print for One Line
ESC SO	Select Expanded Print for One Line
DC4	Cancel Expanded Print
ESC W SOH	Select Expanded Print Until Canceled by ESC W NUL
ESC W NUL	Cancel Expanded Print
ESC w SOH	Select Double-High Print
ESC w NUL	Cancel Double-High Print
SI	Select Compressed Print
ESC SI	Select Compressed Print
DC2	Cancel Compressed Print
ESC x SOH	Select Letter-Quality Print
ESC x NUL	Cancel Letter-Quality Print
ESC - SOH	Select Text-Underline Print
ESC - NUL	Cancel Text-Underline Print
ESC G	Select Boldface Print
ESC H	Cancel Boldface Print
ESC E	Select Shadow Print
ESC F	Cancel Shadow Print
ESC S NUL	Select Superscript Print
ESC T	Cancel Superscript Print
ESC S SOH	Select Subscript Print
ESC T	Cancel Subscript Print
ESC 4	Select Italic Print
ESC 5	Cancel Italic Print
ESC ! n	Select Master Print

Epson FX Emulation Commands (concluded)

Command	Command Name
Raster Graphics	
ESC K *n1 n2*	Select 60 dpi Graphics
ESC ^ NUL *n1 n2*	Select 9-Pin 60 dpi Graphics
ESC L *n1 n2*	Select 120 dpi Graphics
ESC ^ SOH *n1 n2*	Select 9-Pin 120 dpi Graphics
ESC Y *nl n2*	Select High-Speed, 120 dpi Graphics
ESC Z *n1 n2*	Select 240 dpi Graphics
ESC * *m n1 n2*	Select Graphics Mode *m*
ESC ? *s n*	Reassign Graphics Mode

Epson FX Emulation Command Descriptions

The following paragraphs describe the Epson FX emulation commands. The command formats are listed following each command description. Many of the escape-sequence commands contain one or more variables to specify various command parameters. These variables are italicized in the command formats to indicate that they can be set to more than one value.

Printer Operation Commands

The printer operation commands provide printer control functions including printer selection and initialization. These commands allow the host computer to control the basic printer functions.

Note: For clarity, the individual terms of each escape sequence are separated by spaces throughout this chapter. When you enter these commands, you must omit these spaces.

Select Printer

Control character: DC1
Hexadecimal: 11

This command reselects the printer after it has received a Deselect command, unless the printer has been placed offline via the control panel **On Line** switch.

Deselect Printer

Control character: DC3
Hexadecimal: 13

This command sets the printer to its deselected state until it receives a Select Printer command from the host. After the printer has received this command, it cannot be placed online via the control panel **On Line** switch.

Sound Bell

Control character: BEL
Hexadecimal: 07

This command causes the printer to sound a short tone.

Cancel Line

Control character: CAN
Hexadecimal: 18

This command removes all characters except control characters from the current print buffer contents.

Delete Character

Control character: DEL
Hexadecimal: 7F

This command removes the last text character from the current print buffer contents, but does not affect any control character.

Initialize Printer

Escape sequence: ESC   @
Hexadecimal: 1B   40

This command resets the printer to its initial state and clears the print buffer of all printable data from the last line printed before the command was received.

Set Most Significant Bit to Zero

Escape sequence: ESC   =
Hexadecimal: 1B   3D

Some computers, when sending characters from 7-bit character sets, automatically set the most significant bit (MSB) of each character to 1. This causes the printer to print all received characters as italics or character graphics. To prevent this, the Set Most Significant Bit to Zero command sets the MSB of each subsequently received character to 0.

Set Most Significant Bit to One

Escape sequence: ESC   >
Hexadecimal: 1B   3E

This command sets the MSB of all subsequently received characters to 1. This enables the printer to select characters from either the italics character set or the extended graphics character set.

Cancel Most Significant Bit Control

Escape sequence: ESC   #
Hexadecimal: 1B   23

This command cancels printer control of the received character MSB and returns control to the computer. This enables the computer to select characters from either the GL half or the GR half of the selected printer character set.

Select Unidirectional Printing for One Line Only

Escape sequence: ESC   <
Hexadecimal: 1B   3C

This command selects unidirectional printing for one line only. Upon receiving this command, the printer moves its printhead to the left margin and begins printing. A CR control character cancels this command and returns the printer to the bidirectional print mode.

Select Unidirectional Printing

Escape sequence: ESC   U   SOH
Hexadecimal: 1B   55   01

This command selects unidirectional printing. Upon receiving this command, the printer moves its printhead to the left margin and begins printing.

Cancel Unidirectional Printing

Escape sequence: ESC   U   NUL
Hexadecimal: 1B   55   00

This command cancels the unidirectional print mode selected by the Select Unidirectional Printing command and returns the printer to normal bidirectional printing.

Form Format Commands

The form format commands let you set the form length in either lines or inches. These commands also let you enable or disable the automatic perforation skip feature.

Set Form Length to *n* Lines

Escape sequence: ESC C *n*
Hexadecimal: 1B 43 *n*

This command sets the form length to the number of lines specified by the variable *n* in the current line spacing. This command also sets the top-of-form position to the current line. The variable *n* can be any value in the range of 1 through 127.

Set Form Length to *n* Inches

Escape sequence: ESC C NUL *n*
Hexadecimal: 1B 43 00 *n*

This command sets the form length to the number of inches specified by the variable *n*. The variable *n* can be any value in the range of 1 through 22.

Select Automatic Perforation Skip

Escape sequence: ESC N *n*
Hexadecimal: 1B 43 *n*

This command causes the printer to perform the following actions.

1. Skip the number of lines specified by the variable *n* and the current form parameter settings.

2. Print the next line at the first print line position of the following form.

Example. If the current form length setting is 66 lines and the current line spacing is 6 lpi, setting the value of *n* to 6 causes the printer to do the following.

1. Print 60 lines on the current form.

2. Skip 6 lines at the bottom of the current form.

3. Print the next text line at the first print line position of the following page.

Invoking any of the commands ESC O, ESC C *n,* or ESC C NUL *n* cancels the Select Automatic Perforation Skip command.

Cancel Automatic Perforation Skip

Escape sequence: ESC   O
Hexadecimal: 1B   4F

This command cancels the functions set by the Select Automatic Perforation Skip command.

Font Selection Commands

The font selection commands let you choose between the two printer-resident standard fonts.

Select Letter-Quality Gothic Font

Escape sequence: ESC   k   SOH
Hexadecimal: 1B   6B   01

This command selects the printer-resident Gothic font and places the printer in the LQ print mode.

Select Letter-Quality Courier Font

Escape sequence: ESC   k   NUL
Hexadecimal: 1B   6B   00

This command selects the printer-resident Courier font and places the printer in the LQ print mode.

Margin Control Commands

The margin control commands let you set parameters related to the left, right, bottom, and top margins and control print justification and text centering.

Select Left Margin Justification

Escape sequence: ESC   a   NUL
Hexadecimal: 1B   61   00

This command causes the printer to justify any subsequent text to the left margin.

Select Right Margin Justification

Escape sequence: ESC   a   STX
Hexadecimal: 1B   61   02

This command causes the printer to justify any subsequent text to the right margin.

Select Full Justification

Escape sequence: ESC   a   ETX
Hexadecimal: 1B   61   03

This command causes the printer to add sufficient space to cause each print line to occupy the entire space between the left and right margins.

Select Text Centering

Escape sequence: ESC   a   SOH
Hexadecimal: 1B   61   01

This command causes the printer to center each print line between the left and right margins.

Set Left Margin at Column *n*

Escape sequence: ESC   l   *n*
Hexadecimal: 1B   6C   *n*

This command sets the left margin at the position specified by the variable *n.* The minimum distance between the left and right margins is the width of one expanded 10 cpi character. Invoking this command clears all previously set horizontal tab stops and all previous characters from the current print buffer contents. The left margin position (*n*) can be at any column in the range of 1 through the column immediately to the left of the current right margin.

Set Right Margin at Column *n*

Escape sequence: ESC   Q   *n*
Hexadecimal: 1B   51   *n*

This command sets the right margin at the position specified by the variable *n.* The minimum distance between the left and right margins is the width of one expanded 10 cpi character. Invoking this command clears all previously set horizontal tab stops and all previous characters from the current line of the receive buffer contents. The right margin position (*n*) can be at any column in the range of the column immediately to the right of the left margin through the right-most column, as determined by the current line width setting.

Horizontal Motion Commands

The horizontal motion commands control the horizontal motion of the printhead, including direction and distance of each movement. The following paragraphs describe the horizontal motion commands.

Backspace

Control character: BS
Hexadecimal: 08

This command causes the printer to print the current print buffer contents and then move the print position one character to the left. This command is valid at any point to the right of the left margin, but not at or to the left of the left margin. The printer ignores the Backspace command if either full or right margin justification has been selected.

Tab Horizontally

Control character: HT
Hexadecimal: 09

This command moves the print position to the next horizontal tab stop. These tab stops can be the ones set by the Set Horizontal Tab Stops command or the ones set by the default horizontal tab stops. The default tab stops are at 8-character intervals (in the default character size) between the left and right margins.

Carriage Return

Control character: CR
Hexadecimal: 0D

This command causes the printer to print the contents of the current print buffer and then return the printhead to the left margin. This command may be accompanied by a Line Feed command to move the printhead to the next print line position.

Set Absolute Print Position

Escape sequence: ESC $ *n1* *n2*
Hexadecimal: 1B 24 *n1* *n2*

This command sets the first character position of subsequently printed text at 1/60 inch or some multiple of 1/60 inch from the currently set left margin. The variables *n1* and *n2* form a two-byte hexadecimal value that specifies the absolute print position in 1/60 inch increments. After you decide the distance in inches from the left margin to a desired absolute print position, follow these steps to find the values of *n1* and *n2*.

1. Multiply by 60 the absolute distance in inches from the left margin to the first character position to determine the distance (*d*) in l/60 inch increments.

2. Divide the value determined in step 1 by 256 (*d*/256); the quotient and the remainder of *d*/256 are, respectively, the decimal values of *n2* and *n1*.

3. Convert the decimal values of *n2* and *n1* to their hexadecimal equivalents.

Any setting beyond the right margin is ignored.

Set Relative Print Position

Escape sequence: ESC \ *n1* *n2*
Hexadecimal: 1B 5C *n1* *n2*

This command sets the distance from the current print position to the first character of all subsequent text. The variables *n1* and *n2* form a two-byte hexadecimal value which specifies the relative position in 1/120 inch increments.

To determine the values of *n1* and *n2*, modify the procedure described for the Set Absolute Print Position command. In step 1 of this procedure, multiply the absolute distance by 120 instead of 60 to determine the distance (*d*) in 1/120 inch increments. For displacement to the left subtract *d* from 65,536. The printer ignores this command for values of *n1* and *n2* that would move the printhead outside the current margin boundaries.

Set Horizontal Tab Stops

Escape sequence: ESC D *n1...n32* NUL
Hexadecimal: 1B 44 *n1...n32* 00

This command clears all previously set horizontal tab stops and sets a new tab stop at each of the columns specified by the variables *n1...n32*. Each of the variables *n1* and *n2* can be any value in the range of 1 through 127 for a 7-bit character set and 1 through 232 for an 8-bit character set. These variables must be listed in ascending order; that is, the value of each variable must be greater than the one preceding it. Any *n* value of 0 or less than that of the one preceding it terminates the command.

At power-up or upon receiving the Initialize Printer command, the printer automatically sets a horizontal tab stop at every eighth column. These are the default positions.

Clear All Horizontal Tab Stops

Escape sequence: ESC D NUL
Hexadecimal: 1B 44 00

Vertical Motion Commands

The vertical motion commands are those that control the vertical movement of paper within the printer. This set of commands includes commands that allow you to select any of eight vertical tabulation channels (VTCs) and set up to 16 vertical tabs for each channel.

Line Feed

Control character: LF
Hexadecimal: 0A

This command causes the printer to print the current receive buffer contents and then position the printhead at the next print line.

Form Feed

Control character: FF
Hexadecimal: 0C

This command causes the printer to print the current print buffer contents and then move the printhead to the first print line of the next form.

Tab Vertically

Control character: VT
Hexadecimal: 0B

This command advances the print position vertically to the next vertical tab stop in the currently selected vertical tab channel (VTC). If no VTC has been previously selected, the printer automatically uses VTC 0. If no tab stops have been set for the selected VTC, the printer advances the print position to the next print line.

Perform *n*/216 Inch Line Feed

Escape sequence: ESC   J   *n*
Hexadecimal: 1B   4A   *n*

This command advances the print position vertically by a value in the range of 0/216 through 255/216 (0 through 1.18) inches.

Set Vertical Tab Stops

Escape sequence: ESC   B   *n1...n16*   NUL
Hexadecimal: 1B   42   *n1...n16*   00

This command sets up to 16 vertical tab stops (in the current line spacing) for VTC 0. Subsequent line spacing changes do not affect these settings. Each of the variables (*n1* through *n16*) can be any value in the range of 0 through 255.

The tab settings must be entered in ascending order (*n1*, *n2*, and so on); that is, the value of each succeeding *n* variable must be greater than the one preceding it. Any *n* variable with a value of 0 (00) terminates the command.

Select Vertical Tab Channel

Escape sequence: ESC   /   *c*
Hexadecimal: 1B   2F   *c*

This command selects one of the eight preset VTCs. The printer subsequently uses this VTC for all vertical tab operations. The variable *c* specifies the VTC number (0 through 7).

Set VTC Tab Stops

Escape sequence: ESC   b   *c*   *n1...n16*   NUL
Hexadecimal: 1B   42   *c*   *n1...n16*   00

This command sets up to 16 vertical tab stops (in the current line spacing) for the VTC specified by the variable *c*. Subsequent line spacing changes do not affect these settings. Each of the variables (*n1* through *n16*) can be any value in the range of 0 through 255.

The tab settings must be entered in ascending order (*n1, n2,* and so on), that is, the value of each, succeeding, a variable must be greater than the one preceding it. Any *n* variable with a value of 0 (00) terminates the command. The command ESC b *c* 0 clears all tab stops for the VTC specified by the variable *c*.

Clear All VTC Tab Stops

Escape sequence: ESC   b   *c*   NUL
Hexadecimal: 1B   62   *c*   00

This command clears all vertical tab stops from the VTC, specified by the variable *c*.

Clear All Vertical Tab Stops

Escape sequence: ESC   B   NUL
Hexadecimal: 1B   42   00

This command clears all previously set vertical tab stops from VTC 0.

Character Pitch Commands

The character pitch commands let you choose between 10 and 12 cpi or adjust the horizontal spacing between characters. The character pitch is the horizontal distance from the center of one character to the center of the next character.

Set Character Pitch to 10 cpi

Escape sequence: ESC   P
Hexadecimal: 1B   50

This command selects 10 cpi character pitch and cancels 12 cpi character pitch if it has been previously selected.

Set Character Pitch to 12 cpi

Escape sequence: ESC   M
Hexadecimal: 1B   4D

This command selects 12 cpi character pitch for either draft or LQ printing.

Set Intercharacter Space

Escape sequence: ESC   SP   *n*
Hexadecimal: 1B   20   *n*

This command adjusts the space between text characters (for both draft and LQ printing) by an amount specified by the variable *n* where *n* can be any value in the range of 0 through 128. The design of each character of the standard character sets allows a certain amount of space to the right of the character. The Set Intercharacter Space command can add one or more 1/120 inch units of space to the existing character space, depending upon the value of *n*. For example, if the variable *n* is set to 12, the printer adds 12/120 (0.1) inch of space to the existing space.

Line Spacing Commands

The line spacing commands let you choose between line spacing values of 6 or 8 lpi or any of several fractional line spacing values. The line spacing is the vertical distance between print lines.

Set Line Spacing to 6 lpi

Escape sequence: ESC   2
Hexadecimal: 1B   32

This command sets the line spacing to 6 lpi (the default value) for all subsequent line feed operations.

Set Line Spacing to 8 lpi

Escape sequence: ESC   0
Hexadecimal: 1B   30

This command sets the line spacing to 8 lpi for all subsequent line feed operations.

Set Line Spacing to 7/72 Inch

Escape sequence: ESC   1
Hexadecimal: 1B   31

This command sets the line spacing to 7/72 inch for all subsequent line feed operations.

Set Line Spacing to *n*/72 Inch

Escape sequence: ESC   A   *n*
Hexadecimal: 1B   41   *n*

This command sets the line spacing, for subsequent line feed operations, to the value specified by *n*. The variable *n* can be any value in the range of 0 through 85.

Set Line Spacing to *n*/216 Inch

Escape sequence: ESC   3   *n*
Hexadecimal: 1B   33   *n*

This command sets the line spacing to a value in the range of 0/216 through 255/216 (0 through 1.18) inches for subsequent line feed operations.

Character Set Commands

The character set commands enable you to select and use the standard Epson FX character sets or international versions of these character sets. The following paragraphs describe the character set commands.

Select Italic Character Set

Escape sequence: ESC   t   NUL
Hexadecimal: 1B   74   00

This command selects the Epson italic character set.

Select Extended Graphics Character Set

Escape sequence: ESC   t   SOH
Hexadecimal: 1B   74   01

This command selects the Epson extended graphics character set.

Select International Character Set

Escape sequence: ESC   R   *n*
Hexadecimal: 1B   52   *n*

This command selects, for either draft or LQ printing, the international version of the ASCII character set specified by the variable *n*. The variable *n* can be any of the following values.

0	USA	7	Spain I
1	France	8	Japan
2	Germany	9	Norway
3	United Kingdom	10	Denmark II
4	Denmark I	11	Spain II
5	Sweden	12	Latin America
6	Italy		

Enable Character Positions 128-159 as Printable Characters

Escape sequence: ESC   6
Hexadecimal: 1B   36

This command enables the printer to treat the characters in character positions 128-159 (C1 control characters) as printable characters.

Disable Character Positions 128-159 as Printable Characters

Escape sequence: ESC   7
Hexadecimal: 1B   37

Enable Character Positions 0-31 and 128-159 as Printable Characters

Escape sequence: ESC   I   SOH
Hexadecimal: 1B   49   01

This command enables the printer to treat the characters in character positions 0-31 (C0 control characters) and 128-159 (C1 control characters) as printable characters.

Disable Character Positions 0-31 and 128-159 as Printable Characters

Escape sequence: ESC   I   NUL
Hexadecimal: 1B   49   00

Print Enhancement Commands

The print enhancement commands enable your printer to improve or enhance the print quality. Print enhancements include such things as superscript and subscript text, text underlining, expanded, compressed, double-high, LQ, shadow, and emphasized print to make the print appear bolder. The following paragraphs describe the print enhancement commands.

Select Expanded Print for One Line

Control character: SO
Hexadecimal: 0E

Escape Sequence: ESC   SO
Hexadecimal: 1B   0E

These commands select the expanded (double-wide) print mode for either draft or LQ printing. Either a Carriage Return or a Cancel Expanded Print command cancels the expanded print mode; therefore, for two or more consecutive lines of expanded print you must invoke the command for each line.

Cancel Expanded Print

Control character: DC4
Hexadecimal: 14

This command cancels the expanded print mode previously selected
by the Select Expanded Print for One Line commands (SO or ESC
SO). However, this command does not affect the expanded print
mode invoked by the Select Expanded Print command ESC W SOH
or the Select Master Print Mode command (ESC ! *n*).

Select Expanded Print Until Canceled by ESC W NUL

Escape sequence: ESC W SOH
Hexadecimal: 1B 57 01

Cancel Expanded Print

Escape sequence: ESC W NUL
Hexadecimal: 1B 57 00

This command disables the expanded print mode previously invoked
by the Select Expanded Print command ESC W SOH.

Select Double-High Print

Escape sequence: ESC w SOH
Hexadecimal: 1B 77 01

This command selects the double-high print mode for either draft or
LQ printing.

Cancel Double-High Print

Escape sequence: ESC w NUL
Hexadecimal: 1B 77 00

Select Compressed Print

Control character: SI
Hexadecimal: 0F

Escape sequence: ESC SI
Hexadecimal: 1B 0F

These commands cause the printer to print characters at about 60 percent of their normal widths. For example, for a character pitch of 10 cpi, one inch of text contains about 17 characters instead of the normal 10. These commands are valid for either draft or LQ printing.

Cancel Compressed Print

Control character: DC2
Hexadecimal: 12

Select Letter-Quality Print

Escape sequence: ESC x SOH
Hexadecimal: 1B 78 01

Cancel Letter-Quality Print

Escape sequence: ESC x NUL
Hexadecimal: 1B 78 00

This command cancels LQ print and returns the printer to the draft print mode.

Select Text-Underline Print

Escape sequence: ESC - SOH
Hexadecimal: 1B 2D 01

After receiving this command, the printer underlines all subsequent text characters (including the space character) until it receives a Cancel Text-Underline Print command.

Cancel Text-Underline Print

Escape sequence: ESC - NUL
Hexadecimal: 1B 2D 00

Select Boldface Print

Escape sequence: ESC G
Hexadecimal: 1B 47

Cancel Boldface Print

Escape sequence: ESC   H
Hexadecimal: 1B   48

Select Shadow Print

Escape sequence: ESC   E
Hexadecimal: 1B   45

Cancel Shadow Print

Escape sequence: ESC   F
Hexadecimal: 1B   46

Select Superscript Print

Escape sequence: ESC   S   NUL
Hexadecimal: 1B   53   00

This command selects the superscript print mode for either draft or
LQ printing. After receiving this command the printer prints each
subsequent character in the upper part of the character space at about
two-thirds its normal height.

Cancel Superscript Print

Escape sequence: ESC   T
Hexadecimal: 1B   54

Select Subscript Print

Escape sequence: ESC   S   SOH
Hexadecimal: 1B   53   01

This command selects the subscript print mode for either draft or LQ
printing. After receiving this command the printer prints each
subsequent character in the lower part of the character space at about
two-thirds its normal height.

Cancel Subscript Print

Escape sequence: ESC   T
Hexadecimal: 1B   54

Select Italic Print

Escape sequence: ESC   4
Hexadecimal: 1B   34

This command causes the printer to print characters from the Epson italic character set for either draft or LQ printing. This command is valid even if the printer has received an ESC t SOH command to invoke the Epson extended graphics character set; however, character graphics cannot be italicized.

Cancel Italic Print

Escape sequence: ESC   5
Hexadecimal: 1B   35

Select Master Print Mode

Escape sequence: ESC   !   *n*
Hexadecimal: 1B   6B   *n*

This command selects a type style for LQ and draft-quality printing. The variable *n* (a hexadecimal value) can be any valid combination of the following character pitches and print modes.

❑ 10 cpi — decimal 0, hexadecimal 00

❑ 12 cpi — decimal 1, hexidecimal 01

❑ Compressed — decimal 4, hexadecimal 04

❑ Shadow — decimal 8, hexadecimal 08

❑ Boldface — decimal 16, hexadecimal 10

❑ Expanded — decimal 32, hexadecimal 20

❑ Italic — decimal 64, hexadecimal 40

❑ Underline — decimal 128, hexadecimal 80

To select a valid combination of the listed character pitches and print modes, choose the items you wish to combine and add their values to find the correct value of *n*. After finding the decimal value of *n*, convert this value to its hexadecimal equivalent for use in the escape sequence.

For example, to select 12 cpi, expanded, underlined text characters, add the decimal values 1, 32, and 128 to obtain the sum, 161 (the value of *n)*. The hexadecimal equivalent of 161 is A1 (from an 8-bit character table).

The following combinations are invalid.

❑ 10 cpi and 12 cpi

❑ Boldface and LQ print

Graphics Commands

The Epson FX graphics feature provides commands that enable you to design your own images in any shape you desire. These commands allow you to create and adjust the density of various lines and patterns in various combinations. The following paragraphs describe the graphics commands.

To find the values of *n1* and *n2* for any of the following commands, modify the procedure described for the Select 60 dpi Graphics command in Chapter 4. In step 1 of the procedure, substitute the appropriate dot density value for 60.

Select 60 dpi Graphics

| *Escape sequence:* | ESC | K | *n1* | *n2* |
| *Hexadecimal:* | 1B | 4B | *n1* | *n2* |

This command selects the 8-pin, 60 dpi graphics mode for the horizontal line length specified by the variable *n1 n2*.

Select 9-Pin 60 dpi Graphics

Escape sequence:	ESC	^	NUL	*n1*	*n2*
Hexadecimal:	1B	5E	00	*n1*	*n2*

This command causes the printer to print 9-pin graphics at 60 dpi.

Select 120 dpi Graphics

Escape sequence:	ESC	L	*n1*	*n2*
Hexadecimal:	1B	4C	*n1*	*n2*

This command selects the 8-pin, 120 dpi graphics mode for the horizontal distance specified by the two-byte variable *n1 n2*.

Select 9-Pin 120 dpi Graphics

Escape sequence:	ESC	^	SOH	*n1*	*n2*
Hexadecimal:	1B	5E	01	*n1*	*n2*

This command causes the printer to print 9-pin graphics at 120 dpi.

Select High-Speed 120 dpi Graphics

Escape sequence:	ESC	Y	*n1*	*n2*
Hexadecimal:	1B	59	*n1*	*n2*

This command selects the 8-pin, high-speed 120 dpi graphics mode for the horizontal distance specified by the two-byte variable *n1 n2*. This is identical to the 120 dpi graphics mode except that the printing speed is doubled.

Select 240 dpi Graphics

Escape sequence:	ESC	Z	*n1*	*n2*
Hexadecimal:	1B	5A	*n1*	*n2*

This command selects the 8-pin, 240 dpi graphics mode for the horizontal distance specified by the two-byte variable *n1 n2*.

Select Graphics Mode *m*

Escape sequence: ESC   *   *m*   *n1*   *n2*
Hexadecimal: 1B   2A   *m*   *n1*   *n2*

This command selects the graphics mode specified by the variable *m* for the horizontal distance specified by the two-byte variable *n1 n2*. The variable *m* can be any of the following values.

❑   NUL — 60 dpi normal speed

❑   SOH — 120 dpi normal speed

❑   STX — 120 dpi high speed

❑   ETX — 240 dpi normal speed

Reassign Graphics Mode

Escape sequence: ESC   ?   *s*   *n*
Hexadecimal: 1B   3F   *s*   *n*

This command allows the computer to switch between graphics modes. The variable *s* specifies the currently selected mode K, L, Y, or Z from the standard graphics escape sequences. The variable *n* specifies the new mode (0 through 3) specified in the ESC * commands.

Example. If the current mode is single-density and you wish to change to high-speed double density, use the escape sequence ESC ? K 2, where K indicates single-density and 2 indicates high-speed double density.

9
Optional DEC LA 120 Emulation

Introduction

This chapter describes the optional DEC LA120 emulation mode. An optional emulation mode is selectable from the printer setup menu described in Chapter 2 or by global commands described in Chapter 3.

DEC LA120 Emulation Commands

This mode enables your printer to emulate most of the functions of the DEC LA120. Your printer, when operating in the DEC LA120 emulation mode, can respond to both escape-sequence commands and the standard US ASCII control characters. The following table lists the DEC LA120 printer commands.

DEC LA120 Commands

Command	Command Name
Printer Operation	
BEL	Sound Bell
BS	Back space
CR	Carriage Return
DC1	"Ready" Signal - Serial Communication
DC3	"Busy" Signal - Serial Communication
FF	Form Feed
LF	Line Feed
HT	Horizontal Tab
VT	Vertical Tab
ESC [20 h	Enable auto line feed
ESC [20 l	Disable auto line feed
ESC [0 c *or* ESC [c	Product ID Request (transmit response is ESC [? 2 c)
CAN	Line Cancel
ETX	Used with ETX/ACK Busy Protocol
ENQ	Enquiry: Transmit Answerback Message
NUL *or* DEL	No Operation (fill character)

DEC LA120 Commands (continued)

Command	Command Name
Form Format and Margin Control	
ESC [N t	Set Form Length to N Lines
ESC [N r	Set Top Margin to Line N
ESC [; N r	Set Bottom Margin to Line N
ESC [N_1; N_2 r	Set Top and Bottom Margins to Line N_1 and Line N_2
ESC [N s ESC [N ; 0 s	} Set Left Margin to Column N
ESC [; N s ESC [0 ; N s	} Set Right Margin to Column N
ESC [N_1; N_2 s	Set Left and Right Margins to Column N_1 and Column N_2
Horizontal Tab Sequences	
ESC [N '	Advance Active Column Absolute to Column N
ESC [N a	Advance Active Column Forward to Column N
ESC H *or* ESC 1	Set Horizontal Tab at Active Column
ESC [N_1; N_2;...N_k u	Set Horizontal Tab Stops at Columns $N_1, N_2, ... N_k$ $(k \leq l6)$
ESC [2 g ESC [3 g ESC 2	} Clear All Horizontal Tabs
ESC [g *or* ESC [0 g	Clear Horizontal Tab at Active Column
Horizontal Pitch Sequences	
ESC [5 w	Set Character Pitch to 5 cpi
ESC [6 w	Set Character Pitch to 6 cpi
ESC [7 w	Set Character Pitch to 6.6 cpi
ESC [8 w	Set Character Pitch to 8.25 cpi
ESC [w ESC [0 w ESC [1 w	} Set Character Pitch to 10 cpi

DEC LA120 Commands (concluded)

Command	Command Name
Horizontal Pitch Sequences (continued)	
ESC [2 w	Set Character Pitch to 12 cpi
ESC [3 w	Set Character Pitch to 13.2 cpi
ESC [4 w	Set Character Pitch to 16.7 cpi
Vertical Tab Sequences	
ESC [N d	Set Active Line to Line N
ESC [N e	Advance Active Line Forward to Line N
ESC J *or* ESC 3	Set Vertical Tab at Active Line
ESC [N_1 v	Set Vertical Tab at Line N_1
ESC [$N_1; N_2$ v	Set Vertical Tab at Line N_1 and Line N_2
ESC [$N_1; N_2;...N_k$ v	Set Vertical Tab Stops at Lines $N_1, N_2, ...\ N_k$ $(k \leq l6)$
ESC [4 g *or* ESC 4	Clear All Vertical Tabs
ESC [1 g	Clear Vertical Tab at Active Line
ESC E	Set Active Column to Left Margin and Increment Active Line
ESC D	Increment Active Line
Vertical Pitch Sequences	
ESC 4 z	Set Vertical Pitch to 2 lpi
ESC 5 z	Set Vertical Pitch to 3 lpi
ESC 6 z	Set Vertical Pitch to 4 lpi
ESC z	
ESC 0 z	} Set Vertical Pitch to 6 lpi
ESC 1 z	
ESC 2 z	Set Vertical Pitch to 8 lpi
ESC 3 z	Set Vertical Pitch to 12 lpi
Character Set Selection Sequences	
ESC (B	Select U.S.A Character Set
ESC (A	Select United Kingdom Character Set
ESC (C	Select Finland Character Set
ESC (E	Select Norway/Denmark Character Set
ESC (H	Select Sweden Character Set
ESC (K	Select German Character Set
ESC (R	Select France Character Set
SI	Select Primary Character Set
SO	Select Secondary Character Set

DEC LA120 Commands Not Recognized in
DEC LA120 Emulation

Command	Command Name
ESC =	Enable Alternate Keyboard
ESC >	Disable Alternate Keyboard
EOT	End of Transmission
SUB	Substitute
DLE	Data Link Escape

Answerback Memory Function

The DEC LA120 emulation provides, as an LA120 feature, an answerback memory (ABM) that can be programmed with a message of up to 30 characters. If a message is programmed, it is transmitted when the ASCII character ENQ is received. The ABM is stored in the printer's nonvolatile memory and is programmable with an escape sequence when the ABM load setup parameter (ABM MSG LOAD) of the LA120 emulation is turned on.

Escape sequence: ESC	[	Q	*text*	NUL
Hexadecimal: 1B	5B	51	*text*	00

where: *text* can contain up to 30 ASCII characters, and the NUL character is used as the string terminator.

Note: The printer displays an escape sequence error message if *text* exceeds 30 ASCII characters. The default message ESC [? 2 c is set to the Product Identification Response.

New Line Mode

This parameter controls how the DEC LA120 emulation responds to line feed and carriage return commands.

For the CR NEW LINE selection, a line feed is performed in addition to a carriage return when a carriage return control code is received.

When LF NEW LINE is selected and a line feed command is received, a carriage return is performed in addition to the line feed. Carriage returns are also performed with vertical tabs and form feeds when LF NEW LINE is selected.

For the NO NEW LINE selection, a carriage return only is performed upon receipt of a carriage return control code, and a line feed only is performed upon receipt of a line feed control code.

Note: Selection of CR NEW LINE, LF NEW LINE, or NO NEW LINE, deselects or disables the previous selection.

Auto Wrap

This parameter, when turned on, performs an automatic new line at the right margin if the line length of the line to be printed causes the DEC LA120 emulation to attempt to print beyond the right margin.

When the parameter is turned off, attempts to print beyond the right margin will cause characters to be lost.

Answerback Memory Message Load

This parameter, when turned on, allows the answerback memory to be programmed. When turned off, answerback memory programming is inhibited.

10
Communication Interfaces

Introduction

This chapter describes the communication interfaces and provides information about their use with your printer.

The communication interface transfers data in a fixed and orderly manner between the host and the printer. Communication interfaces are of two general types: parallel and serial. Parallel interfaces transfer all bits of a data byte simultaneously. Serial interfaces transfer data in bit-serial fashion, one bit at a time.

To provide communication compatibility with a wide range of systems, your printer offers a choice of any of the following standard and optional communication interfaces.

❑ Parallel interface, standard.

❑ RS-232 or RS-423 serial interface, standard.

❑ RS-422-A serial interface, optional.

❑ Current loop (TTY) interface, optional.

The following figure shows simplified block diagrams of two types of data-communication systems and their associated communication interfaces.

long-distance system

host — RS-232-C serial interface — modem — telephone lines — modem — RS-232-C serial interface — printer

local system

host — parallel interface — local printer

communication interfaces (simplified block diagrams)
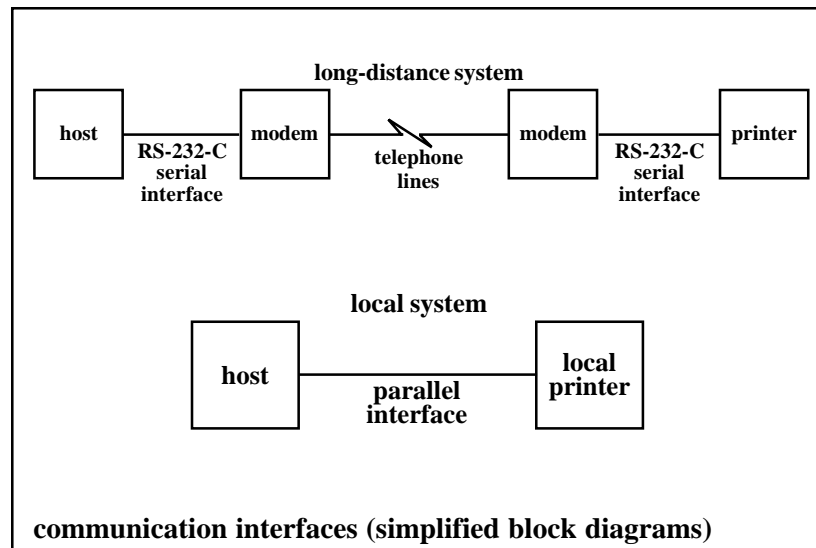
The long-distance system typically uses telephone lines to transfer data from the host to the printer. Because this system is limited to bit-serial data-transfer operations, it is necessary that the host-to-modem interface at one end and the modem-to-printer interface at the other end be serial interfaces. The local system uses a parallel interface to connect a local printer directly to the host.

Data-Transfer Operations

The data-transfer rate can vary from one system to another, depending on such factors as the host data-transfer rate, the type of communication interface used, and the distance over which the data is transferred. To compensate for these transfer-rate variations, the printer provides a receive buffer to temporarily store received data prior to printing it.

The following figure shows a simplified block diagram of the printer receive buffer and the data path between the host and the print mechanism.

printer receive buffer and associated data path
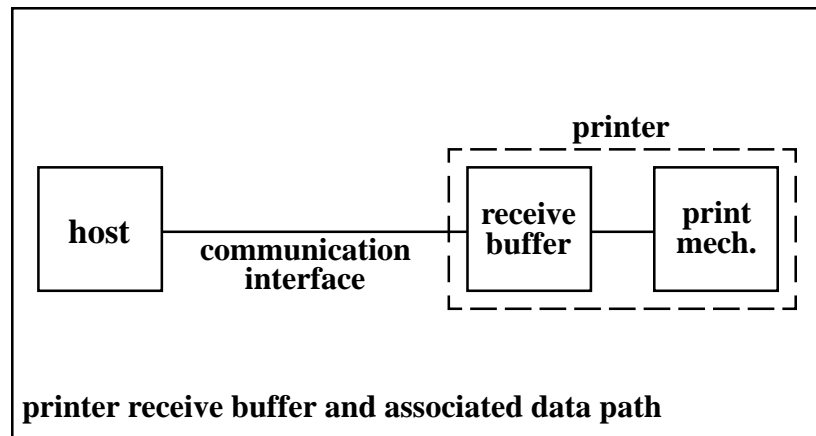
The host transfers characters in the form of 7-bit or 8-bit data bytes, depending on which character set is selected. To ensure that no data is lost between the host and the printer, all data-transfer operations involve the following steps.

1. The host transfers characters via the communication interface into the printer receive buffer and then the printer transfers them at a fixed rate from the receive buffer to the print mechanism.

2. If the host-to-receive buffer transfer rate exceeds the buffer-to-print mechanism transfer rate, the receive buffer eventually approaches its capacity.

3. The printer signals the host to suspend data transfer operations as the printer continues to transfer characters at a fixed rate from the receive buffer to the print mechanism.

4. When the supply of characters in the receive buffer is sufficiently depleted, the printer signals the host that it is ready to receive additional data.

Parallel Communication Interface

The parallel communication interface uses a 36-pin connector (shown in the following figure) that transfers both data and control signals between the printer and the host computer. The parallel interface connector is located at the rear of the printer and provides bail latches to secure the interface cable connector. The table on the following page lists the parallel interface signals, their names, their pin assignments, and their sources (host or printer). The paragraphs that follow the table describe these signals.

The parallel interface can only transfer data from the host to the computer and is limited to a distance of approximately 6 feet (1.8 meters). However, because the parallel interface provides separate lines for each character bit, it can transfer an entire character in a single data-transfer operation. Thus, the parallel interface is much faster than a serial interface and is ideally suited for connecting local printers in a computer system.

parallel interface connector
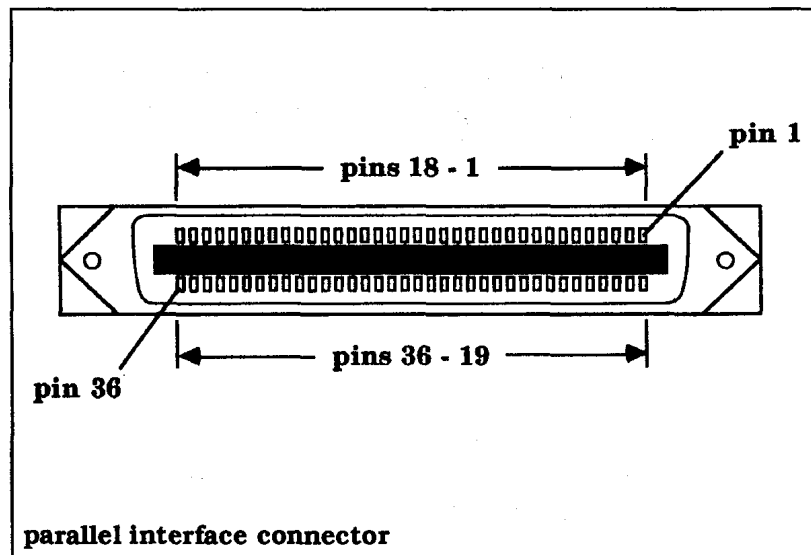
Parallel Interface Signals

Signal	Name	Pin	Return	Source
STROBE-	Data strobe	1	19	Host
DATA1	Data bit 1	2	20	Host
DATA2	Data bit 2	3	21	Host
DATA3	Data bit 3	4	22	Host
DATA4	Data bit 4	5	23	Host
DATA5	Data bit 5	6	24	Host
DATA6	Data bit 6	7	25	Host
DATA7	Data bit 7	8	26	Host
DATA8	Data bit 8	9	27	Host
ACK-	Acknowledge	10	28	Printer
BUSY	Printer busy	11	29	Printer
PE	Paper empty	12	30	Printer
SLCT	Select	13		Printer
LGND	Logic ground	16		
CGND	Chassis ground	17		
PARVCC	+5 volts dc*	18		Printer
INIT-	Initialize	31		Host
FAULT-	Fault	32		Printer
GND	Ground	33		
VFIN	Verify in	34		Host
VFOUT	Verify out	35		Printer

Notes: Pins 14, 15, and 36 are not used.
       *+5vdc supplied through 51 ohm resistor.

Parallel Interface Signal Descriptions

As indicated in the preceding table, the data signals and some of the control signals require both a signal line and a return line. This arrangement provides efficient, trouble-free operation and minimizes electrical noise on the signal lines.

Some parallel interface signals are active when low, as indicated by a hyphen (-) attached as a suffix to the signal name. All other signals (except the data signals) are active when high. Since the data transferred over the data lines consists of binary ones and zeros (highs and lows), the state of these lines depends on the data being sent. The following paragraphs describe the parallel interface signals.

Data Signals

Character transfers from the host to the receiver consist of 8-bit data bytes (DATAl through DATA8) traveling in parallel over the eight data lines. DATAl is the least significant bit and DATA8 is the most significant bit. If a 7-bit character set has been selected, the DATA8 line remains low for all data transfer operations.

Data Strobe Signal

The data strobe (STROBE-) is a host-generated pulse that clocks data into the printer receive buffer. After writing data to the parallel interface data lines (DATAl through DATA8), the host monitors the busy line, and if BUSY is not active (low), the host places a strobe pulse on the interface. This strobe pulse must not occur before the data has had time to stabilize on the data lines (approximately 0.5 microseconds). The leading (negative-going) edge of STROBE- clocks the data into the printer receive buffer and activates BUSY.

Acknowledge Signal

The acknowledge (ACK-) signal from the printer indicates to the host that the printer has received the last character sent and is ready to accept another character. Unless the printer is busy, as described in the following paragraph, the printer activates ACK- (sets it low) under any of the following conditions.

❑ After receiving a character from the host

❑ Each time the printer is placed online

❑ At the completion of a host-generated initialization cycle

Busy Signal

This active-high signal from the printer indicates that the printer is busy and cannot accept additional data. During data-transfer operations, the leading edge of the host-generated strobe signal activates BUSY for each character-transfer cycle. The printer sends an acknowledge pulse and deactivates BUSY at the completion of each character-transfer operation (unless the printer is otherwise busy). BUSY is active (high) under any of the following conditions.

❑ The host has clocked a character into the receive buffer, but the printer has not yet acknowledged it.

❑ The receive buffer is filled to capacity.

❑ The printer is in its offline state.

❑ The printer is out of paper or a printer error condition exists.

❑ One of the control panel menus has been invoked and the printer has not been returned to its online state.

Fault Signal

The fault (FAULT-) signal from the printer indicates to the host that an error condition (such as a mechanical failure or a receive buffer overflow) exists in the printer. A paper-out condition activates both FAULT- and PE to indicate the condition to the host

Initialize Signal

The initialize (INIT-) signal from the host causes the printer to execute a power-up reset sequence. During this sequence, the printer performs its normal self-tests and then assumes its online condition. Since INIT- is a host-generated signal, the conditions under which it is generated depend on the type of computer serving as host.

Paper-Empty Signal

The paper-empty (PE) signal from the printer indicates that the paper supply is empty. The printer activates this signal in combination with the fault signal to indicate the paper-empty condition to the host.

Select Signal

The select (SLCT) signal from the printer indicates to the host that the printer is online and ready to receive data. The completion of either a normal power-up operation or a host-generated initialization cycle activates SLCT.

Verify Signal

The verify signal confirms proper connection of the parallel interface cable between the host and the printer. The verify in (VFIN) and verify out (VFOUT) pins are connected together inside the printer to form a loopback circuit. The host sends VFIN to the printer and, if the cable is connected properly, the printer returns the signal as VFOUT.

Ground Signals

The logic ground (LGND) connects to the printer power supply logic ground to provide a common reference point for all interface signals. The chassis ground (CGND) connects to the ac power cord safety ground to provide protection for the printer and personnel.

Parallel Interface Communication Protocol

The parallel interface communication protocol is a set of conventions that ensures compatibility between the printer and the host computer. The following paragraphs describe these conventions.

Data-Transfer Timing

Because the parallel interface transfers all bits of a character simultaneously, correct timing is important to prevent data loss or corruption. When the host senses that BUSY is inactive (low), the host can initiate a character-transfer cycle on the interface.

The following figure shows the timing sequence for host-to-printer character-transfer operations. The table on the following page lists the timing requirements for the operation.

parallel data timing sequence
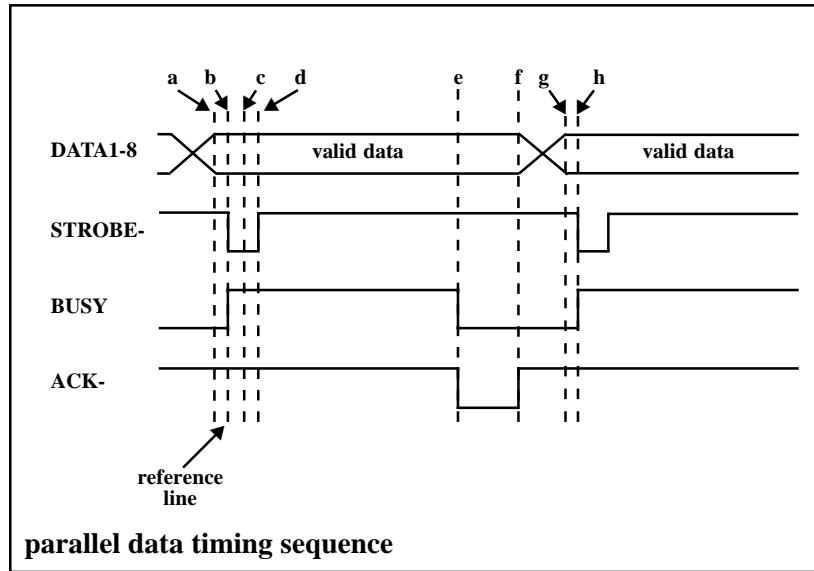
The reference points, **a** through **h** in the preceding figure, are keyed to the table on the following page and to the following character-transfer sequence.

1. The host writes a character to the parallel data lines (**a**). (The data stabilization time, **a-b**, must elapse before the transfer cycle can begin and the minimum data hold time, **b-c**, must elapse before the host can write a subsequent character.)

2. After writing the character to the interface, the host monitors the BUSY line to ensure that the printer is ready to receive a character. If BUSY is inactive, and the required data stabilization time has elapsed, the host activates STROBE- to begin the transfer cycle. The leading edge of STROBE- (**b**) clocks the character into the printer receive buffer and activates BUSY.

3. The printer activates ACK- (**e**) to signal the host that the receive buffer has received the character.

4. If the character does not fill the receive buffer, the printer deactivates BUSY and ACK- (**f**) to notify the host that the transfer operation is complete. The host can then initiate another data-transfer cycle.

If a character-transfer cycle fills the printer receive buffer, BUSY remains active until the buffer empties to the ready point. The printer then deactivates BUSY to allow the host to initiate another character-transfer cycle.

Parallel Interface Timing Requirements

Item	Ref.	Timing Requirements
DATA1-8	a	The host writes a character to the interface.
	a-b	Data stabilization time, 0.5 μs min.
	b-c	Data hold time, 0.5 μs min.
STROBE-	b	Leading edge must not occur in less than 0.5 μs after the character has been written to the interface. This allows time for the data to stabilize.
	b-d	Minimum pulse width, 1.0 μs.
	b-h	Minimum time between pulses, 1.0 μs.
BUSY	b	Leading edge occurs within 100 ns after the leading edge of STROBE-.
	f	Trailing edge must occur before the host can strobe the next character into the receive buffer. For normal write cycles (receive buffer not full), this occurs at 10 μs min., 500 μs nom., and 1000 μs max. after the leading edge of STROBE-.
ACK-	e-f	Pulsewidth: 2.0 μs min., 3.0 μs nom., and 6.0 μs max.

Parallel Interface Timing Requirements (continued)		
Item	**Ref.**	**Timing Requirements**
	f	Trailing edge must occur before the host can strobe the next character into the receive buffer. For normal write cycles (receive buffer not full), this occurs at 10 μs min., 500 μs nom., and 1000 μs max. after the leading edge of STROBE-.
DATA1-8	g	The host writes the next character to the interface. This can occur at any time after the data stabilization time and hold time of the previous character have elapsed. (See Reference items **a-b** and **b-c** on the preceding page.)
STROBE-	h	The host places the next strobe pulse on the interface to initiate the next character-transfer operation.

Initialize Sequence

The initialize sequence is a host-generated power-up reset sequence. When the host activates INIT-, the printer performs the following sequence.

1. Interrupts any ongoing operation.

2. Assumes the offline state.

3. Executes the normal power-up self-test routine.

4. Returns to the online state.

Error Conditions

FAULT- and PE are printer status lines. The printer activates FAULT- to indicate a mechanism failure, such as a paper jam, and deactivates it when the error is corrected. After the paper supply is depleted, the printer activates both PE (paper empty) and FAULT- to indicate the paper-empty condition. Reloading paper causes the printer to deactivate the signals.

Activation of either FAULT- or PE also activates BUSY to indicate that the printer cannot receive data. If the host attempts to transfer a single character during this time, the byte remains on the interface data lines until the error condition is cleared. The printer neither prints the character nor activates ACK-. If the host attempts to send multiple characters during this time, the printer accepts only one character.

Note: The information in the following paragraph entitled "Serial Communication Interface" is valid for either the RS-232 or the RS-423 serial interface.

Serial Communication Interface

Your printer provides a 25-pin serial interface connector (shown in the following figure) at the rear of the printer. This connector carries both control and data information between the printer and the interface cable. The table on the following page lists the serial communication interface signals, their names, their interface connector pin assignments, and their sources.

serial interface connector
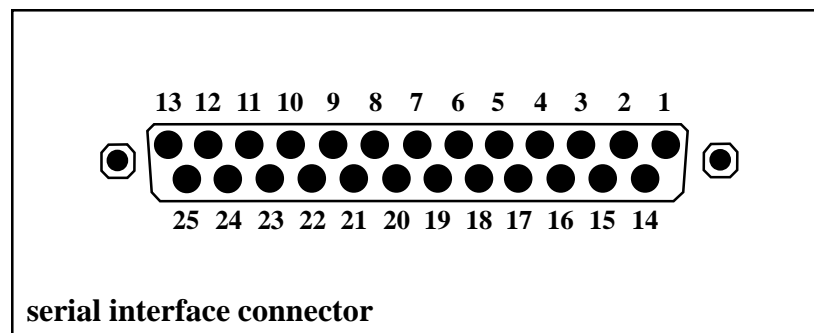
Serial Interface Connector

The serial communication interface transfers either 7-bit or 8-bit character information in an asynchronous, bit-serial format. This format is useful for transferring data over long distance lines via data communication devices such as modems, but it can also be used to transfer data directly between the host and the printer. The following table lists the serial interface signals.

Serial Interface Signals

Signal	Name	EIA	CCITT	Pin	Source
PG	Protective ground	AA	101	1	
TD	Transmit data	BA	103	2	Printer
RD	Receive data	BB	104	3	Host
RTS	Request to send	CA	105	4	Printer
CTS	Clear to send	CB	106	5	Host
DSR	Data set ready	CC	107	6	Host
SG	Signal ground	AB	102	7	
DCD	Data carrier detect	CF	109	8	Host
R/B	Ready/busy	—	—	11	Printer
DTR	Data terminal ready	CD	108.2	20	Printer

Interface Connection

You can connect your printer to the host computer either directly via an interface cable or through a system of modems and telephone lines with an interface cable at each end of the system. The setup menu structure provides settings (**DIRECT CONNECT** and **MODEM CONNECT**) for each of these choices.

Interface Signal Descriptions

The following paragraphs describe the serial interface signals.

Protective Ground

The protective ground (PG) line is connected directly to the power cord ground to provide protection for the equipment and personnel.

Signal Ground

The signal ground (SG) line is connected to the printer power supply ground to provide a common reference level for all interface signals except protective ground.

Transmit Data Signal

The transmit data (TD) line transfers bit-serial data from the printer to the host via the data communication equipment. During times when no data appears on the TD line, the line is held in a mark condition.

Receive Data Signal

The receive data (RD) line transfers bit-serial data from the host to the printer via the data communication equipment. During times when no data appears on the RD line, the line should be held in a mark condition.

Request to Send Signal

The printer generates the request to send (RTS) signal to condition the data communication equipment to transmit data. When the printer is in the **DIRECT CONNECT** mode, this control signal is on at all times following printer power-up and self-test completion. When the printer is in the **MODEM CONNECT** mode, the printer online state holds RTS on and the printer offline state holds RTS inactive. (The **DIRECT CONNECT** and **MODEM CONNECT** modes are selected during printer setup via the **Setup/Test** switch.)

Clear to Send Signal

The host computer generates the clear to send (CTS) signal to indicate that it can receive data from the printer. In the **DIRECT CONNECT** mode, the printer ignores this signal. In the **MODEM CONNECT** mode, CTS must be on for the printer to send data. If the interface cable does not provide a connection to this pin, the printer holds CTS in its on state.

Data Set Ready Signal

The host activates the data set ready (DSR) signal to enable the printer to send and receive data. If the interface cable does not provide a connection to this pin, the printer holds DSR in its active state.

Data Carrier Detect Signal

The host activates the data carrier detect (DCD) signal to enable the printer to send data when operating in the **MODEM CONNECT** mode. When the printer is in the **DIRECT CONNECT** mode, it ignores this signal. If the interface cable does not provide a connection to this pin, the printer holds DCD in its on state.

Data Terminal Ready Signal

If the **PIN 20 H:READY** (pin 20 high on ready) parameter was selected during printer setup and the printer is operating in the **DIRECT CONNECT** mode, the printer activates DTR to indicate that it is ready to receive data and deactivates DTR to indicate that it is busy. Otherwise, the printer activates DTR following self-test completion at power-up to indicate that it is online and ready to receive data.

Interface Data Transmission Rate

Because data-transfer operations on the serial interface occur in a bit-serial fashion, the data transmission rate is measured in bits per second, commonly called the baud rate. To provide compatibility with a variety of systems, your printer offers the following range of baud rates.

❑ 300 bits per second

❑ 600 bits per second

❑ 1200 bits per second

❑ 2400 bits per second

❑ 4800 bits per second (the default value)

❑ 9600 bits per second

❑ 19,200 bits per second

The control panel setup menu (described in Chapter 2) allows you to select the appropriate baud rate for your system.

Serial Data Format

The following figure shows the data format for 7-bit and 8-bit characters. The serial interface can transfer (and the printer can accept) either 7-bit characters or 8-bit characters, depending on which character set is in use. In either case, data bit 1 is the least significant bit (lsb) and the last bit is the most significant bit (msb).

In addition to the data bits, each character contains the following bits.

❑ **Start bit** — A bit immediately preceding the character bits that signals the start of the asynchronous data transmission.

❑ **Parity bit** — A bit immediately following the character bits that allows the printer to check the integrity of the received data. The setup menu allows you to select even, odd, mark, space, or no parity checking.

❑ **Stop bit** — A bit immediately following the parity bit that signals the end of the asynchronous data transmission.

		transfer direction							
start bit	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**stop bit**
	lsb						**msb**		

parity bit

		transfer direction								
start bit	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**stop bit**
	lsb							**msb**		

parity bit

serial data structures
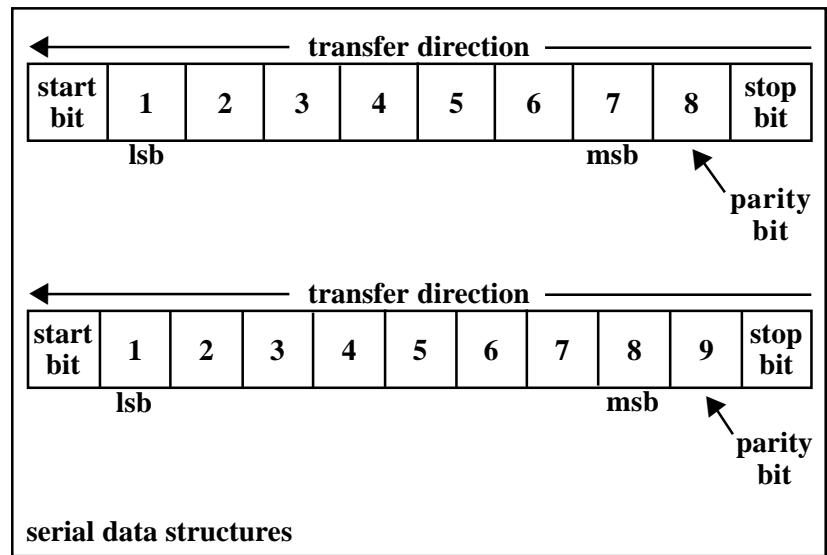
Serial Interface Busy-Handling Protocols

The serial interface provides several methods for the printer to indicate its ready and busy conditions. The communication interface menu, described in Chapter 2 of this manual, allows you to select any of these methods during printer setup. The following paragraphs describe the serial interface busy-handling protocols.

Flow-Control Busy-Handling Protocols

These protocols are busy-handling protocols determined by the host that can be selected via the printer setup menu. The menu structure allows you to select either of the following flow-control busy-handling protocols or to set both protocols inactive.

❑ **Transmit-On/Transmit-Off Protocol** — When you select this busy-handling protocol, the printer sends a transmit-off (X-off) signal to indicate that its receive buffer is full or some other busy condition exists. When the printer is again ready to receive data, it sends a transmit-on (X-on) signal.

These signals (X-on and X-off) are equivalent to the device control characters DC1 and DCS, respectively, of the ASCII character set. Thus, the printer sends the DC3 control character to indicate that it is busy, and the DC1 control character to indicate that it is ready to receive data.

❑ **End-of-Text/Acknowledge Protocol** — When you select this busy-handling protocol, the host sends data in blocks of 256 characters or less. At the end of each block transfer operation, the host sends the end-of-text (ETX) control character to indicate that the operation is complete. The printer responds by sending the acknowledge (ACK) control character to indicate that it is ready to receive any subsequent data.

If the receive buffer is full (or some other busy condition exists), the printer delays sending the ACK control character until the busy condition is cleared.

This busy-handling protocol should not be selected for an emulator that requires that ETX be used as a graphics character or as part of a printer command.

Direct-Connect Busy-Handling Protocols

The control panel menu structure offers the following choices of busy-handling protocols for use with a serial interface connected directly to the host.

❑ **PIN 20 H:READY** *(pin 20 high on ready)* — When you select this parameter, the printer activates DTR (interface pin 20) to indicate that it is ready to receive data and deactivates DTR to indicate a busy condition. This busy-handling protocol is also known as the busy-on-DTR protocol.

❑ **PIN 20 H:ALWAYS** *(pin 20 high always)* — This parameter disables the busy-on-DTR protocol.

❑ **PIN 11 H:READY** *(pin 11 high on ready)* — When you select this parameter, the printer activates B/R (interface pin 11) to indicate that it is ready to receive data and deactivates B/R to indicate a busy condition.

❑ **PIN 11 H:BUSY** *(pin 11 high on busy)* — When you select this parameter, the printer activates B/R to indicate a busy condition and deactivates B/R to indicate that it is ready to receive data.

Optional Communication Interfaces

A printed wiring board connector on the printer mother board provides for the installation of optional communication interfaces. These include the RS-422 serial communication interface and the current loop (TTY) communication interface.

RS-422 Communication Interface

The RS-422 serial communication interface handles data structures
of the same format as those for the serial communication interface.
However, the RS-422 interface can transfer data over distances of up
to 4000 feet (1219 meters) with minimal noise interference.

Current Loop Communication Interface

The current loop (TTY) interface uses a four-wire, passive, neutral
current loop which does not interfere with the standard serial interface.
The printer can receive data via either interface, provided the other
interface is in a spacing condition or its cable is disconnected.

**WARNING: Interface cables installed as part of the building
wiring must conform to the requirements of the U.S. National
Electrical Code. Contact your local inspector to determine that
the correct materials have been chosen for your installation.**

A
Application Instructions

Z-Axis Adjustment Escape Sequence

Introduction

The Model 8900 Series Printers sense top, left, and right edges plus thickness when a form is loaded. These settings provide the location of printout on the form such as top, bottom, left, and right margins and locations of labels or uneven edges.

Caution: Some forms or form sets may have isolated stick-on labels or some areas that contain more copies than others as illustrated in the following figure. These conditions, if not properly handled, can cause the printhead pins to snag on the uneven edges and result in damage to your printhead. To prevent this type of damage, avoid any situation in which the printhead prints across an uneven edge.

If your applications require the use of the types of forms shown in the following figure, you should use Z-axis adjustment escape sequences to handle them.

Note: The 8900 Series Printers make Z-axis adjustments automatically only when forms are initially loaded, power is cycled, or the power-on defaults are reset.

isolated labels

uneven edges
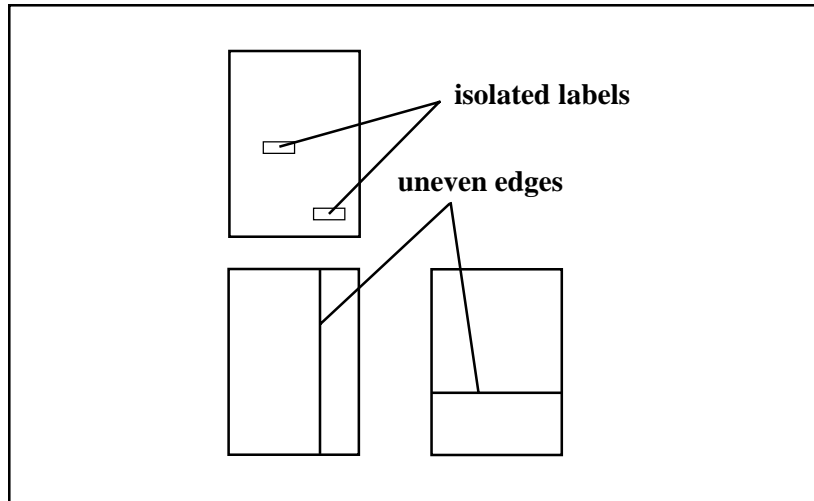
Considerations for Z-Axis Adjustments

The following considerations (plus DOs and DON'Ts) should be given for Z-axis adjustments.

Caution: This escape sequence is designed for use by technically oriented software users to print on forms with multiple thicknesses and is not intended for the casual user. Damage to the printer can occur by misuse of this command.

❑ Do not print across any boundary of a label or uneven edge (top, bottom, left, or right).

❑ Allow space (not used for printing) that is the width or height of several characters on all sides of the label or uneven edge of your form.

❑ Know exactly where a label or uneven edge is located by lines and columns on your form.

❑ The printhead can approach the label or uneven edge from either direction in bidirectional (normal) printing and therefore requires a complete description of Z-axis adjustments.

❑ Valid Z-axis adjustment values are 00 through 99 from the automatic Z-axis initialization adjustment (00) in positive or negative directions (-99 through +99).

❑ Note the location of the Z-axis initialization whenever paper stock is changed or tractors are moved, to determine the 00 calibration and corresponding number of sheets and form thickness.

❑ Z-axis adjustments are not cumulative; each Z-axis adjustment escape sequence is independent from previous adjustments in the escape sequences referenced only to the 00 automatic calibration.

❑ Positive displacement moves the printhead away from the platen.

❑ The direction of printhead initialization displacement is positive. To clear backlash, this requires that a negative displacement be followed by positive displacement unless the adjustment for Z-axis is reinitialization.

❑ The range of the printhead Z-axis adjustment from the control panel is -5 through +20 from the Z-axis initialization adjustment.

❑ Each Z-axis adjustment requires that the printhead stop and therefore acts to decrease throughput. Forms format and printing format are both considerations to maximize throughput.

❑ Avoid a format that prints columns on either side of a label. If printing a column is required, print the column first (but only to the bottom of the label), adjust the printhead Z-axis while reversing paper motion, and then print the label.

⚠ **Caution: Care must be taken that a label is not peeled when paper motion is reversed.**

Escape Sequence — Z-Axis Printhead Position

Escape sequence:	ESC	DLE	*z*	*S*	*NN*
Hexadecimal:	1B	10	7A	*S*	*NN*

where:

> S = "+" or "-" as the sign of the displacement (positive or negative).
>
> NN = ASCII values of the two digit number of the range from initialization.

Note: The escape sequence ESC DLE z, followed by any code, other than specified for the next three characters, calibrates the printhead to the Z-axis initialization.

Using the Z-Axis Escape Sequence

A single example is provided for 880 printer emulation that illustrates the considerations for Z-axis adjustment and maximum throughput. This is the most complex because printing requires that another emulation mode be entered to obtain reverse paper motion to provide maximum throughput rather then making several Z-axis adjustments for possibly four lines.

text begins at 7th line

a left margin of 1-inch is set at column 11

a right margin of 1-inch is set at column 75

at line 44, right margin is set at 48 to prevent printing over label

label located at columns 51 to 75

text

text

label
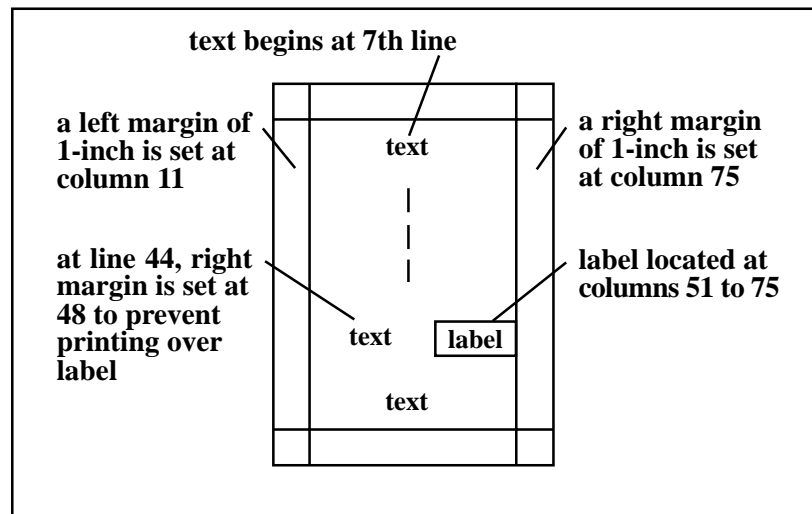
text

880 Emulation Commands

For 880 emulation, send the following **code** and text.

Note: For this example, printing can be continuous, within the margins, on every line of the page.

ESC [7 ; 54 r — prints first print line on line 7, last print line at line 54.

ESC [11 ; 75 s — sets first print column at column 11, and last print column at column 75.

Send text, then at the end of line 43 send

ESC [; 48 s — sets the right print column to column 48.

Send text, then at the end of line 49 send the following sequences.

ESC DLE z + 12 — sets Z-axis to +12.

ESC DLE E TI855 EXT ESC CR P — changes to TI855 WP emulation.

ESC VT - LF — tabs vertically to line 45 then line feeds one line.

ESC DLE E TI880 EXT — changes to TI880 emulation.

ESC [57 ; 73 s — sets left print column to column 53, and right print column to column 73.

Send text, then at the end of line 49 send

ESC [11 ; 48 s —sets column left and right margins.

CR LF ESC DLE z X X X — sets Z-axis to 00.

Send text, then at the end of line 51 send

ESC [11 ; 75 s —sets original left and right margins.

Index

Form Config

Print Impact: Heavy / Normal / Light

LPI: 3 / 4 / 6 / 8 / VMI

Draft Map: Draft / Text / L.Q. / Rapid Print

Quality Map: L.Q. / Rapid Print / Draft / Text

Form Length: Lines / Inches / MM

First Line: adjust

Left Edge: adjust

Right Edge: adjust

Line Width: adjust

Page Finder: Standard / Pre-printed / Disabled

Scan Line: adjust

P/O Detection: Continuous / TOF Only

Overdrive Comp.: A / B / C

Reset Form: No / Yes

PF Scan Line Setup in 144th-inch increments. Range is 1.5" to 10".

Form Select

Print Report

A / B / C / D / E / F / G / H / I / J

Pitch: 10 / 12 / 15 / 16.7

Print Qual.: Draft / Text / L.Q. / Rapid Print

Font: Gothic / Courier / optional — level 1

Status: Screen 1 / Screen 2 / Screen 3 / Screen 4

see note 4

Paper Path

Tractor: Load / Park — available with all models (primary paper supply)

Front Insert: Load / Eject — available only with 8930

Bin 1: Load / Eject
Bin 2: Load / Eject — available only with 8930 ASF option and with ASF parameter in MISC. submenu set to YES

Top Insert: Load / Eject — available on 8930 only but requires top insert option installed

Misc.

Test Mode: Stat Report / Barber Pole

Z-Axis: LCD Setup (+/-20/-5 incr.)

Ribbon Type: Color / Black

Ribbon Adj: LCD Setup (+/-2 incr.)

ASF: No / Yes — 8930 only

Idle Delay: LCD Setup (0.3 to 90 sec. or Disable)

Pwr Up Online: Yes / No

Paper Warning: Count-down / Bell / Both / None

Bi-Dir Graphic: No / Yes

LCD Lang: English / French / German / Spanish

Paper Out=Bsy: No / Yes

Char Set: US ASCII / French / German / UK English / Italian / Spanish / Japanese / Norwegian / Swiss / Swedish / FR Canadian / PC1 / PC2 / Nordic #2 / ISO 8859/1 / Multinational

Interface

Port: Serial / Parallel / Option Port

Buffer Size: 32000 / 256 / 4000

Baud Rate: 9600 / 19200 / 300 / 600 / 1200 / 4800

Data Bits: 8 / 7

Parity: None / Odd / Even / Mark / Space — see note 3

Flow Control:
- Xon/Xoff: No / Yes
- ETX/ACK: No / Yes
- Robust Xon: No / Yes
- Robust Xoff: No / Yes

Connect: Modem / Direct — see note 2
- DTR (Pin 20): Ready High / Always High
- 11 Pin: Ready High / Ready Low

Status — Depress & Hold

Clear Error — Depress & Hold

Paper Path — Depress & Hold

Store Defaults: No / Yes

Setup/Test — Depress & Hold

Key Access: Level 0 / Level 1 / Level 2 / Level 3

Test/Setup

Emul:

TI880:
- Execute Cmds: On / Off
- LF/CR ON LF: On / Off
- LF/CR ON CR: On / Off
- CRwLF VTDC2: On / Off
- Graphics: On / Off
- SO=Exp: On / Off
- Resp Fmt: W/O ESC / W/ESC / W/ESC;
- ABM MSG Load: Off / On

TI855:
- Proc Mode: DP / WP
- Auto LF: No / Yes

Proprinter:
- Auto LF: No / Yes
- Auto CR: No / Yes
- Slashed 0's: No / Yes

Epson:
- Auto LF: No / Yes
- Auto CR: No / Yes
- Slashed 0's: No / Yes

optional

Hexdump

Notes:

1. Shaded screens represent factory default parameter settings.

2. The CONNECT. parameters in the INTERFACE submenu are not valid with optional communication interfaces.

3. MARK and SPACE parity checking are only valid for 8-bit communication.

4. The character pitch choices change to 5, 6, 7.5, 8.55, 10, 12, 15, and 17.1 cpi for the IBM Proprinter emulation mode.